VIRGINIA DEPARTMENT OF TRANSPORTATION

CONSTRUCTION DIVISION

VDOT

Making Ideas A Reality

EST. 2012

2012
CONSTRUCTION RESOURCE GUIDEBOOK

TRIAL USE AND COMMENT

CONSTRUCTION RESOURCE GUIDEBOOK
Preliminary Edition for Trial Use and Comment

INTRODUCTION

Welcome to the Virginia Department of Transportation's ***Construction Resource Guidebook.*** We hope the user will find it a helpful tool in understanding the requirements of the Departments construction projects. It is written around the Road and Bridge Specifications with a focus on the seven rights (7R's) of quality construction. The ***Right Material (1),*** put in the ***Right Way (2)***, at the ***Right Time (3),*** in the ***Right Location (4),*** in the ***Right Quantity (5),*** all verified with the ***Right Documentation (6)***,and then the ***Right Payment (7)*** can be made. These 7R's present the definitive requirements for achieving process and product construction quality.

Each specification section contains five areas:

- A brief introduction to the specification with reference to related documents
- The specification matched to the 7R's of quality
- A four step inspection procedure to clearly communicate objectives
- A list of checkpoints to assist reinforcement of the 7R's
- A list of critical inspection points to assure absolute quality conformance

As a *Guide* it cannot replace the experienced and/or credentialed judgment of the individual practitioner. It is a working document designed to complement, convey, and achieve the Department's construction quality goals. Your comments and suggestions are welcome. Please use the form provided in the Appendices to assist us in accomplishing this endeavor.--

Mark E. Cacamis, P.E., CCM
State Construction Engineer

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ACKNOWLEDGEMENTS

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Trial Use and Comment

County, City and Town Codes

The Commonwealth of Virginia was originally sub-divided into 100 counties. A coding system has been developed in which the counties are given a 2 digit number from 00 to 99, and cities and towns have a 3 digit number from 100 to 350. This coding system is used to identify counties, cities and towns in the project numbers. Counties are grouped together into Districts according to their geographical location.

There are Nine Districts

l. Bristol

2. Salem

3. Lynchburg

4. Richmond

5. Hampton Roads

6. Fredericksburg

7. Culpeper

8. Staunton

9. Northern Virginia

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COUNTIES

County Code	County	District
00	Arlington	Northern Virginia
01	Accomack	Hampton Roads
02	Albemarle	Culpeper
03	Alleghany	Staunton
04	Amelia	Richmond
05	Amherst	Lynchburg
06	Appomattox	Lynchburg
07	Augusta	Staunton
08	Bath	Staunton
09	Bedford	Salem
10	Bland	Bristol
11	Botetourt	Salem
12	Brunswick	Richmond
13	Buchanan	Bristol
14	Buckingham	Lynchburg
15	Campbell	Lynchburg
16	Caroline	Fredericksburg
17	Carroll	Salem
18	Charles City	Richmond
19	Charlotte	Lynchburg
20	Chesterfield	Richmond
21	Clarke	Staunton
22	Craig	Salem
23	Culpeper	Culpeper
24	Cumberland	Lynchburg
25	Dickenson	Bristol
26	Dinwiddie	Richmond
28	Essex	Fredericksburg
29	Fairfax	Northern Virginia
30	Fauquier	Culpeper
31	Floyd	Salem
32	Fluvanna	Culpeper
33	Franklin	Salem
34	Frederick	Staunton
35	Giles	Salem
36	Gloucester	Fredericksburg
37	Goochland	Richmond
38	Grayson	Bristol
39	Greene	Culpeper
40	Greensville	Hampton Roads
41	Halifax	Lynchburg

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42	Hanover	Richmond
43	Henrico	Richmond
44	Henry	Salem
45	Highland	Staunton
46	Isle of Wight	Hampton Roads
47	James City	Hampton Roads
48	King George	Fredericksburg
49	King & Queen	Fredericksburg
50	King William	Fredericksburg
51	Lancaster	Fredericksburg
52	Lee	Bristol
53	Loudoun	Northern Virginia
54	Louisa	Culpeper
55	Lunenburg	Richmond
56	Madison	Culpeper
57	Mathews	Fredericksburg
58	Mecklenburg	Richmond
59	Middlesex	Fredericksburg
60	Montgomery	Salem
62	Nelson	Lynchburg
63	New Kent	Richmond
65	Northampton	Hampton Roads
66	Northumberland	Fredericksburg
67	Nottoway	Richmond
68	Orange	Culpeper
69	Page	Staunton
70	Patrick	Salem
71	Pittsylvania	Lynchburg
72	Powhatan	Richmond
73	Prince Edward	Lynchburg
74	Prince George	Richmond
76	Prince William	Northern Virginia
77	Pulaski	Salem
78	Rappahannock	Culpeper
79	Richmond	Fredericksburg
80	Roanoke	Salem
81	Rockbridge	Staunton
82	Rockingham	Staunton
83	Russell	Bristol
84	Scott	Bristol
85	Shenandoah	Staunton
86	Smyth	Bristol
87	Southampton	Hampton Roads
88	Spotsylvania	Fredericksburg
89	Stafford	Fredericksburg
90	Surry	Hampton Roads

Trial Use and Comment

91	Sussex	Hampton Roads
92	Tazewell	Bristol
93	Warren	Staunton
95	Washington	Bristol
96	Westmoreland	Fredericksburg
97	Wise	Bristol
98	Wythe	Bristol
99	York	Hampton Roads

Trial Use and Comment

CITIES AND TOWNS

County Code	City or Town Code	City or Town	District
95	140	Abingdon	Bristol
01	160	Accomac	Hampton Roads
12	161	Alberta	Richmond
00	100	Alexandria	Northern Virginia
15	162	Altavista	Lynchburg
05	163	Amherst	Lynchburg
97	164	Appalachia	Bristol
06	165	Appomattox	Lynchburg
42	166	Ashland	Richmond
09	141	Bedford	Salem
01	167	Belle Haven	Hampton Roads
21	168	Berryville	Staunton
97	101	Big Stone Gap	Bristol
60	150	Blacksburg	Salem
67	142	Blackstone	Richmond
01	169	Bloxom	Hampton Roads
92	143	Bluefield	Bristol
33	170	Boones Mill	Salem
16	171	Bowling Green	Fredericksburg
21	172	Boyce	Staunton
58	173	Boydton	Richmond
87	174	Boykins	Hampton Roads
87	175	Branchville	Hampton Roads
82	176	Bridgewater	Staunton
95	102	Bristol	Bristol
82	177	Broadway	Staunton
12	178	Brodnax	Richmond
58	178	Brodnax	Richmond
15	179	Brookneal	Lynchburg
11	180	Buchanan	Salem
81	103	Buena Vista	Staunton
67	181	Burkeville	Richmond
65	182	Cape Charles	Hampton Roads
87	183	Capron	Hampton Roads
92	184	Cedar Bluff	Bristol
19	185	Charlotte C.H.	Lynchburg
02	104	Charlottesville	Culpeper
58	186	Chase City	Richmond
71	187	Chatham	Lynchburg
65	188	Cheriton	Hampton Roads

Trial Use and Comment

64	131	Chesapeake	Hampton Roads
86	189	Chilhowie	Bristol
01	190	Chincoteague	Hampton Roads
60	154	Christiansburg	Salem
90	191	Claremont	Hampton Roads
58	192	Clarksville	Richmond
83	193	Cleveland	Bristol
29	194	Clifton	Northern Virginia
03	105	Clifton Forge	Staunton
84	195	Clinchport	Bristol
25	196	Clintwood	Bristol
41	197	Clover	Lynchburg
97	198	Coeburn	Bristol
96	199	Colonial Beach	Fredericksburg
20	106	Colonial Heights	Richmond
32	200	Columbia	Culpeper
87	201	Courtland	Hampton Roads
03	107	Covington	Staunton
07	202	Craigsville	Staunton
67	203	Crewe	Richmond
23	204	Culpeper	Culpeper
95	205	Damascus	Bristol
71	108	Danville	Lynchburg
82	206	Dayton	Staunton
90	207	Dendron	Hampton Roads
14	208	Dillwyn	Lynchburg
19	209	Drakes Branch	Lynchburg
77	210	Dublin	Salem
84	211	Duffield	Bristol
76	212	Dumfries	Northern Virginia
84	213	Dungannon	Bristol
65	214	Eastville	Hampton Roads
85	215	Edinburg	Staunton
82	216	Elkton	Staunton
40	109	Emporia	Hampton Roads
65	217	Exmore	Hampton Roads
29	151	Fairfax	Northern Virginia
29	110	Falls Church	Northern Virginia
73	144	Farmville	Lynchburg
11	218	Fincastle	Salem
31	219	Floyd	Salem
87	145	Franklin	Hampton Roads
88	111	Fredericksburg	Fredericksburg
38	220	Fries	Bristol
93	112	Front Royal	Staunton
17	113	Galax	Salem

Trial Use and Comment

84	221	Gate City	Bristol
95	222	Glade Spring	Bristol
81	223	Glasgow	Staunton
35	224	Glen Lyn	Salem
68	225	Gordonsville	Culpeper
81	226	Goshen	Staunton
71	227	Gretna	Lynchburg
82	228	Grottoes	Staunton
07	228	Grottoes	Staunton
13	229	Grundy	Bristol
41	230	Halifax	Lynchburg
01	231	Hallwood	Hampton Roads
53	232	Hamilton	Northern Virginia
27	114	Hampton	Hampton Roads
82	115	Harrisonburg	Staunton
76	233	Haymarket	Culpeper
25	234	Haysi	Bristol
29	235	Herndon	Northern Virginia
53	236	Hillsboro	Northern Virginia
17	237	Hillsville	Salem
61	238	Holland	Hampton Roads
83	239	Honaker	Bristol
74	116	Hopewell	Richmond
71	331	Hurt	Lynchburg
38	240	Independence	Bristol
03	241	Iron Gate	Staunton
51	242	Irvington	Fredericksburg
87	243	Ivor	Hampton Roads
91	244	Jarrett	Hampton Roads
40	244	Jarratt	Hampton Roads
52	245	Jonesville	Bristol
01	246	Keller	Hampton Roads
55	247	Kenbridge	Richmond
19	248	Keysville	Lynchburg
51	249	Kilmarnock	Fredericksburg
66	249	Kilmarnock	Fredericksburg
58	250	LaCrosse	Richmond
12	251	Lawrenceville	Richmond
83	252	Lebanon	Bristol
53	253	Leesburg	Northern Virginia
81	117	Lexington	Staunton
54	254	Louisa	Culpeper
53	255	Lovettsville	Northern Virginia
69	159	Luray	Staunton
15	118	Lynchburg	Lynchburg
56	256	Madison	Culpeper

Trial Use and Comment

76	155	Manassas	Northern Virginia
76	152	Manassas Park	Northern Virginia
86	119	Marion	Bristol
44	120	Martinsville	Salem
26	257	McKenney	Richmond
01	258	Melfa	Hampton Roads
53	259	Middleburg	Northern Virginia
34	260	Middletown	Staunton
54	261	Mineral	Culpeper
45	262	Monterey	Staunton
96	263	Montross	Fredericksburg
82	264	Mt. Crawford	Staunton
85	265	Mt. Jackson	Staunton
35	266	Narrows	Salem
65	267	Nassawadox	Hampton Roads
22	268	New Castle	Salem
85	269	New Market	Staunton
94	121	Newport News	Hampton Roads
87	270	Newsoms	Hampton Roads
84	271	Nickelsville	Bristol
64	122	Norfolk	Hampton Roads
97	146	Norton	Bristol
76	272	Occoquan	Northern Virginia
01	273	Onancock	Hampton Roads
01	274	Onley	Hampton Roads
68	275	Orange	Culpeper
01	276	Painter	Hampton Roads
06	277	Pamplin City	Lynchburg
73	277	Pamplin City	Lynchburg
01	278	Parksley	Hampton Roads
35	279	Pearisburg	Salem
35	280	Pembroke	Salem
52	281	Pennington Gap	Bristol
26	123	Petersburg	Richmond
19	282	Phenix	Lynchburg
92	283	Pocahontas	Bristol
99	147	Poquoson	Hampton Roads
16	284	Port Royal	Fredericksburg
64	124	Portsmouth	Hampton Roads
97	285	Pound	Bristol
77	125	Pulaski	Salem
53	286	Purcellville	Northern Virginia
76	287	Quantico	Northern Virginia
60	126	Radford	Salem
30	288	Remington	Culpeper
35	289	Rich Creek	Salem

Trial Use and Comment

92	148	Richlands	Bristol
20	127	Richmond	Richmond
44	290	Ridgeway	Salem
80	128	Roanoke	Salem
33	157	Rocky Mount	Salem
53	291	Round Hill	Northern Virginia
98	292	Rural Retreat	Bristol
52	293	Saint Charles	Bristol
97	294	Saint Paul	Bristol
80	129	Salem	Salem
86	295	Saltville	Bristol
95	295	Saltville	Bristol
01	296	Saxis	Hampton Roads
41	297	Scottsburg	Lynchburg
02	298	Scottsville	Culpeper
32	298	Scottsville	Culpeper
69	299	Shenandoah	Staunton
46	300	Smithfield	Hampton Roads
41	130	South Boston	Lynchburg
58	301	South Hill	Richmond
39	302	Standardsville	Culpeper
69	303	Stanley	Staunton
07	132	Staunton	Staunton
34	304	Stephens City	Staunton
91	305	Stony Creek	Hampton Roads
85	306	Strasburg	Staunton
70	307	Stuart	Salem
90	308	Surry	Hampton Roads
01	309	Tangier	Hampton Roads
28	310	Tappahannock	Fredericksburg
92	158	Tazewell	Bristol
30	311	The Plains	Culpeper
82	312	Timberville	Staunton
85	313	Toms Brook	Staunton
38	314	Troutdale	Bristol
11	315	Troutville	Salem
59	316	Urbanna	Fredericksburg
55	317	Victoria	Richmond
29	153	Vienna	Northern Virginia
80	149	Vinton	Salem
41	318	Virgilina	Lynchburg
75	134	Virginia Beach	Hampton Roads
01	319	Wachapreague	Hampton Roads
91	320	Wakefield	Hampton Roads
30	156	Warrenton	Culpeper
79	321	Warsaw	Fredericksburg

Trial Use and Comment

78	322	Washington	Culpeper
91	323	Waverly	Hampton Roads
07	136	Waynesboro	Staunton
84	324	Weber City	Bristol
50	325	West Point	Fredericksburg
51	327	White Stone	Fredericksburg
47	137	Williamsburg	Hampton Roads
46	328	Windsor	Hampton Roads
97	329	Wise	Bristol
85	330	Woodstock	Staunton
98	139	Wytheville	Bristol

Trial Use and Comment

Field Organization of the Department

The field organization of the Department is divided into nine districts. Each district is directed by a District Administrator who is aided by two or more Assistant District Administrators and a staff, consisting of engineers, technicians, maintenance and administrative personnel. The District Administrator and the staff are assigned specific responsibilities associated with the construction and maintenance of highways located within the boundaries of the district.

The Assistant District Administrator for Construction (District Construction Engineer) or DCE is responsible to the District Administrator for all construction, maintenance and operations contract work for the District. DCE manages the District Program through Responsible Charge Engineers called Area Construction Engineers (ACE). The oversight of contract work is the direct responsibility of the assigned ACE. The ACE has the responsibility of determining that all construction projects are being constructed in compliance with the plans, and Specifications. The Area Construction Engineer is also responsible to ensure compliance with a variety of regulatory policies and procedures. Through delegated representatives, the ACE provides the necessary guidance and instruction to the Project Managers, Inspectors and Consultant staff to achieve this end. The ACE periodically inspects the project and verifies the project records. The ACE's verifications are noted in the project records. At the completion of the project the ACE or duly authorized representative, inspects the Contractor's work and notes any unfinished items. When the work is completed the ACE, acting under the authority of the Chief Engineer, accepts the project.

Trial Use and Comment

CONSTRUCTION MANAGER

Distinguishing Features of this Position

The Construction Manager supervises the inspection activities and staff on a group of highway projects. This work involves responsibility for making assignments, supervising, and providing technical advice to Inspectors. Emphasis is placed on the application of a broad knowledge of field testing and inspection techniques to assure that the quality of workmanship and materials conform with plans and Specifications and that construction is progressing in accordance with the terms of the contract. Discussions are held with Contractors and Inspectors and decisions are made in the field to resolve problems requiring interpretations of Specifications and plans. Construction Managers serve as liaison between the field, the Area Construction Engineer's office and other project stake holders. Supervision is received from the Area Construction Engineer through written expectations, periodic discussions and the review of reports.

Examples of Duties of this Position

(1) Determines inspection needs and assigns Inspectors to projects to ensure adequate inspection coverage; instructs subordinates on inspection techniques and field testing methods.

(2) Interprets contract requirements for subordinates and contractors through the analysis of plans and Specifications.

(3) Investigates complaints from landowners arising out of conflicts between construction and right-of-way agreements.

(4) Prepares correspondence and non-routine reports relative to the status of a project.

(5) Reviews monthly progress estimates and brings discrepancies to the attention of Inspectors; checks and approves records of work performed for final cost determination such as work books and monthly estimates.

Trial Use and Comment

(6) Maintains a perspective overview regarding federal, state, and local laws regulating construction procedures, safety practices and working conditions.

(7) Inspects work in progress, to assure that methods, materials, and equipment conform to approved standards.

(8) Supervises the training of Inspectors, evaluates performance, and recommends promotions and transfers.

(9) Participates in preliminary engineering activities including Scoping, Utility Field Inspections, Constructability Reviews, and Bidability Reviews.

Trial Use and Comment

CONSTRUCTION INSPECTOR SENIOR

Distinguishing Features of the Construction Inspector Senior:

The inspector senior monitors and performs all types of inspection work on complex and routine highway projects or acts as a specialist and advisor to other inspectors on certain phases of work requiring specialized talent and experience. Assignments are of an independent nature and include responsibility for inspecting and monitoring the inspection work of any type and size of projects. The inspector senior is responsible for assigning and assisting inspectors in a manner that all phases of work will be given adequate inspection. Supervision is received from the Construction Manager or Area Construction Engineer by periodic visits and review of records and reports. The inspector's authority is limited in that changes to the plans and specifications requested or recommended must be reviewed and approved by a responsible charge engineer to whom the authority has been delegated.

Examples of the duties of this position:

- Inspects all phases of work on a project and advises the contractor superintendent or other representatives of necessary action to ensure conformance with plans, specifications, and the contract.
- Inspects grading projects, paving projects, demolitions projects, special design bridge projects, signal projects, signing projects, coating projects, utility projects, other special projects as assigned.
- Reviews the performance of assistant inspectors daily advising of necessary corrective actions to ensure teamwork, partnering and project success. Answers questions from assistant inspectors and the contractor concerning contract requirements and application. Reviews and/or prepares daily reports for preparation of entries to the project diary, as-built plans, materials books, and work books. Prepares and checks construction project construction reports and monthly project estimates. Makes necessary correction and forwards them to the Construction Project Manager and Area Construction Engineer.
- Performs occasionally any and all duties of an assistant inspector when required by volume of work.
- Is proficient in the use of routine survey equipment and is able to check grades, verify stakeouts (grading, and bridge stakeouts). Is

Trial Use and Comment

able to read and interpret highway construction plans and specifications.

- Performs detailed constructability and bidability reviews.

In addition to the duties noted for Construction Inspector, the Construction Inspector Senior monitors contractor's operations to ensure compliance with contract terms and specifications. Independently coordinates and directs all phases of construction inspection of projects, which are typically complicated by extensive traffic control, sensitive to the public or environmentally challenging, or require significant project coordination with property owners, utility companies, or local/federal government representatives. Verifies lines, grades dimensions, and elevations using survey and field engineering equipment. Coordinates and schedules various phases of construction with the prime contractor and agency personnel; reviews and monitors contractors' plan of operation; and advises contractors of violations and recommends adjustments to operations. Recommends changes to construction plans to meet field condition; makes field measurements of pay items and conducts materials testing; checks equipment; maintains and review comprehensive project records including daily diaries, materials notebooks, as-built plans, pay quantity records, progress schedules, work orders and monthly estimates; and is aware of Civil Rights requirements. The Construction Inspector Senior aids in the development of work orders, investigations and analysis of Notices of Intent, and provides On the Job Training for Construction Inspectors and Construction Inspector Trainees. Proven ability to work at heights, and within confined spaces with the required training for these activities.

This position requires frequent contact with engineers and agency personnel to discuss and resolve field construction issues and to obtain technical guidance in specialty areas of engineering and inspections. These positions also require frequent external contact with contractor personnel to schedule and coordinate project inspection and resolve problems; with local government and law enforcement agencies to explain work under construction and coordinate traffic control; with suppliers to monitor receipt of materials; with utility companies to coordinate relocation and installation; and with the public to provide information and resolve issues.

Trial Use and Comment

Minimum qualifications for Inspector Senior

The Construction Inspector Senior shall typically possess at least six years of inspection experience including knowledge of roadway, structure, and bridge construction methods, materials, standards and specifications. Working knowledge of state and federal safety, environment, and EEO/DBE guidelines and regulations; and of mathematics including algebra, geometry, and trigonometry. Working skill in operating computer equipment, software programs (including but not limited to working in a Microsoft Windows environment, Microsoft Office, and SiteManager, or other currently utilized project management software) and read and interpret roadway, bridge, and structure plans and contract specifications; apply mathematical formulas and engineering principles to determine field adjustments; maintain detailed reports; perform required materials testing; and communicate effectively with agency and contractor personnel and the general public. The Inspector Senior shall be able to communicate effectively. Has computer skills and is proficient in the use of Microsoft Office Applications, Email, Internet navigation and web-based tools. The inspector is expected to be currently VDOT certified or Mid Atlantic Regional Technical Certification Program (MARTCP) certificated in the following disciplines.

- Expected VDOT Certifications:
  - Soil and Aggregate Field Compaction
  - Safety (OSHA) minimum 30 hour training
  - Asphalt Field
  - ACI/VDOT Concrete Field
  - VDOT Concrete Field
  - Paving Marking
  - Flagger Certification
  - Department of Conservation and Recreation (DCR) Certification as an Erosion and Sediment Control Inspector
  - Work Zone Traffic Control Training (Intermediate Level), or ATSSA equivalent
  - Nuclear Gauge Safety Training
  - Fall Protection
  - Confined Space Entry Training
  - Guard Rail Installation (GRIT)

Trial Use and Comment

- Other Specialty Certifications may include one or more of the following:

    - NICET Level III
    - National Association of Corrosion Engineers (NACE) International Coating Inspector Program Sessions I and II
    - IMSA Level 1 Traffic Signal Certification
    - Journeyman Electrician
    - Asphalt Concrete or Hydraulic Cement Concrete Plant Certifications
    - Asphalt Mix Technician

In certain circumstances, Construction Inspector Senior level positions may be staffed with individuals that do not have all required certifications, but are in charge of inspection activities in which they are fully certified. This determination will be made solely by the Construction Project Manager, Area Construction Engineer, or other supervisory personnel as appropriate.

Trial Use and Comment

HIGHWAY CONSTRUCTION INSPECTOR

Distinguishing Features of the Highway Construction Inspector:

The Highway Construction Inspector inspects all phases of construction on highway construction and maintenance projects under the supervision of senior inspectors, construction project managers, or other supervisory personnel. The Highway Construction Inspector, on occasion, will also be the inspector in charge of various construction and maintenance contracts. The inspector shall have the ability to independently inspect routine highway construction phases for maintenance, bridge, and roadway construction projects. Assignments are of an independent or support nature depending the scope or complexity of the project and are made by the Construction Project Manager or Area Construction Engineer on a case by case basis. The work is distinguished from the trainee level by the requirement to act and make decisions independently for routine project issues and to foster partnering relationships with contractors, the general public, or other project stakeholders. Training and supervision of trainees may also be responsibilities of this position.

The Highway Construction Inspector will monitor the work of contractors to ensure quality control and contractor compliance of moderate complexity and generally be under the direct supervision of senior inspectors, construction managers, or supervisory personnel. Considerable freedom of action is allowed and specific instructions are required only as result of the changes of the plans and specifications, non-performance by a contractor or questions raised by the inspector.

Examples of Duties of This Position:

- Inspects assigned phases of work on a project to make official contact with contractor superintendent and other representatives to ensure conformance to plans, specifications, and other contract documents.
- Frequently checks lines, grades, dimensions of roadways and structures with an engineer's level and other survey equipment and advises contractor of any discrepancies.
- Checks methods of construction where specific methods are stated and requires action to correct any variances and methods employed.

Trial Use and Comment

- Ensures that highways work zones and traffic control setups are in accordance with current standards.
- Prepares and reviews daily inspector reports for preparation of entries into project diaries as a working knowledge of SiteManager and is able to properly document materials in the Materials Notebook as well as other test reports for materials.
- Records or monitors recording material received showing quantities estimated to be required in quantities received used and tested
- Checks materials and material documents to make sure that they have been tested or performs routine physical test and analyze sample material on the job, sends additional samples to the District, Central Office, or other testing laboratories for verification of results in coordination with the Materials Division Memorandum and Materials Engineer.
- Assist in constructability and bidability reviews
- Monitors project budget
- Assist in contractor's monthly evaluations

<u>Minimum Qualification</u>

The inspector shall typically possess three years of inspection experience including a working knowledge of roadway, structure, and bridge construction methods, materials, standards, construction symbols and terminology; state and federal environmental, safety, and Equal Employment Opportunity guidelines and regulations; and of mathematics including algebra, geometry, and trigonometry. Inspectors shall be skilled in operating computer equipment, software programs and field inspection equipment. Ability to read and interpret roadway, structure and bridge plans and specification; apply mathematical formulas and engineering principles to determine minor adjustments to construction plans; maintain detailed records; perform required materials testing and communicates with the agency and contractor personnel and the general public. . The Inspector shall be able to communicate effectively. Has computer skills and is proficient in the use of Microsoft Office Applications, Email, Internet navigation and web-based tools. The inspector is expected to be currently VDOT certified or Mid Atlantic Regional Technician Certification Program (MARTCP) certificated in the following basic certifications:

Trial Use and Comment

- Expected VDOT Certifications:
  - Soil and Aggregate Field Compaction
  - Safety (OSHA)
  - Asphalt Field
  - ACI/VDOT Concrete Field
  - Paving Marking
  - Flagger Certification
  - Department of Conservation and Recreation (DCR) Certification for Erosion and Sediment Control Inspector
  - Work Zone Traffic Control Training (Intermediate Level)
  - Nuclear Gauge Safety Training
  - Guard Rail Installation (GRIT)

- Other Specialty Certifications may include one or more of the following:
  - NICET Level II
  - Asphalt Concrete or Hydraulic Cement Concrete Plant Certifications
  - Asphalt Mix Technician

In certain circumstances, inspector level positions may be staffed with individuals that do not have all required certifications, but are in charge of inspection activities in which they are fully certified. This determination will be made solely by the Construction Project Manager, Area Construction Engineer, or other supervisory personnel as appropriate.

Trial Use and Comment

INSPECTOR TRAINEE

Distinguishing Features of the Inspector Trainee Position:

The inspector trainee performs daily assigned inspection tasks in a training capacity preparatory to assuming the duties of an inspector. The assignments follow a plan of on-the-job and classroom training established by the employer for the primary purpose of providing experience to inspection personnel for future highway construction and maintenance projects. The work includes measuring, testing and checking materials, methods, and installations to ensure conformance by the contractor with the plans, specifications, and contract document. Supervisory control is intensive initially, but progressively decreases as knowledge of work increases.

Examples of Duties of the Position:

- Inspects excavations, drainage structures, road surfaces, and structures to compare the work performed to plans and specifications, conferring frequently with higher level inspectors or engineering personnel to clarify or interpret details.
- Checks elevation against reference points using levels or other survey equipment. Prepares routine reports and records involving the application of basic geometric and trigonometric principles. Learns the use of level and survey instruments
- Prepares a daily inspector report, which includes the details of the contractor's work activities and list locations of work, materials, equipment and labor forces used.
- Becomes familiar with plans, specifications, standards, and related material when not occupied with regular assignments and whenever so directed by higher level inspectors or supervisory personnel.
- Advises contractors, supervisory personnel of necessary actions to conform to the plans and specification.
- Assist in preparing project records and forming reports
- Routine Materials testing
- Ensures self, project staff, and contractor staff operates in a safe and effective manner and is also aware of environmental regulations and provides customer service to the traveling public, adjacent property owners, and other project stakeholders.

Trial Use and Comment

Minimum Qualifications:

Inspector trainee will generally be a high school graduate with proven written, oral, and math skills (algebra and geometry), able to interpret and apply written specifications. Understands the general nature of construction and contracting. Is able to communicate effectively. Has computer skills and is proficient in the use of Microsoft Office Applications, Email, and Internet navigation and web-based tools.

Basic Material Certification:

Inspector trainee initially is not required to have any material certifications; however, in the employer's training plan, there shall be a two-year program outlined for the inspector trainee to obtain the basic material certifications to include:

- Asphalt Field
- Soils and Aggregate Field
- Nuclear Density
- Safety (OSHA)
- ACI/VDOT Concrete Field
- DCR Erosion and Sediment Control Inspector Level
- Pavement Markings
- Guard Rail Installation (GRIT)
- Flagger Certification
- Work Zone Traffic Control – Intermediate Level

Trial Use and Comment

Division I
GENERAL PROVISIONS

Trial Use and Comment

SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS

I. INTRODUCTION:

This section describes who can compete for an opportunity to construct the Department's projects. Is also describes the bidding procedure. The contents of a responsive bid are also defined. It describes the *right way* of submitting a bid to the Department.

a.) <u>Forms</u>:

- C-24 Proposal Quantity
- C-32 Prequalification Application
- C-104 Bidder Statement
- C-105 Affidavit
- C-118 Notice to Bidders

<u>2007 ROAD AND BRIDGE SPECIFICATIONS AND THE 7 R'S</u>

II. SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS

102.01 - Prequalification of Bidders

(a) All prospective contractors, joint ventures and subcontractors shall prequalify with the Department and shall have received a certification of qualification in accordance with the Rules Governing Prequalification Privileges prior to bidding. These rules and regulations can be found within the Department's Rules Governing Prequalification Privileges. This requirement may be waived by a Contract provision. Prequalification will not be required for items noted in the proposal as "Specialty Items."

The names of persons authorized to sign bids shall be on file with the Department. A name will be considered to be on file if it appears as that of an officer, a partner, or an owner on the current Contractor's Prequalifiaction Application. Requests by the bidder to revise the list of persons authorized to sign bids shall be submitted in writing and approved prior to the date bids are opened. A bid signed by someone whose name is not on file may be rejected.

A bidder who makes a false certification on the Bid will be subject to forfeiture of the bid bond or disqualification from bidding on future work for a 90-day period, or both.
When an individual is prequalified to bid jointly only with a specific company, the joint venture will be considered a unified entity for qualification purposes.

Comment [1]: Right Way/Right Time

Comment [2]: Right Documentation /Right Way

Comment [3]: Right Way/Right Time

Trial Use and Comment

Bidders seeking new prequalification must complete and submit the prequalification package.

Bidders intending to submit bids consistently shall prequalify at least once each two years using the Prequalification Renewal Application. However, the maximum capacity rating or classification, or both, may be changed by the Department during that period if additional favorable reports are submitted or upon unsatisfactory performance as determined in accordance with the requirements of Section 108.03 or from the Contractor's performance evaluations or upon non-performance as determined in accordance with the provisions of Section 108.07. The Department may require a Contractor to furnish a current financial and experience statement at any time.

(b) If prequalification is approved, prospective bidders will be placed on the Department's List of Prequalified Vendors. Bidders are subject to varying levels of pre-qualification as stated within the Rules Governing Prequalification Privileges. Bidders will be subject to removal from this list based on disqualification in accordance with the Specifications and Prequalification rules and regulations.

Unless otherwise stated, consideration for reinstatement to the Department's List of Prequalified Vendors will be made by the Contract Engineer.

102.02 - Content of Proposal

(a) Standard Proposal - Upon request, the Department will furnish a proposal to any interested party. The proposal will specify the location and description of the contemplated construction, the estimate of the various quantities and kinds of work to be performed or materials to be furnished, and a schedule of items for which unit bid prices are invited. The proposal will specify the time in which the work shall be completed and the date and time by which bids must be filed. The proposal will also include any applicable supplemental specifications, special provisions, or special provision copied notes governing the proposed work.

Attachments to the proposal will be considered a part of the bid. The plans, Specifications, and other documents specified in the proposal will be considered a part of the proposal.

(b) Combination or Conditional Proposals - If the Department so elects, proposals may be issued for projects in combination or separately. Bids may be submitted for either the combination or separate units of the combination. The Department may make awards on combination bids or separate bids to its best advantage. Combination bids other than those set up in the proposals by

Comment [4]: Right Documentation

Comment [5]: Right Time

Comment [6]: Right Documentation

Comment [7]: Right Time

Comment [8]: Right Way/Right Documentation

Trial Use and Comment

the Department will not be considered. Conditional bids will be considered only when so stated in the proposal.

102.03 - Interpretation of Quantities in Proposal

The quantities appearing in the proposal are approximate only, and provide a basis for cost analysis. The Contractor will be paid for the quantities of work accepted and materials furnished and correctly placed or installed in accordance with the requirements of the Contract. The scheduled quantities of work to be performed and materials to be furnished may be increased, diminished, or omitted as provided within these Specifications. When payment of any item in the Contract is indicated to be on the basis of plan quantities, the Contractor will be paid in accordance with the requirements of Section 109.02.

Comment [9]: Right Payment/Right Quantities

In general, the bid proposal will indicate the various utility items known to exist, will indicate items to be adjusted or improvements proposed by the respective owners and will designate any items that are to be adjusted by the Contractor.

Information contained in the bid proposal regarding utility locations is advisory only and shall not be construed as being a representation of completeness or accuracy. The bidder shall contact the owners of the various utilities to determine the exact location of the utilities and the owner's schedule of work. Unless otherwise noted, all utility adjustments will be performed by the Utility or its representative. The Contractor shall cooperate with the owners of any utilities in their adjustment operations. Prior to preparing a bid, the bidder shall contact known utility owners to determine the nature, extent, and location of existing, adjusted, or proposed new utility facilities within the areas of construction. It is understood and agreed that the Contractor has considered in his bid all of the permanent and temporary utility appurtenances in their present and relocated positions, any proposed utility capital improvements, and the Contractor has contacted the utility owner with regard to their proposed schedule of work. The Contractor shall include in his proposed schedule the amount of time to make utility adjustments, from time estimates furnished by the utility owners. Any costs associated with contacting, and coordinating with the utilities shall be reflected in the bid price for other items in the Contract

Comment [10]: Right Time

Comment [11]: Right Location

Comment [12]: Right Time/Right Documentation

102.04 - Examination of Site of Work and Proposal

Comment [13]: Right Location

(a) Evidence of Examination of Site of Work and Proposal

The submission of a bid will be considered conclusive evidence that the bidder has examined the site of the proposed work, the bid proposal and other documents referenced therein, and the plans before submitting a bid and is satisfied as to the conditions to be encountered in performing the work and the requirements specified in the proposal.

Trial Use and Comment

(b) Subsurface Data

Subsurface data may be available for review by the bidder in the office of the District Materials Engineer or State Materials Division Administrator or as stated elsewhere in the proposal documents. Such data are accurate with regard to test holes and are made available to the bidder in good faith in order to apprise him of information in possession of the Department. Any conclusions drawn by the Department concerning subsurface conditions are based solely on the data and are merely indications of what appear to be existing subsurface conditions. The Department does not warrant these conclusions to be correct, either expressly or by implication. Further, the Department does not warrant the condition, amount, or nature of the material that may be encountered or the sufficiency of the data, either expressly or by implication. The bidder shall make his own interpretation of the subsurface data that may be available and satisfy himself with regard to the nature, condition, and extent of the material to be excavated, graded, or driven through. The submission of a bid will be considered conclusive evidence that the bidder is satisfied with regard to the subsurface conditions to be encountered in the work and has taken such conditions into consideration when submitting the bid.

(c) **Notice of Alleged Ambiguities**

If a word, phrase, clause, or any other portion of the proposal is alleged to be ambiguous, the Bidder shall submit to the State Contract Engineer a written notice of the alleged ambiguity not later than 10 days prior to the date of receipt of bids and request an interpretation thereof. This written notice shall be submitted via the CABB (Contractor Advertisement Bulletin Board) system located on the Construction website at www.VDOT.Virginia.gov. Authorized interpretations will be issued by the State Contract Engineer to each person who received a proposal and will be posted on the CABB system. These questions, answers and statements from the CABB will be added to the contract as addenda.

The Department will not be responsible for any other explanations or interpretations of the alleged ambiguities except those brought to the attention of and responded to by the State Contract Engineer. No employee or agent of the Department shall have the authority to furnish any explanation or interpretation, verbal or written, of alleged ambiguities that are not submitted to the Contract Engineer by the bidder.

If the bidder fails to give written notice and request an interpretation of the alleged ambiguity within the specified time, he shall waive any right he may have had to his own interpretation of the alleged ambiguity.

Comment [14]: Right Time see 102.09

102.05 - Preparation of Bid

Trial Use and Comment

(a) General

The names of persons authorized to sign bids shall be on file with the Department. A name will be considered to be on file if it appears as that of an officer, a partner, or an owner on the current Contractor's Prequalification Application. Requests by the bidder to revise the list of persons authorized to sign bids on their behalf shall be submitted in writing and approved prior to the date bids are opened. A bid signed by someone whose name is not on file as someone authorized by the bidder may be rejected.

If the bid is made by an individual, the name and address of the individual shall be shown; if by a partnership, its name and address and the name and title of the partner signing the bid shall be shown; if by a corporation, the name of the corporation, its address, and the name and title of the officer signing the bid shall be shown; if by a joint venture, the aforementioned information shall be shown for each party.

The bidder shall submit his bid by approved electronic media, unless otherwise provided for in the proposal. Bids shall be signed with a digital signature.

The bidder shall furnish a unit or lump sum price as called for in the bidding proposal, in numerical figures, for each pay item listed. The bidder shall also show the products of the unit prices and quantities in numerical figures in the column provided for that purpose and the total amount of the bid.

If a unit or lump sum price is omitted, the bid will be rejected. If there is a discrepancy between the unit price and its extension, the unit price will govern.

In the event there is a discrepancy between the bidder's electronically generated proposal form and the official proposal form as furnished by the Department, the Department proposal form will govern.

Bids will be considered irregular and may be rejected for *any* of the reasons stated in Section 102.06.

The Bidder shall submit a proposal guaranty in accordance with the requirements of Section 102.07.

A bid may be rejected and the Bidder may be disqualified for *any* of the reasons stated in Section 102.08.

(b) Design Options

Except as otherwise specified in the proposal, when regular and alternate design options are shown in the proposal, the bidder shall submit a bid price for at least one design option. The award of the Contract will be made on the

Comment [15]: Right Time

Comment [16]: Right Way

Comment [17]: Right Location

Comment [18]: Right Way

Comment [19]: Right Documentation

Comment [20]: Right Way

Comment [21]: Right Way

Comment [22]: Right Quantity

Trial Use and Comment

basis of the lowest responsive and responsible bid submitted for either of the options. The Department may award the Contract to the bidder who submitted the lowest bid for the regular design option or the lowest bid for the alternate design option, whichever is deemed to be in the best interest of the Commonwealth.

(c) Debarred Suppliers

The bidder is cautioned against utilizing price quotes for materials for use in the preparation of bids from suppliers or vendors that are debarred by the Department. The Engineer will not approve for use any material furnished by a supplier debarred by the Department. The bidder shall ascertain from the Department's listings which suppliers are debarred. Lists of approved suppliers can be found on the Department's Materials Division web site.

Comment [23]: Right Material

If a previously debarred supplier is reinstated to eligibility subsequent to the award of a contract, the Engineer may approve the use of the supplier when requested by the Contractor.

All bidders shall return Form No. C-48 listing all subcontractors/suppliers that were solicited to supply quotes for work on this project within 10 calendar days after the date designated in the proposal for the opening of bids. This form shall show the vendor numbers, legal names of subcontractors/suppliers, whether DBE or non-DBE, and utilization or non-utilization for work on this project.

Comment [24]: Right Time/ Right Way

(d) Required Certifications

A bidder who makes a false certification on the Bidder Certification of Prequalification Classification and Work Capacity Form will be subject to forfeiture of his bid bond or disqualification from bidding on future work for a 90-day period, or both. The State Contract Engineer will determine the imposition and extent of such sanctions.

A sworn statement shall be executed by the bidder or his agent on behalf of each person, firm, association, or corporation submitting a bid. The statement shall certify that the person, firm, association, or corporation has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action to restrain free competitive bidding in connection with the proposal. The sworn statement shall be part of the electronic bid or in the form of an affidavit furnished by the Department and shall be sworn to before a person who is authorized by the laws of the Commonwealth to administer oaths. The electronic bids shall contain the identical sworn statement. For the purpose of this Section, affixing a digital ID to the bid will be considered by

Comment [25]: Right Documenation

Comment [26]: Right Way

Trial Use and Comment

the Department conditional evidence of signing before a person who is authorized by the laws of the Commonwealth to administer oaths.

(e) Acknowledgement of Receipt of Revisions

The bidder shall acknowledge receipt of all revisions to the bid documents issued prior to receipt of bid by inserting the appropriate Revision Letter date(s) as part of his electronic bid submission. Failure by the bidder to acknowledge any Revision Letter date(s) with his bid may result in the bidder being considered non-responsive, his bid irregular, and the bid being rejected.

Comment [27]: Right Time

Comment [28]: Right Way

(f) Signing the Bid

The bid shall be signed by the individual, one or more members of a partnership, or one or more of the officers of a corporation, whichever is applicable, by a digital identification. For a joint venture, the bid shall be signed by the individual identified prior to receipt of bids, as representing the joint venture. If the individual is not previously identified as representing a joint venture, the firm of record is responsible for the bid.

Comment [29]: Right Way/Right Documentation

102.06 - Irregular Bids

Comment [30]: Right Way/Right Documenation

Bids will be considered irregular and may be rejected for *any* of the following reasons:

(a) if the bidder fails to comply with the requirements of Sections 102.05 and 102.07

(b) if the bidder adds any provisions reserving the right to accept or reject an award or enter into a contract pursuant to an award except as otherwise permitted in these Specifications

(c) If the bidder fails to provide Certification of Prequalification Classification and Work Capacity

(d) if the bid is not properly signed

(e) if the bidder fails to acknowledge a Revision Letter.

(f) if there are unauthorized additions, conditional or alternate bids, or irregularities of any kind that may make the bid incomplete, indefinite, or ambiguous

(g) if the unit prices in the bid are obviously unbalanced, either in excess or below the cost analysis values as determined by the Department

Comment [31]: Right Quantity/Right Payment

Trial Use and Comment

(h) if the bidder fails to submit a statement concerning collusion

(i) if bids are submitted showing a designation for a project other than the project for which the bid is made

(j) if a paper bid is not totaled

(k) if erasures or alterations in the bidder's entries on paper bids, when allowed, are not initialed by the bidder

(l) if any attachments included in the bid are detached or altered when the bid is submitted except as otherwise provided for herein

(m) failure to be registered with "eVA Internet e-procurement solution" prior to the award of the Contract.

102.07 - Proposal Guaranty

A bid in excess of $250.000.00 will not be accepted or considered unless accompanied by a guaranty in the form of a bid bond made payable to the Treasurer of Virginia. A bid bond will be accepted only if executed on a form that contains the exact wording as the form furnished by the Department. Any bid accompanied by a bond having wording that differs in any respect from that furnished by the Department will be rejected. The amount of the proposal guaranty shall be 5 percent of the total bid.

When the principal is a joint venture, each party thereof shall be named and shall execute the proposal guaranty. Each surety to the bid bond shall be named and shall execute the bid bond. The bid bond shall be accompanied by a certified copy of the power of attorney for the surety's attorney-in-fact.

102.08 - Disqualification of Bidder

Any of the following causes may be considered sufficient for the disqualification of a bidder and rejection of his bid:

(a) more than one proposal for the same work from an individual, partnership, corporation or joint venture under the same or different name. A proposal submitted by an affiliate of an individual, partnership, corporation or any party of a joint venture will be considered as more than one proposal submitted for the same work. *Affiliate* as used herein shall conform to the definition in Section 101.02 - Terms.

Comment [32]: Right Way

Comment [33]: Right Quantity

Comment [34]: Right Way

Trial Use and Comment

(b) evidence of collusion among bidders; participants in such collusion will not be considered for future bids until requalified by the Board

(c) incompetency or inadequate machinery, plants, or other equipment as revealed by the bidder's financial and experience statements required by these Specifications

(d) unsatisfactory workmanship or progress as described within Sections 105.05, 108.03, 108.07 or other applicable specifications and demonstrated by performance records of current or past work for the Department, other agencies or departments of the Commonwealth, or agencies or departments of other states in the United States or federal government

(e) uncompleted work with the Department that in the judgment of the Engineer might hinder or prevent prompt completion of additional work if awarded

(f) failure to pay or settle satisfactorily all bills for materials, labor, equipment, supplies, or other items specified in contracts in force at the time the new work comes before the Board for award

Comment [35]: Right Payment

(g) failure to comply with any prequalification regulation of the Department

(h) failure to cooperate properly with representatives of the Commonwealth inspecting, monitoring or administering construction or disorderly conduct toward any such representative in contracts

(i) default under a previous contract, or

(j) Failure to pay back amounts owed the Department, as specified in Section 109.10, on other contracts

Comment [36]: Right Payment

Temporary disqualification of a bidder as provided herein will result in the temporary disqualification of each member of a joint venture and any affiliate, having substantially the same operational management or drawing from the same equipment or labor resource pool. Temporary disqualification will also result in non-approval of the bidder, each member of a joint venture, and affiliates as defined herein, for performance of work as subcontractors that in the opinion of the State Contract Engineer, could adversely affect other work under contract to the Department.

The above listed reasons for possible disqualification are not totally inclusive and disqualification may occur based on other requirements within these Specifications.

Bidders who are disqualified may be reinstated, at the discretion of the State Contract Engineer or the Prequalification Panel, upon satisfactory compliance with the requirements of these Specifications.

Trial Use and Comment

102.09 - Submission of Bid

Each bid shall be submitted to the Department by approved electronic media in accordance with the policy in place at the time of the advertisement and bid. This information will be posted on the Construction website at www.virginiadot.org/business/const. Refer to "Electronic Bidding" information.

Bids shall be filed prior to the time and at the place specified in the Notice of Advertisement. Bids received after that time will be returned to the bidder unopened. The date for the opening of bids may be deferred by the Department, in which case the bidders will be notified.

102.10 - Withdrawal of Bid

A bidder may withdraw a bid in accordance with the following.

(a) Standard Withdrawal: Bids may be withdrawn as allowed by the electronic bidding system until bid closing. A bidder may withdraw a bid provided the request for the withdrawal is written and signed by a person(s) who qualifies to execute the bid in accordance with the requirements of Section 102.05.

(b) Conditional Withdrawal: A bidder who desires to bid on more than one project for which bids are to be opened on the same date and desires to protect himself against receiving awards for more projects than he is equipped to handle may secure the protection desired by completing the portion of the electronic bid for the conditional withdrawal of bids.

102.11 – eVA Business-To-Government Vendor Registration

Bidders are not required to be registered with "eVA Internet e-procurement solution" at the time bids are submitted, however, prior to award, the lowest responsive and responsible bidder must be registered with "eVA Internet e-procurement solution" or the bid will be rejected. Registration shall be performed by accessing the eVA website portal www.eva.state.va.us, following the instructions and complying with the requirements therein.

102.12—Public Opening of Bids.

Electronic bids will be decrypted, opened, printed to paper and along with all other bids will be read publicly at the time and place specified in the Notice of Advertisement. Interested parties are invited to be present. As Read results will be posted on the Construction website at www.VDOT.Virginia.gov as soon as possible on the day of reading.

Comment [37]: Right Time/Right Way

Comment [38]: Right Way

Comment [39]: Right Way/Right Time /Right Documentation

Comment [40]: Right Location

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURES

Pre-start planning meeting:

- Review critical inspection points below.

Start:

- Not Applicable (N/A)

Inspection Requirements:

- See Critical Inspection Points

Final Inspection:

- **See documentation required**

Documentation Required:

- Notice of Advertisement is complete
- Proposal is complete
- Bid is responsive

IV. REVIEW QUESTIONS

See 102.06-Irregular Bids

V. CRITICAL INSPECTION POINTS

102.01-Prequalificaton of Bidders • Is the Bidders prequalification current?
102.02-Content of Proposal? • Does the proposal note the fixed completion date? • Does the proposal note the time and date of the letting?
102.05-Preparation of Bid • Is the signature of the person signing the proposal on file with the Department? Form C-104, C-105
102.05 - Preparation of Bid, (d), Required Certifications • Does the bid submission include a sworn statement regarding non-collusion?

Trial Use and Comment

Form C-104, C-105

102.05 - Preparation of Bid, (f), Signing the Bid

- Is the bid signed?

102.06 - Irregular Bids

- Does the bidder have a Certification of Prequalification Classification and Work Capacity on file?
- Is the bid properly signed?
- Did the bidder acknowledge any and all Revision Letters?
- Are there are unauthorized additions, conditional or alternate bids, or irregularities of any kind that may make the bid incomplete, indefinite, or ambiguous?
- Are the unit prices in the bid obviously unbalanced, either in excess or below the cost analysis values as determined by the Department?
- Did the Bidder submit a statement concerning collusion?
- Does the bid show a designation for a project other than the project for which the bid is made?
- If a paper bid are the proposal extensions totaled by row and column?
- Are any and all erasures or alterations in the bidder's entries on paper bids, when allowed, initialed by the bidder?
- Are any attachments included in the bid detached or altered when the bid is submitted except as otherwise provided for herein?
- Did the Bidder fail to be registered with "EVA Internet e-procurement solution" prior to the award of the Contract?

102.07 - Proposal Guaranty

- If the project is over $250,000 did the Bidder include a bid bond?

102.09 - Submission of Bid

- Was the bid submitted prior to the time noted in the Notice of Advertisement?

Trial Use and Comment

SECTION 103 - AWARD AND EXECUTION OF CONTRACTS

I. INTRODUCTION:

The sections describes the steps necessary to assure the apparent low bidder can meet the legal requirements necessary to enter into a contract with the Commonwealth of Virginia. It describes the right way and the right time for meeting those requirements.

a) Forms:

- **C-18 Contract Performance Bond**
- **C-73 Certificate of Insurance**

II. 2007 ROAD & BRIDGE SPECIFICATIONS and the 7 R's

103.01 - Consideration of Bids

After bids have been opened and read, the Department will evaluate bid submittals to determine if all requirements of Section 102 have been met. Bids not submitted in accordance with the requirements of Section 102 will be rejected.

Comment [41]: Right Way

Bids will be compared on the basis of the summation of the products of the quantities shown in the bid schedule and the unit bid prices.

The Department may correct arithmetical errors in the bid prior to such comparison, in accordance with Section 102.05. The results of the comparisons will be available to the public after the determination has been made to award the Contract.

The Board reserves the right to reject any or all bids, waive technicalities, advertise for new bids, or proceed to do the work otherwise if it deems that the best interest of the Commonwealth would be promoted thereby.

103.02 - Award of Contract

Comment [42]: Right Way

If the Contract is awarded, the award will be made to the lowest responsive and responsible bidder without discrimination on the grounds of race, color, sex, or national origin. In the event of tie bids, preference will be given to Virginia persons, firms, or corporations; otherwise, the tie will be decided by lot. Whenever any bidder is a resident of any other state and such state under its laws allows a resident contractor of that state a preference, a like preference may be allowed to the lowest responsive and responsible bidder who is a resident of Virginia. The award date will not be later than midnight on the 60th day after the opening of bids. If the Board, or the Commissioner; where permitted by law, has not awarded the Contract within this period, the bidder may

Comment [43]: Right Time

Trial Use and Comment

withdraw his bid without penalty or prejudice unless the time limit is extended by mutual consent.

103.03 - Cancellation of Award

The Board, or the Commissioner; where permitted by law, may cancel the award of any contract at any time before the execution of the contract by all parties without liability to the Commonwealth.

103.04 - Forfeiture of Proposal Guaranty

When the bidder withdraws his bid prior to award, after being determined the apparent low bidder, the bid bond will be forfeited in accordance with the requirements of the *Code of Virginia* as amended.

103.05 - Requirements of Contract Bond

Within 15 calendar days after notification of award of the Contract the successful bidder shall furnish the following bonds for contracts in excess of $250,000.00:

(a) a performance bond in the sum of the Contract amount, conditioned upon the faithful performance of the Contract in strict conformity with the plans, Specifications and conditions of the Contract, and

(b) a payment bond in the sum of the Contract amount, conditioned upon the prompt payment for all labor, materials, public utility services and rental of equipment used in the prosecution of the work for the Contract.

Bidders will not be awarded an unbonded contract when their bid plus the balance of other unbonded contracts exceeds $250,000.00 or as otherwise limited by their current prequalificaton status.

The bonds shall be made on official forms furnished by the Department and shall be executed by the bidder and a surety company carrying a minimum "Best Rating" of "B +" and authorized to do business in Virginia in accordance with the laws of Virginia and the rules and regulations of the State Corporation Commission. To be considered properly executed, the bonds shall include authorized signatures and titles.

103.06 - Contract Documents

The portion of the executed Contract submitted by the Contractor shall include the following documents unless the filing of any of them at a later date is specifically

Comment [44]: Right Way

Comment [45]: Right Documentation

Trial Use and Comment

permitted by other sections of these Specifications or by Special Provisions or Special Provision Copied Notes:

(a) **Contract:** The Contract shall include the schedule of prices submitted by the bidder, plans, standard drawings, these Specifications, supplemental specifications, special provisions, special provision copied notes, and the standard form of the Contract, all as furnished by the Department.

(b) **Contract Bonds:** Contract bonds shall conform to the requirements of Section 103.05.

(c) **Affidavits and Documents:** Affidavits and documents shall include those required to be made a part of the Contract by any federal or state law in effect on the date of the Notice of Advertisement.

(d) **Workers' Compensation Insurance Certificate:** The certificate shall be filed on forms furnished by the Department within 15 calendar days after notification of award of the Contract. The certificate shall be executed by an approved and authorized insurance company as required by state law and shall cover the Contract it accompanies.

The Contractor shall file notice with the Department at least 30 days prior to the cancellation of any required workers' compensation coverage. If any of his insurance of this class is cancelled, the Contractor shall cease operations on the date of the cancellation and shall not resume operations until new insurance is certified as being in force.

(e) **Progress Schedule:** The Contractor shall submit a progress schedule in accordance with the requirements of Section 108.03 or as specified in the Contract Documents.

(f) **Contractor's Bodily Injury and Property Damage Liability Insurance:** The Contractor shall procure and maintain at his own expense, until final acceptance of the work covered by the Contract, insurance of the kinds and in the amounts specified herein. The minimum limits of liability for this insurance shall be as follows:

A Combined Single Limit for Bodily Injury Liability and Property Damage Liability	
$1,000,000	Each Occurrence
$2,000,000	Aggregate

Evidence of insurance in compliance with the above shall be filed on forms approved by the Department within the time specified herein. The evidence shall be executed by an

Trial Use and Comment

approved and authorized insurance company authorized to do business in Virginia and with a minimum *"Best Rating"* of *"B +"*, and shall cover the Contract it accompanies.

The Contractor shall file notice with the Department at least 30 days prior to the cancellation or reduction of the required insurance, and shall cease operations on the date of the cancellation or reduction until new insurance is in force and the same evidence of insurance is provided to the Department.

The Contractor's Bodily Injury and Property Damage Liability Insurance shall cover liability of the Contractor for damage because of bodily injury to, or death of persons and damage to, or destruction of property, that may be suffered by persons other than the Contractor's own employees as a result of the negligence of the Contractor in performing the work covered by the Contract.

Insurance provided in compliance with this Section shall include liability of the Contractor for damage to or destruction of property that may be suffered by persons other than the Contractor's own employees as a result of blasting operations of the Contractor in performing the work covered by the Contract.

If any part of the work is sublet, insurance meeting the same requirements shall be provided by or in behalf of the subcontractors and evidence of such insurance shall be submitted with the sublet request.

Insurance coverage in the minimum amounts set forth herein shall not be construed to relieve the Contractor or subcontractor(s) of liability in excess of such coverage, nor shall it preclude the Commonwealth from taking such actions as are available to it under any other provision of this Contract or otherwise in law.

103.07 - Failure to Furnish Bonds or Certificate of Insurance

Failure by the successful bidder to furnish the Department acceptable bonds, workers' compensation insurance or the Contractor's Bodily Injury and Property Damage Liability Insurance policy within 15 calendar days after being notified of the award of the Contract shall be considered just cause for cancellation of award and forfeiture of the proposal guaranty. In such event, the proposal guaranty shall become the property of the Commonwealth, not as a penalty but in liquidation of damages sustained. The Contract may then be awarded to the next lowest responsible bidder, or the work may be re-advertised or constructed otherwise, as determined by the Board.

Comment [46]: Right Documentation / Right Time

In the event the successful bidder on an unbonded contract is unwilling or unable to fulfill the Contract and fails to notify the Department prior to execution of the Contract by the Department, the bidder will be declared in default in accordance with the requirements of Section 108.07.

Trial Use and Comment

In the event the bidder, on an unbonded contract, notifies the Department prior to execution of the Contract by the Department of such unwillingness or inability to fulfill the Contract, the bidder will be enjoined from bidding on an unbonded contracts for a period of no less than 90 days from the date of notice by the Department.

A bidder who has never been enjoined or defaulted on an unbonded contract and who notifies the Department prior to contract execution of an unwillingness or inability to fulfill the Contract will not be enjoined for the first occurrence; however, said bidder will not be permitted to rebid or perform work on that specific Contract.

103.08 - Contract Audit

The Contractor shall permit the Department to audit, examine, and copy all documents, computerized records, electronic mail, or other records of the Contractor during the life of the Contract and for a period of not less than five years after the date of final payment, or the date the Contractor is declared in default of Contract, or the date of termination of the Contract. The documents and records shall include, but not be limited to:

(a). Those that were used to prepare and compute the bid, prepare all schedules used on the project, record the progress of work on the project, accounting records, purchasing records, personnel payments or records necessary to determine employee credentials, vendor payments and written policies and procedures used to record, compute and analyze all costs incurred on the project, including those used in the preparation or presentation of claims to the Department.

(b) Records pertaining to the project as the Department may deem necessary in order to permit adequate evaluation and verification of Contractor's compliance with contract requirements, compliance with the Department's business policies, and compliance with provisions for pricing work orders or claims submitted by the Contractor or the Contractor's subcontractors, insurance agents, surety bond agents and material suppliers shall be made available to the auditor(s) at the Department's request. The Contractor shall make his personnel available for interviews when requested by the Department.

(c) Upon request, the Contractor shall provide the Department with data files on data disks, or other suitable alternative computer data exchange format. Data furnished by the Contractor that cannot be verified will be subject to a complete audit by the Department.

The Contractor shall ensure that the requirements of this provision are made applicable to his subcontractors, insurance agents, surety bond agents and material suppliers. The Contractor shall cooperate and shall cause all related parties to furnish or make available in an expeditious manner all such

Trial Use and Comment

information, materials, and data. The Contractor shall be forthcoming in disclosing all sources and locations of media.

The Contractor shall provide immediate access to records for the audit and provide immediate acceptable facilities for the audit. Failure on the part of the Contractor to afford the Department immediate access or proper facilities for the audit will be considered failure to cooperate and will result in disqualification as a bidder in accordance with Section 102.08.

Upon completion of the contract audit, any adjustments or payments due by the Contractor as a result of the audit shall be made within 60 days from presentation of the Department's findings to the Contractor. Failure on the part of the Contractor to make payment may result in disqualification as a bidder in accordance with Section 102.08.

If the Contractor disagrees with the findings of the Department's audit, the Contractor may appeal the decision in accordance with provisions of Section 105.19 or the *Code of Virginia* as amended and as applicable, except that the provision for the Contractor to submit a claim within 60 days after final payment shall not apply. If the Contractor elects to appeal the decision of the audit he shall within 60 days of the date of the notice of the Department's findings submit a written request to appeal the decision to the Chief Engineer. Failure on the part of the Contractor to file a claim disputing the Department's audit within 60 days will be interpreted as a waiver of any claim for dispute of the Department's findings.

103.09 - Execution of Contract

Comment [47]: Right Way

The bid as submitted, including the documents specified in Section 103.06(a) shall constitute the Contract upon submittal of the contract bond, contract bodily injury and property damage liability insurance certificate, and workers' compensation insurance certificate and the final execution by the Department. After the Department has recommended the bid for award the apparent low bidder shall be required to sign and return a paper copy of the contract documents to the State Contract Engineer. Failure to sign and return the contract documents will result in forfeiture of the bid bond. If the Contract is not awarded within the time limit specified in Section 103.02, the bidder may withdraw his bid without penalty or prejudice unless the time limit is extended by mutual consent. No Contract shall be considered effective until it has been fully executed by all parties.

III. FOUR STEP INSPECTION PROCEDURES

Pre-start planning meeting: Review the steps on the Award and Execution milestone chart to assure the project will be awarded within 60 days (103.02).

Trial Use and Comment

Start: N/A

Inspection Requirements: See Critical Inspection Points

Final Inspection: The step is complete by documenting that the award and contract execution meet the requirements of the specification.

IV. REVIEW QUESTIONS

Intentionally Left Blank

V. CRITICAL INSPECTION POINTS

103.01 - Consideration of Bids • Do the Bidders documents conform to the requirements to Section 102-Bidding Requirements and Conditions?
103.05 - Requirements of Contract Bond • For projects over $250,000 have the payment and performance bonds been submitted on the Departments forms by a B+ rated company and received with 15 days of the Notice of Award? • For projects less than $250,000 does the apparent low bidder have outstanding contract balances greater than $250,000 on other un-bonded contracts? Is the apparent low bidder prequalified without any special notices or exceptions?
103.06 - Contract Documents (d) Workers' Compensation Insurance Certificate: • Has the apparent low bidder provided a certificate of insurance on forms furnished by the Department within 15 calendar days after notification of award of the Contract? • Has the Certificate been executed by an approved and authorized insurance company as required by state law and shall cover the Contract it accompanies?

Trial Use and Comment

SECTION 104 -SCOPE OF WORK

I. INTRODUCTION:

This section describes how the work is defined and how any changes to the scope affect the contract. It describes proper ways and numerous processes to follow in order to verify and document project correspondence.

a) <u>Forms:</u>

- **Intentionally Left Blank**

II. <u>2007 ROAD & BRIDGE SPECIFICATIONS and the 7R's</u>

104.01 - Intent of Contract

The intent of the Contract is to provide for completion of the work specified therein within the budget and time limit stated in the Contract. Further it is understood that the Contractor execute the work under the contract as an independent contractor and not as an agent of the Department, the Commissioner or the Commonwealth Transportation Board.

104.02 - Alteration of Quantities or Character of Work

(a) General

The Engineer reserves the right to make, in writing, at any time during the work, such changes in quantities and such alterations in the work as are necessary to complete the project satisfactorily. Such changes in quantities and alterations shall not invalidate the Contract or release the surety, and the Contractor shall agree to perform the work as altered. No change, alteration or modification in or deviations from the Contract or the Contract Documents, or the giving by the Department of any extension of time for the performance of the Contract, or the forbearance on the part of the Department shall release or exonerate in whole or in part either the Contractor or any surety on the obligations of any bond given in connection with the Contract. Neither the Department nor the Contractor shall be under any obligation to notify the surety or sureties of any such alteration, change, extension or forbearance, notice thereof being expressly waived. Any increase in the Contract amount shall automatically result in a corresponding increase in the penal amount of the bonds without notice to or consent from the surety, such notice and consent being hereby waived. Decreases in the Contract amount shall not, however, reduce the penal amount of the bonds unless

Comment [48]: Right Documentation

Comment [49]: Right Quantity

Trial Use and Comment

specifically provided in any change order as authorized in accordance with the provisions of Section 109.05 decreasing the scope of the work.

If the alterations in the nature of the work or changes in quantities, significantly change the character of the work under the Contract, an adjustment, excluding anticipated profits for reduced or eliminated work, may be made to the Contract. The basis for the adjustment shall be agreed upon prior to the performance of the work. If a basis cannot be agreed upon, an adjustment will be made either for or against the Contractor in such amount as the Engineer may determine to be fair and equitable.

At the option of the Engineer, the Contractor may be directed to accomplish the work on a force account basis when the scope of work meets the requirements for such a determination in accordance with the requirements of Section 109.05.

If the alterations or changes in quantities do not significantly change the character of the work to be performed under the contract, the altered work will be paid for as provided elsewhere in the Contract.

The term *significant change* shall be construed to apply only to the following circumstances:

(1) When the character of the work as altered differs materially in kind or nature from that involved or included in the original proposed construction or

(2) When a major item of work, as defined elsewhere in the contract is increased or decreased more than 25 percent of the original contract quantity. Any allowance for an increase or decrease in cost due to an increase in quantity of more than 25 percent shall be calculated only on that quantity in excess of 125 percent of the original contract bid item quantity. Also any allowance for an increase or decrease in cost due to a decrease in quantity of more than 25 percent shall be calculated only on that quantity below 75 percent of the original contract bid item quantity, or in case of a decrease below 75 percent, to the actual amount of work performed, or

(3) When overruns and underruns of piling amount to more than 25 percent of the original bid quantity, whether or not such item has been designated as a major item, or

(4) When overruns or underruns of more than 100% on minor items can be demonstrated as not representative of the true cost of the work when considering the unit bid price.

(b) Value Engineering Proposals

The Contractor may submit to the Engineer written Value Engineering Proposals (VEP) for modifying the plans, Specifications, or other requirements of the Contract for the

Comment [50]: Right Payment

Comment [51]: Right Payment

Comment [52]: Right Payment

Comment [53]: Right Payment

Comment [54]: Right Payment

Comment [55]: Right Payment

Comment [56]: Right Documentation

Trial Use and Comment

purpose of reducing the total cost and/or contract time of construction without reducing the design capacity or quality of the finished product. If the VEP is accepted by the Department, the net savings and/or contract time will be equally divided by the Department and the Contractor. When an accepted VEP includes contract time savings, the contract completion date shall be advanced by half of the time savings accepted in the VEP and the Contractor shall have exclusive use of the remaining half of the time as contractor float.

Each VEP shall result in a net savings over the contract cost and/or contract time without impairing essential functions and characteristics of the item(s) or of any other part of the project, including, but not limited to, service life, reliability, economy of operation, ease of maintenance, aesthetics, and safety. At least the following information shall be submitted with each VEP:

- Statement that the proposal is submitted as a VEP
- Statement concerning the basis for the VEP benefits to the Department and an itemization of the contract items and requirements affected by the VEP
- Detailed estimate of the cost and/or contract time under the existing Contract and under the VEP
- Proposed specifications and recommendations as to the manner in which the VEP changes are to be accomplished
- Statement as to the time by which a contract work order adopting the VEP must be issued so as to obtain the maximum cost-effectiveness

The Department will process the VEP in the same manner as prescribed for any other proposal that would necessitate issuance of a work order. The Department may accept a VEP in whole or part by issuing a work order that will identify the VEP on which it is based. The Department will not be liable to the Contractor for failure to accept or act on any VEP submitted pursuant to these requirements or for delays in the work attributable to any VEP. Until a VEP is put into effect by a work order, the Contractor shall remain obligated to the terms and conditions of the existing Contract. If an executed work order has not been issued by the date on which the Contractor's proposal specifies that a decision should be made or such other date as the Contractor may subsequently have specified in writing, the VEP shall be deemed rejected.

The work order effecting the necessary modification of the Contract will establish the net savings agreed on, provide for adjustment of the contract prices, and/or contract time, and indicate the net savings. The Contractor shall absorb all costs incurred in preparing a VEP. Costs for reviewing and administering a VEP will be borne by the Department. The Department may include in the agreement any conditions it deems appropriate for consideration, approval, and implementation of the VEP. The

Trial Use and Comment

Contractor's 50 percent share of the net savings and/or contract time shall constitute full compensation to him for effecting all changes pursuant to the agreement.

Unless specifically provided for in the work order authorizing the VEP, acceptance of the VEP and performance of the work thereunder will not change the contract time limit.

The Department may adopt a VEP for general use in contracts administered by the Department if it determines that the VEP is suitable for application to other contracts. VEPs identical with or similar to previously submitted VEPs will be eligible for consideration and compensation under these provisions if they have not been previously adopted for general application to other contracts administered by the Department. When a VEP is adopted for general use, compensation pursuant to these requirements will be applied only to those awarded contracts for which the VEP was submitted prior to the date of adoption of the VEP.

Proposed changes in the basic design of a bridge or pavement type or those changes that require different right-of-way limits will not normally be considered an acceptable VEP. If a VEP is based on or is similar to a change in the plans, Specifications, or special provisions adopted by the Department prior to submission of the VEP, the Engineer will not accept the VEP.

The Engineer will be the sole judge of the acceptability of a VEP. The requirements herein apply to each VEP initiated, developed, and identified as such by the Contractor at the time of its submission to the Engineer. However, nothing herein shall be construed as requiring the Engineer to approve a VEP.

Subject to the provisions herein, the Department or any other public agency shall have the right to use all or part of an accepted VEP without obligation or compensation of any kind to the Contractor.

If a VEP is accepted by the Department, the provisions of (a) herein that pertain to the adjustment of contract unit prices attributable to alterations of contract quantities will not apply to the items adjusted or deleted as a result of putting the VEP into effect by a work order.

104.03 - Differing Site Conditions

Comment [57]: Right Location

During the progress of the work, if subsurface or latent physical conditions differing materially from those indicated in the contract are encountered at the site, the Contractor shall promptly notify the Engineer in writing of the specific differing conditions.

If unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in

Comment [58]: Right Documentation

Trial Use and Comment

the Contract, are encountered at the site the Contractor shall promptly notify the Engineer in writing of the specific differing conditions.

Upon receipt of such written notification, the Engineer will acknowledge receipt and investigate the conditions. If it is determined by the Engineer that the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any work under the Contract, an adjustment, excluding anticipated profits, will be made and the Contract may be modified in writing accordingly. The Engineer will notify the Contractor of the determination whether or not an adjustment of the Contract is warranted.

Comment [59]: Right Documentation

III. FOUR STEP INSPECTION PROCEDURES

104.02 Alteration of Quantities or Character of Work

Pre-start planning meeting: If the Engineer alters contract quantities review section 104.02 with the contractor.

Start: Witness progress as necessary to assure specification compliant construction. If there is an issue between the Department and the Contractor about the altered quantities keep accurate records of the labor, equipment, and material in accordance with 109.05 b. Force Account.

Inspection Requirements: Same as "Start".

Final Inspection: Follow contractual acceptance requirements for the item of work, see 109.04.

Documentation: Summarize disputed work using the force account format, see 109.05 B.

104.02 (b) Value Engineering Proposals

Pre-start planning meeting: Review this specification in order to assist the Engineer in his analysis of any Value Engineering Proposals (VEP).

Start: N/A

Trial Use and Comment

Inspection Requirements: Inspect any construction altered by the VEP in accordance with the original contract documents, and as modified by the VEP.

Final Inspection: Follow contractual acceptance requirements as applied to the VE Proposal.

Documentation: Document all VEP work consistent with contract documentation.

104.03 - Differing Site Conditions

Pre-start planning meeting: Review the Contractor's notification of Differing Site Conditions with the engineer.

Start: Capture all information about the alleged differing site condition including the exact location, date and time, photographs, and all other information necessary to enable the Engineer to make an informed decision.

Inspection Requirements: Monitor the contracts actions regarding the alleged conditions including all labor, equipment and material resources involved, see 109.05.B.

Final Inspection: N/A.

Documentation: Provide all related information to the Engineer.

IV. REVIEW QUESTIONS

Spec. Ref.	
104.02(1)	Are deviations from the contract documents properly documented?
104.02(2)	Has extra work been documented and items that require work orders approved prior to work being performed?

V. CRITICAL INSPECTION POINTS

104.02 Alteration of Quantities or Character of Work • Capture all resources expended by the Contractor on disputed items. • Documentation of Force Account Items-Follow 109.05 B.
104.03 - Differing Site Conditions

Trial Use and Comment

- Notify the Engineer about any differing site condition allegations.
- Document all labor, equipment and material used by the contractor that is associated with a differing site condition allegation

Trial Use and Comment

SECTION 105-CONTROL OF WORK

I. INTRODUCTION:

This section Control of the Work can also be considered as Management of the work. It describes the relationships, and responsibilities of the parties necessary to complete the project within the terms and conditions of the contract. More importantly it describes the obligations of the parties. It largely forms the project expectations. It describes the right way.

a) <u>Forms:</u>

- See Construction Directive Memoranda:
- CD-2008-12
- CD-2009-01
- CD-2008-13
- See Forms:
- C-31, Subletting Request
- C-27, Project Claim Record

II. <u>2007 ROAD & BRIDGE SPECIFICATION and the 7R's</u>

105.01 - Notice to Proceed

Unless otherwise indicated in the Contract, the date of the Notice to Proceed will be the date of contract execution. The State Contract Engineer will contact the Contractor on the date of contract execution to inform him of such action. The State Contract Engineer will confirm this date in the Letter of Contract execution. This Letter of Contract Execution will be distributed to Department personnel involved in the administration of the Contract and to the Contractor. The Contractor shall begin work within 15 days of the date of contract execution unless the Notice to Proceed date is otherwise indicated in the Contract, in which case the Contractor shall begin work within 15 days of the date of the Notice to Proceed indicated in the Contract.

Contract Time will commence on the date of the Notice to Proceed. The Letter of Contract Execution will identify the Chief Engineer's authorized representative, who is responsible for written directives and changes to the Contract. The Engineer will contact the Contractor after notice of award to arrange a pre-construction conference.

In the event the Contractor, for matters of his convenience, wishes to begin work later than 15 days from the date of Notice to Proceed he shall make such a request in writing to the Engineer promptly after the execution of the Contract. If the Contractor's requested start date is acceptable to the Department, the Contractor will be notified in writing; however, the Contract fixed completion date will not be adjusted but will remain

Comment [60]: Right Time

Comment [61]: Right Way

Comment [62]: Right Time

Comment [63]: Right Time

Trial Use and Comment

binding. The Contractor's request to adjust the start date for the work on the Contract will not be considered as a basis for claim that the time resulting from Contractor's requested start date, if accepted by the Engineer, is insufficient to accomplish the work nor shall it relieve the Contractor of his responsibility to perform the work in accordance with the scope of work and requirements of the Contract. In no case shall work begin before the Department executes the Contract. The Contractor shall notify the Engineer at least 24 hours prior to the date on which he plans to begin the work.

105.02 - Pre-Construction Conference

Within 14 days after notification of award the Contractor shall attend a pre-construction conference scheduled by the Engineer to discuss the Contractor's planned operations for prosecuting and completing the work within the time limit of the Contract. At the pre-construction conference the Engineer and the Contractor will identify in writing the authorities and responsibilities of project personnel for each party. The pre-construction conference may be held simultaneously with the scheduling conference when the Engineer so indicates this in advance to the Contractor. When these are simultaneously held, the Contractor shall come prepared to discuss preparation and submittal details of the progress schedule in accordance with the requirements of the Contract.

The Engineer will be responsible for setting the conference agenda, conducting discussions and ensuring that minutes of the conference are taken and later timely distributed to all attendees. The pre-construction conference will be the venue to review the contract plans and documents. To that end, the conference agenda may include but not be limited to discussions on the general sequence of work, including the expected primary work tasks as defined by the Contractor, and proposed means and methods for the entire scope of work, potential problems or impacts, constructability issues, special considerations such as limitations and access issues, agreements with local agencies or governments, utility impacts or relocations including railroads, coordination with schedules of the utilities and subcontractors and associated work, sources and delivery of critical materials, submittals required by Contract documents including shop drawings, location of field office, labs, etc., environmental concerns including permits and erosion and siltation efforts, maintenance of traffic issues and EEO\DBE\MBE requirements.

The Contractor shall provide the Engineer with a list of all equipment available for use in the prosecution of the work on the contract at the pre-construction conference or no later than one week prior to the first monthly progress estimate. The make, model, size, capacity, and year of manufacture shall be listed for each piece of equipment. Where possible the Contractor shall provide this list in an electronic format. This list may take the form of the Contractor's fleet list of equipment. The Contractor shall provide the Engineer an updated list of equipment as changes occur.

Comment [64]: Right Time

Comment [65]: Right Time

Comment [66]: Right Time

Comment [67]: Right Time

Comment [68]: Right Way

Comment [69]: Right Location

Comment [70]: Right Time

Trial Use and Comment

105.03 – Authorities of Project Personnel

(a) Authority of Engineer

During prosecution of the work, the Engineer will answer all questions that may arise as to the quantity, quality, and acceptability of materials furnished and work performed; rate of progress of the work; interpretation of the plans and Specifications; acceptable fulfillment of the Contract by the Contractor; disputes and mutual rights between contractors; and compensation.

The Engineer has the authority to suspend the work wholly or in part if the Contractor has created conditions that are unsafe or fails to correct conditions that are unsafe for workers or the general public or fails to carry out the provisions of the Contract. The Engineer may also suspend work for such periods as he may deem necessary because of catastrophic or extraordinary weather in accordance with the definition of such in Section 108.04, conditions considered unsuitable for prosecution of the work, or any other condition or reason deemed to be in the public interest.

The Engineer may issue written clarifications or directives that either enhance or alter the Contract Documents. The Engineer may order such work as may be necessary to complete the Contract satisfactorily.

(b) Authority of Inspector.

Inspectors employed by the Department are authorized to inspect all work performed and materials furnished. Inspection may extend to all or any part of the work and to the preparation, fabrication, and manufacture of the materials to be used. The Inspector is not authorized to alter or waive the provisions of these Specifications or make changes in the plans.

The Inspector is not authorized to make final acceptance of the project, approve any operation or item, or act as foreman for the Contractor. However, the Inspector will have the authority to reject defective work and material and suspend work that is being improperly performed, subject to the concurrence of the Engineer. Such inspection shall not relieve the Contractor of any obligation to furnish acceptable materials or provide completed construction that is in accordance with the requirements of the Contracts.

The Inspector will exercise only such additional authority as may be delegated by the Engineer. The Engineer will advise the Contractor in writing of delegations of authority that will affect his operations.

105.04 – Gratuities

Comment [71]: Right Way

Comment [72]: Right Material

Comment [73]: Right Materials

Comment [74]: Right Material

Comment [75]: Right Way

Comment [76]: Right Material

Comment [77]: Right Way/Right Time/Right Location/Right Quantity

Trial Use and Comment

Gifts, gratuities, or favors shall not be given or offered by the Contractor to personnel of the Department. A gift, gratuity, or favor of any nature whatsoever or offer of such by the Contractor to personnel of the Department shall be a violation of this provision.

The Contractor shall not employ any personnel of the Department for any services without the prior written consent of the Engineer.

If the Engineer determines after investigation that the Contractor or the Contractor's employees, representatives, or agents of any person acting in his behalf have violated this provision, the Contractor may, at the discretion of the Chief Engineer, be disqualified from bidding on future contracts with the Department for a period of six months from the date of the Chief Engineer's determination of such a violation. Any implicated employees, agents, or representatives of the Contractor may be prohibited from working on any contract awarded by the Department for the period of disqualification.

105.05 - Character of Workers, Work Methods, and Equipment

(a) Workers

Comment [78]: Right Way

Workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special or skilled work shall have sufficient experience in such work and in the operation of equipment required to perform it properly and satisfactorily.

Any person employed by the Contractor or any subcontractor who, in the opinion of the Engineer, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, when directed in writing by the Engineer, be removed by the Contractor or subcontractor employing the person and shall not be employed again on any portion of the work without the written approval of the Engineer. If the Contractor fails to remove the person or furnish suitable and sufficient personnel for proper prosecution of the work, the Engineer may withhold all monies that are or may become due the Contractor and may suspend the work until the Contractor has complied with the Engineer's directive.

(b) Equipment

Comment [79]: Right Way

Equipment shall be of sufficient size and in such mechanical condition as to comply with the requirements of the work and produce a satisfactory quality of work. Equipment shall be such that no damage to the roadway, adjacent property, other highways or to danger to the public will result from its use. The Engineer may order the removal and require replacement of unsatisfactory equipment.

(c) Work Methods

Comment [80]: Right Way

Trial Use and Comment

When methods and equipment to be used by the Contractor are not prescribed in the Contract, the Contractor is free to use whatever methods or equipment he feels will accomplish the contract work in conformity with the requirements of the Contract.

When the Contract specifies that construction be performed by the use of particular methods and equipment, they shall be used unless others are authorized by the Engineer. If the Contractor desires to use a different method or type of equipment, he may request permission from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and equipment he proposes to use and an explanation of the reasons for desiring to make the change. If permission is not given, the Contractor shall use the specified methods and equipment. If permission is given, it will be on the condition that the Contractor shall be fully responsible for producing construction work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the Engineer determines that the work produced does not conform to the requirements of the Contract, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining construction with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of the specified quality or take such other corrective action as the Engineer may direct. No change will be made in the basis of payment for the construction items involved or the contract time limit as the result of authorizing or denying a change in methods or equipment under these provisions.

105.06 – Subcontracting

Comment [81]: Right Way

No portion of the Contract shall be subcontracted or otherwise disposed of without the written consent of the District Administrator or his designee.

The Contractor shall perform with his own organization work amounting to not less than 30 percent of the original contract value unless otherwise noted in the Contract.

The Contractor shall not subcontract any part of the contract work to a contractor who is not prequalified with the Department in accordance with the requirements of Section 102.01, unless otherwise indicated in the Contract. This restriction does not apply to contract specialty items, consultants, manufacturers, suppliers, or haulers. Consent to subcontract or otherwise dispose of any portion of the contract work shall not relieve the Contractor of any responsibility for the fulfillment of the entire Contract.

105.07 - Cooperation of Contractor

The Contractor shall give the work the constant attention necessary to facilitate quality and progress and shall fully cooperate with the Engineer, Inspector, and other contractors involved in the prosecution of the work. If any portion of a project is located within the limits of a municipality, military installation, or other federally owned property; the Contractor shall cooperate with the appropriate officials and agents in the prosecution of the work to the same extent as with the Department.

Trial Use and Comment

The Contractor shall have on the project at all times during prosecution of work a competent Superintendent capable of reading and understanding the plans and Specifications and experienced in the type of work being performed who shall receive instructions from the Engineer or his authorized representatives. The Superintendent shall have full authority to execute the orders and directions of the Engineer without delay and supply promptly such materials, equipment, tools, labor, and incidentals as may be required.

105.08 - Cooperation With Regard to Utilities

Comment [82]: Right Location

The adjustment of utilities consists of the relocation, removal, replacement, rearrangement, reconstruction, improvement, disconnection, connection, shifting, or altering of an existing utility facility in any manner.

Existing utilities within the Department's knowledge at the design stage of the project will be indicated on the plans. Where possible, arrangements for adjusting these utilities will be made by the Department prior to project construction. Existing private and public utilities that require adjustment will be adjusted by the utility owner or if denoted in the Contract, shall be adjusted by the Contractor as a contract item. The new location of such utilities will not normally be shown on the plans. Some utilities may remain or be adjusted within the construction limits simultaneously with project construction operations.

The Contractor shall coordinate project construction with planned utility adjustments and take all necessary precautions to prevent disturbance of the utility facilities. The Contractor shall report to the Engineer any failure on the part of the utility owner to cooperate or proceed with the planned utility adjustments.

The Contractor shall perform contract utility work in a manner that will cause the least inconvenience to the utility owner and those being served by the utility owner.

Existing, adjusted, or new utility facilities that are to remain within the right of way shall be properly protected by the Contractor to prevent disturbance or damage resulting from construction operations. If during prosecution of the work the Contractor encounters an existing utility that requires adjustment he shall not interfere with the utility but shall take the proper precautions to protect the facility and shall promptly notify the Engineer of the need for adjustment.

Comment [83]: Right Way

If the Contractor desires the temporary or permanent adjustment of utilities for his own benefit, he shall conduct all negotiations with the utility owners and pay all costs in connection with the adjustment.

Comment [84]: Right Payment

When delays, inconvenience, or damage sustained by the Contractor are deemed by him to be attributable to interference by utility appurtenances, or the operation of moving

Trial Use and Comment

the same, written requests from the Contractor for an extension of time will be considered provided there has been a delay to either the critical path or the controlling item of work. Such delays shall be demonstrated by an impact analysis of the Contractor's schedule.

If it is determined that interference by utility appurtenances caused a delay of such magnitude or otherwise altered project operations so as to increase significantly the Contractor's cost of performing the work, the Engineer will consider additional compensation limited to the actual costs incurred by the Contractor. Actual costs will not include unabsorbed office overhead unless the delay or impact adversely affects the critical path or controlling item of work to such extent that the fixed completion date is delayed. Prior to the Engineer's review, the Contractor shall present sufficient documentation to substantiate fully the request for additional compensation. Such documentation shall be furnished in sufficient detail as requested by the Engineer. Nothing herein shall be construed as requiring the payment of additional compensation.

105.09 - Cooperation Among Contractors

The Department may at any time contract or approve concurrent contracts for performance of other work on, near, or within the same geographical area of the work specified in an existing contract. Contractors shall not impede or limit access to such work by others.

When separate contracts are awarded within the limits of one project, contractors shall not hinder the work being performed by other contractors. Contractors working on the same project shall cooperate with each other. In case of dispute, the Engineer will be the referee, and his decision will be binding on all parties.

When contracts are awarded to separate contractors for known concurrent construction in a common area, the contractors, in conference with the Engineer, shall establish a written joint schedule of operations. The schedule shall be based on the limitations of the individual contracts and the joining of the work of one contract with the others. The schedule shall set forth the approximate dates and sequences for the several items of work to be performed and shall ensure completion within the contract time limit. The schedule shall be submitted to the Engineer for review and approval no later than 30 days after the award date of the later contract and prior to the first monthly progress estimate. The schedule shall be agreeable to, signed by, and binding on each contractor. The Engineer may allow modifications of the schedule when benefit to the contractors and the Department will result.

Any modification of the schedule shall be in writing, mutually agreed to and signed by the contractors, and shall be binding on the contractors in the same manner as the original agreement.

Comment [85]: Right Time

Comment [86]: Right Documentation

Comment [87]: Right Payment

Comment [88]: Right Location

Comment [89]: Right Time

Trial Use and Comment

If the contractors fail to agree on a joint schedule of operations, they shall submit their individual schedules to the Engineer, who will prepare a schedule that will be binding on each contractor.

The joint schedule and any modification thereof shall become a part of each contract involved. The failure of any contractor to abide by the terms of the joint schedule will be justification for declaring the contractor in default of his Contract.

Each contractor shall assume all liability, financial or otherwise, in connection with his Contract and shall protect and save harmless the Commonwealth from any and all damages and claims that may arise because of any inconvenience, delay, or loss he experiences as a result of the presence and operations of other contractors working in or near the work covered by his Contract. He shall also assume all responsibility for any of his work not completed because of the presence or operation of other contractors.

Except for an extension of the contract time limit, the Department will not be responsible for any inconvenience, delay, or loss experienced by the Contractor as a result of his failure to gain access to the work at the time contemplated. When the failure to gain access is not due to any fault or negligence of the Contractor, an extension of the contract time limit will be allowed on the basis of the amount of time delayed.

Comment [90]: Right Time

The Department will not assume any responsibility for acts, failures, or omissions of one contractor that delay the work of another except as provided herein.

105.10 - Plans and Working Drawings

(a) General

The Contractor will be supplied with two copies of the executed Contract. The Department's *Road and Bridge Specifications* and the Department's *Road State and Bridge Standards* will be available for purchase by the Contractor from the office of the Contract Engineer.

(b) Plans

Plans will be furnished to the Contractor without charge as follows:

Original Contract Amount in Dollars		Number of Plan Sets	
From	**To**	**Full Size**	**Half Size**
0	1,999,999	4	6
2,000,000	4,999,999	6	8
5,000,000	9,999,9	8	10

Trial Use and Comment

	99	
10,000,000+	10	10

Plan revisions issued while the project is under construction will be furnished to the Contractor in the same sizes and number

The Contractor shall keep one complete set of plans, standard drawings, contract assemblies, and Specifications available on the project at all times. For maintenance projects, certain sign projects, and other projects having no field office or on which the Contractor has no office, the Contractor shall keep one complete set of plans, contract assemblies, and Specifications with him while prosecuting the work. In the event items of work are required as per the Standard Drawings, the Contractor shall also keep the appropriate Standard Drawings on the project during the performance of that work.

Plans consisting of general drawings and showing such details as are necessary to give a comprehensive understanding of the work specified will be furnished by the Department. Except as otherwise shown on the plans, dimensions shown on the plans are measured in the respective horizontal or vertical planes. Dimensions that are affected by gradients or vertical curvatures shall be adjusted as necessary by the Contractor to accommodate actual field conditions and shall be specifically denoted as "field adjusted" on the working drawings. Failure on the part of the Contractor to so denote field adjustments on the working drawings shall not relieve the Contractor of the responsibility to accommodate and incorporate such existing conditions into the finished work.

(c) Working Drawings

Comment [91]: Right Way

The Contractor shall furnish working drawings to the extent, detail and number as may be required by the Contract requirements. The Contractor shall submit to the Department for review nine sets of required working drawings unless otherwise indicated in the Contract requirements. Working drawings and submittals shall be identified by the complete state project and job designation number, as well as the federal project number if applicable. Items or component materials shall be identified by the specific contract item number and Specification reference in the Contract. Any changes from the requirements of the Contract shall be specifically denoted, together with justification, and submitted to the Engineer for review. Working drawings shall be submitted in sufficient time to allow for review, discussion and correction prior to the beginning of the work they reference. Work shall not be performed or materials ordered prior to the completion of the Department's review of the working drawings.

Reviewed working drawings will be returned to the Contractor within 30 days from the date of receipt by the Department. If a railroad, municipality, or other entity as specified in the Contract or on the plans is required to review the working drawings, the reviewed working drawings will be returned within 45 days from the date of

Comment [92]: Right Time

Comment [93]: Right Time

Trial Use and Comment

receipt by the Department. If the working drawings are not returned by the time specified, no additional compensation will be allowed except that an extension of time in accordance with the requirements of Section 108.04 will be considered if the work element detailed by the working drawings is on the project critical path or involves a controlling item of work. Three sets of working drawings marked with any suggested modifications or comments will be returned to the Contractor. The other sets will be retained by the Department.

The Department's review of the Contractor's working drawings will relate to conformance to the requirements of the Contract. The review will not relieve the Contractor from responsibility for errors in the working drawings or from complying with the requirements of the Contract for a fully functional finished work item as specified or designed.

Deviations from the Contract requirements initiated by the Contractor shall be requested in writing and clearly identified on the working drawings. Explicit supporting justification shall be furnished specifically describing the reason for the requested deviations as well as any impact such deviations shall have on the schedule of work. Failure to address time or other impacts associated with the Contractor's request will be cause for rejection of the Contractor's request. Deviations from the Contract requirements shall not be made unless authorized by the Engineer. If authorized by the Engineer, such authorization shall not relieve the Contractor from the responsibility for complying with the requirements of the Contract for a fully functional finished work item as specified or designed.

If working drawings detailing a change(s) initiated by the Contractor require more than two resubmissions or revisions, the cost of additional reviews by the Department or its designated representative(s) will be assessed to the Contractor.

Upon completion of the requested work, working drawings indicating the actual as-constructed field conditions, if required, shall be supplied to the Department.

The cost of working drawings furnished by the Contractor shall be included in the cost of appropriate contract items.

Comment [94]: Right Payment

The Contractor may authorize the fabricator in writing to act for him in matters relating to working drawings. Such authorization shall have the force and effect of any other representative of the Contractor's organization.

Comment [95]: Right Documentation

(1) Steel Structures

Working drawings for steel structures, including metal handrails, shall consist of shop detail, erection, and other working drawings showing details, dimensions, sizes of units, and other information necessary for the fabrication and erection of metal work. Such drawings shall be signed and sealed by a

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Professional Engineer, holding a valid license to practice engineering in the Commonwealth of Virginia.

(2) Falsework

Working drawings for falsework supporting a bridge superstructure shall be signed and sealed by a Professional Engineer, holding a valid license to practice engineering in the Commonwealth of Virginia.

(3) Concrete Structures and Prestressed Concrete Members

Working drawings for concrete structures and prestressed concrete members shall provide such details as required for the successful prosecution of the work and which are not included in the plans furnished by the Department. Drawings shall include plans for items such as prestressing strand details and elongation calculations, location of lift points, falsework, bracing, centering, form work, masonry, layout diagrams and bending diagrams for reinforcing steel when necessary or when requested. Such drawings shall be signed and sealed by a Professional Engineer, holding a valid license to practice engineering in the Commonwealth of Virginia.

(4) Lighting, signal and pedestal poles, overhead and bridge mounted sign structures, breakaway support systems, anchor bolts, framing units, panels, and foundations.

Prior to fabrication or construction, the Contractor shall submit for review one original and six copies of each working drawing and design calculation for lighting, signal and pedestal poles, overhead and bridge mounted sign structures, breakaway support systems, anchor bolts, framing units, panels, and foundations. All sheets of these submittals shall include the Professional Engineer's signature and seal. Certification for foundations will be required only when the designs are furnished by the Contractor. The designs shall be in accordance with the specific editions of the AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals* as required in Section 700. Such designs shall be signed and sealed by a Professional Engineer, holding a valid license to practice engineering in the Commonwealth of Virginia.

(5) Reinforced Concrete Pipe

When specified, and prior to manufacture of reinforced concrete pipe, the Contractor shall furnish to the Department a certification of the acceptability of the design of such pipe, as determined from a review that has been signed and sealed by a Professional Engineer holding a valid license to practice engineering in the Commonwealth of Virginia. Such certification shall cover all

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design data, supporting calculations and materials. Pipe designs previously certified or approved by the Department will not require recertification.

105.11 - Conformity with Plans and Specifications

Values for materials to be used in the work shall conform to the specified values or range of values specified in the Contract. Less than complete conformity may be tolerated if obtaining exact or complete conformity would not be feasible and if authorized by the Engineer.

Permissible tolerances for the elevation of subgrade and finished grade, and for the thickness of the various courses of pavement structure are specified in these Specifications. If permissive tolerances are exceeded or if consistent deviations from the plans or abrupt changes in grade occur, even though within the tolerances, the affected areas shall be reconstructed to conform to the specified tolerance and provide a smooth riding surface. When it is not feasible to reconstruct the areas, payment will be made in accordance with the requirements of the applicable specification for each material placed or adjusted in accordance with the provisions of Section 105.18.

When the plans require the finished surface to tie into any structural item whose elevation is fixed, the elevation of the finished surface must coincide with the elevation of the structural item.

105.12 - Coordination of Plans, Standard Drawings, Specifications, Supplemental Specifications, Special Provisions, and Special Provision Copied Notes

The plans, Standard Drawings, these Specifications, supplemental specifications, special provisions, special provision copied notes, and supplementary documents are parts of the Contract. These Contract documents are defined in Section 101 - Definitions. A requirement occurring in one shall be as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In case of a discrepancy, the following order of priority will apply, with the highest governing item appearing first and the least governing item appearing last:

(a) Special provision copied notes. The pay items and pay units listed in the proposal have the same status as special provision copied notes.

(b) Special provisions

(c) Plans

(d) Supplemental Specifications.

(e) Specifications

Comment [96]: Right Material

Comment [97]: Right Location

Comment [98]: Right Payment

Comment [99]: Right Location

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(f) Standard Drawings. Calculated dimensions, unless obviously incorrect, will govern over scaled dimensions.

The Contractor shall not take advantage of any obvious or apparent error or omission in the plans or Specifications. If the Contractor discovers an error or omission, he shall immediately notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the Contract.

105.13—State Force Construction Surveying

(a) **General Description:**

This work shall consist of the Department performing all surveying and providing surveying and stakeout sketches and information as detailed herein for the successful prosecution of work as indicated on the plans and as directed by the Engineer. Stakeout work will be in accordance with the details and requirements of the Department's Survey Manual and the provisions herein. Survey services will be provided to the extent detailed herein for Construction and for Minimum Plan projects.

(b) **Request for Survey Services:**

Once the Contractor requests survey services, the Department will begin the requested work within 3 working days. The Contractor shall not expect the Department survey party to work in the field during adverse weather conditions that could be detrimental to the survey equipment or paperwork, therefore the Contractor shall plan the need for such services accordingly.

It shall be the Contractor's responsibility to preserve all Department furnished centerline or baseline controls, references and location benchmarks. After initial stakeout, an hourly charge equal to the current hourly rate for Department survey services per district will be billed to the Contractor for resetting stakes where the cause for the resetting of such stakes is due to the fault of the Contractor or his operations. This rate will also apply to travel time to and from the project.

If the Contractor requests stakes after the initial staking and he is not ready to accommodate such work, the Contractor will be billed the hourly rate for Department survey services per district measured in travel time to and from the project. Such fees will be billed to the Contractor on the next monthly estimate.

(c) **Contractor Responsibility for Examination of Data:**

It shall be the responsibility of the Contractor to examine all surveying work provided by the Department for accuracy. Should a disagreement involving the accuracy of stakeout or survey work arise during construction, the Contractor shall within 24 hours

Comment [100]: Right Way

Comment [101]: Right Time

Comment [102]: Right Payment

Comment [103]: Right Payment

Comment [104]: Right Time

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provide written notice to the Engineer, precisely describing and documenting the discrepancy. The Engineer will determine the validity of the Contractor's assertion in the notice, respond to the Contractor within 3 working days of receipt of the Contractor's notice and provide direction on how to proceed. The Engineer will give consideration to an extension of time in accordance with the requirements of Section 108.04 of the Specifications or provide additional compensation as deemed appropriate after documentation and evidence to the Engineer's satisfaction if the following occurs:

1. There are delays to the project as a result of inaccurate stakeout information provided or a controlling item of work by the Department where such delays adversely impact the critical path of the work or,

2. where extra expense is encountered by the Contractor to correct elements of defective survey work by the Department, and

3. where written notice is provided by the Contractor within the timeframe specified. Failure to furnish written notice of such a discrepancy within the timeframe specified will invalidate any later claim for time impact or costs by the Contractor unless specifically waived by the Engineer.

(d) **Survey Services Furnished:**

1. **Construction (C) Projects:**

a. **Survey Stakeout Descriptions:**

Unless otherwise stated the Department will provide required horizontal and vertical controls for the proper construction stakeout of the project. The Contractor shall preserve all horizontal and vertical controls furnished by the Department.

The following surveying work will be performed by the Department:

(1) **Digital Terrain Model (DTM) and Construction Cross-Sections:** Original location Digital Terrain Model (DTMs) will be provided by the Department and will serve as a basis of payment for earthwork. The Contractor shall be responsible for taking construction DTMs or cross-sections of areas that, in their determination, do not agree with the Department furnished original location DTMs. The Contractor shall submit the disputed DTM information to the Engineer for verification prior to any excavation by the Contractor in these alleged areas of change. The DTM information furnished by the Department and submitted by the Contractor shall be compatible to the Department's current DTM format.

(2) **Borrow Pits:** All borrow pit DTM's or cross-sections, originals and finals, will be secured by the Department. The Contractor is encouraged to also secure DTM's

Comment [105]: Right Time

Comment [106]: Right Time/Right Payment

Comment [107]: Right Way

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or cross-sections of borrow areas. A claim of discrepancy in borrow volume will not be considered by the Engineer unless survey data was obtained and submitted by the Contractor to substantiate his claim.

(3) **Horizontal and Vertical Control for Bridges:** Certified plats, field notes, coordinates and computations will be furnished to the Contractor by the Department prior to the Contractor beginning work on these structures.

(5) **Horizontal and Vertical Controls for all Box Culverts, all Pipe Culvert Installations (including single and multiple line installations) with total hydraulic openings equivalent to 12.6 square feet and larger, and for all closed systems such as storm sewers, and sanitary sewers regardless of size:** The Department will stake all such installations. Certified Plats will be furnished to the Contractor prior to the Contractor beginning work on these culvert structures. The notes, coordinates, or computations used to support the platted information will be furnished to the Contractor with the certified plat. For the purposes of identifying those pipe culvert installations please refer to the areas (hydraulic openings) shown in the PB-1 Standards for the respective sizes of pipes specified on the plans. Where multiple lines of pipes are shown, the areas of the pipe sizes will apply to the total areas of the number of lines specified in the plans. For box culverts refer to the sizes shown in the BC-1 Standards to determine areas of total hydraulic opening.

(6) **Horizontal and Vertical Control for Pipe Culvert Installations (including single and multiple line installations) having total hydraulic openings equivalent to 3.1 square feet and up to 12.5 square feet:** The Department will be responsible for staking horizontal and vertical control for pipe culvert installations having a total hydraulic opening equivalent to 3.1 square feet and up to 12.5 square feet. Sketches will be furnished to the Contractor prior to the Contractor beginning work on these culvert structures. For the purposes of identifying those pipe culvert installations please refer to the areas (hydraulic openings) shown in the PB-1 Standards for the respective sizes of pipes specified on the plans. Where multiple lines of pipes are shown, the areas of the pipe sizes shall apply to the total areas of the number of lines specified in the plans. For box culverts refer to the sizes shown in the BC-1 Standards to determine areas of total hydraulic opening.

(7) **Horizontal and Vertical Control for additional centerlines or baselines for roadways, ramps, loops and connections:** Upon written request from the Contractor the Department will provide horizontal and vertical controls for additional centerlines or baselines for roadways, ramps, loops and connections.

(8) **Grading and paving construction:** The Department will provide fine grade or other grade stakes required for the construction of the project as the work progresses except as stated herein.

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Fine grade stakes will be set on all projects on which the plans show a definite grade line. Fine grade hubs will be set on at least one side with distances and grades referenced to the finished centerline grade. Typically, on curves, the Department will provide the distances and elevations to each edge of pavement and centerline through the transitions and the distances and elevations to the edge of pavement only (straight-line super) through full super portions of the curve.

On projects where grading and paving is performed under the same contract, only one set of fine grade stakes will be provided to the Contractor. Fine grade stakes may be used for fine grade and paving grade.

On Secondary Road projects, fine grade stakes will be provided by the Department only on those projects having curb and gutter or as directed by the Engineer.

Special design ditches will be staked with an offset and cut to the centerline of the ditch. Radius points for pavement flares at connections will be staked only if requested by the Contractor.

The Department will set all slope stakes. Upon written request from the Contractor cut\fill sheets for slope stakes will be furnished by the Department to the Contractor within 3 working days of the survey party's arrival at the project site or a timeframe agreed upon by the Contractor and the Engineer after reviewing the length and complexity of the project.

(9) **Right of way and boundary stakeout affecting property ownership:** Right of Way will be staked by the Department prior to the start of the project. Right of way stakes will be placed at a minimum of 100-foot intervals on each side of the roadway or as directed by the Engineer and the stakes will be marked with both the station and offset back to centerline. All final boundary stakeout will be performed by the Department's survey party.

(10) **Setting right-of-way monuments:** Final right of way monumentation will be performed by the Department in accordance with the following:

a) RM-1: The Department will furnish and install RM-1 right-of-way monuments in accordance with the Road and Bridge Standards.

b) RM-2: The Department will furnish and install RM-2 right-of-way monuments and optional locator posts, including the required caps, in accordance with the Road and Bridge Standards.

c) Other monumentation: The Department will determine if an alternative form of permanent monumentation will be used if RM-1 or RM-2 monuments are unsuitable for marking the right-of-way at various locations. The Department

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will indicate this alternative monument usage on the final as-built plan in accordance with the Department's Survey Manual.

Where available, electronic data files along with paper sketches and drawings will be furnished by the Department when requested in writing by the Contractor. All electronic data files furnished to the Contractor will be in the format of the Department's current computer hardware and software or a format fully compatible with such hardware and software.

Additional surveying work and supplemental layout work shall be performed by the Contractor as needed to successfully complete the work. The Contractor shall provide and protect temporary construction benchmarks within the construction limits. Temporary construction benchmarks shall be located not farther than 500 feet apart for the total length of the project or as indicated on the plans. Temporary construction benchmarks that are disturbed during construction operations shall be reestablished by the Contractor at no additional cost to the Department. All drawings, field notes, and computations from such survey work performed by the Contractor shall be submitted to the Engineer.

2. **Minimum Plan (M) Projects:**

a. **Survey Stakeout Descriptions:**

Unless otherwise stated, the Department will provide required horizontal and vertical control for the proper construction stakeout of the project. The Contractor shall preserve all horizontal and vertical controls furnished by the Department.

The following surveying work will be performed by the Department:

(1) **Digital Terrain Model (DTM) and Construction Cross-Sections:** "M" projects are based on plan quantities; therefore DTM and construction cross-sections are not required, except for borrow pits.

Should the Engineer determine at any time that an actual measurement is warranted, the Department will make the necessary measurement in the field.

(2) **Borrow Pits:** All borrow pit DTM's, originals and finals, will be secured by the Department. The Contractor is encouraged to also secure DTM's or cross-sections of borrow areas. A claim of discrepancy in borrow volume will not be considered by the Engineer unless survey data was obtained by the Contractor to substantiate his claim.

(3) **Horizontal and vertical control for bridges:** Certified plats, field notes, coordinates and computations will be furnished to the Contractor prior to the Contractor beginning work on these structures.

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(4) **Horizontal and Vertical Control for all Box Culverts, all Pipe Culvert Installations (including single and multiple line installations) with a total hydraulic openings equivalent to 12.6 square feet and larger, and for all closed systems such as storm sewers, and sanitary sewers regardless of size:** The Department will stake all such installations. Certified Plats for these stakeouts will be furnished to the Contractor prior to the Contractor beginning work on these culvert structures. The notes, or computations used to support the platted information will be furnished to the Contractor with the certified plat. For the purposes of identifying those pipe culvert installations please refer to the areas (hydraulic openings) shown in the PB-1 Standards for the respective sizes of pipes specified on the plans. Where multiple lines of pipes are shown, the areas of the pipe sizes will apply to the total areas of the number of lines specified in the plans. For box culverts refer to the sizes shown in the BC-1 Standards to determine areas of total hydraulic openings.

(5) **Horizontal and Verticals Control for Pipe Culvert installations (including single and multiple line installations) having total hydraulic openings equivalent to 3.1 square feet and up to 12.5 square feet:** The Department will be responsible for staking horizontal and vertical controls for pipe culvert installations having a total hydraulic opening equivalent to 3.1 square feet and up to 12.5 square feet. Sketches will be furnished to the Contractor prior to the Contractor beginning work on these culvert structures. For the purposes of identifying those pipe culvert installations please refer to the areas (hydraulic openings) shown in the PB-1 Standards for the respective sizes of pipes specified on the plans. Where multiple lines of pipes are shown, the areas of the pipe sizes will apply to the total areas of the number of lines specified in the plans. For box culverts refer to the sizes shown in the BC-1 Standards to determine areas of total hydraulic opening.

(6) **Grading and paving construction:** The Department will provide fine grade or other grade stakes required for the construction of all projects except as stated herein as the work progresses. Slope stakes are not required on “M” projects

Fine grade stakes will be set on all projects on which the plans show a definite grade line. Fine grade hubs will be set on at least one side with distances and grades referenced to the finished centerline grade. Typically, on curves, the Department will provide the distances and elevations to each edge of pavement and centerline through the transitions and the distances and elevations to the edge of pavement only (straight-line super) through full super portions of the curve.

On projects where grading and paving is performed under the same contract, only one set of fine grade stakes will be provided by the Department.. Fine grade stakes may be used for fine grade and paving grade.

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On Secondary Road projects, fine grade stakes will be provided by the Department only on those projects having curb and gutter or as directed by the Engineer.

Special design ditches will be staked with an offset and cut to the centerline of the ditch. Radius points for pavement flares at connections will be staked only if requested by the Contractor.
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(7) **Right of way and boundary stakeout affecting property ownership:** Right of Way will be staked by the Department prior to the start of the job. Right of way stakes will be placed at a minimum of 100-foot intervals on each side of the roadway or as directed by the Engineer and the stakes will be marked with both the station and offset back to centerline. All final boundary stakeout will be performed by the Department survey party.

(8) **Setting right-of-way monuments:** Final right of way monumentation will be performed by the Department in accordance with the following:

a) RM-1: The Department will furnish and install RM-1 right-of-way monuments in accordance with the Road and Bridge Standards.

b) RM-2: The Department will furnish and install RM-2 right-of-way monuments and optional locator posts, including the required caps, in accordance with the Road and Bridge Standards.

c) Other monumentation: The Department will determine if an alternative form of permanent monumentation will be used if RM-1 or RM-2 monuments are unsuitable for marking the right-of-way at various locations. The Department will indicate this alternative monument usage on the final as-built plan in accordance with the Department's Survey Manual.

105.14 - Maintenance During Construction

Comment [108]: Right Way

The Contractor shall prosecute his work so as to avoid obstructions to traffic to the greatest extent practicable. The Contractor shall provide for the safety and convenience of the general public and residents along the roadway and the protection of persons and property.

Highways closed to traffic shall be protected by barricades and other warning devices as required by the Engineer. Barricades and warning devices shall be illuminated where required during periods of darkness and low visibility. The Contractor shall erect warning devices in advance of a location on the project where operations or

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obstructions may interfere with the use of the road by traffic and at all intermediate points where the new work crosses or coincides with an existing roadway. The Contractor shall maintain sign faces and reflective surfaces of warning devices in a clean and visible condition. The Contractor shall cover or remove signs when the messages thereon are not applicable. Barricades, warning signs, lights, temporary signals, and other protective devices shall conform to the requirements of Section 512.

The Contractor shall maintain the work from the beginning of construction operations until final acceptance. Maintenance shall be inherent to the continuous and effective work prosecuted day by day with adequate equipment and forces to such end that the roadway and structures are sustained in a safe and satisfactory condition at all times.

When a Contract specifies placing a course on another course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade in accordance with the contract requirements during all construction operations.

The road shall be kept open to all traffic while undergoing improvements, unless otherwise permitted in the Contract. The Contractor shall keep the portion of the project being used by public, pedestrian, and vehicular traffic in such condition that traffic will be safely and adequately accommodated. However, removal of snow and control of ice on roads open to public travel will be performed by the Department.

The Contractor shall bear all costs of performing maintenance work before final acceptance and of constructing and maintaining necessary approaches, crossings, intersections, and other features without direct compensation except as provided for herein. When the Contractor confines his operation to the surface of the roadway and reasonable width of the shoulder and the surface is disturbed or damaged by his operations or equipment, he shall be responsible for the restoration and maintenance of the surface that is disturbed or damaged.

Comment [109]: Right Payment

The Contractor shall keep the portions of the road being used by the public free from irregularities and obstructions that could present a hazard or annoyance to traffic. When directed by the Engineer, allaying of dust shall be performed and paid for in accordance with the requirements of Section 511. Holes in hard surface pavements shall be filled with approved asphalt patching material.

Comment [110]: Right Material

(a) **Detours:** Detours may be indicated on the plans or in the special provisions or may be used with the approval of the Engineer. Unless otherwise designated in the contract, the Contractor will furnish and erect all directional markings for through traffic on off-project detours authorized or requested by the Engineer. Detours over existing state roads will be designated, marked, and maintained by the Department. If any project is located wholly or in part within the corporate limits of a municipality and through traffic is to be detoured at the request of the municipality, the municipality will provide and maintain the detours within the corporate limits and will furnish and erect all directional markings. The provision of detours and marking of alternate routes will not relieve the Contractor of the responsibility for ensuring the safety of the public or from complying

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with any requirements of these Specifications affecting the rights of the public within his contract limits, including those concerning lights and barricades. Maintenance of all other detours shall be the responsibility of the Contractor.

Right of way for temporary highways, diversion channels, sediment and erosion control features or bridges required by these provisions will be furnished by the Department.

(b) **Maintenance of Traffic During Suspension of Work:** During any suspension of work, the Contractor shall temporarily open to traffic such portions of the project and temporary roadways as may be agreed upon by the Contractor and Engineer.

(c) **Flagging Traffic:** Certified flaggers shall be provided in sufficient number and locations as necessary for control and protection of vehicular and pedestrian traffic in accordance with the requirements of the *Virginia Work Area Protection Manual (VWAPM)*. Flaggers shall be able to communicate to the traveling public in English while performing the job duty as a flagger at the flaffer station. Flagger shall use sign paddles to regulate traffic in accordance with the requirements of the *VWAPM*.

Certification for flaggers will be awarded upon a candidate's satisfactory completion of an examination. Certification cards shall be carried by flaggers while performing flagging duties. Flaggers found not to be in possession of their certification card shall be removed from the flagging site and operations requiring flagging will be suspended by the Engineer. Further, flaggers performing duties improperly will have their certifications revoked.

(d) **Delays:** Unless indicated in the Contract Documents or otherwise approved by the Engineer, two-way traffic shall be maintained at all times. The Contractor shall not stop traffic without permission of the Engineer.

If one-way traffic is approved, the Contractor shall provide flaggers to direct the traffic. When specified in the Contract as a pay item, pilot vehicles shall be furnished in accordance with the requirements of Section 512. Upon request from the Contractor and where deemed appropriate by the Department, the Department will install traffic signals that may be used for the control of one-way traffic. The Contractor shall pay the costs of installation, electrical service, maintenance or repair work, and a predetermined rental charge per day for the signals and removal when no longer needed.

(e) **Connections and Entrances:** Connections with other roads and public and private entrances shall be kept in a reasonably smooth condition at all times.

Stabilization or surfacing material shall be applied to connections and entrances. When specified in the Contract, such material will be paid for at the contract unit price for the specific material. Where such material is not specified in the Contract and determined to be required by the Engineer, the cost for stabilization or surfacing material will be handled in accordance with the provisions of Section 109.05.

Comment [111]: Right Payment

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The Contractor shall schedule construction operations so that approved continuous access is provided for all property adjacent to the construction when the property is shown on the plans to require access. When frontage roads are shown on the plans, they shall be constructed prior to the closing of any access routes unless other approved access is provided and is acceptable to the property owner.

Connections or entrances shall not be disturbed by the Contractor until necessary. Once connections or entrances have been disturbed, they shall be maintained and completed as follows:

1. **Connections:** Connections that had an original paved surface shall be brought to a grade that will smoothly and safely accommodate vehicular traffic through the intersection, using temporary pavement as soon as practicable after connections are disturbed. Connections that had an original unpaved surface shall be brought to a grade that will smoothly and safely accommodate vehicular traffic through the intersection, using either the required material or a temporary aggregate stabilization course that shall be placed as soon as practicable after connections are disturbed.

If there are delays in prosecution of work for connections, connections that were originally paved shall have at least two lanes maintained with a temporary paved surface. Those that were not originally paved shall be maintained with a temporary aggregate stabilization course.

2. **Entrances:** Entrances shall be graded concurrently with the roadway with which they intersect. Once an entrance has been disturbed, it shall be completed as soon as is practicable, including placing the required base and surface course or stabilization. If the entrance must be constructed in stages, such as when there is a substantial change in the elevation of the roadway with which it intersects, the surface shall be covered with a temporary aggregate stabilization course or other suitable salvaged material until the entrance can be completed and the required base and surface or stabilization course can be placed.

(f) **Grading Operations:** When the Contractor elects to complete the rough grading operations for the entire project or exceed the length of one full day's surfacing operations, the rough grade shall be machined to a uniform slope from the top edge of the existing pavement to the ditch line.

When the surface is to be widened on both sides of the existing pavement, construction operations involving grading or paving shall not be conducted simultaneously on sections directly opposite each other.

The surface of pavement shall be kept free from soil and other materials that might be hazardous to traffic. Prior to opening of new pavement to traffic, shoulders shall be roughly dressed for a distance of 3 feet from the edge of the paved surface.

Comment [112]: Right Time

Comment [113]: Right Time

Comment [114]: Right Time

Comment [115]: Right Location

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(g) **Obstruction Crossing Roadways:** Where the Contractor places obstructions such as suction or discharge pipes, pump hoses, steel plates or any other obstruction that must be crossed by vehicular traffic, they shall be bridged as directed by the Engineer at the Contractor's expense. Traffic shall be protected by the display of warning devices both day and night. If operations or obstructions placed by the Contractor damage an existing traveled roadway, the Contractor shall cease operations and repair damages to the roadway at no additional cost to the Department.

Comment [116]: Right Payment

(h) **Patching Operations:** Where existing hydraulic cement concrete pavement is to be patched, the operation of breaking and excavating old pavement shall extend for a distance of not more than two miles. Patching shall be coordinated with excavating so that an area of not more than one-half mile in which excavated patches are located shall be left at the end of any day's work. Necessary precautions shall be taken to protect traffic during patching operations.

Comment [117]: Right Location

(i) **Temporary Structures:** The Contractor shall construct, maintain, and remove temporary structures and approaches necessary for use by traffic. Unless otherwise specified in the Contract, the cost of these operations shall be included in pay items for the new structure. After new structures have been opened to traffic, temporary structures and approaches shall be removed. The materials contained therein shall remain the property of the Contractor.

The proposed design of temporary structures shall be submitted to the Engineer prior to the beginning of construction in accordance with the requirements of Section 105.10.

(j) **Failure To Maintain Roadway or Structures:** If the Contractor fails to remedy unsatisfactory maintenance immediately after receipt of a notice by the Engineer, the Engineer may proceed with adequate forces, equipment, and material to maintain the project. The cost of the maintenance, plus 25 percent for supervisory and administrative personnel, will be deducted from monies due the Contractor for the project.

Comment [118]: Right Payment

(k) **Haul Route:** The Contractor shall select haul routes between the project and material source(s) that will minimize disturbance to the community. The Contractor shall furnish to the Engineer for review, his plan for the haul route and for minimizing the adverse effects of hauling operations on persons who reside adjacent to the haul route or persons who otherwise use a portion of the haul route for ingress or egress to their residential or work area. The Department may select alternate haul routes, divide the hauling traffic over several routes, and impose other restrictions deemed necessary to minimize the impact of the hauling operation on local residents.

(l) **Opening Sections of Projects to Traffic**

When specified in the Contract or when directed by the Engineer, certain sections of the work may be opened to traffic. Such opening shall not constitute acceptance of the work or any part thereof or a waiver of any provision of the Contract.

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On any section of the work opened by order of the Engineer where the Contract does not provide for traffic to be carried through the work the Contractor will not be required to assume any expense entailed in maintaining the road for traffic. Such expense will be borne by the Department or will be compensated for in accordance with the requirements of Section 109.05. Repair of slides and repair of damage attributable to traffic will be compensated for in accordance with the requirements of Section 109.05. Slides shall be removed by the Contractor in accordance with the requirements of Section 303.

On any section of the work opened by order of the Engineer where the Contract does not provide for traffic to be carried through the work, any additional cost for the completion of other items of work that are required because of the changed working conditions will be compensated in accordance with the requirements of Section 109.05.

If the Contractor is not continuously prosecuting the work to the satisfaction of the Engineer, he shall not be relieved of the responsibility for maintenance during the period the section is opened to traffic prior to final acceptance. Any expense resulting from the opening of such portions under these circumstances, except slides, shall be borne by the Contractor. The Contractor shall conduct the remainder of the construction operations so as to cause the least obstruction to traffic.

105.15 - Removing and Disposing of Structures and Obstructions

The Contractor shall remove and dispose of or store, as directed by the Engineer, fences, buildings, structures, or encumbrances within the construction limits unless separate pay items for this work are included in the Contract. Payment for these operations will be in accordance with the requirements of Section 301.03. Materials so removed, including existing drains or pipe culverts, shall become the property of the Contractor, with the exception of those materials to be stored or delivered to the Department or others as designated in the Contract.

(a) **Signs:** The Contractor shall relocate all signs within the construction limits that conflict with construction work as approved by the Engineer. Signs that are not needed for the safe and orderly control of traffic during construction as determined by the Engineer shall be removed and stored at a designated location within the project limits. The removed signs shall be stored above ground in a manner that will preclude damage and shall be reinstalled in their permanent locations prior to final acceptance. If any of the removed signs are not to be reinstalled, the Contractor shall notify the Engineer at the time the signs have been properly stored. Such signs will be removed from the storage area by the Department. Any sign that is damaged or lost because of the fault of the Contractor shall be repaired or replaced at his expense. Costs for removing, storing, protecting, and reinstalling such signs shall be included in the price bid for other items in the Contract, and no additional compensation will be made.

Comment [119]: Right Payment

Comment [120]: Right Payment

Comment [121]: Right Payment

Comment [122]: Right Payment

Comment [123]: Right Way

Comment [124]: Right Payment

Comment [125]: Right Location

Comment [126]: Right Location

Comment [127]: Right Payment

Comment [128]: Right Payment

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(b) **Mailboxes and Newspaper Boxes:** When removal of mailboxes and newspaper boxes is made necessary by construction operations, the Contractor shall place them in temporary locations so that access to them will not be impaired. Prior to final acceptance, boxes shall be placed in their permanent locations as designated by the Engineer and left in as good condition as when found. Boxes or their supports that are damaged through negligence on the part of the Contractor shall be replaced at his expense. The cost of removing and resetting boxes shall be as specified in the Contract.

Comment [129]: Right Location/Right Payment

105.16 – Cleanup

Comment [130]: Right Way

Removal from the project of rubbish, scrap material, and debris caused by the Contractor's personnel or construction operations shall be a continuing process throughout the course of the work. The work site shall have a neat, safe and orderly appearance at all times.

Before final acceptance, the highway, borrow pits, quarries, disposal areas, storage areas, and all ground occupied by the Contractor in connection with the work shall be cleaned of rubbish, surplus materials, and temporary structures, except in the case where the property is owned or controlled by the Contractor. All parts of the work shall be left in a neat, safe and orderly condition.

Within 30 days after final acceptance, the Contractor shall remove his equipment, materials and debris from the right of way and property adjacent to the project that he does not own or control.

Comment [131]: Right Time

105.17 - Inspection of Work

Comment [132]: Right Way

Comment [133]: Right Time

Inspection will be performed at critical stages. However, all stages, materials, and details of the work are subject to inspection. The Contractor shall provide the Engineer and Inspectors with full and safe access to all parts of the work and shall be furnished such information and assistance by the Contractor as are required to make a complete, timely and detailed inspection. The Engineer and his appointed representatives shall have ready access to machines and plant equipment used in processing or placing materials.

Prior to the beginning of operations, the Engineer will meet with the Contractor to establish an understanding of the critical stages of work that shall be performed in the presence of the Inspector. In order for the Department to schedule inspection of the work, the Contractor shall keep the Engineer informed of planned operations in accordance with the requirements of Section 108.03

Comment [134]: Right Time

If the Engineer requests it, the Contractor shall remove or uncover such portions of the finished work as may be directed at any time before final acceptance. The Contractor

Trial Use and Comment

shall restore such portions of the work to comply with the appropriate contract specification requirements. If the work exposed is acceptable, the uncovering or removing and replacing the covering or making good the parts removed will be paid for as extra work in accordance with the requirements of Section 104.03. If the work is unacceptable, the cost of uncovering or removing and replacing the covering or making good the parts removed shall be borne by the Contractor.

When any unit of government, political subdivision, or public or private corporation is to pay a portion of the cost of the work specified in the Contract, its representatives shall have the right to inspect the work. The exercise of this right shall not be construed as making them a party or parties to the Contract or conferring on them the right to issue instructions or orders to the Contractor.

If materials are used or work is performed without inspection by an authorized representative of the Department, the Contractor may be ordered to remove and replace the work or material at his own expense unless the Department's representative failed to inspect the work or material after having been given reasonable notice in writing that the material was to be used or the work was to be performed.

If an inspection reveals that work has not been properly performed, the Contractor will be so advised and he shall immediately inform the Department of his schedule for correcting such work and the time when a reinspection can be made.

105.18 - Removal of Unacceptable and Unauthorized Work

Work that does not conform to the requirements of the Contract will be considered unacceptable work.

Unacceptable work shall be remedied or removed as determined by the Engineer and replaced in an acceptable manner at the Contractor's expense. The Engineer may accept the work at a reduced price when acceptance is considered to be in the best interest of the public.

Work that is done contrary to the instructions of the Engineer, contrary to the requirements of the Contract, beyond the lines shown on the plans or as designated by the Engineer except as specified herein, or without authority will be considered unauthorized and will not be paid for. Such work may be ordered removed or replaced at the Contractor's expense.

The Contractor shall not perform destructive sampling or testing of the work without written authorization of the Engineer. Unauthorized destructive sampling or testing will cause the work to be considered unacceptable.

In the event the Contractor is granted authorization to perform destructive sampling or testing, the Contractor shall obtain the approval of the Engineer for the method and

Comment [135]: Right Payment

Comment [136]: Right Payment

Comment [137]: Right Time

Comment [138]: Right Time

Comment [139]: Right Way

Comment [140]: Right Way Right Time

Comment [141]: Right Payment

Comment [142]: Right Payment

Comment [143]: Right Payment

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location of each test prior to beginning such sampling or testing. In addition, destructive sampling and testing shall be performed in the presence of the Engineer.

If the Contractor fails to comply immediately with any order of the Engineer made under the provisions of this Section, the Engineer will have the authority to cause unacceptable work to be removed and replaced and to deduct the cost from any monies due or to become due the Contractor.

105.19 - Submission and Disposition of Claims

Early or prior knowledge by the Department of an existing or impending claim for damages could alter the plans, scheduling, or other action of the Department or result in mitigation or elimination of the effect of the act objected to by the Contractor. Therefore, a written statement describing the act of omission or commission by the Department or its agents that allegedly caused damage to the Contractor and the nature of the claimed damage shall be submitted to the Engineer at the time of each and every occurrence that the Contractor feels gives it the right to make a claim or prior to the beginning of the work upon which a claim and any subsequent action will be based. The written statement shall clearly inform the Department that it is a "notice of intent to file a claim." If such damage is deemed certain in the opinion of the Contractor to result from his acting on an order from the Engineer, he shall immediately take written exception to the order. Submission of a notice of intent to file a claim as specified shall be mandatory. Failure to submit such notice of intent shall be a conclusive waiver to such claim for damages by the Contractor. An oral notice or statement will not be sufficient nor will a notice or statement after the event.

In addition, at the time of each and every occurrence that the Contractor feels gives it the right to make a claim or prior to beginning the work upon which a claim and any subsequent action will be based, the Contractor shall furnish the Engineer an itemized list of materials, equipment and labor for which additional compensation will be claimed. Only actual cost for materials, labor and equipment will be considered. The Contractor shall afford the Engineer every facility for keeping an actual cost record of the work. The Contractor and the Engineer shall compare records and bring them into agreement at the end of each day. Failure on the part of the Contractor to afford the Engineer proper facilities for keeping a record of actual costs will constitute a waiver of a claim for such extra compensation except to the extent that it is substantiated by the Department's records. The filing of such notice of intent by the Contractor and the keeping of cost records by the Engineer shall in no way establish the validity of a claim.

Upon completion of the Contract, the Contractor may, within 60 days after the final estimate date established by the Department pursuant to Virginia Code, § 33.2-1101, deliver to the Department a written claim, which must be a signed original claim document along with three legible copies of the claim document, for the amount he deems he is entitled to under the Contract. For the purpose of this Section, the final estimate date shall be that date set forth in a letter from the Department to the Contractor sent by certified mail and shall be considered as the date of notification of

Comment [144]: Right Material

Comment [145]: Right Payment

Comment [146]: Right Way

Comment [147]: Right Time

Comment [148]: Right Time

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the Department's final estimate. Regardless of the manner of delivery of the claim, the Department must receive and have physical possession of the Contractor's written claim within the 60 day period that commences with the final estimate date. Submittals received by the Department either before the final estimate date or after the 60 day period shall not have standing as a claim. The claim shall set forth the facts upon which the claim is based. The Contractor shall include all pertinent data and correspondence that may substantiate the claim. Only actual cost for materials, labor and equipment will be considered. If the Contractor makes a claim, the Department shall have the right, at its expense, to review and copy all of the Contractor's non-privileged project files and documents, both electronic and paper, for use in analyzing the claim. Within 90 days from the receipt of the claim, the Department will make an investigation and notify the Contractor by certified mail of its decision. However, by mutual agreement, the Department and Contractor may extend the 90-day period for another 30 days.

If the Contractor is dissatisfied with the decision, he shall notify the Commissioner in writing within 30 days from receipt of the Department's decision that he desires to appear before him, whether in person or through counsel, and present additional facts and arguments in support of his claim. The Commissioner will schedule and meet with the Contractor within 30 days after receiving the request. However, the Commissioner and Contractor, by mutual agreement, may schedule the meeting to be held after 30 days but before the 60th day from the receipt of the Contractor's written request. Within 45 days from the date of the meeting, the Commissioner will investigate the claim, including the additional facts presented, and notify the Contractor in writing of his decision. However, the Commissioner and Contractor, by mutual agreement, may extend the 45-day period for another 30 days. If the Commissioner deems that all or any portion of a claim is valid, he shall have the authority to negotiate a settlement with the Contractor subject to any approvals required by the *Code of Virginia.*

Any monies that become payable as the result of claim settlement after payment of the final estimate will not be subject to payment of interest unless such payment is specified as a condition of the claim settlement.

The Contractor shall submit a certification with any claim using the following format:

Pursuant to *Code of Virginia*, I hereby certify that this contract claim submission for Virginia Department of Transportation Project _____ in _____ County, Virginia is a true and accurate representation of additional costs and/or delays incurred by (name of Contractor) in the performance of the required contract work. Any statements made, and known to be false, shall be considered a violation of the Virginia Governmental Frauds Act, punishable as allowed by the Virginia Code for a Class 6 Felony.

(Company)

By:

As officer or duly appointed agent of (Company)

Comment [149]: Right Time

Comment [150]: Right Time

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Title:

Date:

State Of:

City/County of _____, To-Wit:

I, the undersigned, a Notary Public in and for the City/ County and State aforesaid, do hereby certify that , whose name is signed to the foregoing instrument, bearing date of the_____ day of , 20_, has this day acknowledged the same before me in my City/ County and State aforesaid.

Given under my hand this day of , 20_.

Notary Public:

My commission expires:

Claims submitted during the statutory period for submitting contract claims and submitted without the certification described above shall not have standing as a claim and shall not be considered by the Department.

III. FOUR STEP INSPECTION PROCEDURES

105.01 - Notice to Proceed

Pre-start planning meeting: Many of the requirements of this *Section 104-Control of the Work* will be covered in the Pre-construction Conference. That is often a busy meeting and it is easy to forget the salient points. Once the inspector and the contractor are on site it is time to review this section in more detail. The following should be included in the onsite meeting agenda:

- The date of contract execution is the date of the Notice to Proceed and the starting date of the contract.
- Make a list of the all the key project personnel, VDOT, Contractor, subcontractors, FHWA, emergency agencies, localities, etc. including working and home phone numbers.
- Discuss level of authority of project participants.
- Discuss the general sequence of work, including the expected primary work tasks as defined by the Contractor, and proposed means and methods for the entire scope of work, potential problems or impacts, constructability issues, special considerations such as limitations and access issues, agreements with local agencies or governments, utility impacts or relocations including railroads, coordination with schedules of the utilities and subcontractors and associated work, sources and delivery of critical materials

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- Submittals required by the Contract documents including shop drawings and material certifications. Review Form C-24 *Source of Materials*.
- The location of field office, labs, etc.
- Discuss and review environmental concerns including permits, erosion and siltation controls, and the Storm Water Pollution Prevention Plan (SWPPP)
- Review maintenance of traffic issues
- Review EEO\DBE\MBE requirements
- Review the work to be subcontracted and subcontract requirements.
- Review other ongoing contracts in or near the work zone. Set up a meeting with these contractors.
- Review the need for locating and adjusting utilities.
- Review the importance of the timely and accurate submission of working drawings, including
    - Steel components and structures
    - Falsework
    - Concrete and prestressed concrete structures
    - Lighting and Sign Structures
    - Pipe and appurtenances
- Review surveying and layout requirements and responsibilities
- Pay particular attention to payments such as barrow pits.

Start: Record the starting date of the contract on Form C-5, *Reporting Starting and Completion Date of Projects*. Make sure all required submittals are in hand, physically or electronically.

Inspection Requirements: Monitor work in progress and that it conforms to the contract documents including submittals.

Final Inspection: Submit all required documents to the final auditor. Note the completion date on Form C-5, *Reporting Starting and Completion Date of Projects*

105.11 - Conformity with Plans and Specifications

Pre-start planning meeting: Review with the contractor prior to the start of any activity the actable range of values listed in the specifications. Also review the level of accuracy of Measurements and Payments section of the specification.

Start: Verify that the construction is within the specified range.

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Inspection Requirements: Monitor work in progress to assure conformance with specified tolerances.

Final Inspection: Verify the completed construction is within the specified tolerances.

Documentation: The Daily Work Report should include all measures taken to verify tolerances, and note and items out of tolerance with an explanation for review by the construction manager or area construction engineer.

105.14 - Maintenance During Construction

Pre-start planning meeting:

- Review with the Contractor the importance of safely maintaining traffic, the Traffic Management Plan, the proper use of signage and flaggers, the necessity of providing access to residential, public, and commercial properties , requirement to have a certified wztc on site as required.

Start:

- Verify that all work zone traffic control items are in place and in accordance with Virginia's Work Area Protection Manual.

- Verify that all entrances are accessible, and if not verify agreements with the property owner.

Inspection Requirements:

- Periodic review and/or observation that work zone traffic control elements are in place.

Final Inspection:

- Review the project site that work zone traffic elements are not longer required and control devices have been removed from clear zone as required.

Documentation: The Daily Work Report should include the results of work zone reviews.

105.15 - Removing and Disposing of Structures and Obstructions

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Pre-start planning meeting: Review with the contractor the approved, or to be approved location for the disposal of structures. Discuss acceptable methods for abandoning structures in place. Review which items may be retained by VDOT and proper storage. Discuss the proper handling of mail boxes.

Start: Verify by observation the handling of structures to be disposed, stored, or removed to an offsite location for reuse.

Inspection Requirements: Periodic monitoring of the removal and disposal of structures.

Final Inspection: Verify that structures have been completely removed or abandoned, and that any material is stored appropriately.

Documentation: The Daily Work Report should report on the proper disposition of all structures and obstructions.

105.16 – Cleanup

Pre-start planning meeting: Review this specification emphasizing the need for continually maintaining a clean project site.

Removal from the project of rubbish, scrap material, and debris caused by the Contractor's personnel or construction operations shall be a continuing process throughout the course of the work. The work site shall have a neat, safe and orderly appearance at all times.

Before final acceptance, the highway, borrow pits, quarries, disposal areas, storage areas, and all ground occupied by the Contractor in connection with the work shall be cleaned of rubbish, surplus materials, and temporary structures, except in the case where the property is owned or controlled by the Contractor. All parts of the work shall be left in a neat, safe and orderly condition.

Within 30 days after final acceptance, the Contractor shall remove his equipment, materials and debris from the right of way and property adjacent to the project that he does not own or control.

Trial Use and Comment

Start: Start right: Removal from the project of rubbish, scrap material, and debris caused by the Contractor's personnel or construction operations shall be a continuing process throughout the course of the work. The work site shall have a neat, safe and orderly appearance at all times.

Inspection Requirements: Stay right: Removal from the project of rubbish, scrap material, and debris caused by the Contractor's personnel or construction operations shall be a continuing process throughout the course of the work. The work site shall have a neat, safe and orderly appearance at all times.

Final Inspection: Before final acceptance, the highway, borrow pits, quarries, disposal areas, storage areas, and all ground occupied by the Contractor in connection with the work shall be cleaned of rubbish, surplus materials, and temporary structures, except in the case where the property is owned or controlled by the Contractor. All parts of the work shall be left in a neat, safe and orderly condition.

Within 30 days after final acceptance, the Contractor shall remove his equipment, materials and debris from the right of way and property adjacent to the project that he does not own or control.

Documentation: The Daily Work Report should note directives to clean the site. Obtain from the contractor the written release from any private sites used for barrow or disposal.

105.17 - Inspection of Work

Pre-start planning meeting: Review the inspection process with the Contractor focused on the seven rights (7-R's) of quality:
The *Right Material*, put in the *Right Way*, at the *Right Time*, in the *Right Place*, in the *Right Quantity*, all then having the *Right Documentation* makes it easy for VDOT to make the *Right Payment*.

Start: At the beginning of all activities verify that the operations are in conformance with the contract documents.

Inspection Requirements: See Critical Inspection Points and observe work in progress. Review with the Contractor any non-conforming working with the applicable drawing, standard, or specification. Discuss a timeline for correction. If necessary issue a Notice of Contract Non-Compliance. Work that does not conform to the requirements of the Contract will be considered unacceptable work.

Trial Use and Comment

Unacceptable work shall be remedied or removed as determined by the Engineer and replaced in an acceptable manner at the Contractor's expense.

Final Inspection: Make sure any and all Notices of Non-Compliance are resolved.

Documentation: Complete all necessary forms and reports for each portion of the work indicating conformance with the contract documents.

105.19 - Submission and Disposition of Claims

Pre-start planning meeting: It's important that the contractor understand the need for a written Notice of Intent to File Claim (NOI) in order to preserve his rights.

Start: When any issue becomes a dispute recommend the Contractor review this section for further actions.

Inspection Requirements: Monitor alignment between actual field conditions and the contract documents.

Final Inspection: Review all Notice of Intent to File Claim submissions and closeout all Notices that have been resolved, and report to the construction manager or area construction engineer all outstanding NOI's.

Documentation: Document all labor, equipment, and material associated with an NOI.

IV. REVIEW QUESTIONS

105.01	Unless otherwise permitted, has the Contractor started work within 15 days of the date of contract execution specified in the Notice to Proceed?

Trial Use and Comment

105.14	Are entrances and connections in satisfactory locations and being properly maintained?
105.17	When an inspection reveals that work has not been properly performed, and the Contractor has been so advised, does he immediately inform the Department of a schedule for correcting such work and time at which reinspections of such work can be made?
105.19(1)	Has the Contractor submitted a written statement that clearly identifies intent to file a claim at the time of occurrence or beginning of the related work?
105.19(2)	At the time of occurrence or prior to the beginning of the work, does the Contractor furnish the Engineer with an itemized list for which additional compensation will be claimed?
105.19(3)	When documenting the claim, did the Contractor and the Engineer compare records and bring them into agreement at the end of each day?

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V. CRITICAL INSPECTION POINTS

105.06 – Subcontracting -Prior to the start of the work has the subcontractor been approved, see Form C-31, *Subletting Request.*
105.05 - **Cooperation With Regard to Utilities-**See **107.09—Contractor's Responsibility for Utility Property and Services**
105.10 - Plans and Working Drawings (c) Working Drawings-Has the Contractor furnished working drawings to the extent, detail and number as may be required by the Contract requirements? o Work shall not be performed or materials ordered prior to the completion of the Department's review of the working drawings. **105.13—State Force Construction Surveying** (a) **General Description:** When applicable, has the Department performed all surveying and provided all surveying and stakeout sketches and information as detailed herein for the successful prosecution of work as indicated on the plans and as directed by the Engineer?

Trial Use and Comment

SECTION 106-CONTROL OF MATERIAL

I. INTRODUCTION:

This section describes how materials are to be supplied and approved. It describes the right way to assure that projects have the right material.

a. Forms:

- C-107 – Construction Runoff Inspection Form
- C-25 - Source of Materials

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

106.01 - Source of Supply and Quality Requirements

The materials used throughout the work shall conform to the requirements of the Contract. The Contractor shall regulate his supplies so that there will be a sufficient quantity of tested material on hand at all times to prevent any delay of work. Except as otherwise specified, materials, equipment, and components that are to be incorporated into the finished work shall be new. Within 30 days after notification of award of the Contract, but not later than 7 days prior to the beginning of construction operations under the Contract, the Contractor shall file a statement of the known origin, composition and manufacture of all materials to be used in the work, including optional or alternate items. Material requirements not previously reported shall be submitted at least 60 days prior to their use on the project, but not less than two weeks prior to delivery. The Contractor's statement shall be electronically submitted by use of **Form C-25** and shall be identified by the complete project number, and all items or component materials shall be identified by the specific contract item number and the Specification reference shown in the Contract.

At the option of the Engineer, materials may be approved at the source of supply. If it is found during the life of the Contract that previously approved sources of supply do not supply materials or equipment conforming to the requirements of the Contract, do not furnish the valid test data required to document the quality of the material or equipment, or do not furnish documentation to validate quantities to document payment, the Contractor shall change the source of supply and furnish material or equipment from other approved sources. The Contractor shall notify the Department of this change, and provide the same identifying information noted in this Section, at least 60 days prior to their use on the project, but not less than two weeks prior to delivery.

Materials shall not contain toxic, hazardous, or regulated solid wastes or be furnished from a source containing toxic, hazardous or regulated solid wastes.

Comment [151]: Right Material

Comment [152]: Right Time

Comment [153]: Right Time

Comment [154]: Right Time

Comment [155]: Right Documentation

Comment [156]: Right Time

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When optional materials are included in the Contract, the Contractor shall advise the Engineer in writing of the specific materials selected. Thereafter, the Contractor shall use the selected materials throughout the project unless a change is authorized in writing by the Engineer. However, when the Contractor has an option as to the type of pipe that may be used, he may use any of the approved types for each size of pipe, but he shall use the same type for a particular line. The Engineer may authorize other types and sources in an emergency that will not unreasonably delay delivery of the selected material.

Equipment and material guaranties or warranties that are normally given by a manufacturer or supplier, or are otherwise required in the Contract, shall be obtained by the Contractor and assigned to the Commonwealth in writing. The Contractor shall also provide an in-service operation guaranty on all mechanical and electrical equipment and related components for a period of at least six months, beginning on the date of partial acceptance of that specific item(s) or final acceptance of the project.

Comment [157]: Right Documentation

106.02 - Material Delivery

The Contractor shall advise the Engineer at least 2 weeks prior to the delivery of any material from a commercial source. Upon delivery of any such material to the project, the Contractor shall provide the Engineer with one copy of all invoices (prices are not required). The following materials shall also comply with the requirements of Section 109.01: asphalt concrete; dense graded aggregate, to include aggregate base, subbase, and select material; fine aggregate; open graded coarse aggregate; crusher run aggregate; and road stabilization aggregate. The printed weights of each load of these materials, as specified in Section 109.01, shall accompany the delivery, and such information shall be furnished to the Inspector at the project.

Comment [158]: Right Time

Comment [159]: Right Documentation

Comment [160]: Right Documentation

106.03 - Local Material Sources (Pits and Quarries)

The requirements set forth herein apply exclusively to non-commercial pits and quarries from which materials are obtained for use on contracts awarded by the Department.

Comment [161]: Right Location

Local material sources shall be concealed from view from the completed roadway and any existing public roadway. Concealment shall be accomplished by selectively locating the pit or quarry and spoil pile, providing environmentally compatible screening between the pit or quarry site and the roadway, or using the site for another purpose after removal of the material, or restoration equivalent to the original use (such as farm land, pasture, turf, etc.). The foregoing requirements shall also apply to any pit or quarry opened or reopened by a subcontractor or supplier. However, the requirements will not apply to commercial sand and gravel and quarry operations actively processing material at the site prior to the date of the Notice of Advertisement.

Comment [162]: Right Location

The Contractor shall furnish the Engineer a statement signed by the property owner in which the property owner agrees to the use of his property as a source of material for

Comment [163]: Right Documentation

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the project. Upon completion of the use of the property as a material source, the Contractor shall furnish the Engineer a release signed by the property owner indicating that the property has been satisfactorily restored. This requirement will be waived for commercial sources, sources owned by the Contractor, and sources furnished by the Department.

Local material pits and quarries that are not operated under a local or State permit shall not be opened or reopened without authorization by the Engineer. The Contractor shall submit for approval a site plan, including, but not limited to, the following

(1) the location and approximate boundaries of the excavation;

(2) procedures to minimize erosion and siltation;

(3) provision of environmentally compatible screening;

(4) restoration;

(5) cover vegetation;

(6) other use of the pit or quarry after removal of material, including the spoil pile;

(7) the drainage pattern on and away from the area of land affected, including the directional flow of water and a certification with appropriate calculations that verify all receiving channels are in compliance with Minimum Standard 19 of the Virginia Erosion and Sediment Control Regulations;

(8) location of haul roads and stabilized construction entrances if construction equipment will enter a paved roadway;

(9) constructed or natural waterways used for discharge;

(10) a sequence and schedule to achieve the approved plan and;

(11) the total drainage area for temporary sediment traps and basins shall be shown. Sediment traps are required if the runoff from a watershed area of less than three acres flows across a disturbed area. Sediment basins are required if the runoff from a watershed area of three acres or more flows across a disturbed area. The Contractor shall certify that the sediment trap or basin design is in compliance with VDOT Standards and Specifications, and all local, state, and federal laws. Once a sediment trap or basin is constructed, the dam and all outfall areas shall be immediately stabilized.

The Contractor's design and restoration shall be in accordance with the Contract requirements and in accordance with the requirements of the federal, state, and local laws and regulations.

Comment [164]: Right Documentation

Comment [165]: Right Way

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If the approved plan provides for the continued use or other use of the pit or quarry beyond the date of final acceptance, the Contractor shall furnish the Department a bond made payable to the Commonwealth of Virginia in an amount equal to the Engineer's estimate of the cost of performing the restoration work. If the pit or quarry is not used in accordance with the approved plan within 8 months after final acceptance, the Contractor shall perform restoration work as directed by the Engineer, forfeit his bond, or furnish the Engineer with evidence that he has complied with the applicable requirements of the State Mining Law.

Topsoil on Department owned or furnished borrow sites shall be stripped and stockpiled as directed by the Engineer for use as needed within the construction limits of the project or in the reclamation of borrow and disposal areas.

If payment is to be made for material measured in its original position, material shall not be removed until Digital Terrain Model (DTM) or cross-sections have been taken. The material shall be reserved exclusively for use on the project until completion of the project or until final DTM or cross-sections have been taken.

If the Contractor fails to provide necessary controls to prevent erosion and siltation, if such efforts are not made in accordance with the approved sequence, or if the efforts are found to be inadequate the Department will withdraw approval for the use of the site and may cause the Contractor to cease all contributing operations and direct his efforts toward corrective action or may perform the work with state forces or other means as determined by the Engineer. If the work is not performed by the Contractor, the cost of performing the work, plus 25 percent for supervisory and administrative personnel, will be deducted from monies due the Contractor.

Costs for applying seed, fertilizer, lime, and mulch; restoration; drainage; erosion and siltation control; regrading; haul roads; and screening shall be included in the Contract price for the type of excavation or other appropriate items.

If the Contractor fails to fulfill the provisions of the approved plan for screening or restoring material sources, the Department may withhold and use for the purpose of performing such work any monies due the Contractor at the time of the final estimate. The Contractor shall be held liable for penalties, fines, or damages incurred by the Department as a result of his failure to prevent erosion or siltation and take restorative action.

After removing the material, the Contractor shall remove metal, lumber, and other debris resulting from his operations and shall shape and landscape the area in accordance with the approved plan for such work.

(a) **Sources Furnished by the Department:** Sources furnished by the Department will be made available to the Contractor together with the right to use such property as may be

Comment [166]: Right Documentation/Right Payment

Comment [167]: Right Way/Right Time

Comment [168]: Right Location

Comment [169]: Right Way

Comment [170]: Right Quantity

Comment [171]: Right Payment

Comment [172]: Right Payment

Comment [173]: Right Payment

Comment [174]: Right Way

Comment [175]: Right Payment

Comment [176]: Right Way

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required for a plant site, stockpiles, and haul roads. The Contractor shall confine his excavation operations to those areas of the property specified in the Contract.

The Contractor shall be responsible for excavation that shall be performed in order to furnish the specified material.

(b) **Sources Furnished by the Contractor:** When the Contractor desires to use local material from sources other than those furnished by the Department, he shall first secure the approval of the Engineer. The use of material from such sources will not be permitted until test results have been approved by the Engineer and written authority for its use has been issued.

The Contractor shall acquire the necessary rights to take material from sources he locates and shall pay all related costs, including costs that may result from an increase in the length of the haul. Costs of exploring, sampling, testing, and developing such sources shall be borne by the Contractor. The Contractor shall obtain representative samples from at least two borings in parcels of 10 acres or less and at least three additional borings per increment of 5 acres or portion thereof to ensure that lateral changes in material are recorded. Drill logs for each test shall include a soil description and the moisture content at intervals where a soil change is observed or at least every 5 feet of depth for consistent material. Samples obtained from the boring shall be tested by an approved laboratory for grading, Atterberg limits, CBR, maximum density, and optimum moisture. The Department will review and evaluate the material based on test results provided by the Contractor. The Department will reject any material from a previously approved source that fails a visual examination or whose test results show that it does not conform to the Specifications or specific contract requirements.

106.04 - Disposal Areas

Unsuitable or surplus material shown on the plans shall be disposed of as specified herein. Material not used on the project shall be disposed of by the Contractor off the right of way. The Contractor shall obtain the necessary rights to property to be used as an approved disposal area. For the purpose of this Specification an approved disposal area is defined as that which is owned privately, not operated under a local or State permit and has been approved by the Department for use in disposing of material not used on the project.

When neither unsuitable nor surplus material is shown on the plans, the Contractor shall dispose of it as shown herein. If the Contractor, having shown reasonable effort, is unsuccessful in obtaining the necessary rights to property to be used as an approved disposal area, the Department will obtain rights for disposal unless otherwise provided for in the contract Compensation, if not shown in the Contract, will be in accordance with the requirements of Section 104.02.

Comment [177]: Right Location

Comment [178]: Right Materials

Comment [179]: Right Material

Comment [180]: Right Documentation/Right Payment/ Right Location

Comment [181]: Right Documentation

Comment [182]: Right Material

Comment [183]: Right Way

Comment [184]: Right Location

Comment [185]: Right Documentation

Trial Use and Comment

Prior to the Department approving a disposal area, the Contractor shall submit a site plan. The plan shall show:

(1) the location and approximate boundaries of the disposal area;

(2) procedures to minimize erosion and siltation;

(3) provision of environmentally compatible screening;

(4) restoration;

(5) cover vegetation;

(6) other use of the disposal site;

(7) the drainage pattern on and away from the area of land affected, including the directional flow of water and a certification with appropriate calculations that verify all receiving channels are in compliance with Minimum Standard 19 of the Virginia Erosion and Sediment Control Regulations;

(8) location of haul roads and stabilized construction entrances if construction equipment will enter a paved roadway;

(9) constructed or natural waterways used for discharge;

(10) a sequence and schedule to achieve the approved plan and;

(11) the total drainage area for temporary sediment traps and basins shall be shown. Sediment traps are required if the runoff from a watershed area of less than three acres flows across a disturbed area. Sediment basins are required if the runoff from a watershed area of three acres or more flows across a disturbed area. The Contractor shall certify that the sediment trap or basin design is in compliance with VDOT Standards and Specifications~~,~~ all local, state, and federal laws. Once a sediment trap or basin is constructed, the dam and all outfall areas shall be immediately stabilized.

Disposal areas shall be cleared but need not be grubbed. The clearing work shall not damage grass, shrubs, or vegetation outside the limits of the approved area and haul roads thereto. After the material has been deposited, the area shall be shaped to minimize erosion and siltation of nearby streams and landscaped in accordance with the approved plan for such work or shall be used as approved by the Engineer. The Contractor's design and restoration shall conform to the requirements of the contract and federal, state, and local laws and regulations.

Comment [186]: Right Way/Right Location

Comment [187]: Right Way

Trial Use and Comment

If the Contractor fails to provide and maintain necessary controls to prevent erosion and siltation, if such efforts are not made in accordance with the approved sequence, or if the efforts are found to be inadequate, the Department will withdraw approval for the use of the site and may cause the Contractor to cease all contributing operations and direct his efforts toward corrective action or may perform the work with state forces or other means as determined by the Engineer. If the work is not performed by the Contractor, the cost of performing the work, plus 25 percent for supervisory and administrative personnel, will be deducted from monies due the Contractor.

The Contractor shall furnish the Engineer a statement signed by the property owner in which the owner agrees to the use of his property for the deposit of material from the project. Upon completion of the use of the property as an approved disposal area, the Contractor shall furnish the Engineer a release signed by the property owner indicating that the property has been satisfactorily restored. This requirement will be waived for commercial sources, sources owned by the Contractor, and sources furnished by the Department.

Material encountered by the Contractor shall be handled as follows:

(a) **Unsuitable material** for the purpose of this Specification is defined as material having poor bearing capacity, excessive moisture content, extreme plasticity or other characteristics as defined by the Engineer that makes it unacceptable for use in the work and shall be disposed of at an approved disposal area or landfill licensed to receive such material.

(b) **Surplus material** as shown on the plans shall be disposed of by flattening slopes, used to fill in ramp gores and medians, or if not needed, disposed of at an approved disposal area or a landfill licensed to receive such material.

Surplus material stockpile areas on the right-of-way shall be cleared but need not be grubbed. The clearing work shall not damage grass, shrubs, or vegetation outside the limits of the approved area and the haul roads thereto. Placement of fill material shall not adversely affect existing drainage structures. If necessary, modified existing drainage structures, as approved by the Engineer, shall be paid for in accordance with Section 109.05. Within 7 days after the material has been deposited, the area shall be shaped and stabilized to minimize erosion and siltation.

(c) **Organic materials** such as, but not limited to, tree stumps and limbs (not considered merchantable timber), roots, rootmat, leaves, grass cuttings, or other similar materials shall be chipped or shredded and used on the project as mulch, given away, sold as firewood or mulch, burned at the Contractor's option if permitted by local ordinance, or disposed of at a facility licensed to receive such materials. Organic material shall not be buried in state rights of way or in an approved disposal area.

Comment [188]: Right Way

Comment [189]: Right Payment

Comment [190]: Right Documentation

Comment [191]: Right Documentation

Comment [192]: Right Material

Comment [193]: Right Way

Comment [194]: Right Payment

Comment [195]: Right Time

Comment [196]: Right Way

Trial Use and Comment

(d) **Rootmat** for the purpose of this Specification is defined as any material that, by volume, contains approximately 60 percent or more roots and shall be disposed of in accordance with (c) herein.

(e) **Inorganic materials** such as brick, cinder block, broken concrete without exposed reinforcing steel, or other such material may be used in accordance with Section 303.04 or shall be disposed of at an approved disposal area or landfill licensed to receive such materials. If disposed of in an approved disposal area, the material shall have enough cover to promote soil stabilization in accordance with the requirements of Section 303 and shall be restored in accordance with other provisions of this Section.

Concrete without exposed reinforcing steel, may be crushed and used as rock in accordance with Section 303. If approved by the Engineer, these materials may be blended with soils that meet AASHTO M57 requirements and deposited in fill areas within the right-of-way in accordance with the requirements of Section 303 as applicable.

(f) **Excavated rock** in excess of that used within the project site in accordance with the requirements of Section 303 shall be treated as surplus material.

(g) **Other materials** such as, but not limited to, antifreeze, asphalt (liquid), building forms, concrete with reinforcing steel exposed, curing compound, fuel, hazardous materials, lubricants, metal, metal pipe, oil, paint, wood or metal from building demolition, or similar materials shall not be disposed of at an approved disposal area but shall be disposed of at a landfill licensed to receive such material.

106.05 - Rights for and Use of Materials Found on Project

With the approval of the Engineer, the Contractor may use in the project any materials found in the excavation that comply with the requirements of the Specifications. Unless otherwise specified, the Contractor will be paid for both the excavation of such materials at the contract unit price and for the pay item for which the excavated material is used. However, the Contractor shall replace at his own expense with other acceptable material the excavation material removed and used that is needed for use in embankments, backfills, approaches, or otherwise. The Contractor shall not excavate or remove any material from within the construction limits that is not within the grading limits, indicated by the typical section, slope and grade lines shown in the plans without written authorization by the Engineer.

106.06 - Samples, Tests, and Cited Specifications

Materials will be inspected and tested by the Engineer before or during their incorporation in the work. However, the inspection and testing of such material shall not

Comment [197]: Right Location

Comment [198]: Right Location

Comment [199]: Right Location

Comment [200]: Right Material

Comment [201]: Right Payment

Comment [202]: Right Location

Comment [203]: Right Material

Trial Use and Comment

relieve the Contractor of the responsibility for furnishing material that conforms to the requirements of the Specifications. The Department may retest all materials that have been accepted at the source of supply after delivery and will reject those that do not conform to the requirements of the Specifications. Stored material may be re-inspected prior to use. Work in which untested materials are used without the written permission of the Engineer may be considered unacceptable.

Unless reference is made to a specific dated Specification, references in these Specifications to AASHTO, ASTM, VTM, and other standard test methods and materials requirements shall refer to either the test specifications that have been formally adopted or the latest interim or tentative specifications that have been published by the appropriate committee of such organizations as of the date of the Notice of Advertisement. Unless otherwise indicated, tests for compliance with specification requirements will be made by and at the Department's expense except that the cost of retests, exclusive of the first retest, shall be borne by the Contractor. Samples shall be furnished by the Contractor at his expense, and those that are not tested by the Contractor will be tested by a representative of the Department.

The inspection cost of structural steel items fabricated in a country other than the continental United States shall be borne by the Contractor. Inspection of structural fabrication shall be performed in accordance with the requirements of the appropriate VTM by a commercial laboratory approved by the Department. Additional cleaning or repair necessary because of environmental conditions in transit shall be at the Contractor's expense.

Comment [204]: Right Payment

In lieu of testing, the Engineer may approve the use of materials based on the receipt of a certification furnished by the Contractor from the manufacturer. However, furnishing the certificate shall not relieve the Contractor of the responsibility for furnishing materials that conform to the requirements of the Specifications or the contract requirements.

Comment [205]: Right Documentation

Materials requiring an MSDS will not be accepted at the project site for sampling or at the Department's laboratories for testing without the document.

Comment [206]: Right Documentation –MSDS=Material Safety Data Sheet

106.07 - Plant Inspection

If the Engineer inspects materials at the source, the following conditions shall be met:

Comment [207]: Right Material

(a) The Engineer shall have the cooperation and assistance of the Contractor and producer of the materials.

(b) The Engineer shall have full access to parts of the plant that concern the manufacture or production of the materials being furnished.

Trial Use and Comment

(c) For materials accepted under a quality assurance plan, the Contractor or producer shall furnish equipment and maintain a plant laboratory at locations approved for plant processing of materials. The Contractor or producer shall use the laboratory and equipment to perform quality control testing.

The laboratory shall be of weatherproof construction, tightly floored and roofed, and shall have adequate lighting, heating, running water, ventilation, and electrical service. The ambient temperature shall be maintained between 68 degrees F and 86 degrees F and thermostatically controlled. The laboratory shall be equipped with a telephone, intercom, or other electronic communication system connecting the laboratory and scale house if the facilities are not in close proximity to each other. The laboratory shall be constructed in accordance with the requirements of local building codes.

The Contractor or producer shall furnish, install, maintain, and replace, as conditions necessitate, testing equipment specified by the appropriate ASTM, AASHTO method or VTM being used and provide necessary office equipment and supplies to facilitate keeping records and generating test reports. The Contractor or producer's technician shall maintain current copies of test procedures performed in the laboratory. The Contractor shall calibrate or verify all balances, scales and weights associated with testing performed as specified in AASHTO R18. The Contractor or producer shall also provide and maintain an approved test stand for accessing truck beds for the purpose of sampling and inspection. The Department may approve a single laboratory to service more than one plant belonging to the same Contractor or producer.

Comment [208]: Right Way

For crushed glass, the plant equipment requirements are waived in lieu of an independent third-party evaluation and certification of crushed glass properties by an AASHTO Materials Reference Laboratory (AMRL)-accredited commercial soil testing laboratory demonstrating that the supplied material conforms to the specified requirements of Section 203. Random triplicate samples will be evaluated and analyzed for every 1,000 tons of material supplied to the project. The averaged results will be used for evaluation purposes. Suppliers of crushed glass shall maintain third party certification records for a period of three years.

106.08 - Storing Materials

Materials shall be stored in a manner so as to ensure the preservation of their quality and fitness for the work. When considered necessary by the Engineer, materials shall be stored in weatherproof buildings on wooden platforms or other hard, clean surfaces that will keep the material off the ground. Materials shall be covered when directed by the Engineer. Stored material shall be located so as to facilitate their prompt inspection. Approved portions of the right of way may be used for storage of material and equipment and for plant operations. However, equipment and materials shall not be stored within the clear zone of the travel lanes open to traffic.

Comment [209]: Right Way/Right Location

Trial Use and Comment

Additional required storage space shall be provided by the Contractor at his expense. Private property shall not be used for storage purposes without the written permission of the owner or lessee. The Contractor shall furnish copies of the owner's written permission to the Engineer. Upon completion of the use of the property, the Contractor shall furnish the Engineer a release signed by the property owner indicating that the property has been satisfactorily restored.

Chemicals, fuels, lubricants, bitumens, paints, raw sewage, and other harmful materials as determined by the Engineer shall not be stored within any floodplain unless no other location is available and only then shall the material be stored in a secondary containment structure(s) with an impervious liner. Also, any storage of these materials in proximity to natural or man-made drainage conveyances or otherwise where the materials could potentially reach a waterway if released under adverse weather conditions, must be stored in a bermed or diked area or inside a container capable of preventing a release. Double-walled storage tanks shall meet the berm/dike containment requirement except for storage within flood plains. Any spills, leaks or releases of such materials shall be addressed in accordance with Section 107.16(b). Accumulated rain water may also be pumped out of the impoundment area into approved dewatering devices

106.09 - Handling Materials

Materials shall be handled in a manner that will preserve their quality, integrity and fitness for the work. Aggregates shall be transported in vehicles constructed to prevent loss or segregation of materials.

106.10 - Unacceptable Materials

Materials that do not conform to the requirements of the Specifications shall be considered unacceptable. Such materials, whether in place or not, will be rejected and shall be removed from the site of the work. If it is not practical for the Contractor to remove rejected material immediately, the Engineer will mark the material for identification. Rejected material whose defects have been corrected shall not be used until approval has been given by the Engineer.

106.11 - Material Furnished by the Department

The Contractor shall furnish all materials required to complete the work except those specified to be furnished by the Department.

Material furnished by the Department will be delivered or made available to the Contractor at the points specified in the Contract. The cost of handling and placing materials after delivery to the Contractor shall be included in the contract price for the item with which they are used.

Comment [210]: Right Documentation

Comment [211]: Right Documentation

Comment [212]: Right Location/Right Way

Comment [213]: Right Way

Comment [214]: Right Materials

Comment [215]: Right Way

Comment [216]: Right Way

Comment [217]: Right Payment

Trial Use and Comment

After receipt of the materials, the Contractor shall be responsible for material delivered to him, including shortages, deficiencies, and damages that occur after delivery, and any demurrage charges.

106.12 - Critical Materials

Raw, manufactured materials or supplies that are necessary for the fabrication, construction, installation or completion of any item of work that is, or becomes, in extremely short supply regionally or nationally as substantiated by recognized public reports such as news media, trade association journals, etc. due to catastrophic events of nature, needs of national defense or industrial conditions beyond the control of the Department or Contractor, will be declared Critical by the Department.

When the supply of materials becomes critical, the provisions of this Section will become applicable to the Contract.

When all items of work involving noncritical materials have been completed by the Contractor or have progressed to a point where no further work is practicable prior to receipt of critical materials, a complete suspension of work will be granted by the Department. Requests for partial suspension orders because of delays attributable to nonreceipt of critical materials will be considered on the basis of merit in each case.

The Department reserves the right to substitute materials by means of a work order.

Contractors, via their manufacturers or suppliers, that request relief due to critical shortage of materials as specified in this Section shall immediately supply information concerning the product and other supporting data to permit the Department an opportunity to access possible alternatives or methods to avoid undue delay or expenditure.

Comment [218]: Right Documentation

Comment [219]: Right Way

Comment [220]: Right Time

Comment [221]: Right Materials

Comment [222]: Right Documentation

FOUR STEP INSPECTION PROCEDURES

Pre-start planning meeting:

- Review specification requirements, materials documentation, construction procedures, measurement, and payment.

Start:

- Contractor is to submit for approval a Source of Materials (Form C-25) prior to the start of Construction. Contractor is to submit for approval, property owner's agreement(s) for any proposed off-site disposal site, and/or borrow site(s) with their site plan including erosion and sediment control prior to the use of the property. The Contractor is to submit for approval, laboratory test results for proposed borrow material prior to use of the material.

Trial Use and Comment

Inspection Requirements:

- Verify all material is from an approved source. Verify that all needed property owner agreements have been submitted. Inspect all off-site facilities for installation and maintenance of E & S controls. Inspect storage sites for conformance.

Final Inspection: Ensure that Contractor furnishes property owner's releases. All materials entered into Materials Book.

REVIEW QUESTIONS

106.01(1)	Does the Inspector have available an approved source of materials list on site?
106.01(2)	Has the Contractor submitted a source of materials in accordance with contract requirements?
106.02	Has the Contractor provided the Engineer with a copy of all invoices for materials delivered to the project?
106.03	Has the Contractor submitted for approval in accordance with the specifications on Local Mine Sources, all necessary agreements and plans for opening or reopening a local pit or quarry prior to performing any work?
106.04	Has the Contractor submitted and had approved all information required in this section before utilizing a disposal area?
106.09	Are materials being handled in a manner that will preserve their quality and fitness for work?
106.10	Have materials that do not conform to the specifications been replaced or if repaired, approved by the Engineer prior to use?

CRITICAL INSPECTION POINTS

• Approved Source of Materials
• Invoices provided for all materials.
• Printed weigh tickets for all asphalt and aggregate delivered
• Signed property owner agreements
• Approved Laboratory test results for off-site borrow
• Disposal site approvals and installation of E & S controls
• Inspection of storage sites and stored materials.

Trial Use and Comment

SECTION 107-LEGAL RESPONSIBILITIES

I. INTRODUCTION:

This section addresses the laws governing the execution of the project work. It describes the right way, and the right documentation necessary to conform to local, state, and federal laws.

a) Forms:

- C-28
- C-57
- C-37
- C-38A
- C-61
- C-45 Storm Water Pollution Prevention Plan (SWPPP) General Permit for the Discharge of Storm Water from Construction Activities and Subcontractor Certification Statement
- C-107 Construction Runoff Control Inspection Form
- C-111 Minimum DBE Requirements
- C-112 Certification of Binding Agreement with DBE
- Environmental Compliance Report
-

Construction Directive Memoranda:

- CD-2011-01
- CD-2011-02
- CD-2007-05
- CD-2008-04

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's:

107.01 - Laws To Be Observed

Comment [223]: Right Way/Right Documentation

The Contractor shall keep fully informed of federal, state, and local laws, bylaws, ordinances, orders, decrees, and regulations of governing bodies, courts, and agencies having any jurisdiction or authority that affects those engaged or employed on the work, the conduct of the work, or the execution of any documents in connection with the work. The Contractor shall observe and comply with such laws, ordinances, regulations, orders, or decrees and shall indemnify and hold harmless the Commonwealth and its agents, officers, or employees against any claim for liability arising from or based on their violation, whether by himself, his agents, his employees, or subcontractors. The

Trial Use and Comment

Contractor shall execute and file the documents, statements, and affidavits required under any applicable federal or state law or regulation required by or affecting his bid or Contract or prosecution of the work there under. The Contractor shall permit examination of any records made subject to such examination by any federal or state law or by regulations promulgated there under by any state or federal agency charged with enforcement of such law.

In accordance with the *Code of Virginia* (Virginia Public Procurement Act), the Contractor shall make payment to all subcontractors, as defined in the Code, within seven days after receipt of payment from the Department; or shall notify the Department and subcontractor in writing of his intention to withhold all or a part of the amount due along with the reason for nonpayment.

In the event payment is not made as noted, the Contractor shall pay interest at the rate of 1 percent per month, unless otherwise provided in the Contract, to the subcontractor on all amounts that remain unpaid after seven days except for the amounts withheld as provided in this Section.

These same requirements shall be included in each subcontract and shall be applicable to each lower-tier subcontractor.

107.02—Permits, Certificates, and Licenses.

General

The Contractor shall conform to the permit conditions as shown in the contract documents. Construction methods shall confirm to the stipulations of the permit and/or certification conditions. The Contractor shall assume all obligations and costs incurred as a result of complying with the terms and conditions of the permits and certificates.

If any of the permits shown herein are applicable to the project, the contract documents will indicate such and the applicable permit conditions will be included in the contract documents.

a) **Department of the Army, Corps of Engineers Nationwide Permits**: A nationwide permit is issued to the Department by the U.S. Army Corps of Engineers to place fill or dredge material in waters of the United States including wetlands.

b) **The State Program General Permit for Linear Transportation Projects (SPGP- 01 2A & B)**: The SPGP-01 2A & B is a permit issued to the Department by the U.S. Army Corps of Engineers to proceed with linear transportation projects involving work, structures and filling both temporary and permanent, in waters of the United States including wetlands.

c) **Letter of Permission (LOP-1):** The LOP-1 is a regional permit issued to the Department by the U.S. Army Corps of Engineers to proceed with roadway projects

Comment [224]: Right Payment/RightTime

Comment [225]: Right Time/ Right Quantity

Comment [226]: Right Way

Comment [227]: Right Documentation-Verify permit compliance using the Environmental Compliance Report

Trial Use and Comment

involving work, structures and filling both temporary and permanent, in waters of the United States including wetlands.

d) **Virginia Marine Resources Commission – Virginia General Permit (VGP-1)**: A VGP-1 permit is issued to the Department by the Virginia Marine Resources Commission and is required on projects that cross in, on or over state-owned land which is submerged below low water (channelward of the mean low water line), in tidal areas including tidal wetlands, or below ordinary high water anywhere in the Commonwealth of Virginia.

e) **Virginia Water Protection Permit (VWPP):** The VWPP is issued to the Department by the Virginia Department of Environmental Quality, Water Division and is required for activities that result in a discharge to surface waters and wetlands. The VWPP is issued as an individual or general permit.

f) **Virginia Stormwater Management Program General/Stormwater Management Permit (VSMP)**: The VSMP permit is issued by the Virginia Department of Conservation and Recreation and is required for all construction activities in accordance with Section 107.16. The general VSMP permit covers the discharges from the site during construction. The Department will be responsible for acquiring the VSMP permit from the Virginia Department of Conservation and Recreation for the project.

g) **Coastal Zone Management (CZM) Consistency Concurrence**: This clearance is issued to the Department by the Virginia Department of Environmental Quality for projects in navigable waters requiring a U.S. Coast Guard bridge permit.

h) **Tennessee Valley Authority (TVA) Permit**: The TVA Section 26a permit is issued to the Department by the Tennessee Valley Authority and is required for construction activities in or along the Tennessee River or its tributaries.

i) **U.S. Coast Guard Bridge Permit**: This permit is required for bridge projects over navigable waters. The Department is responsible for acquiring these permits.

j) **Other Permits, Certificates and Licenses**: Except as otherwise specified herein, the Contractor shall procure all necessary permits, certificates or licenses that have not been obtained by the Department. The Contractor shall pay all charges, fees, and taxes and shall comply with all conditions of the permits, certificates or licenses.

Construction or excavation material shall not be stored within the waterway or wetlands. Cofferdams, stream channel retaining structures and all necessary dikes shall be constructed of non-erodible materials or if specified in the permit(s), faced with coarse non-erodible materials. If faced with non-erodible material, filter cloth shall be placed between the granular fill and riprap in accordance with Section 245, 204, 303.03 and 414. Temporary structures shall be removed from the waterway with minimal disturbance of the streambed. Discharge of dredge or fill material shall be placed in accordance with the best management practice, project permits and all applicable laws

Comment [228]: Right Location / Right Time

Trial Use and Comment

and regulations. Dredged or fill material shall be removed to an approved, contained, upland location in accordance with Section 106.04. The disposal area will be of sufficient size and capacity to properly contain the dredge material, to allow for adequate dewatering and settling of sediment, and to prevent overtopping. The disposal area shall be stabilized prior to placement of dredge material.

The Contractor activities shall not substantially disrupt the movement of those species of aquatic life indigenous to the water body including those species that normally migrate through the area. The Contractor to the maximum extent practicable shall not permanently restrict or impede the passage of normal or expected high flows or cause the relocation of the water. The Contractor shall avoid and minimize all temporary disturbances to surface waters during construction. The Contractor shall remove any temporary fill in its entirety and the affected areas returned to their preexisting elevation conditions within 30 days of completing work, which shall include re-establishing pre-construction contours, and planting or seeding with appropriate wetland vegetation according to cover type (emergent, scrub/shrub, or forested). The Contractor shall perform all work activities during low-flow conditions and shall isolate the construction area via the implementation of nonerodible cofferdams, sheetpiling, stream diversions or similar structures.

The Contractor shall accomplish all construction, construction access (e.g., cofferdams, sheetpiling, and causeways) and demolition activities associated with this project in a manner that minimizes construction or waste materials from entering surface waters. Access roads and associated bridges or culverts shall be constructed to minimize the adverse effects on surface waters. Access roads constructed above preconstruction contours and elevations in surface waters must be bridged or culverted to maintain surface flows. All utility line work in surface waters shall be performed in a manner that minimizes disturbance, and the area shall be returned to its original contours and restored within 30 days of completing work in the area.

The Contractor shall prepare and implement an erosion and sediment control plan in compliance with the Erosion and Sediment Control Law, the Erosion and Sediment Control Regulations, and the annual erosion and sediment control standards and specifications approved by the Department of Conservation and Recreation. The Contractor shall stockpile excavated material in a manner that prevents reentry into the stream, restores original streambed and streambank contours, revegitates barren areas, and implements strict erosion and sediment control measures throughout the project period as described in the Virginia Department of Transporation Annual Program approved by the Virginia Department of Conservation and Recreation.

The Contractor shall comply with the Stormwater Management Act, the Stormwater Management Regulations, and the annual storm water management standards and specifications approved by the Department of Conservation and Recreation. The Contractor shall provide fill material that is clean and free of contaminants in toxic concentrations or amounts in accordance with all applicable laws and regulations. The

Comment [229]: Right Time

Comment [230]: Right Location

Comment [231]: Right Time

Comment [232]: Right Way- See contractor provided Storm Water Pollution Prevention Plan (SWPPP)

Comment [233]: Right Way

Comment [234]: Right Material

Trial Use and Comment

Contractor shall comply with all applicable FEMA-approved state or local floodplain management requirements.

The Contractor shall adhere to any time-of-year restriction conditions as required by state and federal permitting agencies. No in-stream work shall be permitted during in-stream time-of-year restriction.

The Contractor shall prohibit wet or uncured concrete from entry into flowing surface waters. The Contractor shall not dispose of excess or waste concrete in surface waters and prevent wash water from discharging into surface waters. The Contractor shall employ measures to prevent spills of fuels or lubricants into state waters.

The Contractor shall not violate the water quality standards as a result of the construction activities. The Contractor shall not alter the physical, chemical, or biological properties of surface waters and wetlands or make them detrimental to the public health, to animal or aquatic life, to the uses of such waters for domestic or industrial consumption, for recreation, or for other uses.

The Contractor shall not proceed with work covered by a permit until the work is released in writing by the Engineer.

If the Department has not released work covered by a U.S. Army Corps of Engineers permit and the Contractor has completed all other work within the limits of the project, the Contractor shall so advise the Engineer in writing. Upon receipt of the notification, the Engineer will evaluate the status of the project and advise the Contractor within 45 days of the portion of the project that is acceptable under Section 108.09. If the Engineer determines that all of the work except that encumbered by the permit application is acceptable under the requirements of Section 108.09, the Contractor will be notified accordingly. The Department or the Contractor may then elect to continue or terminate the remaining portion of the Contract.

The party electing to terminate the Contract shall so advise the other party in writing after the 45-day period. The terms of contract termination will be in accordance with the requirements of Section 108.08 No compensation will be made for delays encountered or for work not performed except for an extension of time as determined in accordance with the requirements of Section 108.04.

The Contractor shall submit a request to the Engineer in writing if he wants to deviate from the plans or change his proposed method(s) regarding any proposed work located in waterways or wetlands. Such work may require additional environmental permits. If the Engineer determines that the activities are necessary for completion of the work, the Contractor shall furnish the Engineer all necessary information pertaining to the activity. The Contractor shall be responsible for designing and supplying all sketches and notes necessary to acquire any permit modification required for changes in the proposed construction methods. Such information shall be furnished at least 180 days prior to the date the proposed changed activity is to begin. The District Environmental Manager will

Comment [235]: Right Time

Comment [236]: Right Way

Comment [237]: Right Way

Comment [238]: Right Time

Comment [239]: Right Time

Comment [240]: Right Documentation

Comment [241]: Right Way

Comment [242]: Right Time

Trial Use and Comment

apply for the necessary permits modifications to the permits obtained by the Department. The Contractor shall not begin the activity until directed to do so by the Engineer. Additional compensation will not be made for delay to the work or change in the Contractor's proposed methods that result from jurisdiction agency review or disapproval of Contractor's proposed methods.

If additional permits are required to perform dredging for flotation of construction equipment or for other permanent or temporary work as indicated in the Contractor's accepted plan of operation, but have not been obtained by the Department, the Contractor shall furnish the Engineer, at least 75 days prior to the proposed activity, all necessary information pertaining to the proposed activity in order for the Department to apply for the permits. The Contractor shall not begin the proposed activity until the additional permits have been secured and the Engineer has advised the Contractor that the proposed activity may proceed.

The Contractor shall permit representatives of state and federal environmental regulatory agencies to make inspections at any time in order to insure that the activity being performed under authority of the permit(s) is in accordance with the terms and conditions prescribed herein.

107.03 - Federal-Aid Provisions

When the U.S. government pays all or any portion of the cost of a project, the Contractor shall comply with the federal laws and rules and regulations made pursuant to such laws. The work shall be subject to inspection by the appropriate federal agency. Such inspection shall in no sense make the federal government a party of the Contract and will in no way interfere with the rights of either party to the Contract.

107.04 - Furnishing Right of Way

The Department will secure necessary rights of way and easements in advance of construction. The Department will not be responsible for any delay in the acquisition of a right of way other than consideration of an extension of time. The Department will provide notification of known delays in the proposal for work to assist bidders in planning the work and composing their bids. Easements for temporary uses and detours requested by the Contractor and approved by the Department in lieu of a detour within the right of way or easement area shall be acquired by the Contractor without the Department being a party to the agreement.

107.05 - Patented Devices, Materials, and Processes

If the Contractor employs any design, device, material, or process covered by a patent or copyright outside the requirements of the Contract he shall provide for its use by

Comment [243]: Right Payment

Comment [244]: Right Time

Comment [245]: Right Way

Comment [246]: Right Location

Comment [247]: Right Time

Comment [248]: Right Location/Right Payment

Comment [249]: Right Way

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obtaining a legal agreement with the patentee or owner. The Contractor and the surety shall indemnify and save harmless the Commonwealth, any affected third party, or political subdivision from claims for infringement because of such use. The Contractor shall indemnify the Commonwealth for costs, expenses, or damages resulting from infringement during prosecution or after completion of the work.

107.06 - Personal Liability of Public Officials

In carrying out any of the provisions of these Specifications or in exercising any power or authority granted to them by or within the scope of the Contract, there shall be no liability upon the Board, Commissioner, Engineer, or their authorized representatives, either personally or as officials of the Commonwealth. In all such matters, they act solely as agents and representatives of the Commonwealth.

107.07 - No Waiver of Legal Rights

Comment [250]: Right Way

The Commonwealth shall not be precluded or estopped by any measurement, estimate, or certificate made either before or after final acceptance of the work and payment therefor from showing (1) the true amount and character of the work performed and materials furnished by the Contractor, (2) that any such measurement, estimate, or certificate is untrue or incorrectly made, or (3) that the work or materials do not comply with the provisions of the Contract. The Commonwealth shall not be precluded or estopped, notwithstanding any such measurement, estimate, or certificate, and payment in accordance therewith, from recovering from the Contractor or his surety, or both, such damage as it may sustain by reason of his failure to comply with the terms of the Contract. Neither the acceptance by the Department or any representative of the Department nor any payment for or acceptance of the whole or any part of the work, nor any extension of time, nor any possession taken by the Department shall operate as a waiver of any portion of the Contract or of any power herein reserved or of any right to damages. A waiver of any breach of the Contract shall not be held to be a waiver of any other or subsequent breach.

107.08 - Protecting and Restoring Property and Landscape

Comment [251]: Right Way

The Contractor shall preserve property and improvements along the boundary lines of and adjacent to the work unless their removal or destruction is specified in the Contract Documents. The Contractor shall use suitable precautions to prevent damage to such property.

When the Contractor finds it necessary to enter on private property, beyond the limits of the construction easement shown on the plans, he shall secure from the owner or

Comment [252]: Right Documentation

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lessee a written permit for such entry prior to moving thereon. An executed copy of this permit shall be furnished to the Engineer.

The Contractor shall be responsible for any damage or injury to property during the prosecution of the work resulting from any act, omission, neglect, or misconduct in the Contractor's method of executing the work or attributable to defective work or materials. This responsibility shall not be released until final acceptance of the project and a written release from the owner or lessee of the property is obtained.

When direct or indirect damage is done to property by or on account of any act, omission, neglect, or misconduct in the Contractor's method of executing the work or in consequence of the nonexecution thereof on the part of the Contractor, the Contractor shall restore such property to a condition similar or equal to that existing before such damage was done by repairing, rebuilding, or restoring, as may be directed by the Engineer, or making settlement with the property owner. The Contractor shall secure from the owner a release from any claim against the Department without additional compensation therefor. A copy of this release shall be furnished the Engineer.

107.09 - Contractor's Responsibility for Utility Property and Services

At points where the Contractor's operations are on or adjacent to the properties of any utility, including railroads, and damage to which might result in expense, loss, or inconvenience, work shall not commence until arrangements necessary for the protection thereof have been completed.

The Contractor shall cooperate with owners of utilities so that removal and adjustment operations may progress in a timely, responsible, and reasonable manner, duplication of adjustment work may be reduced to a minimum, and services rendered by those parties will not be unnecessarily interrupted.

If any utility service is interrupted as a result of accidental breakage or of being exposed or unsupported, the Contractor shall promptly notify the proper authority and shall cooperate fully with the authority in the restoration of service. If utility service is interrupted, repair work shall be continuous until service is restored. No work shall be undertaken around fire hydrants until provisions for continued service have been approved by the local fire authority. When the Contractor's work operations require the disconnection of "in service" fire hydrants, the Contractor shall notify the locality's fire department or communication center at least 24 hours prior to disconnection. In addition, the Contractor shall notify the locality's fire department or communications center no later than 24 hours after reconnection of such hydrants. The Contractor shall be responsible for any damage to utilities that, in the investigation and determination of the Engineer, is found to be attributable to the Contractor's neglect, means or methods of performing the work.

Comment [253]: Right Documentation

Comment [254]: Right Way

Comment [255]: Right Documentation

Comment [256]: Right Way

Comment [257]: Right Time

Comment [258]: Right Time

Comment [259]: Right Time

Comment [260]: Right Time

Comment [261]: Right Time

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Nothing in this Section shall be construed to be in conflict with the provisions of Section 107.08.

The Contractor shall comply with all requirements of the *Virginia Underground Utility Damage Prevention Act* (the Miss Utility law). The Contractor shall wait a minimum of 48 hours after notifying the Miss Utility notification center before commencing excavation work. The Contractor may commence excavation work after 48 hours only if confirmed through the Ticket Information Exchange (TIE) System that all applicable utilities have either marked their underground line locations or reported that no lines are present in the work vicinity. The Contractor shall wait an additional 24 hours before commencing excavation operations if any utility operators have failed to respond to the TIE within the first 48 hours.

Comment [262]: Right Time

Comment [263]: Right Time

Comment [264]: Right Documentation

Comment [265]: Right Time

107.10 - Restoration of Work Performed by Others

Comment [266]: Right Way

The Department may construct or reconstruct any utility service within the construction limits or grant a permit for the same at any time. The Contractor shall not be entitled to any damages occasioned thereby other than a consideration of an extension of time, unless the Contractor's Work is damaged, altered or impeded by the condition.

Comment [267]: Right Way

Comment [268]: Right Payment/RightTme

When authorized by the Engineer, the Contractor shall allow any person, firm, or corporation to make an opening in the highway within the limits of the project upon presentation of a duly executed permit from the Department or any municipality for sections within its corporate limits. When directed by the Engineer, the Contractor shall satisfactorily repair portions of the work disturbed by the openings. The work for such repairs as authorized and directed by the Engineer will be paid for in accordance with the requirements of Section 109.05 and shall be subject to the same conditions as the original work performed.

107.11 - Use of Explosives

Comment [269]: Right Way

Explosives shall be stored and used in a secure manner in compliance with federal, state, and local laws and ordinances. Prior to prosecuting the work, the Contractor shall conduct an on-site review of the work involved and develop a plan of operations for performing excavation work. Where feasible, the Contractor shall explore other means of loosening and or reducing the size of the excavation without blasting. When blasting becomes necessary, the Contractor's plan of operations shall include a blasting plan detailing the blasting techniques to be used during excavation operations requiring the use of explosives. Both plans shall be submitted to the Engineer for review prior to commencing blasting operations.

Comment [270]: Right Location

The Contractor shall be responsible for damage resulting from the use of explosives. The Contractor shall notify each property and utility owner having a building, structure, or other installation above or below ground in proximity to the site of the work of his

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intention to use explosives. Notice shall be given sufficiently in advance of the start of blasting operations to enable the owners to take steps to protect their property. The review of the Contractor's plan of operations, blasting plan and the notification of property owners shall in no way relieve the Contractor of his responsibility for damage resulting from his blasting operations.

107.12 - Responsibility for Damage Claims

Comment [271]: Right Payment /Right Way

The Contractor shall indemnify and save harmless the Commonwealth, the Board, and its officers, agents, and employees, and the city, town, county, or other municipality in which the work is performed and their officers, agents, and employees, from suits, actions, or claims brought for or on account of any injuries or damages received or sustained by any person, persons, or property resulting from or arising out of the work performed by the Contractor, or by or in consequence of any neglect in safeguarding the work, through the use of unacceptable materials in the construction or the improvement, or resulting from any act or omission, neglect, or misconduct of the Contractor; or by or on account of any claims or amounts recovered by infringement of any patent, trademark, or copyright. The Commissioner may retain as much of the monies due the Contractor under and by virtue of his Contract as the Commonwealth considers necessary to ensure that a fund will be available to pay a settlement or judgment of such suits, actions, or claims. If no monies are due, the Contractor's surety will be held accountable until all such claims and actions have been settled and suitable evidence to that effect has been furnished the Board. Any extension of time granted the Contractor, in which to complete the Contract shall not relieve him or his surety of this responsibility.

It is not intended by any of the provisions of any part of the Contract to establish the public or any member thereof as a third party beneficiary hereunder, or to authorize anyone not a party to the Contract to enter into a suit for personal injuries or property damage pursuant to the terms or provisions of the Contract.

The Contractor shall comply with all requirements, conditions, and terms of the Contract, including but not limited to, environmental permits, commitments identified in the Contract, and applicable environmental laws and regulations. The Contractor shall not cause damage, except as allowed under the terms of the Contract, or as allowed under applicable permits or laws, to the air, water, or other natural resources, or cause damage to adjacent or off-site property.

When any act, omission, or other action of the Contractor occurs, that violates the requirements, conditions or terms of the Contract, and affects the health, safety, or welfare of the public or natural resources, the Engineer will direct the Contractor to take prompt action to repair, replace, or restore the damage or injury within a time frame established by the Engineer, and to comply with the requirements of Section 107.01. If the Contractor fails to make such repair, replacement, or restoration within the established time frame, the Engineer will have the damage or injury repaired, replaced, or restored and will deduct the cost of such repair, replacement, or restoration from monies due the Contractor.

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If the Department determines by its own investigation that injury or damage has occurred as a result of work performed or neglected by the Contractor, the Department may suspend the Contractor from future bidding for a period of time commensurate with the severity of the injury or damage as determined by the Chief Engineer. Injury is defined as harm or impairment to persons or natural resources. Damage is defined as the loss or harm resulting from injury to person or property. In addition, the Department may recover either (i) the loss or damage that the Department suffers as a result of such act, omission or other action or (ii) any liquidated damages established in such contract plus (iii) reasonable attorney's fees, expert witness fees, staff salaries, incidental and equipment charges associated with any investigation.

Upon a finding against the Contractor by the Department, the Contractor shall be responsible for and shall reimburse the Department for all expenses associated with the injury or damage. Expenses include, but are not limited to: costs for investigating the act, omission or other action, financial penalties incurred by the Department as a result of the injury or damage, salary and expenses incurred by employees or consultants of the Commonwealth, road user expenses as determined by the Department due to damage or loss of use of the project area, attorney fees, and expert witness fees. The Department may deduct the reimbursement of expenses from any payments owed the Contractor.

Upon determination by the Department of willful, flagrant or repetitious acts, omissions or other actions related to injury or damage to person or property, the Contractor shall be responsible for and shall reimburse the Department for all expenses associated with the investigation as shown herein, and the Department will impose other appropriate actions, as permitted by law, policy and Specifications, such as but not limited to, suspension of work, termination for cause, removal from the bidders' list.

Once a determination is made that injury or damage has resulted in an action against the Contractor, the Contractor shall have the right of appeal in accordance with the provisions and requirements of Section 105.19.

Should any cost remain in dispute after appeal, resolution shall be handled in accordance with the provisions and requirements of Section 105.19.

107.13 - Labor and Wages

Comment [272]: Right Payment

The Contractor shall comply with the provisions and requirements of the workers' compensation law and public statutes that regulate hours of employment on public work.

(a) **Predetermined Minimum Wages:** The provisions of laws requiring the payment of a minimum wage of a predetermined minimum wage scale for the various classes of laborers and mechanics, when such a scale is incorporated in the Contract, shall be

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expressly made a part of any Contract hereunder. The Contractor and his agents shall promptly comply with all such applicable provisions.

Any classification not listed and subsequently required shall be classified or reclassified in accordance with the wage determination. If other classifications are used, omission of classifications shall not be cause for additional compensation. The Contractor shall be responsible for determining local practices with regard to the application of the various labor classifications.

(b) **Labor Rate Forms:** The Contractor shall complete Form C-28, indicating by classification the total number of employees, excluding executive and administrative employees, employed on the project. The Contractor shall also indicate on the form the compensation rate per hour for each classification. The Contractor shall submit an original and two copies of the form prior to the due date of the second estimate for payment and for each 90-day period thereafter until the work specified in the Contract has been completed.

If at the time of final acceptance the period since the last labor report is 30 days or more, the Contractor shall furnish an additional labor report as outlined herein prior to payment of the final estimate.

107.14 - Equal Employment Opportunity

The Contractor shall comply with the applicable provisions of presidential executive orders and the rules, regulations, and orders of the President's Committee on Equal Employment Opportunity.

The Contractor shall maintain the following records and reports as required by the contract EEO provisions:

a. record of all applicants for employment

b. new hires by race, work classification, hourly rate, and date employed

c. minority and non-minority employees employed in each work classification

d. changes in work classifications

e. employees enrolled in approved training programs and the status of each

f. minority subcontractor or subcontractors with meaningful minority group representation

g. copies of Form C-57 submitted by subcontractors

Comment [273]: Right Documentation

Comment [274]: Right Documentation/ Right Time

Comment [275]: Right Documentation/ Right Time

Comment [276]: Right Way

Comment [277]: Right Documentation

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If the Contract has a stipulation or requirement for trainees, the Contractor shall submit semiannual training reports in accordance with the instructions shown on the forms furnished by the Department. If the Contractor fails to submit such reports in accordance with the instructions, his monthly progress estimate for payment may be delayed.

The Contractor shall cooperate with the Department in carrying out EEO obligations and in the Department's review of activities under the Contract. The Contractor shall comply with the specific EEO requirements specified herein and shall include these requirements in every subcontract of $10,000 or more with such modification of language as may be necessary to make them binding on the subcontractor.

(a) **EEO Policy:** The Contractor shall accept as operating policy the following statement:

It is the policy of this Company to assure that applicants are employed and that employees are treated during employment without regard to their race, religion, sex, color, or national origin. Such action shall include employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship or on-the-job training.

(b) **EEO Officer:** The Contractor shall designate and make known to the Department an EEO Officer who can effectively administer and promote an active contractor EEO program and who shall be assigned adequate authority and responsibility to do so.

(c) **Dissemination of Policy:**

1. Members of the Contractor's staff who are authorized to hire, supervise, promote, and discharge employees or recommend such action or are substantially involved in such action shall be made fully aware of and shall implement the Contractor's EEO policy and contractual responsibilities to provide equal employment opportunity in each grade and classification of employment. The following actions shall be taken as a minimum:

   a. Periodic meetings of supervisory and personnel office employees shall be conducted before the start of work and at least once every 6 months thereafter, at which time the Contractor's EEO policy and its implementation shall be reviewed and explained. The meetings shall be conducted by the EEO Officer or another knowledgeable company official.

   b. New supervisory or personnel office employees shall be given a thorough indoctrination by the EEO Officer or another knowledgeable company official covering all major aspects of the Contractor's EEO obligations within 30 days following their reporting for duty with the Contractor.

Comment [278]: Right Documentation

Comment [279]: Right Time

Comment [280]: Right Time

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c. The EEO Officer or appropriate company official shall instruct employees engaged in the direct recruitment of employees for the project relative to the methods followed by the Contractor in locating and hiring minority group employees.

2. In order to make the Contractor's EEO policy known to all employees, prospective employees, and potential sources of employees such as, but not limited to, schools, employment agencies, labor unions where appropriate, and college placement officers, the Contractor shall take the following actions:

a. Notices and posters setting forth the Contractor's EEO policy shall be placed in areas readily accessible to employees, applicants for employment, and potential employees.

The Contractor shall furnish, erect, and maintain at least two bulletin boards having dimensions of at least 48 inches in width and 36 inches in height at locations readily accessible to all personnel concerned with the project. The boards shall be erected immediately upon initiation of the contract work and shall be maintained until the completion of such work, at which time they shall be removed from the project. Each bulletin board shall be equipped with a removable glass or plastic cover that when in place will protect posters from weather or damage. The Contractor shall promptly post official notices on the bulletin boards. The costs for such work shall be included in the price bid for other contract items.

b. The Contractor's EEO policy and the procedures to implement such policy shall be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

(d) **Recruitment:**

1. When advertising for employees, the Contractor shall include in all advertisements for employees the notation "An Equal Opportunity Employer" and shall insert all such advertisements in newspapers or other publications having a large circulation among minority groups in the area from which the project work force would normally be derived.

2. Unless precluded by a valid bargaining agreement, the Contractor shall conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minority group applicants, including, but not limited to, state employment agencies, schools, colleges, and minority group organizations. The Contractor shall identify sources of potential minority group employees and shall establish procedures with such sources whereby minority group applicants may be referred to him for employment consideration.

3. The Contractor shall encourage his employees to refer minority group applicants for employment by posting appropriate notices or bulletins in areas accessible to all employees. In addition, information and procedures with regard to referring minority group applicants shall be discussed with employees.

Comment [281]: Right Way

Comment [282]: Right Way/ Right Location

Comment [283]: Right Way

Comment [284]: Right Way / Right Location

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(e) **Personnel Actions:** Wages, working conditions, and employee benefits shall be established and administered, and personnel action of any type shall be taken without regard to race, color, religion, sex, or national origin.

1. The Contractor shall conduct periodic inspections of project sites to ensure that working conditions and employee facilities do not indicate discriminatory treatment of personnel.

2. The Contractor shall periodically evaluate the spread of wages paid within each classification to determine whether there is evidence of discriminatory wage practices.

3. The Contractor shall periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the Contractor shall promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, corrective action shall include all affected persons.

4. The Contractor shall investigate all complaints of alleged discrimination made to him in connection with obligations under the Contract, attempt to resolve such complaints, and take appropriate corrective action. If the investigation indicates that the discrimination may affect persons other than the complainant, corrective action shall include those persons. Upon completion of each investigation, the Contractor shall inform every complainant of all avenues of appeal.

(f) **Training:**

1. The Contractor shall assist in locating, qualifying, and increasing the skills of minority group and women employees and applicants for employment.

2. Consistent with work force requirements and as permissible under federal and state regulations, the Contractor shall make full use of training programs, i.e., apprenticeship and on-the-job training programs for the geographical area of contract performance. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

3. The Contractor shall advise employees and applicants for employment of available training programs and the entrance requirements for each.

4. The Contractor shall periodically review the training and promotion potential of minority group employees and shall encourage eligible employees to apply for such training and promotion.

5. If the Contract does not provide a separate pay item for trainees, the cost associated with the training specified herein shall be included in the price bid for other items in the Contract.

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6. If the Contract provides a pay item for trainees, training shall be in accordance with the requirements of Section 518.

(g) **Unions:** If the Contractor relies in whole or in part on unions as a source of employees, best efforts shall be made to obtain the cooperation of such unions to increase opportunities for minority groups and women in the unions and to effect referrals by such unions of minority and women employees. Actions by the Contractor, either directly or through his Contractor's Association acting as agent, shall include the following procedures:

1. In cooperation with the unions, best efforts shall be used to develop joint training programs aimed toward qualifying more minority group members and women for membership in the unions and to increase the skills of minority group employees and women so that they may qualify for higher-paying employment.

2. Best efforts shall be used to incorporate an EEO clause into union agreements to the end that unions shall be contractually bound to refer applicants without regard to race, color, religion, sex, or national origin.

3. Information shall be obtained concerning referral practices and policies of the labor union except that to the extent the information is within the exclusive possession of the union. If the labor union refuses to furnish the information to the Contractor, the Contractor shall so certify to the Department and shall set forth what efforts he made to obtain the information.

4. If a union is unable to provide the Contractor with a reasonable flow of minority and women referrals within the time limit set forth in the union agreement, the Contractor shall, through his recruitment procedures, fill the employment vacancies without regard to race, color, religion, sex, or national origin, making full efforts to obtain qualified or qualifiable minority group persons and women. If union referral practice prevents the Contractor from complying with the EEO requirements, the Contractor shall immediately notify the Department.

(h) **Subcontracting:** The Contractor shall use best efforts to use minority group subcontractors or subcontractors with meaningful minority group and female representation among their employees. Contractors shall obtain lists of MBE, DBE, and WBE construction firms from the Department. If MBE, DBE, or WBE goals are established in the proposal, the Contractor shall comply with the requirements of Section 107.15.

The Contractor shall use best efforts to ensure subcontractor compliance with his EEO obligations.

(i) **Records and Reports:** The Contractor shall keep such records as are necessary to determine compliance with his EEO obligations. The records shall be designed to indicate the following:

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1. the number of minority and nonminority group members and females employed in each work classification on the project

2. the progress and efforts being made in cooperation with unions to increase employment opportunities for minorities and females if unions are used as a source of the work force

3. the progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees

4. the progress and efforts being made in securing the services of minority group subcontractors or subcontractors with meaningful minority group and female representation among their employees

Records shall be retained for a period of three years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the Department.

Each month for the first three months after construction begins and every month of July thereafter for the duration of the project, Form C-57 shall be completed to indicate the number of minority, nonminority, and female employees currently engaged in each work classification shown on the form. The completed Form C-57 shall be submitted within three weeks after the reporting period. Failure to do so may result in delay of approval of the Contractor's monthly progress estimate for payment.

107.15—Use of Minority Business Enterprises (MBEs)

It is the policy of the Department that Minority Business Enterprises (MBEs) shall have the maximum opportunity to participate in the performance of the Contract. The Contractor is encouraged to take necessary and reasonable steps to ensure that MBEs have the maximum opportunity to compete for and perform work on the Contract**,** including participation in any subsequent subcontracts.

MBE shall mean a small business concern (as defined pursuant to Section 3 of the Small Business Act and implementing regulations) that is owned and controlled by one or more minorities or women. *Owned and controlled* means: at least 51 percent of the business is owned by one or more minorities or women or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more minorities or women; and the management and daily business operations are controlled by one or more such individuals.

Minority shall mean a person who is a citizen or lawful permanent resident of the United States and is a bona fide member of a minority group, so regarded by that particular minority community, and who is:

- Black (a person having origins in any of the black racial groups of Africa) or;

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Comment [288]: Right Documentation/Right Way/ Right Payment

Comment [289]: Right Way

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- Hispanic (a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race) or;

- Portuguese (a person of Portuguese, Brazilian, or other Portuguese culture or origin, regardless of race) or;

- Asian American (a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands) or;

- American Indian or Alaskan Native (a person having origins in any of the original peoples of North America); or

- a member of another group, or other individual, found to be economically and socially disadvantaged by the Small Business Administration under 8(a) of the Small Business Act as amended (15 U.S.C. 637[a]).

The Department will furnish, upon request, a list of certified MBEs. This list shall not be construed as an endorsement of the quality or performance of the business, but is simply a listing of firms who are certified by the Department as being MBEs.

The Contractor is encouraged to use the services of banks owned or controlled by minorities or females; however, use of such services will not be credited toward participation achievement for the Contract. The Department has on file, and will make available on request, the names and addresses of known minority and female owned banks in the Commonwealth of Virginia.

The Contractor shall designate and make known to the Department a liaison officer who is assigned the responsibility of actively and effectively administering, encouraging and promoting a responsive program for the use of MBEs.

The performance of the Contract for the purpose of this specification shall be interpreted to include, but not necessarily be limited to, subcontracting; furnishing materials, supplies, and services; and, leasing equipment.

If the Contractor intends to sublet a portion of the work on the project, the Contractor is encouraged to seek out and consider MBEs as potential subcontractors. The Contractor is encouraged to contact MBEs to solicit their interest, capability, and prices and shall retain on file the proper documentation to substantiate such contacts.

By signing the bid, the bidder certifies to the following:

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- That on the work proposed to be sublet and shown on the form for *Contractors Proposal to Sublet*, the bidder has taken reasonable steps to seek out and consider MBEs as potential subcontractors.

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- That, if awarded the project, any work proposed to be sublet and not shown on the form for *Contractors Proposal to Sublet*, the same reasonable steps certified herein will be taken.

If the Department has determined that specific opportunities for participation by MBEs are available on a particular Contract, such participation will be shown as a percentage of the Contract amount and will be indicated in the proposal on Form C-61, *Potential MBE Participation.*

Comment [291]: Right Documentation

If the bidder is an MBE that is owned and controlled by a minority female(s), participation achievement may be shown as either minority or female, but not both. Further, each bidder shall comply with the requirements of Section 102.01.

If the apparent low bidder is a currently certified MBE firm, the MBE requirements of this provision will not be applicable except for those referring to the reporting of participation achievement.

The following are examples of efforts the Department encourages Contractors to make in soliciting MBE participation. Other factors or types of efforts may be relevant in appropriate cases. The Contractor is encouraged to:

(a) attend any pre-solicitation or pre-bid meetings at which MBEs could be informed of contracting and subcontracting opportunities;

(b) advertise in general circulation, trade association and minority-focus media concerning the subcontracting opportunities;

(c) provide written notice to a reasonable number of specific MBEs that their interest in the Contract was being solicited in sufficient time to allow the MBEs to participate effectively;

(d) follow-up initial solicitations of interest by contacting MBEs to determine with certainty whether the MBEs were interested;

(e) select portions of the work to be performed by MBEs in order to increase the likelihood of obtaining MBE participation (including, where appropriate, breaking down contracts into economically feasible units to facilitate MBE participation);

(f) provide interested MBEs with adequate information about the plans, Specifications, and requirements of the Contract;

(g) negotiate in good faith with interested MBEs, not rejecting MBEs as unqualified without sound reasons based on a thorough investigation of their capabilities;

(h) make efforts to assist interested MBEs in obtaining bonding, lines of credit, or insurance required by the Department or Contractor;

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(i) make efforts to assist interested MBEs in obtaining necessary equipment, supplies, materials, or other necessary or related assistance or services; and,

(j) effectively use the services of available minority community organizations; minority contractors' groups; local, state and federal minority business assistance offices; and other organizations that provide assistance in the recruitment and placement of MBEs.

Any agreement between a bidder and an MBE whereby the MBE agrees not to provide quotations for performance of work to other bidders is prohibited.

Within 14 days after the opening of proposals in accordance with Section 102.12, if the apparent low bidder, as read at the bid opening, is reporting participation achievement on the Contract, he shall submit to the Department a fully executed Form C-61 showing the name(s) and certification number(s) of any currently certified MBEs who will perform work eligible to be reported as said participation credit.

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The signatures on Form C-61 shall be those of authorized representatives of the bidder as shown on Forms C-37 and C-38A or as authorized by letter from the bidder.

Comment [293]: Right Documentation

If it is determined, subsequent to the bid opening, that the apparent low bidder as read at the bid opening has changed, the new apparent low bidder will be advised by letter and shall submit the information required herein within 14 days after the date of notification.

Comment [294]: Right Time

Any award made by the Board prior to receipt of the information required will be conditional, pending receipt of such information.

The Contractor shall furnish, and require each subcontractor to furnish, prior to final acceptance of the Contract, information relative to all MBE involvement on the project if such work is to be claimed as participation achievement and verification is available. The information shall be indicated on Form C-63, *MBE/DBE/SWAM Payment Compliance Report* or by copies of canceled checks with appropriate identifying notations. If participation achievement is with an MBE whose name has not been previously furnished, an initial or revised Form C-61, whichever is appropriate, shall be submitted prior to such MBE beginning the work. Failure to provide the Department the forms by the Contractor's semi-final estimate may result in delay of approval of the Contractor's estimate for payment.

Comment [295]: Right Time/ Right Documentation/ Right Payment

If an MBE, through no fault of the Contractor, is unable or unwilling to fulfill his agreement with the Contractor, the Contractor shall immediately notify the Department and provide all relevant facts. If any subcontractor is relieved of the responsibility to perform work under their subcontract, the Contractor is encouraged to take steps to obtain an MBE to perform an equal or greater dollar value of the work. The substitute MBE's name, description of the work, and dollar value of the work shall be submitted to

Comment [296]: Right Documentation/ Right Time /Right Way

Trial Use and Comment

the Department on Form C-61 prior to such MBE beginning the work, if such work is to be counted for participation achievement.

107.16 - Environmental Stipulations

By signing the bid, the bidder shall have stipulated (1) that any facility to be used in the performance of the Contract (unless the Contract is exempt under the Clean Air Act as amended [42 U.S.C. 1857, et seq., as amended by P.L. 91-604], the Federal Water Pollution Control Act as amended [33 U.S.C. 1251 et seq. as amended by P.L. 92-500], and Executive Order 11738 and regulations in implementation thereof [40 C.F.R., Part 15]) is not listed on the EPA's List of Violating Facilities pursuant to 40 C.F.R. 15.20; and (2) that the Department will be promptly notified prior to the award of the Contract if the bidder receives any communication from the Director, Office of Federal Activities, EPA, indicating that a facility to be used for the Contract is under consideration to be listed on the EPA's List of Violating Facilities.

Comment [297]: Right Way/ Right Documentation/ Right Location

No separate payment will be made for the work or precautions described herein except where provided for as a specific item in the Contract or except where provision has been made for such payment in these Specifications.

Comment [298]: Right Payment

Reference is made in various subsections of this section to Tidewater, Virginia. For the purposes of identifying the affected regions assigned to this designation and the requirements therein Tidewater, Virginia is defined as the Counties of Accomack, Arlington, Caroline, Charles City, Chesterfield, Essex, Fairfax, Gloucester, Hanover, Henrico, Isle of Wight, James City, King George, King and Queen, King William, Lancaster, Mathews, Middlesex, New Kent, Northampton, Northumberland, Prince George, Prince William, Richmond, Spotsylvania, Stafford, Surry, Westmoreland and York and the Cities of Alexandria, Chesapeake, Colonial Heights, Fairfax, Falls Church, Fredericksburg, Hampton, Hopewell, Newport News, Norfolk, Petersburg, Poquoson, Portsmouth, Richmond, Suffolk, Virginia Beach and Williamsburg.

Comment [299]: Right Location

(a) **Erosion and Siltation**: The Contractor shall exercise every reasonable precaution, including temporary and permanent soil stabilization measures, throughout the duration of the project to control erosion and prevent siltation of adjacent lands, rivers, streams, wetlands, lakes, and impoundments. Soil stabilization and/or erosion control measures shall be applied to erodible soil or ground materials exposed by any activity associated with construction, including clearing, grubbing, and grading, but not limited to local or on-site sources of materials, stockpiles, disposal areas and haul roads.

Comment [300]: Right Way/ Right Location, Right Documentation, see Form C-107.

The Contractor shall comply with the requirements of Sections 301.02 and 303.03. Should the Contractor as a result of negligence or noncompliance leave an area exposed more than 15 days, the cost of temporary soil stabilization in accordance with the provisions of Section 303 shall be at the Contractor's expense. If the delay in stabilizing an exposed area of land is due to circumstances beyond the Contractor's control, the Department will be responsible for the expense.

Comment [301]: Right Time / Right Payment

Trial Use and Comment

Temporary measures shall be coordinated with the work to ensure effective and continuous erosion and sediment control. Permanent erosion control measures and drainage facilities shall be installed as the work progresses.

Comment [302]: Right Time/Right Location

For projects that disturb 10,000 square feet or greater of land or 2,500 square feet or greater in Tidewater, Virginia, the Contractor shall have within the limits of the project during land disturbance activities, an employee certified by the Department in Erosion and Sediment control who shall inspect erosion and siltation control devices and measures for proper installation and operation immediately after each rainfall, at least daily during periods of prolonged rainfall, and weekly when no rainfall event occurs and promptly report their findings to the Inspector. Failure of the Contractor to maintain a certified employee within the limits of the project will result in the Engineer suspending work related to any land disturbing activity until such time as a certified employee is present on the project. Failure on the part of the Contractor to maintain appropriate erosion and siltation control devices in a functioning condition may result in the Engineer notifying the Contractor in writing of specific deficiencies. Deficiencies shall be corrected immediately. If the Contractor fails to correct or take appropriate actions to correct the specified deficiencies within 24 hours after receipt of such notification, the Department may do one or more of the following: require the Contractor to suspend work in other areas and concentrate efforts towards correcting the specified deficiencies, withhold payment of monthly progress estimates, or proceed to correct the specified deficiencies and deduct the entire cost of such work from monies due the Contractor. Failure on the part of the Contractor to maintain a Department certified erosion and sediment control employee within the project limits when land disturbance activities are being performed will result in the Engineer suspending work related to any land disturbance activity until such time as the Contractor is in compliance with this requirement.

Comment [303]: Right Location/ Right Documentation/ Right Time/ Right Payment/ Right Way

(b) **Pollution:**

1. **Water:** The Contractor shall exercise every reasonable precaution throughout the duration of the project to prevent pollution of rivers, streams, and impoundments. Pollutants such as, but not limited to, chemicals, fuels, lubricants, bitumens, raw sewage, paints, sedimentation, and other harmful material shall not be discharged into or alongside rivers, streams, or impoundments or into channels leading to them. The Contractor shall provide the Engineer a contingency plan for reporting and immediate actions to be taken in the event of a dump, discharge, or spill within eight hours after he has mobilized to the project site.

Comment [304]: Right Way/ Right Documentation

Construction discharge water shall be filtered to remove deleterious materials prior to discharge into state waters. Filtering shall be accomplished by the use of a standard dewatering basin or a dewatering bag. Dewatering bags shall conform to the requirements of Section 245. During specified spawning seasons, discharges and construction activities in spawning areas of state waters shall be restricted so as not to disturb or inhibit aquatic species that are indigenous to the waters. Neither water nor

Comment [305]: Right Way/Right Time/ Right Location

Trial Use and Comment

other effluence shall be discharged onto wetlands or breeding or nesting areas of migratory waterfowl. When used extensively in wetlands, heavy equipment shall be placed on mats. Temporary construction fills and mats in wetlands and flood plains shall be constructed of approved nonerodible materials and shall be removed by the Contractor to natural ground when the Engineer so directs.

If the Contractor dumps, discharges, or spills any oil or chemical that reaches or has the potential to reach a waterway, he shall immediately notify all appropriate jurisdictional state and federal agencies in accordance with the requirements of Section 107.01 and shall take immediate actions to contain, remove, and properly dispose of the oil or chemical.

Comment [306]: Right Way/Right Documentation

Excavation material shall be disposed of in approved areas above the mean high water mark shown on the plans in a manner that will prevent the return of solid or suspended materials to state waters. If the mark is not shown on the plans, the mean high water mark shall be considered the elevation of the top of stream banks.

Comment [307]: Right Way/ Right Location

Constructing new bridge(s) and dismantling and removing existing bridge(s) shall be accomplished in a manner that will prevent the dumping or discharge of construction or disposable materials into rivers, streams, or impoundments.

Comment [308]: Right Way

Construction operations in rivers, streams, or impoundments shall be restricted to those areas where identified on the plans and to those that must be entered for the construction of structures. Rivers, streams, and impoundments shall be cleared of falsework, piling, debris, or other obstructions placed therein or caused by construction operations. Stabilization of the streambed and banks shall occur immediately upon completion of work if work is suspended for more than 15 days.

Comment [309]: Right Location/ Right Time

The Contractor shall prevent stream constriction that would reduce stream flows below the minimum, as defined by the State Water Control Board, during construction operations.

If it is necessary to relocate an existing stream or drainage facility temporarily to facilitate construction, the Contractor shall design and provide temporary channels or culverts of adequate size to carry the normal flow of the stream or drainage facility. The Contractor shall submit a temporary relocation design to the Engineer for review and acceptance in sufficient time to allow for discussion and correction prior to beginning the work the design covers. Costs for the temporary relocation of the stream or drainage facility shall be included in the Contract price for the related pipe or box culvert, unless specifically provided for under another Pay Item. Stabilization of the streambed and banks shall occur immediately upon completion of, or during the work or if the work is suspended for more than 15 days.

Comment [310]: Right Way/ Right Location/ Right Payment/ Right Time

Temporary bridges or other minimally invasive structures shall be used wherever the Contractor finds it necessary to cross a stream more than twice in a 6 month period, unless otherwise authorized by water quality permits issued by the U. S. Army Corps of

Comment [311]: Right Time/ Right Location

Trial Use and Comment

Engineers, Virginia Marine Resources Commission or the Virginia Department of Environmental Quality for the Contract.

2. **Air:** The Contractor shall comply with the provisions of Section 107.01 and the State Air Pollution Control Law and Rules of the State Air Pollution Control Board, including notifications required therein.

Burning shall be performed in accordance with all applicable local laws and ordinances and under the constant surveillance of watchpersons. Care shall be taken so that the burning of materials does not destroy or damage property or cause excessive air pollution. The Contractor shall not burn rubber tires, asphalt, used crankcase oil, or other materials that produce dense smoke. Burning shall not be initiated when atmospheric conditions are such that smoke will create a hazard to the motoring public or airport operations. Provisions shall be made for flagging vehicular traffic if visibility is obstructed or impaired by smoke. At no time shall a fire be left unattended.

Asphalt mixing plants shall be designed, equipped, and operated so that the amount and quality of air pollutants emitted will conform to the rules of the State Air Pollution Control Board.

Emission standards for asbestos incorporated in the EPA's National Emission Standards for Hazardous Air Pollutants apply to the demolition or renovation of any institutional, commercial, or industrial building, structure, facility, installation, or portion thereof that contains friable asbestos or where the Contractor's methods for such actions will produce friable asbestos.

3. **Noise:** The Contractor's operations shall be performed so that exterior noise levels measured during a noise-sensitive activity shall not exceed 80 decibels. Such noise level measurements shall be taken at a point on the perimeter of the construction limit that is closest to the adjoining property on which a noise sensitive activity is occurring. A *noise-sensitive activity* is any activity for which lowered noise levels are essential if the activity is to serve its intended purpose and not present an unreasonable public nuisance. Such activities include, but are not limited to, those associated with residences, hospitals, nursing homes, churches, schools, libraries, parks, and recreational areas.

The Department may monitor construction-related noise. If construction noise levels exceed 80 decibels during noise sensitive activities, the Contractor shall take corrective action before proceeding with operations. The Contractor shall be responsible for costs associated with the abatement of construction noise and the delay of operations attributable to noncompliance with these requirements.

The Department may prohibit or restrict to certain portions of the project any work that produces objectionable noise between 10 P.M. and 6 A.M. If other hours are established by local ordinance, the local ordinance shall govern.

Comment [312]: Right Way

Comment [313]: Right Quantity/ Right Location

Comment [314]: Right Payment

Comment [315]: Right Time

Trial Use and Comment

Equipment shall in no way be altered so as to result in noise levels that are greater than those produced by the original equipment.

When feasible, the Contractor shall establish haul routes that direct his vehicles away from developed areas and ensure that noise from hauling operations is kept to a minimum.

These requirements shall not be applicable if the noise produced by sources other than the Contractor's operation at the point of reception is greater than the noise from the Contractor's operation at the same point.

(c) **Forests:** The Contractor shall take all reasonable precautions to prevent and suppress forest fires in any area involved in construction operations or occupied by him as a result of such operations. The Contractor shall cooperate with the proper authorities of the state and federal governments in reporting, preventing, and suppressing forest fires. Labor, tools, or equipment furnished by the Contractor upon the order of any forest official issued under authority granted the official by law shall not be considered a part of the Contract. The Contractor shall negotiate with the proper forest official for compensation for such labor, tools, or equipment

(d) **Archeological, Paleontological, and Rare Mineralogical Findings:** In the event of the discovery of prehistoric ruins, Indian or early settler sites, burial grounds, relics, fossils, meteorites, or other articles of archeological, paleontological, or rare mineralogical interest during the prosecution of work, the Contractor shall act immediately to suspend work at the site of the discovery and notify the Engineer. The Engineer will immediately notify the proper state authority charged with the responsibility of investigating and evaluating such finds. The Contractor shall cooperate and, upon the request of the Engineer, assist in protecting, mapping, and removing the findings. Labor, tools, or equipment furnished by the Contractor for such work will be paid for in accordance with the requirements of Section 104.03. Findings shall become the property of the Commonwealth unless they are located on federal lands, in which event they shall become the property of the U.S. government.

When such findings delay the progress or performance of the work, the Contractor shall notify the Engineer in accordance with the provisions of Sections 108.03 and Section 109.05.

(e) **Storm Water Pollution Prevention Plan**

The Storm Water Pollution Prevention Plan (SWPPP) is comprised of, but not limited to, the Erosion and Sediment Control (ESC) Plan, the Stormwater Management (SWM) Plan and related Specifications and Standards contained within all contract documents and shall be required for all land-disturbing activities that disturb 10,000 square feet or greater, or 2,500 square feet or greater in Tidewater, Virginia.

Comment [316]: Right Payment

Comment [317]: Right Time/ Right Documentation/Right Location/ Right Payment

Comment [318]: Right Time

Comment [319]: Right Way/ Right Documentation/ Right Location

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For land-disturbing activities that disturb 1 acre or greater, or 2500 square feet or greater in an area designated as a Chesapeake Bay Preservation Area, coverage under the Department of Conservation and Recreation's Virginia Stormwater Management Program (VSMP) General Construction Permit DCR-01 is required. Where applicable, the Department will apply for and retain coverage under this permit for the land disturbing activity. The requirements of this permit will be satisfied by the Contractor's compliance with the project's SWPPP terms and conditions.

The Contractor shall be responsible for reading, understanding, and complying with the terms and conditions of the DCR-01 General Permit and the project's SWPPP as follows:

1. **Project Implementation Responsibilities**

The Contractor shall be responsible for the installation, maintenance, inspection, and ensuring the functionality of all erosion and sediment control measures on a daily basis and all other stormwater and pollutant runoff control measures identified within or referenced within the plans, Specifications, permits, and other contract documents.

The Contractor shall take all reasonable steps to prevent or minimize any stormwater or non-stormwater discharge that will have a reasonable likelihood of adversely affecting human health or public and/or private properties.

2. **Certification Requirements**

In addition to satisfying the personnel certification requirements contained herein, the Contractor shall certify his activities by completing, signing, and submitting Form C-45 VDOT SWPPP Contractor and Subcontractor Certification Statement to the Engineer at least 7 days prior to commencing any project related land-disturbing activities, both on-site and off-site.

3. **Off Site (Outside the Construction Limits) Requirements**

The Contractor shall develop erosion and sediment control plan(s) and stormwater pollution prevention plan(s) for submission and acceptance by the Engineer prior to usage of any support facilities, off-site borrow and disposal areas, construction materials or equipment storage areas, and any other areas that may generate a stormwater or non-stormwater discharge directly related to the construction process. Such plans, upon acceptance, shall become a part of and subject to the overall project plan, the VSMP General Construction Permit, and all other contract requirements.

4. **Reporting Procedures**

a. **Inspection Requirements**

Comment [320]: Right Documentation

Comment [321]: Right Time

Comment [322]: Right Documentation/ Right Time

Comment [323]: Right Documentation

Comment [324]: Right Documentation/Right Way

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The Contractor shall be responsible for conducting inspections in accordance with the requirements herein. The Contractor shall document such inspections by completion of Form C-107 (a) and (b), Construction Runoff Control Inspection Form and Continuation Sheet, in strict accordance with the directions contained within the form.

b. **Unauthorized Discharge Requirements**

The Contractor shall not discharge into state waters sewage, industrial wastes, other wastes or any noxious or deleterious substances nor shall otherwise alter the physical, chemical, or biological properties of such waters that render such waters detrimental for or to domestic use, industrial consumption, recreational or other public uses.

(1). **Notification of non-compliant discharges**

The Contractor shall immediately notify the Engineer upon the discovery of or potential of any unauthorized, unusual, extraordinary, or non-compliant discharge from the land disturbing activity. Where immediate notification is not possible, such notification shall be not later than 24 hours after said discovery.

Comment [325]: Right Time

(2). **Detailed report requirements for non-compliant discharges**

The Contractor shall submit to the Engineer within 5 days of the discovery of any actual or potential non-compliant discharge a written report describing details of the discharge to include its volume, location, cause, and any apparent or potential effects on private and/or public properties and state waters or endangerment to public health, as well as steps being taken to eliminate the discharge. A completed Form C-107 (a) and (b) shall be used for such reports.

Comment [326]: Right Time/ Right Quantity/ Right Location/ Right Documentation

15. **Plans, Changes, Deficiencies and Revisions**

a. **Contractor SWPPP**

The Contractor shall develop and provide a SWPPP that documents the location and description of potential pollutant sources such as vehicle fueling areas, storage areas for fertilizers or chemicals, sanitary waste facilities, construction and waste material storage areas, etc. prior to any such pollutant sources being established on the project site. Such plans and documentation shall include a description of the controls to reduce, prevent and control pollutants from these sources including spill prevention and response. The Contractor shall submit such plans and documentation as specified herein to the Engineer and, upon review and approval, they shall immediately become a component of the project's SWPPP and subject to all corresponding requirements contained therein.

Comment [327]: Right Documentation/ Right Location/ Right Way

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The Contractor shall ensure that the SWPPP is kept on the project site at all times in accordance with the provisions of Section 105.10 and shall be available for review upon request.

b. **Changes and Deficiencies**

The Contractor shall report to the Engineer when any planned physical alterations or additions are made to the land disturbing activity or deficiencies in the project plans or contract documents are discovered that could significantly change the nature or increase the quantity of the pollutants discharged from the land disturbing activity to surface waters.

c. **Revisions to the SWPPP**

Where site conditions or construction sequencing or scheduling necessitates revisions or modifications to the erosion and sediment control plan or other any other component of the SWPPP for the land disturbing activity, such revisions or modifications shall be approved by the Engineer and shall be documented by the Contractor on a designated plan set (Record Set). Such plans shall be kept on the project site at all times and shall be available for review upon request.

107.17 - Construction Safety and Health Standards

Compliance with construction safety and health standards is a condition of the Contract, and shall be made a condition of each subcontract entered into pursuant to the Contract, that the Contractor and any subcontractor shall not require any worker employed in performance of the Contract to work in surroundings or under working conditions that are unsanitary, hazardous, or dangerous to their health or safety, as determined under construction safety and health standards promulgated by the U.S. Secretary of Labor in accordance with the requirements of Section 107 of the Contract Work Hours and Safety Standards Act.

The Contractor shall comply with the Virginia Occupational Safety and Health Standards adopted under the *Code of Virginia* and the duties imposed under the Code. Any violation of the requirements or duties that is brought to the attention of the Contractor by the Engineer or any other person shall be immediately abated.

At a minimum, all Contractor personnel shall comply with the following, unless otherwise determined unsafe or inappropriate in accordance with OSHA regulations:

1. Hard hats shall be worn while participating in or observing all types of field work when outside of a building or outside of the cab of a vehicle, and exposed to, participating in or supervising construction.

Comment [328]: Right Location

Comment [329]: Right Way

Comment [330]: Right Documentation

Comment [331]: Right Way

Comment [332]: Right Way/Right Location

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12. Respiratory protective equipment shall be worn whenever an individual is exposed to any item listed in the OSHA Standards as needing such protection unless it is shown that the employee is protected by engineering controls.

13. Adequate eye protection shall be worn in the proximity of grinding, breaking of rock and/or concrete, while using brush chippers, striking metal against metal or when working in situations where the eyesight may be in jeopardy.

14. A safety vest shall be worn by all exposed to vehicular traffic and construction equipment.

15. Standards and guidelines of the current Virginia Work Area Protection Manual shall be used when setting, reviewing, maintaining, and removing traffic controls.

16. Flaggers shall be certified in accordance with the Virginia Flagger Certification Program.

17. No person shall be permitted to position themselves under any raised load or between hinge points of equipment without first taking steps to support the load by the placing of a safety bar or blocking.

18. Explosives shall be purchased, transported, stored, used and disposed of by a Virginia State Certified Blaster in possession of a current criminal history record check and a commercial driver's license with hazardous materials endorsement and a valid medical examiner's certificate. All Federal, State and local regulations pertaining to explosives shall be strictly followed.

19. All electrical tools shall be adequately grounded or double insulated. Ground Fault Circuit Interrupter (GFCI) protection must be installed in accordance with the National Electrical Code (NEC) and current Virginia Occupational Safety and Health agency (VOSH). If extension cords are used, they shall be free of defects and designed for their environment and intended use.

10. No person shall enter a confined space without training, permits and authorization.

11. Fall protection shall be required whenever an employee is exposed to a fall six feet or greater.

107.18 - Sanitary Provisions

The Contractor shall provide and maintain in a neat, sanitary condition such accommodations for the use of employees as may be necessary to comply with the requirements of the state and local Board of Health or other bodies or tribunals having jurisdiction.

Comment [333]: Right Documentation

Comment [334]: Right Documentation

Comment [335]: Right Documentation

Comment [336]: Right Location

Comment [337]: Right Way

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107.19 - Railway-Highway Provisions

If the Contractor's work requires hauling materials across the tracks of a railway, he shall make arrangements with the railway for any new crossing(s) required. Access to existing rail crossings with off-road heavy equipment shall also be arranged by the Contractor. Charges made by the railway company for the construction or use of new or existing crossings and their subsequent removal and for watchperson or flagger service at such crossings shall be reimbursed by the Contractor directly to the railway company under the terms of their separate individual arrangements before final acceptance.

Work to be performed by the Contractor in construction on or over the railway right of way shall be performed at times and in a manner that will not unnecessarily interfere with the movement of trains or traffic on the railway track. The Contractor shall use care to avoid accidents, damage, or unnecessary delay or interference with the railway company's trains or other property. If any interruption of railway traffic is required by the Contractor's actions, he shall obtain prior written approval from the railway company.

The Contractor shall conduct operations that occur on or over the right of way of any railway company fully within the rules, regulations, and requirements of the railway company and in accordance with the requirements of any agreements made between the Department and the railway company that are a part of the Contract. Said agreements are included within the Contract Documents.

(a) **Flagger or Watchperson Services:** Flagger or watchperson services required by the railway company for the safety of railroad operations because of work being performed by the Contractor or incidental thereto will be provided by the railway company. The cost for such services as required for work shown on the plans will be borne by the Department. Any cost of such services resulting from work not shown on the plans or for the Contractor's convenience shall be borne by the Contractor and shall be paid directly to the railway company(s) under the terms of their separate individual agreement.

No work shall be undertaken on or over the railway right of way until the watchpersons or flaggers are present at the project site. The Contractor shall continuously prosecute the affected work to completion to minimize the need for flagger or watchperson services. Costs for such services that the Engineer determines to be unnecessary because of the Contractor's failure to give notice as required herein before initially starting, intermittently continuing, or discontinuing work on or over the railway right of way shall be borne by the Contractor and will be deducted from monies due him.

(b) **Approval of Construction Methods on Railway Right of Way:** The Contractor shall submit to the Department a plan of operations showing the design and method of proposed structural operations and shall obtain its approval before performing any work on the railway company's right of way unless otherwise indicated in the railroad

Comment [338]: Right Way/ Right Location/ Right Payment

Comment [339]: Right Time/ Right Way

Comment [340]: Right Way/Right Location

Comment [341]: Right Payment

Comment [342]: Right Time

Comment [343]: Right Way/Right Documentation

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agreement. The plan shall be clear and legible, and details shall be drawn to scale. The plan shall incorporate any stipulations or requirements the railroad may impose for the evaluation of the Contractor's contemplated operations. The plan shall show, but not be limited to, the following:

1. proximity of construction operations to tracks

2. depth of excavation with respect to tracks

3. description of structural units

4. vertical and horizontal clearances to be afforded the railroad during installation and upon completion of excavation

5. sheeting and bracing

6. method and sequence of operations

Approval shall not relieve the Contractor of any liability under the Contract. The Contractor shall arrange the work so as not to interfere with the railway company's operation except by agreement with the railway company.

(c) **Insurance:** In addition to insurance or bonds required under the terms of the Contract, the Contractor shall carry insurance covering operations affecting the property of the railway company. The original railroad protective liability insurance policy and certificate of insurance showing insurance carried by the Contractor and any subcontractors shall be submitted to the railway company for approval and retention.

Neither the Contractor nor any subcontractor shall begin any work affecting the railway company until the railway company has received the insurance.

Notice of any material change in or cancellation of the required policies shall be furnished the Department and the railway company at least 30 days prior to the effective date of the change or cancellation. The insurance shall be of the following kinds and amounts:

1. **Contractor's public liability and property damage insurance:** The Contractor shall furnish evidence to the Department with respect to the operations to be performed that he carries regular contractor's public liability insurance. The insurance shall provide for a limit of at least the dollar value specified in the Contract for all damages arising out of bodily injuries to or the death of one person, and subject to that limit for each person, a total limit of at least the dollar value specified in the Contract for all damages arising out of bodily injuries to or death of two or more persons in any one occurrence, and regular contractor's property damage insurance providing for a limit of at least the dollar value specified in the Contract for all damages arising out of bodily injury to or destruction of property in any one occurrence, and subject to that limit per occurrence, a total or

Comment [344]: Right Dcoumentation

Comment [345]: Right Time

Comment [346]: Right Time

Comment [347]: Right Documentation

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aggregate limit of at least the dollar value specified in the Contract for all damages arising out of injury to or destruction of property during the policy period. The Contractor's public liability and property damage insurance shall include explosion, collapse, and underground damage coverage. If the Contractor subcontracts any portion of the work, he shall secure insurance protection in his own behalf under the Contract's public liability and property damage insurance policies to cover any liability imposed on him by law for damages because of bodily injury to, or death of persons and injury to, or destruction of property as a result of work undertaken by the subcontractors. In addition, the Contractor shall provide similar insurance protection for and on behalf of any subcontractors to cover their operation by means of separate and individual contractor's public liability and property damage policies. As an alternative, he shall require each subcontractor to provide such insurance in his own behalf.

2. **Railroad protective insurance and public liability and property damage:** The policy furnished the railway company shall include coverage for contamination, pollution, explosion, collapse, and underground damage. The policy shall be of the type specified hereinafter and shall be expressed in standard language that may not be amended. No part shall be omitted except as indicated hereinafter or by an endorsement that states an amendment or exclusion of some provision of the form in accordance with the provisions of a manual rule. The form of the endorsement shall be approved as may be required by the supervising authority of the state in which the policy is issued. A facsimile of the Policy Declarations form as shown in the proposal shall be made a part of the policy and shall be executed by an officer of the insurance company. The several parts of the requirements and stipulations specified or inferred herein may appear in the policy in such sequence as the company may elect.

Comment [348]: Right Documentation

a. **For a policy issued by one company:**

Comment [349]: Right Documentation

(NAME AND LOCATION OF INDEMNITY COMPANY), a _____ Insurance
(Type of Company)
Company, herein called the Company, agrees with the insured named in the Policy Declarations made a part hereof, in consideration of the payment of the premium and in reliance upon the statements in the Policy Declarations made by the named insured and subject to all of the terms of his policy.

For a policy issued by two companies:

(NAME AND LOCATION OF INDEMNITY COMPANY) and
(NAME AND LOCATION OF INDEMNITY COMPANY),
each a _____ Insurance Company, herein called the Company, severally
(Type of Company)
agree with the insured named in the Policy Declarations made a part hereof, in consideration of the payment of the premium and in reliance upon the statements in the Policy Declaration made by the named insured and subject to all of the terms of

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this policy, provided the named Indemnity Company shall be the insured with respect to Coverage _____ and no other and the named Insurance Company shall be the insurer with respect to Coverage _____ and no other.

b. **Insuring agreements:**

Comment [350]: Right documentation

(1) **Coverages: Coverage A—Bodily injury liability:** To pay on behalf of the insured all sums that the insured shall become legally obligated to pay as damages because of bodily injury, sickness, or disease including death at any time resulting therefrom (hereinafter called bodily injury) either (1) sustained by any person arising out of acts or omissions at the designated job site that are related to or are in connection with the work described in Item 6 of the Policy Declarations; or (2) sustained at the designated job site by the Contractor, any employee of the Contractor, any employee of the governmental authority specified in Item 5 of the Policy Declarations, or any designated employee of the insured, whether or not arising out of such acts or omissions.

Coverage B—Property damage liability: To pay on behalf of the insured all sums the insured shall become legally obligated to pay as damages because of physical injury to or destruction of property, including loss of use of any property because of such injury or destruction (hereinafter called property damage) arising out of acts or omissions at the designated job site that are related to or are in connection with the work described in Item 6 of the Policy Declarations.

Coverage C—Physical damage to property: To pay for direct and accidental loss of or damage to rolling stock and other contents, mechanical construction equipment, or motive power equipment (hereinafter called loss) arising out of acts or omissions at the designated job site that are related to or are in connection with the work described in Item 6 of the Policy Declarations; provided such property is owned by the named insured or is leased or entrusted to the named insured under a lease or trust agreement.

(2) **Definitions:** *Insured* means and includes the named insured and any executive officer, director, or stockholder thereof while acting within the scope of his duties as such.

Contractor means the Contractor designated in Item 4 of the Policy Declarations and includes all subcontractors of the Contractor but not the named insured.

Designated employee of the insured means (1) any supervisory employee of the insured at the job site; (2) any employee of the insured while operating, attached to, or engaged on work trains or other railroad equipment at the job site that is assigned exclusively to the Contractor; or (3) any employee of the insured not within (1) or (2) who is specifically loaned or assigned to the work of the Contractor for preventi

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on of accidents or protection of property, the cost of whose services is borne specifically by the Contractor or governmental authority.

Contract means any contract or agreement to carry a person or property for a consideration or any lease, trust, or interchange contract or agreement respecting motive power, rolling stock, or mechanical construction equipment.

(3) **Defense and settlement supplementary payments:** With respect to such insurance as is afforded by this policy under Coverages A and B, the Company shall defend any suit against the insured alleging such bodily injury or property damage and seeking damages that are payable under the terms of this policy, even if any of the allegations of the suit are groundless, false, or fraudulent. However, the Company may make such investigation and settlement of any claim or suit as it deems expedient.

In addition to the applicable limits of liability, the Company shall pay (1) all expenses incurred by the company, all costs taxed against the insured in any such suit, and all interest on the entire amount of any judgment therein that accrues after entry of the judgment and before the Company has paid or tendered or deposited in court that part of the judgment that does not exceed the limit of the Company's liability thereon; (2) premiums on appeal bonds required in any such suit and premiums on bonds to release attachments for an amount not in excess of the applicable limit of liability of this policy, but without obligation to apply for or furnish any such bonds; (3) expenses incurred by the insured for first aid to others that shall be imperative at the time of the occurrence; and (4) all reasonable expenses, other than loss of earnings, incurred by the insured at the Company's request.

(4) **Policy period and territory:** This policy applies only to occurrences and losses during the policy period and within the United States, its territories or possessions, or Canada.

c. **Exclusions:** This policy does not apply to the following:

(1) liability assumed by the insured under any contract or agreement except a contract as defined herein

(2) bodily injury or property damage caused intentionally by or at the direction of the insured

(3) bodily injury, property damage, or loss that occurs after notification to the named insured of the acceptance of the work by the governmental authority, other than bodily injury, property damage, or loss resulting from the existence or removal of tools, uninstalled equipment, and abandoned or unused materials

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(4) under Coverage A(1), B, and C, to bodily injury, property damage, or loss, the sole proximate cause of which is an act or omission of any insured

(5) under Coverage A, to any obligation for which the insured or any carrier as his insurer may be held liable under any workers' compensation, employment compensation, or disability benefits law or under any similar law; provided that the Federal Employer's Liability Act, *U.S. Code* (1946) Title 45, Sections 51-60, as amended, shall for the purpose of this insurance be deemed not to be any similar law

(6) under Coverage B, to injury to or destruction of property owned by the named insured or leased or entrusted to the named insured under a lease or trust agreement

(7) under any liability coverage, to injury, sickness, disease, death, or destruction (1) with respect to which an insured under the policy is also an insured under a nuclear energy liability policy issued by the Nuclear Energy Liability Insurance Association, Mutual Atomic Energy Liability Underwriters, or Nuclear Insurance Association of Canada or would be an insured under any such policy but for its termination upon exhaustion of its limit of liability; or (2) resulting from the hazardous properties of nuclear material and with respect to which any person or organization is required to maintain financial protection pursuant to the Atomic Energy Act of 1954 or any law amendatory thereof or the insured is (or had this policy not been issued would be) entitled to indemnity from the United States or any agency thereof under any agreement entered into by the United States, or any agency thereof, with any person or organization

(8) under any Medical Payments Coverage or any Supplementary Payments provision relating to immediate medical or surgical relief or to expenses incurred with respect to bodily injury, sickness, disease, or death resulting from the hazardous properties of nuclear material and arising out of the operation of a nuclear facility by any person or organization

(9) under any liability coverage, to injury, sickness, disease, death, or destruction resulting from the hazardous properties of nuclear material if (1) the nuclear material is at any nuclear facility owned or operated by or on behalf of an insured or has been discharged or dispersed therefrom; (2) the nuclear material is contained in spent fuel or waste at any time possessed, handled, used, processed, stored, transported, or disposed of by or on behalf of an insured; or (3) the injury, sickness, disease, death, or destruction arises out of the furnishing by an insured of services, materials, or parts for equipment in connection with the planning, construction, maintenance, operation, or use of any nuclear facility; if such facility is located in the United States, its territories or possessions, or Canada, this exclusion applies only to injury to or destruction of property at such nuclear facility

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(11) under Coverage C, to loss attributable to nuclear reaction, nuclear radiation, or radioactive contamination or to any act or condition incident to any of the foregoing

As used in exclusions (7), (8), and (9), the following definitions apply: *Hazardous properties* include radioactive, toxic, or explosive properties. *Nuclear material* means source material, special nuclear material, or byproduct material. *Source material, special nuclear material, and byproduct material* have the meanings given them in the Atomic Energy Act of 1954 or in any law amendatory thereof. *Spent fuel* means any fuel element or fuel component (solid or liquid) that has been used or exposed to radiation in a nuclear reaction. *Disposable material* means material containing byproduct material and resulting from the operation by any person or organization of any nuclear facility included in the definition of nuclear facility under 1 or 2 below. *Nuclear facility* means:

(1) any nuclear reactor

(2) any equipment or device designed or used for separating the isotopes of uranium or plutonium; processing or utilizing spent fuel; or handling, processing, or packaging waste

(3) any equipment or device designed or used for the processing, fabricating, or alloying of special nuclear material if at any time the total amount of such material in the custody of the insured at the premises where such equipment or device is located consists of or contains more than 25 grams of plutonium or uranium 233 (or any combination thereof) or more than 250 grams of uranium 235

(4) any structure, basin, excavation, premises, or place prepared or used for the storage or disposal of waste (includes the site on which any of the foregoing is located, all operation conducted on such site, and all premises used for such operations)

Nuclear reactor means any apparatus designed or used to sustain nuclear fission in a self-supporting chain reaction or to contain a critical mass of fissionable material. With respect to injury to or destruction of property, *injury* or *destruction* includes all forms of radioactive contamination of property.

d. **Conditions:** The following conditions, except conditions (3) through (12), apply to all coverages. Conditions (3) through (12) apply only to the coverage noted thereunder.

(1) **Premium:** The premium bases and rates for the hazards described in the Policy Declarations are stated therein. Premium bases and rates for hazards not so described are those applicable in accordance with the requirements of the manuals used by the company. The term “contract cost” means the total cost of

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all work described in Item 6 of the Policy Declaration. The term “rental cost” means the total cost to the Contractor for rental or work trains or other railroad equipment, including the remuneration of all employees of the insured while operating, attached to, or engaged thereon. The advance premium stated in the Policy Declarations is an estimated premium only. Upon termination of this policy, the earned premium shall be computed in accordance with the Company’s rules, rates, rating plans, premiums, and minimum premiums applicable to this insurance. If the earned premium thus computed exceeds the estimated advance premium paid, the Company shall look to the Contractor specified in the Policy Declarations for any such excess. If the earned premium is less than the estimated advance premium paid, the Company shall return to the Contractor the unearned portion paid. In no event shall payment or premium be an obligation of the named insured.

(2) **Inspection:** The named insured shall make available to the Company records of information relating to the subject matter of this insurance. The Company shall be permitted to inspect all operations in connection with the work described in Item 6 of the Policy Declarations.

(3) **Limits of liability, Coverage A:** The limit of bodily injury liability stated in the Policy Declarations as applicable to "each person" is the limit of the Company’s liability for all damages (including damages for care and loss of services) arising out of bodily injury sustained by one person as the result of any one occurrence. The limit of such liability stated in the Policy Declarations as applicable to "each occurrence" is (subject to the provision respecting each person) the total limit of the Company’s liability for all such damage arising out of bodily injury sustained by two or more persons as the result of any one occurrence.

(4) **Limits of liability, Coverages B and C:** The limit of liability under Coverages B and C stated in the Policy Declarations as applicable to "each occurrence" is the total limit of the Company’s liability for all damages and all loss under Coverages B and C combined arising out of physical injury to, destruction of, or loss of all property of one or more persons or organizations, including the loss or use of any property attributable to such injury or destruction under Coverage B, as the result of any one occurrence. Subject to the provision respecting "each occurrence", the limit of liability under Coverages B and C stated in the Policy Declaration as "aggregate" is the total limit of the Company’s liability for all damages and all loss under Coverages B and C combined arising out of physical injury to, destruction of, or loss of property, including the loss or use of any property attributable to such injury or destruction under Coverage B.

Under Coverage C, the limit of the Company’s liability for loss shall not exceed the actual cash value of the property, or if the loss is a part thereof, the actual cash value of such part, at time of loss, nor what it would then cost to repair or replace the property of such part thereof with other of like kind and quality.

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(5) **Severability of interests, Coverages A and B:** The term *the insured* is used severally and not collectively. However, inclusion herein of more than one insured shall not operate to increase the limits of the Company's liability.

(6) **Notice:** In the event of an occurrence or loss, written notice containing particulars sufficient to identify the insured and also reasonably obtainable information with respect to the time, place, and circumstances thereof and the names and addresses of the injured and of able witnesses shall be given by or for the insured to the company or any of its authorized agents as soon as is practicable. If a claim is made or a suit is brought against the insured, he shall immediately forward to the Company every demand, notice, summons, or other process received by him or his representative.

(7) **Assistance and cooperation of the insured, Coverages A and B:** The insured shall cooperate with the Company and upon the Company's request attend hearings and trials and assist in making settlements, securing and giving evidence, obtaining the attendance of witnesses, and conducting suits. Except at his own cost, the insured shall not voluntarily make any payment, assume any obligations, or incur any expense other than for first aid to others that shall be imperative at the time of an accident.

(8) **Action against Company, Coverages A and B:** No action shall lie against the Company unless as a condition precedent thereto the insured shall have fully complied with all the terms of this policy, nor until the amount of the insured's obligation to pay shall have been finally determined either by judgment against the insured after actual trial or by written agreement of the insured, the claimant, and the Company. Any person or organization or the legal representative thereof who has secured such judgment or written agreement shall thereafter be entitled to recover under this policy to the extent of the insurance afforded by this policy. No person or organization shall have any right under this policy to join the Company as a part to any action against the insured to determine the insured's liability. Bankruptcy or insolvency of the insured or of the insured's estate shall not relieve the Company of any of its obligations hereunder.

(9) **Action against Company, Coverage C:** No action shall lie against the Company unless as a condition precedent thereto there shall have been full compliance with all the terms of this policy nor until 30 days after proof of loss is filed and the amount of loss is determined as provided in this policy.

(10) **Insured's duties in event of loss, Coverage C:** In the event of loss, the insured shall protect the property, whether or not the loss is covered by this policy. Any further loss attributable to the insured's failure to protect shall not be recoverable under this policy. Reasonable expenses incurred in affording such protection shall be deemed incurred at the company's request.

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The insured shall also file with the Company, as soon as practicable after loss, his sworn proof of loss in such form and including such information as the Company may reasonably require and shall, upon the Company's request, exhibit the damaged property.

(11) **Appraisal, Coverage C:** If the insured and the Company fail to agree as to the amount of loss, either may demand an appraisal of the loss within 60 days after the proof of loss is filed. In such event the insured and the Company shall each select a competent appraiser, and the appraisers shall select a competent and disinterested umpire. An award in writing or any two shall determine the amount of loss. The insured and the Company shall each pay his chosen appraiser and shall bear equally the other expenses of the appraisal and umpire. The Company shall not be held to have waived any of its rights by any act relating to appraisal.

(12) **Payment of loss, Coverage C:** The Company may pay for the loss in money, but there shall be no abandonment of the damaged property to the Company.

(13) **No benefit to bailee coverage:** The insurance afforded by this policy shall not enure directly or indirectly to the benefit of any carrier or bailee (other than the named insured) liable for loss to the property.

(14) **Subrogation:** In the event of any payment under this policy, the Company shall be subrogated to all of the insured's rights of recovery therefor against any person or organization. The insured shall execute and deliver instruments and papers and do whatever else is necessary to secure such rights. The insured shall do nothing after loss to prejudice such rights.

Application of insurance: The insurance afforded by this policy is primary insurance. If the insured has other primary insurance against a loss covered by this policy, the Company shall not be liable under the policy for a greater proportion of such loss than the applicable limit of liability stated in the Contract bears to the total applicable limit of all valid and equitable insurance against such loss.

(15) **3-year policy:** A policy period of 3 years is comprised of three consecutive annual periods. Computation and adjustment of earned premium shall be made at the end of each annual period. Aggregate limits of liability as stated in this policy shall apply separately to each annual period.

(16) **Changes:** Notice to any agent of knowledge possessed by any agent or by any other person shall not affect a waiver or a change in any part of this policy or stop the Company from asserting any right under the terms except by endorsement issued to form a part of this policy signed by *_____ provided, however, changes may be made in the written portion of the Policy Declaration by *_____ when initialed by

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such *_____ or by endorsement issued to form a part of this policy signed by such *_____. [*Insert titles of authorized company representatives.]

(17) **Assignment:** Assignment of interest under this policy shall not bind the Company until its consent is endorsed hereon.

(18) **Cancellation:** This policy may be cancelled by the named insured by mailing to the Company written notice stating when the cancellation shall become effective. This policy may be cancelled by the Company by mailing to the named insured, Contractor, and governmental authority at the respective addresses shown in this policy written notice stating when such cancellation shall be effective (not less than 30 days thereafter). The mailing of notice shall be sufficient proof of notice. The effective date and hour of cancellation stated in the notice shall become the end of the policy period. Delivery of such written notice either by the named insured or the Company shall be equivalent to mailing. If the named insured cancels, the earned premium shall be computed in accordance with the customary short rate table and procedure. If the Company cancels, the earned premium shall be computed pro rata. The premium may be adjusted either at the time cancellation is effected or as soon as practicable after the cancellation becomes effective, but payment or tender of unearned premium is not a condition of cancellation.

(19) Policy Declarations: By acceptance of this policy, the named insured agrees that such statements in the Policy Declarations as are made by him are his agreements and representations, that his policy is issued in reliance on the truth of such representations, and that this policy embodies all agreements existing between himself and the Company or any of its agents relating to this insurance.

e. **For a policy issued by one company:**

In witness whereof, the _____ Indemnity Company has caused this policy to be signed by its president and a secretary at _____ and countersigned on the Policy Declarations page by a duly authorized agent of the Company.

(Facsimile of Signature) Secretary	(Facsimile of Signature) President

For a policy issued by two companies:

In witness whereof, the _____ Indemnity Company has caused this policy with respect to Coverages _____ and such other parts of the policy as are applicable thereto to be signed by its president and a secretary at

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_____ and countersigned on the Policy Declarations page by a duly authorized agent of the Company.

(Facsimile of Signature)	(Facsimile of Signature)
Secretary	President

(d) **Submitting Copies of Insurance Policies:** Prior to beginning construction operations on or over the railway right of way, the Contractor shall submit to the Department evidence of the railway company's approval and a copy of the required insurance policies. The Commonwealth will not be responsible for any claims from the Contractor resulting from delay in the acceptance of any of these policies by the railway company other than consideration of an extension of time. If the delay is caused by the failure of the Contractor or his insurer to file the required insurance policies promptly, an extension of time will not be granted.

(e) **Beginning Construction:** Preliminary contingent work or other work by the railway company may delay the starting or continuous prosecution of the work by the Contractor. The Contractor shall be satisfied as to the probable extent of such work and its effect on the operations prior to submitting a bid for the work. The Commonwealth will not be responsible for any claims by the Contractor resulting from such delays except that an extension of time may be considered.

(f) **Arranging for Tests:**

1. **Railroad specifications:** When ordering materials that are to conform to railroad specifications, the Contractor shall notify the railway company, who will arrange for tests. The Contractor shall specify in each order that the materials are to be tested in accordance with the requirements of the railroad specifications and not those of the Department.

2. **Highway Specifications:** When ordering materials that are to conform to highway Specifications, the Contractor shall specify in each order that the materials are to be tested in accordance with the requirements of Department Specifications.

107.20 - Construction Over or Adjacent to Navigable Waters

The Department will obtain a permit from the U.S. Coast Guard for the anticipated construction and/or demolition activities of structures on Department projects that cross a waterway(s) under the jurisdiction of the U.S. Coast Guard. As the permit holder, the Department must apply to the U.S. Coast Guard for approval of permit modifications to the original Department permit that the Contractor requests.

Prior to starting demolition or construction operations the Contractor shall meet with the Engineer and the U.S. Coast Guard (U.S. Coast Guard Coordination Meeting) to

Comment [351]: Right Documentation

Comment [352]: Right Material

Comment [353]: Right Documentation

Comment [354]: Right Time/ Right Documentation

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present its planned operations and the potential impacts those operations may pose to water traffic. As part of this meeting, the parties shall establish in writing the proper protocol for emergency closures and be governed accordingly.

(a) Activities subject to Coast Guard regulation under the Permit. Following the U.S. Coast Guard Coordination meeting, the Contractor shall submit its proposed schedule of operations in writing to the Engineer. The Engineer shall review and provide written comments, if applicable, to the Contractor within 7 calendar days following receipt of the Contractor's schedule of operations. The Contractor shall incorporate the Engineer's comments and submit its notice of scheduled operations to the Engineer and to the U.S. Coast Guard at least 30 days prior to commencement of any permitted construction or demolition operations. U.S. Coast Guard acceptance of the Contractor's written schedule of operations is a condition precedent to the Contractor's commencement of those operations.

Comment [355]: Right Time

(b) **Activities that require channel closures or restrictions**. In addition to the submittal of its proposed schedule of operations as described in (a) above, Contractor shall submit plans that comply with the Permit for falsework, cofferdams, floating equipment and other obstructions to the channel or channels to the Engineer. The Contractor's attention is directed to the possibility that advance notification for consideration of approval may vary depending on the type and duration of proposed closures, the time of year for requested closure(s), and location of existing bridge(s) and waterway(s) involved, and the impact to entities served along or through the waterway(s). The Engineer shall review and provide written comments, if applicable, to the Contractor within thirty (30) calendar days following receipt of the Contractor's plans. The Contractor shall incorporate the Engineer's comments and submit its plans to the Engineer and to the U.S. Coast Guard at least 30 days prior to commencement of any permitted construction or demolition operations. The Contractor may not commence activities that require channel closures or restrictions without the prior written approval of the Department and the U.S. Coast Guard. The Contractor shall be responsible for complying with all operational requirements that the U.S. Coast Guard may place on the Contractor as conditions of approval.

Comment [356]: Right Documentation/ Right Time

In addition, the Contractor shall request and obtain Department and U.S. Coast Guard approval in writing before commencing any operations that deviate from the Contractor's schedule of operations when these operations interfere or have the potential to interfere with navigation of water traffic outside of timeframes previously approved by the Department and the U.S. Coast Guard.

Notices shall be sent to the U.S. Coast Guard, Fifth District Bridge Office (OBR), 431 Crawford Street, Portsmouth, VA 23704-5004. Payment of any penalty or fine that may be levied by the U.S. Coast Guard for Contractor violations of bridge regulations found in 33 CFR Parts 115, 116, 117 and 118 shall be the responsibility of the Contractor. Further, any delay to the contract as a result of actions or inaction by the Contractor relative to the requirements herein that are determined by the Department to be the fault of the Contractor will not be compensable.

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The cost to comply with the requirements of this provision and to provide and maintain temporary navigation lights, signals and other temporary work associated with the structure(s) under this contract required by the U.S. Coast Guard for the protection of navigation during construction or demolition operations shall be included in price bid for other appropriate items.

Comment [357]: Right Payment

107.21 - Size and Weight Limitations

Comment [358]: Right Way

(a) **Hauling or Moving Material and Equipment on Public Roads Open to Traffic:** The Contractor shall comply with legal size and weight limitations in the hauling or moving of material and equipment on public roads open to traffic unless the hauling or moving is covered by a hauling permit.

(b) **Hauling or Moving Material and Equipment on Public Roads Not Open to Traffic:** The Contractor shall comply with legal weight limitations in the hauling or moving of material and equipment on public roads that are not open to traffic unless the hauling or moving is permitted elsewhere herein or is otherwise covered by a hauling permit. The Contractor shall be liable for damage that results from the hauling or moving of material and equipment. The hauling or moving of material and equipment on the pavement structure or across any structure during various stages of construction shall be subject to additional restrictions as specified or directed by the Engineer.

Furnishing Items in Component Parts of Sections: If the size or weight of fabricated or manufactured items together with that of the hauling or moving vehicle exceeds the limitations covered by hauling permit policies and other means of transportation are not available, permission will be given to furnish the items in component parts of sections with adequately designed splices or connections at appropriate points. Permission for such adjustments shall be requested in writing, and approval in writing shall be secured from the Department prior to fabrication or manufacture of the items. The request shall state the reasons for adjustment and shall be accompanied by supporting data, including working drawings where necessary.

III. FOUR STEP INSPECTION PROCEDURES

Pre-start planning meeting:

- Review contract special provisions
- Review all permits and keep copies on file
- Monitor permit compliance
- Document any non-compliance and make corrections as needed

Start:

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- Verify that all documents are correct and up-to-date

Inspection Requirements:

- See Critical Inspection Points. If Applicable, complete the Environmental Compliance Report prior to or concurrently with completing the monthly voucher.

Final Inspection:

- The step is complete as documented by Area Construction Engineer.

IV. REVIEW QUESTIONS

• On vehicles with an obstructed view to the rear, is the Contractor using audible back-up alarms or an effective ground guide system?
• Is the correct angle of repose or adequate shoring being used for trenches or excavations 5 feet or more in depth?
• Are all employees wearing proper head protection as required?
• Are employees using personal protective equipment for eyes, hands, feet, and any other body parts as required?
• Where needed, is the proper fall protection device/devices being used?
• Has the contractor's qualified person monitored the fall protection devices to see that they meet current standards?
• Are employees who are exposed to vehicular traffic wearing traffic vest?
• Have required measures been taken prior to employees entering a confined space?
• Has the contractor/subcontractor completed form C-107 (construction runoff control inspection form) as required?
• Does the contractor have an employee certified by the Department(ESCCC) during land disturbance activities within the limits of the project?
• Prior to commencing work, did the Contractor notify or request the utility company to locate their underground utilities?
• Has the Contractor properly protected any existing, adjusted, or new utility facilities which are to remain within the right-of-way?
• Has the Contractor submitted to the Department and had approved by railway a plan of operations showing the design and method of proposed structural operations on railway right-of-way?
• Does the Contractor continuously prosecute the work on or over the railway right-of-way to minimize the need for flagger or watchman service?

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• Has the Contractor and/or subcontractors submitted for approval and retention to the Railway Company, a railroad protection liability insurance policy and certificate of insurance prior to starting work on railway right-of-way?
• Has the Contractor submitted to the Department a copy of the Railway Company's approval of his railroad insurance?

• Has Form C107 been completed as required?
• If applicable has the Environmental Compliance Report been completed before the monthly voucher has been approved?

V. CRITICAL INSPECTION POINTS

• Review all environmental permits
• Place permits in a conspicuous location
• Ensure that all EEO policies are met
• Ensure that the SWPPP is submitted and on file
• Monitor and record all safety concerns
• Ensure that the contractor has an approved railroad insurance

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SECTION 108—PROSECUTION AND PROGRESS OF WORK

I. INTRODUCTION:

This section describes who can compete for an opportunity to construct the Department's projects. Is also describes the bidding procedure. The contents of a responsive bid are also defined. It describes the *right way* of submitting a bid to the Department.

a) <u>Forms:</u>

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II. <u>2007 ROAD & BRIDGE SPECIFICATION and the 7R's:</u>

108.01 - Prosecution of Work

The Contractor shall begin work within 15 calendar days of the date of contract execution unless otherwise permitted by specific language in the Contract or as permitted by the provisions of Section 108.02.

Prior to beginning construction operations, the Contractor shall attend a pre-construction scheduling meeting to discuss the Contractor's general plan of operations, work times, and proposed means and methods for accomplishing the work. The pre-construction scheduling meeting may be held in conjunction with the pre-construction conference or in a separate meeting as mutually agreed to by the Department and the Contractor.

The Contractor shall provide a sufficient force of workers, materials, equipment, and tools; and shall prosecute the work with such diligence as is required to attain and maintain a rate of progress necessary to ensure completion of the project in accordance with the plans, specifications, and other requirements of the Contract.

Once the Contractor has begun work, it shall be prosecuted continuously and to the fullest extent possible except for authorized suspensions ordered by the Engineer as defined in Section-108.05. If approval is given to discontinue the work temporarily, the Contractor shall notify the Engineer at least 24 hours in advance of resuming operations.

At least once every 30 days or as specified in the contract documents, the Contractor shall meet with the Engineer to discuss his current progress relative to his Schedule of Record (SOR) and to establish the approximate date for starting each critical inspection stage during the following 30 days. The Engineer shall be advised at least 24 hours in advance of any changes in the Contractor's planned operations or critical stage work

Comment [359]: Right Way

Comment [360]: Right Time

Comment [361]: Right Time

Comment [362]: Right Time

Comment [363]: Right Time

Comment [364]: Right Time

Comment [365]: Right Time

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requiring inspection. For the purposes stated herein, the Schedule of Record (SOR) is defined in accordance with the provisions of Section 108.03.

Work shall be conducted in such a manner and with sufficient materials, equipment, tools, and labor as are necessary to ensure its completion in accordance with the plans and these Specifications within the time limit specified in the Contract–Documents. Once the Contractor has begun work, it shall be prosecuted continuously and to the fullest extent possible except for interruptions caused by weather or delays authorized or ordered by the Engineer. If approval is given to discontinue the work temporarily, the Contractor shall notify the Engineer at least 24 hours in advance of resuming operations.

Comment [366]: Right Time

Comment [367]: Right Time

108.02 - Limitation of Operations

(a) General.

The Contractor shall conduct the work in a manner and sequence that will ensure its expeditious completion with the least interference to traffic and shall have due regard for the location of detours and provisions for handling traffic. The Contractor shall not open any work to the prejudice or detriment of work already started. The Engineer may require the Contractor to finish a section of work before work is started on any other section.

Comment [368]: Right Way

(b) Holidays

Except as is necessary to maintain traffic, work shall not be performed on Sundays or the following holidays without the permission of the Engineer: January 1, Easter, Memorial Day, July 4, Labor Day, Thanksgiving Day, and Christmas Day.

Comment [369]: Right Time

If any of these holidays occurs on a Sunday, the following Monday shall be considered the holiday.

108.03 - Progress Schedule

General Requirements: The Contractor shall plan and schedule the work on the project so as to complete the work within the time limit and budget established by the contract and shall submit his plan to accomplish these objectives in the form of a Progress Schedule for the Engineer's review and acceptance. The Progress Schedule shall be used by the Engineer for planning, coordination and inspection activities, and for evaluation of the Contractor's rate of progress and the effects of time-related impacts on the project.

Comment [370]: Right Time

Comment [371]: Right Way

Prior to preparing the schedule, the Engineer or the Contractor may request a meeting to discuss any project specific items required for preparation of the progress schedule.

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The Contractor shall prepare and submit a practicable schedule to reflect a logical progress of the work. The progress schedule shall represent the Contractor's overall work plan to accomplish the work in accordance with the requirements herein and those of the Contract as detailed in the Contract documents. It shall include all time-based tasks required for timely completion of the work, including as applicable the work to be performed by sub-contractors, suppliers, the Department, and/or others. When preparing the schedule, the Contractor shall consider all applicable constraints and restrictions such as seasonal, weather, traffic, utility, railroad, right-of-way, environmental, permits, and other limitations to the work.

(a) Progress Schedule Requirements:

1. **Baseline Progress Schedule –** The Contractor shall submit to the Engineer his Baseline Progress Schedule at least 7 calendar days prior to beginning work. The Baseline Progress Schedule submittal shall include three (3) sets of a written Progress Schedule Narrative and, where applicable, a Progress Earnings Schedule as defined below:

a.) Progress Schedule Narrative: The Progress Schedule Narrative shall consist of the following information, as applicable:

i. A description of the Contractor's overall plan of operations including the planned procedures and crew(s) required to accomplish each major operation;

ii. A Tabular Schedule to establish milestone(s) for completing each phase, feature, or stage of work as specified by contract or, where not specified by the contract, as determined by the Contractor. The schedule shall also indicate the planned sequence and start/finish dates for all time-based tasks required to complete each milestone;

iii. A discussion on the working calendar with considerations for applicable constraints or restrictions; (i.e. normal weather, traffic, holidays, time of year, utility, etc.);

iv. A description of any potential issues that may impact the schedule.

b.) Progress Earnings Schedule: Progress Earnings Schedule will not be required for projects with a contract duration of sixty (60) calendar days or less. The Progress Earnings Schedule shall be prepared on forms furnished by the Department to indicate the anticipated earnings for each payment period as of the Contractor's payment cut-off date as determined in accordance with Section 109.08. Progress earnings shall be based on the total contract value. Total contract value will be considered to mean the original amount of the contract including any authorized adjustments in accordance with, but not limited to, the provisions of Sections 104 and

Comment [372]: Right Time

Comment [373]: Right Way

Comment [374]: Right Documentation

Comment [375]: Right Documentation

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109.05. Payments for stored or stockpiled material in accordance with Section 109.09 of the Specifications will not be considered in the earnings schedule.

2. **Revised Progress Schedule:**

The Contractor shall submit a Revised Progress Schedule as determined and requested by the Engineer, if prosecution of the work deviates significantly from the phasing, general sequence, or the proposed means and methods as represented on the Schedule of Record (SOR). The Contractor will also be required to submit a Revised Progress Schedule to reflect any impacts to the schedule for changes authorized by the Engineer including, but not limited to changes in the work in accordance with the requirements of Section 104 and Section 109.05 of the Specifications.

The Contractor shall submit the Revised Progress Schedule within 10 calendar days of the date of the Engineer's written request. The Revised Progress Schedule shall be in the form of a Revised Baseline Progress Schedule which shall reflect the actual progress of accomplished work (actual work to date), any impact of a change authorized by the Engineer, and the proposed time based plan for completing the remaining work. Upon acceptance by the Engineer, the latest Revised Progress Schedule shall replace the previously accepted Baseline or Revised Progress Schedule.

3. **Failure to Furnish Progress Schedules** – Work shall not commence until the Contractor submits his Baseline Progress Schedule in accordance with the requirements of this section, unless otherwise approved in writing by the Engineer.

Delays in work resulting from the Contractor's failure to provide the progress schedule will not be considered just cause for extension of the contract time limit or for additional compensation.

(b) Review and Acceptance

The Engineer will review all progress schedule submittals within 7 calendar days of receipt of the Contractor's complete submittal. Review and acceptance by the Engineer will be based on completeness and conformance with the requirements of this section, the Contract and the Specifications. If the Contractor's Progress Schedule is deemed to be unacceptable, the Engineer will issue a written notification for resubmission describing the deficiencies in completeness or conformance prompting the Engineer's decision.

Upon acceptance, the Engineer will issue a written notice of acceptance that may include comments or concerns on the schedule. The Contractor shall respond within 7 calendar days of receipt of the Engineer's comments, concerns or written notification for resubmission.

Upon acceptance, the latest Baseline Progress Schedule or Revised Progress Schedule shall become the Schedule of Record (SOR). The SOR is defined as the

Comment [376]: Right Way

Comment [377]: Right Time

Comment [378]: Right Time

Comment [379]: Right Time

Comment [380]: Right Way

Comment [381]: Right Way

Comment [382]: Right Time

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currently accepted progress schedule by which all schedule references will be made and progress evaluated.

Review and acceptance by the Engineer will not constitute a waiver of any contract requirements and will in no way assign responsibilities of the work plan, scheduling assumptions, and validity of the schedule to the Department. Failure of the Contractor to include in the Progress Schedule any element of work required for timely completion of the project shall not excuse the Contractor from completing the entire scope of work within the Contract specified completion milestone(s).

(c). Monitoring the Work and Assessing Progress

1. Monitoring the Work – The Engineer will monitor the work regularly to identify any deviations from the Contractor's scheduled performance relative to the currently accepted Baseline or Revised Progress Schedule. The Engineer may request a meeting with the Contractor to discuss the Contractor's current progress or to establish the approximate date for starting each critical inspection stage during the following 30 days. At least once a week, the Contractor shall advise the Engineer of the approximate timing for anticipated critical stages for the subsequent week. The Engineer shall be advised at least 24 hours in advance of any changes in the Contractor's planned operations or critical stage work requiring Department inspection.

2. Progress Evaluation – The Engineer will evaluate the Contractor's progress monthly relative to the currently accepted Baseline or Revised Progress Schedule. The Contractor's actual progress may be considered unsatisfactory if:

a) The cumulative actual earnings for work completed is 10 or more percentage points behind the cumulative earnings for work scheduled; or

b) Any interim milestone is later than the scheduled milestone by more than 7 calendar days or the projected project completion date is later than the contract completion date by the least of 14 calendar days or 10 percent of the remaining contract time.

(d). Progress Deficiency and Schedule Slippage: When the Contractor's actual progress is deemed to be unsatisfactory, the Engineer will issue a written notice of unsatisfactory performance to indicate that further actions may be taken as defined in Sections 102.01 and 109.08.of the Specifications, if progress remains unsatisfactory at the time of preparation of the next monthly progress estimate. Within 10 calendar days of the date of the Engineer's notice of unsatisfactory progress, the Contractor may submit to the Engineer, a recovery plan to reflect a proposed plan to correct the progress deficiency or schedule slippage, or submit to the Engineer a written explanation and supporting documentation to establish that such delinquency is due to conditions beyond the Contractor's control. Any schedule revisions resulting from a recovery plan will be reviewed in accordance with subsection (c) herein, but shall not replace the SOR.

Comment [383]: Right Way

Comment [384]: Right Time

Comment [385]: Right Time

Comment [386]: Right Way

Comment [387]: Right Way

Comment [388]: Right Time

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108.04 - Determination and Extension of Contract Time Limit

The Contract time limit for completion will be determined by the Department and specified in the Contract Documents. No request for an extension of time will be considered that is based on any claim that the contract time limit as originally established was inadequate.

With a fixed date contract when the date of contract execution is not within 60 calendar days after the opening of bids, or when the Contractor is unable to commence work because of any failure of the Department, or when the Contractor is delayed because of the fault of the Department, the Contractor will be given an extension of time based on the number of days delayed beyond the 60 calendar days. No time extension will be allowed for a delay in the date of contract execution when the delay is the fault of the Contractor.

The Engineer will determine if an extension of the Contract time limit for completion is warranted by additions to the Contract. The Contractor shall inform the Department, in writing, of a request for time extensions in his Work Order in accordance with the applicable portion(s) of Section 104 or 109. The Contractor shall provide written supporting data for any request for extension of time due to quantity additions and or additional or altered work.

During prosecution of the work, the Contractor shall identify the causes for any delays attributable to conditions he deems to be beyond his control and shall identify the particular construction operations affected, their criticality to project milestones or overall contract completion, and the significant dates that encompass the periods of delay. The Contractor shall furnish all such information necessary for the Department to make an adequate evaluation of any claim received from the Contractor for an extension of the contract time limit within three days of experiencing such a delay.

(a) **Fixed Date:** Unless otherwise indicated in the Contract, the contract time limit will be specified as a fixed date for completion. The Contractor shall take into consideration normal conditions considered unfavorable for the prosecution of the work, and shall place sufficient workers and equipment on the project to complete the work in accordance with the specified contract time limit.

The Engineer may give consideration for extension of time when a delay occurs due to unforeseen causes beyond the control of or without the fault or negligence of the Contractor. However, consideration will not be given to extensions of time attributable to normal weather conditions or conditions resulting from normal weather.

For the purposes of this Section normal weather is defined as that which is not considered extraordinary or catastrophic and is not reasonably conducive to the Contractor progressively prosecuting critical path work under the Contract. Weather

Comment [389]: Right Way

Comment [390]: Right Time/ Right Time

Comment [391]: Right Way

Comment [392]: Right Documentation

Comment [393]: Right Documentation/ Right Time

Comment [394]: Right Way

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events considered extraordinary or catastrophic include, but are not limited to tornados, hurricanes, earthquakes, and floods that exceed a 25-year storm event as defined by National Oceanic and Atmospheric Administration (NOAA) for the NOAA data gathering location that is nearest the project site.

If there is a delay in the progress of the work due to unforeseen causes described within these Specifications, and the delay extends the contract time limit into the period between November 30 of one year and April 1 of the following year and working conditions during such period are unsuitable for the continuous prosecution **or** completion of the work, then consideration may only be given to granting an extension of time that will encompass a suitable period during which such work can be expeditiously and acceptably performed.

108.05 - Suspension of Work Ordered by the Engineer

If the performance of all or any portion of the work is suspended or delayed by the Engineer in writing for an unreasonable period of time (not originally anticipated, customary, or inherent to the construction industry) and the Contractor believes that additional compensation and/or contract time is due as a result of such suspension or delay, the Contractor shall submit to the Engineer in writing a request for adjustment within seven calendar days of receipt of the notice to resume work. The request shall set forth the reasons and support for such adjustment.

Upon receipt, the Engineer will review the Contractor's documentation and evaluate the Contractor's request. If the Engineer agrees that the cost and/or time required for the performance of the contract has increased as a result of such suspension and the suspension was caused by conditions beyond the control of and not the fault of the Contractor, his suppliers, or subcontractors at any approved tier, and was not caused by normal weather, the Engineer will make an adjustment (excluding profit) and modify the contract in writing accordingly. The Engineer will notify the Contractor of the determination regarding whether or not an adjustment of the contract is warranted.

No contract adjustment will be allowed unless the Contractor has submitted the request for adjustment within the time prescribed.

No contract adjustment will be allowed under this clause to the extent that performance would have been suspended or delayed by any other cause, or for which an adjustment is provided for or excluded under any other term or condition of the contract.

108.06 - Failure To Complete on Time

(a) General

For each calendar day that any work remains incomplete after the contract time limit specified for the completion of the work, the Department will assess liquidated damages

Comment [395]: Right Documentation/Right Time

Comment [396]: Right Time

Comment [397]: Right Way

Comment [398]: Right Payment

Trial Use and Comment

against the Contractor. Liquidated damages will be assessed at the rate applicable to the Contract in accordance with the Schedule of Liquidated Damages, Table I-1, or as otherwise specified in the contract provisions. Liquidated damages will be deducted from any monies due the Contractor for each calendar day of additional time consumed until final completion and acceptance of the work, subject to such adjustments as provided in accordance with the requirements of Section 108.04, not as a penalty, but as liquidated damages. The Contractor waives any defense as to the validity of any liquidated damages stated in the Contract, the Contract Documents, or these Specifications and assessed by the Department against the Contractor on the grounds that such liquidated damages are void as penalties or are not reasonably related to actual damages.

(b) Liquidated Damages.

The following Schedule of Liquidated Damages, representing the cost of administration, engineering, supervision, inspection and other expenses, will be charged against the Contractor for each calendar day beyond the fixed contract time that the Contract remains in an incomplete state:

TABLE I-1
Schedule of Liquidated Damages

Comment [399]: Right Payment

Original Contract Amount in Dollars	Daily Charge in Dollars
0 – 500,000.00	350
500,000.01 – 2,000,000.00	600
2,000,000.01-8,000,000.00	1,350
8,000,000.01- 15,000,000.00	2,500
15,000,000.01- Plus	3,100

108.07 – Default of Contract

Comment [400]: Consult Responsible Charge Engineer

The Contractor may be declared in default if he does *any* one of the following:

(a) fails to begin the work under the Contract within 15 calendar days of the date of contract execution except as otherwise permitted by specific contract language or the provisions of Section 108.02.

(b) fails to perform the work with sufficient workers and equipment or with sufficient materials to ensure prompt completion of the work

(c) performs the work unsuitably or neglects or refuses to remove materials or perform anew work that is unacceptable

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(d) discontinues prosecution of the work

(e) fails to resume work that has been discontinued within a reasonable time after notice to do so

(f) becomes insolvent, is declared bankrupt, or commits any act of bankruptcy or insolvency

(g) allows any final judgment to stand against him unsatisfied for a period of 10 days

(h) makes an assignment for the benefit of creditors, or

(i) fails for any other cause whatsoever to carry on the work or contractual obligations in an acceptable manner

If any of these conditions exists, the Engineer will give notice in writing to the Contractor and his surety of the delay, neglect, or default. If within 10 days after the date of such notice the Contractor or his surety has not taken measures that will, in the judgment of the Chief Engineer, ensure satisfactory progress of the work or give assurances satisfactory to the Engineer that the provisions of the Contract will be fully carried out and instructions complied with, the Commissioner may then, or at any time thereafter, declare the Contractor in default. Without violating the Contract, the Commissioner may call upon the Contractor's surety for the satisfactory and expeditious completion of all work under the Contract or may otherwise terminate the Contract in accordance with the provisions of Section 108.08.

If the Contractor is declared in default, subsequent payments will be made to the surety and further negotiations will be conducted with the surety.

If the Contractor's surety fails or refuses to proceed with the work in accordance with the instructions of the Commissioner, the Commissioner will appropriate and use any or all materials and equipment on the project site that are suitable and acceptable and will enter into an agreement with others for the completion of the work, or he will use such other methods as he deems necessary to ensure the completion of the work.

Costs and charges incurred by the Department, including the cost of completing the work under the Contract, will be deducted from any monies due or that will become due the Contractor and his surety. If the expense incurred by the Department is less than the sum that would have been payable under the Contract had the work been completed by the Contractor, the Contractor and his surety will be entitled to receive the difference. If the expense exceeds the sum that would have been payable under the Contract, the Contractor and his surety shall be liable for and shall pay to the Commonwealth the amount of the excess.

Ref Prosecution and Progress Spec

Comment [401]: Right Documentation

Comment [402]: Right Time

Comment [403]: Right Payment

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108.08 - Termination of Contract

(a) **Conditions for Termination:** The Department may terminate the Contract or any portion thereof because of *any* of the following conditions:

1. default

2. national emergency

3. action by the Commonwealth, U.S. government, or court order, or

4. conditions beyond the control of the Department

(b) **Provisions of Termination:** Termination will be in accordance with the following:

1. Disturbed areas shall be promptly placed in an acceptable condition as directed by the Engineer. Payment for such work will be made at the contract unit prices or, in the absence of contract unit prices, in accordance with the requirements of Section 104.03.

2. Payment will be made for the actual number of units or items of work completed at the contract unit price, or as mutually agreed, for items of work partially completed. No claim for loss of anticipated profits will be considered, and the provisions of Section 104.02 will not apply.

3. Reimbursement for organizing the work when not specified in the Contract and moving equipment to and from the job will be considered where the volume of work completed is too small to compensate the Contractor for these expenses under the contract unit prices.

4. At the option of the Engineer, materials the Contractor obtains for the work that have been inspected, tested, and accepted by the Engineer and that have not been incorporated in the work may be purchased from the Contractor at actual costs as shown by receipted bills, purchase orders, bills of lading or other similar actual cost records at such points of delivery as may be designated by the Engineer.

5. The termination of the Contract or a portion thereof shall not relieve the Contractor of his responsibilities for the completed work, nor shall it relieve his surety of its obligation for and concerning any just claims arising out of the work performed or remaining to be performed.

108.09 - Acceptance

Comment [404]: Consult Responsible Charge Engineer

Comment [405]: Right Way

Trial Use and Comment

(a) **Contractor's Responsibility for Work**: Until final acceptance of the work by the Engineer in accordance with the requirements of this Section, the Contractor shall have charge and care thereof and shall take every precaution against damage to any part thereof by action of the elements or from any other cause. The Contractor shall rebuild, repair, restore, and make good on damage to any portion of the work occasioned by any of the foregoing causes before final acceptance and shall bear the expense thereof. The Department may reimburse the Contractor for repair of damage to work attributable to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor as determined by the Engineer.

In case of suspension of work, the Contractor shall be responsible for the project and shall take such precautions as may be necessary to prevent damage to the work, provide for erosion control and drainage, and erect any necessary temporary structures, signs, or other facilities as determined by the Engineer. During the suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established plantings, seedings, and soddings furnished under the Contract and shall take adequate precautions to protect new tree growth and other important vegetation against damage.

(b) Partial Acceptance: If at any time during the prosecution of the project the Contractor completes a unit or portion of the project, such as a structure, an interchange, slopes, pavement, or a section of a roadway in its entirety, he may ask the Engineer to make final inspection of such work. If the Engineer finds upon inspection that the work conforms to the requirements of the Contract and that acceptance is in the best interest of the public, he may accept the work as being completed, and the Contractor will be relieved of further responsibility for the work. Partial acceptance shall in no way void or alter any terms of the Contract.

If any damage is sustained by an accepted unit or portion of the project attributable to causes beyond the control of the Contractor, the Engineer may authorize the Contractor to make the necessary repairs. These repairs will be paid for at the contract price for the items requiring repair. In the absence of contract prices covering the items of repair, the work will be paid for in accordance with the requirements of Section 109.05.

(c) Final Acceptance: Upon receipt of a written notice from the Contractor of presumptive completion of the entire project, the Engineer will make an inspection. If all work specified in the Contract has been completed, the inspection will constitute the final inspection and the Engineer will make the final acceptance. The Contractor will be notified in writing, of the determination of final acceptance within five days of the date of the Engineer's final acceptance.

Comment [406]: Right Payment

Comment [407]: Right Way

Comment [408]: Right Way

Comment [409]: Right Payment

Comment [410]: Right Time

Comment [411]: Right Documentation

Trial Use and Comment

If the Engineer's inspection discloses that any work, in whole or in part, is incomplete or unacceptable, the Contractor shall immediately correct the deficiency. A written list of deficiencies will be provided to the Contractor by the Engineer. Upon completion or correction of the work, another inspection will be made of the deficient work. If the work is then satisfactory, the Engineer will notify the Contractor in writing within five days of the Engineer's final acceptance. In any event, the Contractor shall be responsible for and maintain the project until final acceptance except under conditions that may be specifically exempted by the Specifications or specific contract language.

Comment [412]: Right Documentation

Comment [413]: Right Time

108.10 - Termination of Contractor's Responsibilities

The Contract will be considered complete upon final acceptance. The Contractor's responsibility to the work of the Contract will then cease except as set forth in his bond and the requirements of Sections 109.08 and 109.10.

III. FOUR STEP INSPECTION PROCEDURES

108.01 - Prosecution of Work

Pre-start planning meeting:

- Has the contract been properly executed?

Start:

- Schedule preconstruction and scheduling conference (may be scheduled simultaneously or separate).
- Be prepared to discuss all aspects of the contract document and also focus on known concerns or special conditions that may impact the ability of the work and scheduling. As an example, give contractor times needed for review of submissions to ensure timely receipt of the documents.

Inspection Requirements:

- Are the required updates being submitted within the time frames included in the contract?
- Is the contractor meeting to discuss critical items of the schedule?
- Is the department receiving proper notification of stoppages and return to work schedules?
- Is the contractor supplying adequate labor, materials and equipment to the project?

Final Inspection:

- Is the project completed the fixed date or the adjusted fixed date?

108.03 - Progress Schedule

Trial Use and Comment

Start:

- Has the schedule of operations been submitted in the proper format?

http://www.virginiadot.org/business/resources/const/C13C.xls
http://www.virginiadot.org/business/resources/const/C13CPM.xls
http://www.virginiadot.org/business/resources/const/cdmemo-0814.pdf

Inspection Requirements:

- Has the schedule been reviewed within 7 days of receipt?
- Has the contractor, if necessary, been notified of the need to revise and resubmit schedule?
- If requested, has a revised schedule been submitted?
- Has the contractor's progress been monitored?
- If the progress is found to be behind schedule as described (10 percent), has the appropriate notification been made?
- If slippage has occurred, has a recovery plan been submitted?

108.04 - Determination and Extension of Contract Time Limit

It is the responsibility of the Inspection Staff and the Construction Project Manager to have maintained the project records to address the matter of any requested time extension. Data recorded throughout the life of the project in the diary should have included the prominent items; such as labor, equipment, sub-contractor resources, etc., to allow for evaluation of time extension requests. As notice of intents (Section 105.19 2007 specifications) submitted are most often the root source of time/delay issues, proper documentation of the intent is a critical action in the resolution of a request for time extension. Questions regarding the level of documentation needed by the project field staff should be directed to the Project Manager (CPM) or the Area Construction Engineer (ACE).

108.05 - Suspension of Work Ordered by the Engineer

As with Section 108.04, the responsibility of the project staff in a matter involving the suspension of work by the Engineer, the primary task is providing detailed documentation of the contractor's action to allow for a comprehensive review of the matter. Questions pertaining to the level of documentation should be referred to the CPM or the ACE.

108.06 - Failure To Complete on Time

Proper monitoring and documenting the contractor's efforts as they occur are again the central component necessary for the project field staff to perform in regards to this section. Refer to the process described in Sections 108.04 and 108.05 for instruction.

108.07 – Default of Contract & 108.08 - Termination of Contract

These sections of the specifications are typically associated with more complex legal issues. Questions and discussions that would result in either default or termination

Trial Use and Comment

should be directed to the ACE or designated Responsible Charge Engineer for the contract.

108.09 - Acceptance

As required in order to have an acceptance of a project or any portion, the contractor must submit a written request for such action. It is the responsibility of the project staff to validate such request by ensuring the project is completed with regards to the specifications and contract documents. Any areas found to be incomplete or incorrect should be detailed on a "punch" list and delivered to the CPM or ACE.

IV. REVIEW QUESTIONS

• 108.01(1) -Is a preconstruction scheduling meeting held prior to beginning construction?
• 108.03(a)4- If the Contractor started work prior to submittal of the baseline progress schedule, was it approved in writing by the Engineer?
• 108.03(d)- Did the Engineer issue a written notice of unsatisfactory performance where progress remains unsatisfactory at the time of preparation of the next monthly progress estimate?
• 108.01(2) -Does the Contractor meet with the Engineer every 30 days to establish dates for starting each critical inspection stage during the next 30 days?
• 108.01(3) -Does the Contractor advise the Engineer at least 24 hours in advance of any changes in planned operations or critical staging in accordance with this section and the section for inspection of work?
• 108.03(a)1 -Has the Contractor's progress schedule, plan of operations, and/or working schedule been submitted within the time frame specified and per applicable requirements? (Ref. Special Provisions)
• 108.03(a)2 -Is the Contractor meeting the approved progress schedule and/or earnings schedule? (Ref. Special Provisions)
• 108.03(a)3- When required, did the Contractor submit a revised progress schedule 10 calendar days of the Engineer's request?
• 108.03(c)1- Does the Contractor advise the Engineer at least once a week of all anticipated critical inspection stages for the subsequent week?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

Has the Contractor submitted a schedule at the level of detail required by the contract documents?
o Has the schedule been reviewed and accepted or returned to the contractor for correction and resubmission?
o Are schedule updates or revisions submitted as described?
• If contractor is found to be behind schedule, are the proper notices being prepared and forwarded to the contractor?
• Is the level of documentation in the inspector's diary adequate to revisit and reconstruct the efforts made by the contractor to adequately prosecute the work?

Trial Use and Comment

SECTION 301- CLEARING AND GRUBBING

I. INTRODUCTION:

Definition: The removal of trees and other vegetation prior to the start of construction.

All trees and undergrowth are to be cleared and grubbed as noted on the plans or in the Specifications.

In the event of the discovery of prehistoric ruins, Indian or "early settler" sites, burial grounds, relics, fossils, meteorites or other articles of archeological and paleontological interest during the prosecution of the contract, work must be immediately suspended at the site. The Inspector should notify the Construction Manager or Residency Administrator who in turn will contact the Environmental Engineer at the Central Office and advise him of the site's location.

Private or public property adjacent to the right-of-way, and all natural growth and improvements thereon, must be continually protected from damage by equipment and construction operations. When or where such damage is done by the Contractor's equipment and operation, it shall be his sole responsibility to rebuild, repair or make good such damage or injury at his expense. The Inspector should document all efforts to prevent the Contractor from damaging private property.

Trees and shrubs which will not interfere with the use of a highway and its drainage system are often selected to remain in place. Precautionary measures must be taken to protect selected trees from damage during all phases of construction. Branches of trees extending over the roadbed are to be trimmed to give a clear height of at least 20 feet above the roadway surface.

Burning of combustible materials is governed by the laws and regulations of the State. Highway construction is particularly affected by the regulations of the Department of Environmental Quality and the Department of Forestry. For areas in or adjacent to national forests, the regulations of the National Forest Service are also applicable. The burning shall be attended at all times.

a) Forms:

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Trial Use and Comment

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's:

301.01—Description

This work shall consist of clearing, grubbing, removing, and disposing of vegetation, debris, and other objects within the construction limits except for vegetation and objects that are designated to be preserved, protected, or removed in accordance with the requirements of other provisions of these specifications.

301.02—Procedures

If approved by the Engineer, the Contractor may clear and grub to accommodate construction equipment within the right of way up to 5 feet beyond the construction limits at his own expense. The Contractor shall install erosion and siltation control devices prior to beginning clearing or grubbing operations and such devices shall be functional before upland land-disturbing activities take place.

The surface area of earth material exposed by grubbing, stripping topsoil, or excavation shall be limited to that necessary to perform the next operation within a given area. Grubbing of root mat and stumps shall be confined to that area of land which excavation or other land disturbance activities shall be performed by the Contractor within 15 days following grubbing.

Stumps, roots, other perishable material, and nonperishable objects that will be less than 5 feet below the top of earthwork within the area directly beneath the pavement and shoulders shall be removed. However, such material and objects that will be 5 or more than 5 feet below the top of earthwork within the area directly beneath the pavement and shoulders and all such material and objects beneath slopes of embankments shall be left in place unless removal is necessary for installation of a structure. The top of stumps left in place shall be not more than 6 inches above the existing ground surface or low water level.

Branches of trees that overhang the roadway or reduce sight distance and that are less than 20 feet above the elevation of the finished grade shall be trimmed using approved tree surgery practices in accordance with the requirements of Section 601.03(b).

Vegetation, structures, or other items outside the construction limits shall not be damaged. Trees and shrubs in ungraded areas shall not be cut without the approval of the Engineer.

Combustible cleared and grubbed material shall be disposed of in accordance with the following:

Trees, limbs, and other timber having a diameter of 3 inches and greater shall be disposed of as saw logs, pulpwood, firewood, or other usable material; however, treated

Comment [414]: Right Way

Comment [415]: Right Way / Right Location

Comment [416]: Right Time / Right Way

Comment [417]: Right Location / Right Time / Right Way

Comment [418]: Right Way / Right Location

Comment [419]: Right Way

Comment [420]: Right Location / Right Way

Comment [421]: Right Way

Trial Use and Comment

timber shall not be disposed of as firewood. Not more than 2 feet of trunk shall be left attached to grubbed stumps.

When specified that trees or other timber is to be reserved for the property owner, such material shall be cut in the lengths specified and piled where designated, either within the limits of the right of way or not more than 100 feet from the right-of-way line. When not reserved for the property owner, such material shall become the property of the Contractor.

Material less than 3 inches in diameter shall be used to form brush silt barriers when located within 500 feet of the source of such material when specified on the plans or where directed by the Engineer. Material shall be placed approximately 5 feet beyond the toe of fill in a strip approximately 10 feet wide to form a continuous barrier on the downhill side of fills. Where selective clearing has been done, material shall be piled, for stability, against trees in the proper location. On the uphill side of fills, brush shall be stacked against fills at approximately 100-foot intervals in piles approximately 5 feet high and 10 feet wide. Any such material not needed to form silt barriers shall be processed into chips having a thickness of not more than 3/8 inch and an area of not more than 6 square inches and may be stockpiled out of sight of any public highway for use as mulch.

Stumps and material less than 3 inches in diameter that are not needed to form silt barriers and that are not processed into wood chips shall be handled in accordance with the requirements of Section 106 and Section 107.

301.03—Measurement and Payment

Clearing and grubbing will be measured and paid for in accordance with one of the following methods, as specified:

Lump sum basis: No measurement of the area to be cleared and grubbed will be made.

Acre basis: The work to be paid for will be the number of acres, computed to the nearest 1/10 of an acre, actually cleared and grubbed. Areas within the limits of any existing roadway or local material pit will not be measured.

Unit basis: The work to be paid for will be determined by the actual count of trees, stumps, structures, or other obstructions removed.

These prices shall include disposing of cleared and grubbed material.

When clearing and grubbing is not a pay item, the cost thereof shall be included in the price for other appropriate pay items. Allowance will not be made for clearing and grubbing borrow pits or other local material pits.

Comment [422]: Right Way / Right Location

Comment [423]: Right Way / right Location

Comment [424]: Right Way

Comment [425]: Measurement and payment

Trial Use and Comment

Payment will be made under:

Pay Item	Pay Unit
Clearing and grubbing	Lump sum, acre, or unit

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review specification requirements, material documentation, construction procedures, measurement and payment.
- Discuss *critical* points.
- Review the necessary submittals.
- Review SWPP requirements.
- Review marked clearing limits to ensure correct location.

Start:

- Observe contractor's operation to make sure he is working within clearing and grubbing limits (length, width, and depth).
- SWPP requirements are in place.

Intermittent inspection:

- Ensure contractor is handling material as specified and is working within the clearing and grubbing limits.
- Periodic inspection of environmental controls and of disposal areas.

Final Inspection:

- Verify clear and grubbed area is as shown on the plans.
- Verify materials have been removed to the proper depth below grade.
- Obtain a release from the disposal area owner

Documentation Required:

- Disposal area approval
- Measurements for payment of area cleared and grubbed.
- Contractor Furnished Sources, 106.03
- Restoration Release, 106.03
- Owner's approval statement
- Site Plan
- Owner's release
- Payment computations
- Engineers Approval/Authorization

IV. REVIEW QUESTIONS

Spec Ref.	
301.01	Is the clearing and grubbing confined to the area within the construction limits and to other objects as designated on the plans and in the contract?
301.02(1)	Did the Contractor install erosion and siltation control devices prior to beginning clearing or grubbing operations?
301.02(2)	Has the Contractor confined the grubbing of root mat and stumps to the area over which excavation is to be actively prosecuted within 15 days following the grubbing operation?
301.02(3)	Have all items which will be less than 5 feet below the top of earthwork within the area directly below the pavement and shoulders, been removed?
301.02(4)	Are stumps, other perishable materials, and non-perishable objects that are left in place in accordance with this section?
301.02(5)	Have trees and vegetation been disposed of in accordance with this Section?

V. CRITICAL INSPECTION POINTS

• Section 106.04-Approved Disposal Area documentation
• Erosion and Sedimentation Controls are in place and properly maintained.
• Section 106.04-Release from disposal area owner documentation

Trial Use and Comment

SECTION 302 –DRAINAGE STRUCTURES

I. INTRODUCTION:

Excavation should be adequate to accommodate the structure to be installed and should provide sufficient working space and room for forms and bracing if required. The trench for a culvert should be prepared according to the applicable Safety Standards.

All lines should be cleaned periodically, especially after a prolonged wet spell. Materials such as silt, gravel, and debris, should not be allowed to accumulate in the pipe to such an extent that the material threatens to halt the flow of water. Silt and larger material may be removed by the use of drag type equipment. High pressure water may be used only when the necessary precautions have been taken to prevent and control the siltation and erosion of drainage areas.

FOUNDATION AND BEDDING

It is essential that the foundation beneath the structure be firm, but not unyielding, and uniform throughout the length of the installation. If the structure is to be placed on two different types of material or entirely on rock, the Project Inspector should have the condition examined to see if special precautions need to be taken.

The *Road and Bridge Standards* governing the installation of pipe culverts and storm sewers specify 4 inches of bedding under all types of pipe on normal earth foundations. Bedding material is specified for several reasons:

1. Provides exploration which could reveal the presence of boulders or rock pinnacles which would otherwise lay undetected immediately beneath the pipe.

2. The use of a granular backfill material immediately beneath the pipe serves to block the intrusion of silty clay or other small particles which would be carried into the pipe at the joints.

3. The bedding material assists in maintaining uniform support for the pipe throughout its length.

4. The use of selected bedding material facilitates the proper shaping of the foundation.

unacceptable because of the poor supporting capacity in wet environments. The Project Inspector should refer any doubts about the acceptability of local bedding material to the Construction Manager.

The 4-inch layer of bedding material may be eliminated or reduced in depth under entrance pipe as directed by the Engineer, depending upon the type of material encountered. However, bedding will be used as shown on the standard drawings under

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all entrance pipe situated in live streams or where the foundation material is weak or unyielding.

On all cross drainage culverts in which the foundation must be undercut to remove unsuitable or unyielding material, local material is to be used to backfill up to within approximately 8 inches of the bottom of the pipe, provided the material is such that its supporting capacity will not be appreciably reduced when it becomes wet and providing the material is free from unyielding material larger than 4 inches.

PIPE INSTALLATION

Many different procedures are used to establish the grade in the bottom of the trench. When checking the flow line grade, be sure to hold the grade rod in a vertical position. All pipes should be inspected prior to backfilling the trench.

The joints of all rigid pipes must be sealed in accordance with the Section 302 of the Specifications. Check all lines over 36 inches in diameter after backfilling. Joints that have become unsealed should be resealed with approved materials from the inside.

Corrugated metal pipe culverts should normally be laid with separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides.

BOX CULVERTS

Concrete box culverts are to be constructed in accordance with the plans, Standard Drawings, Section 404 and other applicable sections of the Specifications.

Location of Structure:

The Inspector should check on location as to stationing, barrel length compared to roadway cross section, skew and flow lines and check survey stake-out out in accordance with current survey manual.

Invert elevations in relation to finished streambed should also be verified.

Excavation and Foundation Exploration

Secure the data necessary to compute minor structure excavation quantities.

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The Contractor and Inspector should explore the adequacy of the sub-foundation in accordance with Section 401. Foundation material should be uniform for the entire length of the structure. Where unsuitable materials, rock or combinations of rock and soil are encountered, special treatment may be needed. In these instances, notify the Construction Manager.

Minor structure excavation will be measured and computed in accordance with Section 303 of the Specifications.

The Inspector should check Contractor's plan for bypass of drainage water.

Forming

Form dimensions must be checked to ensure dimensions are in accordance with the plans or Standard Drawings. Forms must be well built, with tight joints and smooth surfaces.

Forms must be oiled or wetted before use.

Reinforcing Steel

Certain box culvert reinforcing bars (such as: J, J-l, K and L bars) are designated on the Standard Plans for the BC series to be placed alternately. In general, the sets of each of these bars have the same spacing. In a few instances the design does not permit making these spacings the same. For all cases, the Typical Section shows these bars as alternating with each other. Where spacings differ and it is obviously not possible to obtain true alternation, it is intended that the independent spacings be adhered to and adjusted only to the extent that clearances between any two adjacent bars will be 1 1/2 times the specified maximum size of coarse aggregate, but not less than 1 1/2 inches in order to provide for proper placement of the concrete.

Mixing and Placing Concrete

Concrete must be accurately batched and delivered in accordance with the applicable Specifications.

Required finishing tools must be on hand.

Reinforcing steel must be secured in proper position before concrete placement.

Be sure all spacers are removed and accounted for.

Finish concrete to neatlines. Prohibit the use of free water during finishing of concrete.

Trial Use and Comment

Provide the proper curing environment for fresh concrete.

Oversee the making of test cylinders if the Contractor plans early form removal or to backfill the culvert before the prescribed time has elapsed.

If curing compound is used, be sure it is thoroughly mixed and properly applied. Curing compound must not be used on surfaces that are to be abutted with additional concrete.

REMOVAL OF FORMS

Box Culvert Header Forms Removal

It will be satisfactory to permit the removal of the header form in box culvert construction and the placement of concrete in the adjoining sections after a delay of not less than 12 hours (measured from the end of the concreting operation to the beginning of the removal of the header form), provided a sectional type header form is used that will permit its removal without disturbing the reinforcing steel protruding from the previous placement and provided the appropriate precautions are taken to prevent the application of load or force on protruding bars. A work bridge should be used over the protruding bars in floor and top slabs to prevent workers from stepping upon such bars and thereby causing injury to the “green” concrete in which the bars are embedded.

In the event the protruding bars cannot be properly protected, the header form shall remain in place not less than two days or until the concrete has attained at least 30 percent of the design compressive strength.

The Contractor may remove forms by curing time requirements or cylinder break requirements.

Require tie-bar holes and minor honeycomb to be patched as soon as possible after form removal.

Backfilling

- Use suitable material at proper moisture content.
- Place in layers conforming to the Specification requirements.
- Compact each layer thoroughly.
- Backfill both sides of culvert or arch at same time.
- Run compaction tests on every third lift at random locations or more often as practicable.

Trial Use and Comment

Records

Concrete and reinforcing steel is normally paid for by plan quantities in accordance with Section 109. Accurate records of concrete, reinforcing steel, etc, placed, should be kept in the event the Contractor disputes the plan quantities.

a) Forms:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's:

302.01—Description

This work shall consist of installing pipe culverts, endwalls, box culverts, precast concrete and metal arches, storm drains, drop inlets, manholes, spring boxes, junction boxes, and intake boxes and removing and replacing existing structures in accordance with these specifications and in conformity with the lines and grades shown on the plans or as established by the Engineer.

302.02—Materials

Comment [426]: 12-46: Right Material

(a) **Pipe** shall conform to the requirements of Section 232 and shall be furnished in accordance with the diameter, wall thickness, class, and strength or corrugation specified for the maximum height of fill to be encountered along the length of the pipe culvert, storm drain, or sewer.

(b) **End sections** shall conform to the applicable requirements of Section 232. End sections used with rigid pipe shall be concrete. End sections used with asphalt-coated or paved pipe shall not be asphalt coated or paved.

(c) **Pipe fittings,** such as tees, elbows, wyes, and bends, shall conform to the applicable requirements of Section 232. Fittings shall be of the same type, class, thickness, gage, and strength as the line in which they are used.

(d) **Steel grates, steel frames, and structural steel** shall conform to the requirements of Section 226 and shall be galvanized in accordance with the requirements of Section 233.

(e) **Concrete blocks** shall conform to the requirements of Section 222 for masonry blocks.

(f) **Brick** shall conform to the requirements of Section 222.

(g) **Hydraulic cement mortar** shall conform to the requirements of Section 218.

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(h) **Cast-in-place concrete** shall conform to the requirements of Section 217 for Class A3.

(i) **Bedding material** shall conform to the requirements of Section 205.

(j) **Joint material and gaskets** shall conform to the requirements of Section 212.

(k) **Gray-iron castings** shall conform to the requirements of Section 224.

(l) **Reinforcing steel** shall conform to the requirements of Section 223, Grade 40 or 60.

(m) **Curing materials** shall conform to the requirements of Section 220.

302.03—Procedures

Excavation and backfill operations shall be performed in accordance with the requirements of Section 303. Foundation exploration shall be performed in accordance with the requirements of Section 401 unless otherwise provided herein. Concrete construction shall conform to the requirements of Section 404. Reinforcing steel placement shall conform to the requirements of **Section 406**. Bearing pile operations shall be performed in accordance with the requirements of Section 403. When specified on the plans or directed by the Engineer, a temporary diversion channel shall be constructed to facilitate installation of a pipe or box culvert.

The Contractor shall be responsible for anticipating and locating underground utilities and obstructions in accordance with the requirements of Section 105.08.

When construction appears to be in close proximity to existing utilities, the trench(es) shall be opened a sufficient distance ahead of the work or test pits made to verify the exact locations and inverts of the utility to determine if changes in line or grade are required for the new work.

When lift holes are provided in concrete pipe or precast box culverts, the Contractor shall install a lift hole plug furnished by the manufacturer in accordance with the requirements of Section 232.02(a)1. After pipe installation and prior to backfilling, plugs shall be installed from the exterior of the pipe or box culvert and snugly seated.

(a) **Pipe Culverts:** Not more than one type of pipe shall be used in any one pipeline. When the proposal indicates that all types of pipe of one size are combined into one bid item, one bid price shall be submitted for each size of pipe to be used.

When field cutting corrugated metal pipe is permitted by the Engineer, damaged areas of the protective coating shall be repaired in accordance with the

Comment [427]: Right Way

Comment [428]: Right Way

Comment [429]: Right Location

Comment [430]: 11-14: Right Time

Comment [431]: Right Material

Comment [432]: Right Way

Trial Use and Comment

requirements of Section 233 for galvanized pipe and in accordance with the manufacturer's recommended procedures for all other metallic or polymer coatings.

1. **Jack and bore method:** The Contractor shall submit to the Engineer a complete plan and schedule for jack and bore pipe installation prior to beginning such work. The submission shall include complete details for dewatering; soil stabilization; jacking and receiving pits; jacks; reaction block; boring equipment; sheeting, shoring, and bracing for protecting the roadbed; installation sequence; materials; and equipment. The Contractor shall not proceed with pipe installation until the plan has been reviewed and accepted by the Engineer.

The jack and bore method shall be applicable for installing concrete pipe 12 through 108 inches in diameter and smooth-wall steel pipe 12 3/4 through 48 inches in diameter.

Pipe shall have a design strength and wall thickness sufficient to withstand the jacking operation and maximum height of fill to be encountered along the length of the pipe.

Construction shall be performed in such a manner that the ground surface above the pipe line will not settle. The hole shall be bored mechanically with a suitable boring assembly designed to produce a smooth, straight shaft and so operated that the completed shaft shall be at the established line and grade. The size of the bored hole shall be of such diameter to provide ample clearance for bells or other joints. The holes shall be bored mechanically. The boring shall be done by using either a pilot hole or a dry bore method.

In operating jacks, even pressure shall be applied to all jacks used. Suitable bracing between jacks and the jacking head shall be provided so that pressure shall be applied to the pipe uniformly around the ring of the pipe. The jacking head shall be of such weight and dimensions that it shall not bend or deflect when full pressure is applied at the jack. The jacking head shall be provided with an opening for the removal of excavated material as the jacking proceeds. The pipe to be jacked shall be set on guides that are straight and securely braced together in such manner as to support the section of pipe and to direct it in the proper line and grade.

Installation of the pipeline shall immediately follow heading or tunneling excavation. Voids occurring behind the pipe during installation shall be filled with hydraulic cement grout, placed under pressure, upon completion of the jack and bore operation.

Joint sealant material on concrete pipe shall be placed ahead of the jacking frame. The Contractor shall replace or repair, as directed by the Engineer, pipe that is damaged during jacking operations at his own expense. Joints of steel pipe shall be butt welded, watertight, as installation progresses.

When work is stopped, the heading shall be bulkheaded.

Comment [433]: Right Documentation

Comment [434]: Right Material

Comment [435]: 39-45: Right Way

Comment [436]: Right Way

Comment [437]: 1-3: Right Time

Comment [438]: 5-10: Right Time/Right Way

Trial Use and Comment

When the Contractor encounters an obstruction during the jacking and boring operation that stops the forward progress of the work for more than 60 minutes, the following procedure shall be followed:

a. The Contractor shall notify the Engineer immediately upon encountering an obstruction that stops the forward progress of the work. The Engineer shall verify that an obstruction has stopped the forward progress of the work in excess of 60 minutes and that the Contractor's efforts to remove or bore through the obstruction have been deliberately and diligently pursued.

b. The Contractor shall consult with the Engineer and offer appropriate options for consideration. Upon authorization by the Engineer, the Contractor shall proceed with removal of the obstruction by other methods on a force account basis in accordance with the requirements of Section 109.05. Such alternative methods may include tunneling. In the event tunneling is determined to be necessary by the Engineer, the Contractor shall detail a plan for such an operation including all necessary safety and health precautions for workers as required by local, state, and federal regulations as required by the work being performed. Work shall not commence until this plan is received and authorized by the Engineer. The Contractor shall notify the Engineer before resuming work and afford the Engineer the opportunity to witness all work performed by the Contractor. Payment for obstruction removal shall be from the start of removal operations until the successful removal of the obstruction.

c. Upon removal of the obstruction, the Engineer shall make a determination as to the method to use to proceed with the pipe installation.

2. **Open trench method:**

a. **Foundation:** The foundation shall be explored below the bottom of the excavation to determine the type and condition of the foundation. However, explorations need not be made for routine entrance or crossover pipe 12 through 30 inches in diameter that is to be installed under fills 15 feet or less in height. Foundation exploration shall extend to a depth equal to 1/2 inch per foot of fill height or 8 inches, whichever is greater. The Contractor shall report the findings of the foundation exploration to the Engineer for approval prior to placing pipe.

Where unsuitable foundation is encountered at the established grade, as determined by the Engineer, such material shall be removed and replaced.

Backfill for areas where unsuitable material has been removed shall be placed and compacted in accordance with the requirements of **Section 303.04(g).**

b. **Bedding:** Bedding material for culvert foundations, including foundations in soft, yielding, or otherwise unsuitable material, shall be aggregate No. 25 or 26

Comment [439]: 16-20: Right Time

Comment [440]: 22-25: Right Payment

Comment [441]: 26-33: Right Documentation/Right Time

Comment [442]: Right Time/ Right Way

Comment [443]: 41-45: Right Way

Comment [444]: Right Way

Comment [445]: 53-56: Right Material

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conforming to the requirements of Section 205. Where standing or running water is present in the pipe foundation excavation, pipe bedding material shall be aggregate No. 57 for the depth specified on the plans or as directed by the Engineer capped with 4 inches of aggregate No. 25 or 26. Where such conditions are discovered in the field and the Contractor is directed by the Engineer to use No. 57 stone, No. 57 stone will be paid for at the existing contract unit price or, if not in the contract, in accordance with the provisions of Section 109.05.

Pipe bedding shall be lightly and uniformly compacted and shall be carefully shaped so that the lower section of the pipe exterior is in contact with the bedding material for at least 10 percent of the overall height of the pipe. Bedding material shall be shaped to accommodate the bell when bell and spigot pipe is used. The depth of bedding material shall be at least 4 inches or as specified on the plans.

c. **Placing pipe:** Pipe shall be placed beginning at the downstream end of the pipeline. The lower segment of pipe shall be in contact with the shaped bedding for its entire length. Bell or groove ends of rigid pipe shall be placed facing upstream.

Paved or partially lined pipe shall be placed so that the longitudinal centerline of the paved segment coincides with the flow line.

Pipe will be inspected before backfill is placed. Pipe found to be out of alignment, unduly settled, or damaged shall be taken up and reinstalled or replaced.

d. **Joining pipe:**

(1) **Rigid pipe:** The method of joining pipe sections shall be such that ends are fully entered and inner surfaces are reasonably flush and even so as to permit sealing as specified herein.

Joints shall be sealed with any one or combination of the following to form a leak-resistant joint: rubber, preformed plastic, or mastic gaskets from the Department's approved list; oakum and mortar; oakum and joint compound; or cold-applied pipe joint sealer.

Rubber ring gaskets shall be installed to form a flexible, leak-resistant seal. Where oakum is used, the joint shall be caulked with this material and then sealed with mortar or joint compound.

(2) **Flexible pipe:** Flexible pipe sections shall be aligned and firmly joined by approved coupling bands to form a leak-resistant joint.

e. **Structural plate pipe, pipe arches, and arches:** Erection shall be in accordance with the manufacturer's assembly diagrams and instruction sheets. Splices in the haunch areas of structural plate pipe arches shall be constructed using the reverse shingle method or the side plates shall be provided without longitudinal seams in the haunch

Comment [446]: 2-4: Right Documentation

Comment [447]: 6-10: Right Way

Comment [448]: 12-17: Right Location

Comment [449]: Right Way

Comment [450]: Right Time/ Right Way

Comment [451]: 24-37: Right Way

Comment [452]: 39-45: Right Documentation/Right Way

Trial Use and Comment

areas. The complete line shall be assembled before backfill is placed. Bolts shall be tightened to a torque of 150 to 250 foot-pounds. If spiraling occurs during installation, bolts shall be loosened and the pipe assembly adjusted to the correct position.

f. **Arch substructures:** Each side of an arch shall rest in a groove formed into the masonry or on a galvanized angle or channel securely anchored to or embedded in the substructure. Where the span of the arch is more than 15 feet or the skew angle is more than 20 degrees, a metal bearing surface having a width at least equal to the depth of the corrugation shall be provided.

Metal bearings for arches shall be cold-formed galvanized channel conforming to the requirements of ASTM A 569 at least 3/16 inch in thickness, with the horizontal leg securely anchored to the substructure at points spaced on centers of not more than 24 inches. When the metal bearing is not embedded in a groove in the substructure, one vertical leg shall be punched to allow bolting to the bottom row of plates.

g. **Backfilling:** Class I backfill material shall be crusher run aggregate, No. 25 or 26; aggregate base material, Size 21A or 21B; or flowable fill.

Class I backfill material shall be crusher run aggregate size No. 25 or 26, aggregate base material size 21A or 21B, flowable fill, or crushed glass conforming to the size requirements for crusher run aggregate size 25 and 26.

Regular backfill material outside the neat lines of the Class I areas shown on the Standard PB-1 drawings shall be regular excavation conforming to the requirements of Section 303. Regular and classified backfill shall be placed in uniform layers not more than 6 inches in thickness, loose measurement, before compaction. Each layer of Class I and regular backfill material shall be thoroughly compacted as specified in Section 303.04(g) with the exception that Class I backfill material shall be placed and compacted at a moisture content of optimum to plus 2 percentage points of optimum. Class I backfill material shall be thoroughly compacted under the haunches of pipe culverts. Each layer of Class I and regular backfill material shall be compacted by rolling, tamping with mechanical rammers, or hand tamping with heavy metal tampers with a face of at least 25 square inches. If vibratory rollers are used in the backfill operations, vibratory motors shall not be activated until at least 3 feet of backfill has been placed and compacted over the pipe. Backfill and compaction shall be advanced simultaneously on both sides of the pipe. The fill above the top of the regular backfill shall be installed and completed as specified for embankment construction.

Field density determinations will be performed in accordance with the requirements of VTM-1, VTM-10, or other methods approved by the Engineer.

Concrete pipe with a height of cover greater than that shown in the Standard PC-1 drawings, table for Class V pipe, shall be special design pipe with Method A bedding and backfill in accordance with the requirements of Standard PB-1.

Comment [453]: Right Way/ Right Material

Comment [454]: Right Material/ Right Location

Comment [455]: Right Material

Comment [456]: Right Way

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Puddling will not be permitted. Rock more than 2 inches in its greatest dimension shall not be placed within 12 inches of pipe.

Backfill and compaction shall be advanced simultaneously on both sides of the pipe. The fill above the top of the pipe shall be completed as specified for embankment construction unless the induced trench method of installation is used.

3. **Tunneling operations:** The jacked tunneling method shall be applicable for installing concrete pipe 30 through 108 inches in diameter and smooth-wall steel pipe 30 through 48 inches in diameter. Where the plans specifically identify tunneling as the means of pipe installation, tunneling shall be performed by the Contractor as follows:

The tunnel shall be excavated in such a manner and to such dimensions that shall permit placing of the proper supports necessary to protect the excavation. The Contractor shall take the proper precautions to avoid excavating earth or rock or shattering rock beyond the limits of excavation necessary for the safe and proper installation of the pipe. Damage from excavating and blasting, either to surface or subsurface structures, shall be repaired or replaced by the Contractor at his own expense. Adequate provisions shall be made for the safety and health of the workers required by the work being performed.

No pipe shall be placed until the foundation is in a condition satisfactory to the Engineer. Tunnel dimensions shown on the plans are minimum dimensions. Any excess excavation and subsequent backfill, concrete or grout fill shall be at the Contractor's expense. The pipe shall be laid in the tunnel true to line and grade. If required by the plans or if required for safety, suitable steel or timber sheeting, shoring, and bracing shall be used to support the sides and roof of the excavation. Supports may be left in place provided they clear the encasement or carrier pipe. No

separate payment shall be made for supports left in place. Installation of the pipeline shall immediately follow tunneling excavation.

If indicated or specified, the entire void between the outside of the pipe and the tunnel walls or the inside face of the tunnel lining shall be grouted in accordance with ASTM C 476 unless the permanent sheeting, bottom, sides, and roof of the tunnel are in a condition satisfactory to the Engineer. The minimum thickness of grout backfill shall be maintained throughout. Grout required for backfill in excess of the excavation tolerances specified herein shall be at the Contractor's expense.

Any pipe damaged during construction operations shall be repaired, if approved by the Engineer, or removed and replaced by the Contractor at his expense.

If corrugated galvanized metal pipe is used, joints may be made by field bolting or by connecting bands, whichever is feasible. When reinforced concrete pipe 24 inches and

Comment [457]: Right Material

Comment [458]: Right Way

Comment [459]: Right Way/ Right Paymenti

Comment [460]: 13-14: Right Time

Comment [461]: 16-30: Right Way

Trial Use and Comment

larger in diameter with tongue-and-groove joints is used for the encasement pipe, the interior joints for the full circumference shall be sealed, packed with mortar, and finished smooth and even with the adjacent section of pipe.

(b) **Precast Drainage Structures:** Submittal of designs for precast items included in the standard drawings will not be required provided fabrication is in accordance with the standard details. Submittal of designs for precast box culverts on the Department's approved list will not be required provided the Contractor submits a certification that the item will be fabricated in accordance with the preapproved design drawings.

Requests for approval of a precast design shall include detailed plans and supporting computations that have been reviewed and approved by a registered Professional Engineer having at least 5 years experience in structural design of the type of precast structures or components proposed and licensed in the Commonwealth. Concrete shall conform to the requirements of Section 217 unless otherwise specified and have a design strength at 28 days of at least 4,000 pounds per square inch and an air content of 6 ± 2 percent. The design of the concrete mixture and the method of casting, curing, handling, and erecting shall be subject to review by the Engineer. Precast units may be shipped after reaching 85 percent of the design strength as determined by control cylinders tested in accordance with the requirements of Section 404. However, units shall retain their structural integrity during shipment and shall be subject to inspection at the job site. Approval to use precast units shall not be construed as waiving the size and weight hauling limitations specified in Section 107.21.

1. **Standard precast drainage units** shall conform to the material requirements of AASHTO M 199 and the following:

   a. If the grade on the adjacent gutter is less than 1.5 percent, the grade on the invert of the throat section of the inlet shall be at least 1.5 percent. Precast throats having flat inverts will be permitted in sag locations provided the total length of the required throat opening does not exceed 6 feet.

   b. Pipe openings in precast drainage units shall not exceed the outside cross-sectional dimensions of the pipes by more than a total of 8 inches regardless of the placement of the pipes, the angles of intersection, or the shapes of the pipes. Pipe openings shall be formed, drilled, or neatly cut.

   c. The Contractor shall use brick, masonry block, other standard masonry units, and sound local stone in conjunction with mortar to fill the void between the pipe culverts and the precast drainage structures. Stone or masonry units, areas of the pipe openings, and exterior walls of pipe shall be thoroughly wetted and then bonded with mortar by standard masonry practice in such a manner as to provide a contiguous masonry connection between the precast drainage structures and the pipe culverts. The remaining exterior and interior voids shall be filled with mortar and shaped to the contour of the precast structure.

Comment [462]: 32-50: Right Documentation

Comment [463]: Right Material

Comment [464]: Right Way/ Right Loacation

Comment [465]: Right Way

Comment [466]: Right Material/ Right Way

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d. When precast units are to be located adjacent to the subbase or base course, units with chambers shall be provided with weep holes 3 inches in diameter and hardware cloth and shall be located to drain the subbase or base.

e. Precast units located adjacent to cast-in-place concrete items, such as flumes, ditches, and gutters, shall be connected to the adjacent unit by means of No. 4 smooth steel dowels spaced on approximately 12-inch centers throughout the contact length and extending at least 4 inches into both the precast unit and the cast-in-place item. If holes to receive the dowels are provided in the precast unit, they shall be not more than 5/8 inch in diameter. Other methods of providing the connection, such as keyed joints, shall be approved by the Engineer prior to fabrication.

f. The chamber section shall be installed in the plumb position. The throat and top sections shall have positive restraints, such as adjacent concrete, pavement, or soil, on all sides to prevent displacement and shall have a positive interlock, such as dowels, with the chamber section. The throat and top sections shall be installed to conform with the normal slope of the finished grade and may be canted up to a maximum grade of 10 percent. The chamber may be built up to a maximum of 12 inches at any point to provide for complete and uniform bearing of the throat and top sections on the chamber flat slab top or other approved top section. The built-up section shall be constructed using whole concrete spacer units where feasible and partial and whole sections of concrete block or brick with high-strength grout and mortar. High-strength grout shall be used to provide the final grade adjustment and uniform bearing. The width of the built-up section shall match the wall thickness of the chamber section. The concrete block and brick shall be thoroughly bonded with mortar, and the inside and outside of the built-up section shall be plastered with mortar except that the concrete spacer unit shall not be plastered.

2. **Precast arches** shall conform to the applicable requirements of AASHTO's *Standard Specifications for Highway Bridges* with the following modifications:

a. **Combination of loads:** For service load design: E: vertical loads: 1.00; lateral loads: 1.00 and 0.5 (check both loadings).

For load factor design: E: vertical loads: 1.00; lateral loads: 1.30 and 0.5 (check both loadings).

b. **Protection against corrosion:** The concrete cover of reinforcement shall be at least 1 1/2 inches.

In corrosive or marine environments or other severe exposure conditions, reinforcement shall be epoxy coated in accordance with the requirements of +

Exposed reinforcing bars, inserts, and plates intended for bonding with future extensions shall be protected from corrosion as directed by the Engineer.

Comment [467]: Right Way/ Right Location

Comment [468]: Right Way/ Rright Material

Comment [469]: Right Location/ Right Way

Comment [470]: Right Material

Comment [471]: Right Location

Comment [472]: Right Way

Trial Use and Comment

Reinforcement shall be designed and detailed in consideration of fabrication and construction tolerances so that the minimum required cover and proper positioning of reinforcement shall be maintained.

c. **Anchorage:** Sufficient anchorage shall be provided at the terminus of lines of precast units. Anchorage may consist of a cast-in-place end section at least 3 feet in length with a headwall or collar around the precast unit(s) provided adequate connection can be made between the collar and units.

d. **Joints:** Joints between units shall be sealed by preformed plastic or mastic gaskets or grout. When preformed gaskets are used, they shall be of a type listed on the Department's approved products list.

e. **Pipe openings:** Pipe openings will not be allowed in the precast arch but may be provided through the wingwalls. When required, openings shall conform to the requirements of (b)1.b. herein.

3. **Precast box culverts** shall conform to the applicable requirements of AASHTO M 259 or M 273 and AASHTO's *Standard Specifications for Highway Bridges* with the following modifications:

a. The combination of loads shall be as follows: For service load design or load factor design: E: new reinforced concrete boxes: vertical loads: 1.00; lateral loads: 1.00 and 0.5 (check both loadings).

b. For protection against corrosion, the following minimum concrete cover shall be provided for reinforcement: For boxes with more than 2 feet of fill over the top slab: 1 1/2 inches. For boxes with less than 2 feet of fill over the top slab: top reinforcement of top slab: 2 1/2 inches; bottom reinforcement of top slab: 2 inches; all other reinforcement: 1 1/2 inches.

The minimum cover for reinforcement may be reduced by not more than 1/2 inch provided the reinforcement having reduced cover is epoxy coated or the concrete surfaces adjacent to the reinforcement are coated in accordance with the requirements of Section 416.

Reinforcing steel for box culverts used in 0 to 2 foot fills, used in corrosive or marine environments, or used in other severe exposure conditions shall be epoxy coated. When epoxy-coated reinforcing steel is required due to these conditions, the minimum cover specified shall not be reduced.

c. The type of sealant used in joints between units shall be from the Department's Approved List of Preformed Plastic or Mastic Gaskets.

Where double or greater lines of precast units are used, a buffer zone of 3 to 6 inches between lines shall be provided. This buffer zone shall be backfilled with porous backfill

Comment [473]: Right Location

Comment [474]: Right Way

Comment [475]: Right Material

Comment [476]: Right Location

Comment [477]: Right Location

Comment [478]: Right Way/ Right Location

Comment [479]: Right Location/ Right Material

Comment [480]: Right Material

Comment [481]: Right Material/Right Location/Right Way

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conforming to the requirements of Section 204. The porous backfill shall be drained by a 3-inch-diameter weep hole, formed by non-rigid tubing, located at the top of the bottom haunch, centered in the outlet end section and at approximately 50-foot intervals along the length of the box. Weep holes shall be covered with a 3-foot-square section of filter barrier cloth firmly attached to the outside of the box. A 3-foot width of filter barrier cloth shall also be centered over the buffer zone for the entire length of the structure after placement of the porous backfill material. Filter barrier cloth shall conform to the requirements of Section 245.

Forming weep holes and furnishing and placing of the filter barrier cloth shall be included in the price bid per linear foot for the precast box culvert.

d. At the terminus of precast units, sufficient anchorage shall be provided. This anchorage may consist of a cast-in-place end section at least 3 feet in length with a headwall and curtain wall or a collar cast-in-place around the units provided adequate connection can be made between the collar and units.

When the ends of precast units are skewed, the end section shall be cast monolithically. The skew may be provided by forming, saw cutting, or other methods approved by the Engineer. Regardless of the method used, the variation in the precast unit from the exact skew shall be not greater than 1 1/2 inches at any point.

e. Pipe openings shall conform to the requirements of 1.b. herein.

f. Bedding and backfill shall be in accordance with Standard PB-1 for box culverts.

(c) **Drop Inlets, Manholes, Junction Boxes, Spring Boxes, Intake Boxes, and Endwalls:** Masonry construction shall not be initiated when the air temperature is below 40 degrees F in the shade.

The foundation shall be explored below the bottom of the excavation to determine the type and condition of the foundation. Foundation exploration shall extend to a depth equal to 1/2 inch per foot of fill height or 8 inches, whichever is greater. The Contractor shall report the findings of the foundation exploration to the Engineer for approval prior to placing structure.

Where unsuitable foundation is encountered at the established grade, as determined by the Engineer, such material shall be removed and replaced.

Backfill for areas where unsuitable material has been removed shall be placed and compacted in accordance with the requirements of Section 303.04(g).

Bedding material shall be placed in accordance with the Standard Drawings and shall be aggregate No. 25 or 26 conforming to the requirements of Section 205 except where standing or running water is present in the foundation excavation; then, bedding material shall be aggregate No. 57 for the depth specified on the plans or as directed by

Comment [482]: Right Payment

Comment [483]: Right Way

Comment [484]: Right Way

Comment [485]: Right Time

Comment [486]: Right Way/ Right Time

Comment [487]: Right Material/Right Time

Comment [488]: Right Way

Comment [489]: Right Material/ Right Location

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the Engineer capped with 4 inches of aggregate No. 25 or 26. Where such conditions are discovered in the field and the Contractor is directed by the Engineer to use No. 57 stone, No. 57 stone will be paid for at the existing contract unit price or, if not in the Contract, in accordance with Section 109.05.

Bedding shall be lightly and uniformly compacted. The depth of bedding material shall be as specified on the standard drawings or in the plans.

Brick and concrete block masonry shall be placed so that each unit will be thoroughly bonded with mortar. Joints shall be full-mortar joints not more than 1/2 inch in width. Where brick masonry is used, headers and stretchers shall be arranged to bond the mass fully. Every seventh course shall be placed entirely with headers. Inside joints shall be neatly pointed, and the outside of such walls shall be plastered with mortar as they are placed.

Iron fittings entering the masonry shall be placed as the work is built up, thoroughly bonded, and accurately spaced and aligned.

Inlet and outlet pipe connections shall conform to the same requirements as the pipe to which they connect and shall be of the same size and kind. Pipe sections shall be flush on the inside of the structure wall and shall project outside sufficiently for proper connection with the next pipe section. Masonry shall fit neatly and tightly around the pipe.

Immediately following finishing operations, hydraulic cement concrete shall be cured and protected in accordance with the requirements of Section 316.04(j).

Backfilling shall be performed in accordance with the requirements of Section 303.04(g). Surplus material shall be removed, and the site shall be left in a neat and orderly condition.

When grade adjustment of existing structures is specified, frames, covers, and gratings shall be removed and the walls shall be reconstructed as required. Cleaned frames shall be reset at the required elevation. Upon completion, each structure shall be cleaned of silt, debris, and foreign matter and shall be kept clear of such accumulation until final acceptance.

302.04—Measurement and Payment

Pipe culverts will be measured in linear feet. The quantity will be determined by counting the number of sections and multiplying by the length of the section used. When a partial section is required, the actual length of the partial section will be measured in place.

Structural plate pipe and pipe arches will be measured in linear feet along the invert line.

Pipe tees and elbows will be measured in linear feet of pipe.

Comment [490]: Right Way

Comment [491]: Right Way/ Right Location

Comment [492]: Right Time Right Location

Comment [493]: Right Material/ Right Location

Comment [494]: Right Time

Comment [495]: Right Way

Comment [496]: Right Way

Comment [497]: Right Payment

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Pipe reducers will be measured in linear feet of pipe for payment at the larger pipe size.

Pipe shall be paid for at the contract unit price per linear foot. This price shall include excavating, when not paid for as minor structure excavation; sheeting; shoring; dewatering; disposing of surplus and unsuitable material; and restoring existing surfaces. The upper 4 inches of bedding material and the Class I backfill material within the neat lines shown for each foundation type on the Standard PB-1 drawings shall be included in the price for the related pipe. When unit prices for extended pipelines are not specified, the unit price for new pipe of the same size shall apply. When not a pay item, the cost of the temporary relocation of a stream to facilitate the installation of the pipe shall be included in the price for the pipe. The cost of fittings, anti-seepage collars, and anchor blocks shall be included in the price for the pipe.

Jacked and bored pipe will be measured in linear feet to the nearest 1/10 of a foot along the centerline of completed jacked and bored pipe for the size indicated and will be paid for at the contract unit price per linear foot. This price shall include excavating and backfilling jacking and receiving pits, sheeting, shoring, bracing, jacking equipment, casing pipe, casing chocks, furnishing and installing carrier pipe, grout to install carrier pipe, drainage, safety equipment, and all other items necessary for this operation,

Tunneled pipe will be measured in linear feet to the nearest 1/10 of a foot along the centerline of completed tunnel for the size of lining and will be paid for at the contract unit price per linear foot. This item shall include equipment, materials, handling and disposal of all materials encountered, drainage, pumping and dewatering, tunnel support, lining, furnishing and installing pipe, grouting, ventilation, lighting and wiring, coordination and planning with the railroad or other specified entity, and all other appurtenances necessary to complete the work.

Reinstalled pipe will be measured in linear feet along a line parallel to the flow line and will be paid for at the contract unit price per linear foot of pipe and per cubic yard of minor structure excavation. This price shall include excavation involved in removing pipe, hauling, cleaning, relaying, backfilling, necessary cutting for joining to other sections of pipe, furnishing new coupling bands, disposing of surplus excavation, and replacing any otherwise usable sections damaged or broken because of the negligence of the Contractor.

End sections and pipe spillouts will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each.

Endwalls and arch substructures will be measured in cubic yards of concrete and pounds of reinforcing steel except that EW-12 endwalls will be measured in units of each, complete-in-place. Endwalls and arch substructures will be paid for at the contract unit price per cubic yard of miscellaneous concrete and per pound of reinforcing steel except that crack control bars shall be included in the price bid for miscellaneous

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concrete and Standard EW-12 endwalls will be paid for at the contract unit price per each.

Minor structure excavation will be measured and paid for in accordance with the requirements of Section 303.06.

Cast-in-place box culverts will be measured in cubic yards of concrete and pounds of reinforcing steel and will be paid for at the contract unit price per cubic yard of concrete and per pound of reinforcing steel. These prices shall include excavating, sheeting, shoring, dewatering, waterproofing, disposing of surplus and unsuitable material, restoring existing surfaces, the upper 6 inches of bedding material within the neat lines shown on the Standard PB-1 drawings, and all necessary work to key the bottom slab into an existing rock foundation. When not a pay item, the cost of the temporary relocation of a stream to facilitate the installation of the structure shall be included in the price for the concrete and steel.

If the Contractor elects to furnish and install precast box culverts or precast arches, payment will be made for the original quantities shown on the plans for cast-in-place units. No additional compensation will be made for casting, prestressing, or shipping precast units or performing additional work, such as waterproofing, epoxy coating, or joint sealing, required as a result of the substitution.

Precast box culverts will be measured in linear feet along the centerline of the barrel from face of curtain wall to face of curtain wall and will be paid for at the contract unit price per linear foot. This price shall include designing, casting, reinforcing, excavating, sheeting, shoring, dewatering, installing, waterproofing, sealing joints, anchoring, disposing of surplus and unsuitable material, restoring existing surfaces, the upper 6 inches of bedding material within the neat lines shown on the Standard PB-1 drawings, fittings, and providing buffer zones and porous backfill for multiple lines. When not a pay item, the cost of the temporary relocation of a stream to facilitate the installation of the structure shall be included in the price for the box culvert.

Comment [498]: Right Payment

If the Contractor elects to furnish and install precast box culverts or precast arches, payment will be made for the original quantities shown on the plans for cast-in-place units. No additional compensation will be made for casting, prestressing, or shipping precast units or performing additional work, such as waterproofing, epoxy coating, or joint sealing, required as a result of the substitution.

Grates and frames will be measured in units of each and will be paid for at the contract unit price per each.

Pipe grate will be measured in linear feet and will be paid for at the contract unit price per linear foot. This price shall include fabricating, furnishing, galvanizing, and installing.

Drop inlets and intake boxes will be measured as complete units, including the frame and grate or cover, and will be paid for at the contract unit price per each. The contract

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unit price for drop inlets will be adjusted at the rate of 5 percent per foot for increases or decreases in the depth indicated on the plans except that no adjustment will be made for changes amounting to less than 6 inches in the height of a single drop inlet. Where curb or curb and gutter extend along the drop inlet, the contract unit price for drop inlets shall include that part of the curb or gutter within the limits of the structure. Bedding material, except aggregate No. 57, will be included in the price of the structure.

Base sections of pipe tee units used as drop inlets and manholes will be measured in linear feet horizontally and will be paid for at the contract unit price per linear foot of pipe specified. The riser section and additional costs for the tee shall be included in the price for the drop inlet or manhole.

Manholes will be measured in linear feet, vertical measure, from top of foundation slab to top of masonry on which the casting frame is placed. However, when manholes are constructed as tee sections, measurement will be made to the pay limits shown on the plans. Manholes will be paid for at the contract unit price per vertical linear foot exclusive of frame and cover. Bedding material, except aggregate No. 57, will be included in the unit price per foot for the manhole.

Concrete spring boxes will be measured in cubic yards of concrete, pounds of reinforcing steel, and linear feet of pipe and will be paid for at the contract unit price per cubic yard of concrete, per pound of reinforcing steel, and per linear foot of pipe.

Junction boxes will be measured in cubic yards of concrete, pounds of reinforcing steel, pounds of structural steel, and each complete frame and cover assembly and will be paid for at the contract unit price per cubic yard of concrete, per pound of reinforcing steel, per pound of structural steel, and per each frame and cover assembly. Bedding material, except aggregate No. 57, will be included in the price of the structure.
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Casting frames and covers will be measured in units of one complete frame and cover and will be paid for at the contract unit price per each.

Reconstructed manholes will be measured as a complete unit and will be paid for at the contract unit price per each.

Precast arches will be measured in linear feet along the centerline of the invert from face of headwall to face of headwall. When a pay item, precast arches will be paid for at the contract unit price per linear foot. This price shall include designing, forming, casting, reinforcing, excavating, wingwalls, installing, waterproofing, sealing joints, anchoring and bedding, and providing buffer zones for multiple lines. The cost for cast-in-place work other than that specified on the plans shall be included in the price for precast arches.

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Temporary diversion channel lining will be measured in square yards for the class specified and will be paid for at the contract unit price per square yard. This price shall include installing the channel lining and removal when no longer required.

Temporary diversion channel excavation will be measured in cubic yards and will be paid for at the contract unit price per cubic yard. This price shall include excavation, temporary pipe culverts, removal of pipe culverts when no longer required, backfilling, and site restoration including regrading and seeding.

Excavation, backfill, and disposal of unsuitable or surplus material for drop inlets, intake boxes, manholes both new and reconstructed, spring boxes, junction boxes, and base sections of pipe tee units used as drop inlets and manholes will not be measured for separate payment, and the cost thereof shall be included in the bid price for such items. In the event steps or invert shaping is required, the cost thereof shall also be included in the price for such items.

Comment [499]: Right Payment

Storm water management drainage structure will be measured in linear feet, vertical measure, from top of concrete foundation to the top of the concrete cover. The price bid shall include Class A3 concrete; reinforcing steel; trash rack; debris rack; orifice; steps; steel plate; and, when required, polyethylene tubing, pipe hangers, and steel pipe.

Temporary sediment riser pipe will be measured in linear feet for the size specified and will be paid for at the contract unit price per linear foot. The price shall include the riser pipe, steel plate, perforated pipe, debris rack, orifice and Class A1 riprap, and anti-vortex device when required.

Storm water management dam will be measured and paid for at the contract unit price per cubic yard of concrete and pound of reinforcing steel.

Payment will be made under:

Pay Item	Pay Unit
Pipe (Size and type)	Linear foot
Structural plate arch (Size)	Linear foot
Jacked and bored pipe (Size)	Linear foot
Tunneled pipe (Size)	Linear foot
Reinstalled pipe	Linear foot
End section (Standard and size)	Each
Pipe spillout (Standard)	Each
Concrete (Class)	Cubic yard
Reinforcing steel	Pound
Endwall grate and frame (Standard)	Each
Precast box culvert (Size)	Linear foot
Endwall pipe grate (Type)	Linear foot
Drop inlet (Standard and length)	Each

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Intake box (Standard)	Each
Structural steel (Type)	Pound
Manhole (Standard)	Linear foot
Frame and cover (Standard)	Each
Reconstructed manhole	Each
Precast arch (Size)	Linear foot
Temporary diversion channel lining (Class)	Square yard
Temporary diversion channel excavation	Cubic yard
Endwall, Standard EW-12	Each
Storm water management drainage structure (Type)	Linear foot
Temporary sediment riser pipe (Size)	Linear foot

III. FOUR STEP INSPECTION PROCEDURE:

Pre-start planning meeting:
Review specification requirements, planes, standards, survey data, and source of material, utility coordination, construction procedures, measurement and payment, hold and witness points.

Start:
Locate existing utilities, Verify foundation by probing, Verify placement temperature for masonry, material storage, access, verify traffic control plan, temporary diversion, Verify pipes and structures are certified, clean & free of damage, verify survey locations, compaction equipment

Continuous inspection:
Visual monitoring of material, bedding & backfill placement, compaction, density, lift thickness, pipe and structure alignment, joints, connections, verify inlet throat grade, take measurements.

Final Inspection:
Payment quantity, site restoration, disposal of excess material, traffic pattern restoration.

Documentation Required:
- Contractor's approved material C-25.
- Measurements for payment and or weigh tickets.
- Contractor Furnished Sources, 106.03
- Payment computations
- Engineers Approval/Authorization

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REVIEW QUESTIONS

Spec Ref.

302.02	Is the pipe the required gage and strength, to include the special design pipe, and do other materials meet the requirements of this section?
302.03	Has the contractor furnished and installed lift hole plugs as specified?
302.03(a)	Have all pipe culverts been checked to determine if damaged materials have been repaired or replaced?
302.03(a1)	Has the Contractor submitted to the Engineer a complete plan and schedule for jacked and bored pipe installation prior to the beginning of work?
302.03(a2a)2	Have the pipe culvert foundations been explored by the contractor below the bottom of the excavation?
302.03(a2a)3	Is the foundation firm, but not unyielding for its full length and width and excavated according to the standard drawings?
302.03(a2b)1	Has bedding material been furnished in accordance with this section?
302.03(a2b)2	Has the bedding material been placed and shaped in accordance to this section?
302.03(a2c)2	Has the pipe been placed in accordance with this Section?
302.03(a2d)	Are the joints of the pipe tight and properly sealed?
302.03(a2g)2	Is the backfill placed in uniform layers at the specified thickness?
302.03(a2g)3	Is the backfill placed simultaneously and compacted on both sides of the pipe as specified?
302.03(a2g)4	Has all rock over 2 inches in its greatest dimension been removed from within 12 inches of the pipe?
302.03(a2g)6	Has backfill material been furnished as specified?
302.03(b1a)	Does the grade of the throat section of the inlets meet the appropriate grade of the gutter?

• Is the trench excavated to the required depth?
• Did the Contractor explore the foundation?
• Is the pipe obtained from the source indicated on the approved Form C-25 Source of Materials and does it have the required stamp or certifications?
• Was the pipe unloaded, stored, and moved in such a way that it was not damaged?

INSPECTOR'S CHECKLIST FOR PIPE

• Is the pipe of the correct gage or strength?
• Is the culvert placed so as to best meet field conditions and is the pipe long enough?
• Are the proper invert and outfall elevations established?
• Is the Contractor shaping the pipe bedding properly?

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• Is the pipe installed with tight joints and properly installed joint material?
• Is the Contractor backfilling the trench using four inch compacted lifts?
• Does the density of each lift meet the minimum requirements?
• Is the pipe protected against heavy construction loads?
• Is rock not more than 2” not placed within 12” of the pipe?

INSPECTOR'S CHECKLIST FOR BOX CULVERTS

• Is the Contractor's mix design approved?
• Is the Contractor prepared to furnish the concrete at an adequate rate?
• Is the equipment necessary to perform all tests and to make test cylinders at the site?
• Are all the test results and other information entered on the Forms TL-28?
• Is the Contractor's placing and finishing equipment free from dirt and accumulations of hardened concrete?
• Do the mixing, delivery and placement times conform to Specification requirements?
• Are the form dimensions correct and is the bracing adequate?
• Are the forms clean? All sawdust, dirt and other foreign material including ponded water must be removed.
• Are the forms oiled or thoroughly wetted?
• Do forms for exposed surfaces have an approved liner?
• Do the metal ties or anchorages within the forms conform to the Specifications?
• Do the dimensions and location of all chamfer strips agree with the plans?
• Are all keyways formed correctly?
• Are all embedded fixtures such as pipe sleeves, conduits and weep holes positioned correctly and attached to prevent movement when concrete is placed?
• Does the condition and position of the reinforcing steel conform to the specifications?
• Is the joint filler material of proper type and correctly positioned?
• Are pile heads clean and properly prepared?
• Are foundation and form elevations correct?
• Are water stops installed properly?
• Has contractor stakeout been checked and does this match current grade and streat bed elevations for correct length of box culvert and wing height?
• If box culvert is to be stage constructed, has reinforcing steel been checked for correct lap length?

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V. CRITICAL INSPECTION POINTS

• **Foundation Exploration**
• **Placement temperature for masonry construction**
• **Grade and alignment**
• **Source of material**
• **Locate existing Utilities**

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SECTION 303 - EXCAVATION AND EARTHWORK

I. INTRODUCTION

One of the most critical stages of roadway construction is the foundation on which the roadway is to be constructed. The use of proper suitable material cannot be over emphasized. The use of proper erosion control measures is important during the earthwork phase of roadway construction.

Erosion and Siltation Control (ESC)

Prior to performing land disturbing operations, the proper ESC measures need to be taken. The Inspector must first verify that the Contractor has been qualified by the Department of Conservation and Recreation (DCR). This DCR certified person must be on the job site during all land disturbing activities.

ESC devices are to be installed in accordance with the plans, Specifications and the Department of Conservation and Recreation Erosion and Sedimentation Control Handbook.

Definitions of Terms

Regular Excavation - Removal of all materials as necessary within the construction limits as defined below.

1. Cut Sections

   All material down to a point one foot below either the elevation of the top of earthwork or the elevation of unsuitable material shown on the plans.

2. Fill Sections

   (a) Fill height less than 5 feet - All material down to a point one foot below (l) the bottom of rootmat or topsoil, (2) unsuitable material shown on plans or (3) original ground if no topsoil or root mat is present and no unsuitable material is shown on plans.

   (b) Fill height greater than 5 feet - All material down to a point one foot below either the original ground or the elevation of unsuitable material as shown on the plans.

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Undercut Excavation - The removal of unsuitable material below the regular excavation limits as defined above, or below the limits of normal excavation for minor structures less than 48" span.

Unsuitable Material - Material deemed to be unfit for incorporation into the work due to poor bearing capacity, excessive moisture or other reasons. Unsuitable material may be designated on the plans or encountered during construction. Removal of unsuitable material is to be measured as regular excavation or undercut as defined above or as minor structure excavation.

Borrow Excavation - Suitable material from sources outside the project typical sections used primarily for embankments. Borrow is generally measured at the source by cross sections.

Select Borrow - Borrow material having specified physical characteristics such as specified CBR values.

Embankment - A structure of soil, broken rock or soil aggregate between the embankment foundation and the subgrade, commonly referred to as "fill".

Minor Structure Excavation - The removal of material below original ground level for the purpose of placing or constructing a culvert, drop inlet or other minor structure.

Special Minor Structure Excavation - Minor structure excavation specified as such on the plans and contract for separate payment because of unusual conditions which may require special equipment or procedures.

Regular Excavation

Regular excavation normally includes all materials encountered regardless of their nature or the manner in which they must be removed. The Inspector should ascertain from the plans which quantities are designated "plan quantities" and which quantities require measurement.

Generally all excavation which conforms to the project typical sections will be included in the "plan quantities". Topsoil stripped from cut areas is generally included in the plan quantities. Removal of unsuitable material, not shown on plans, stripping of topsoil and rootmat in fill sections, and excavation of side ditches will usually require measurement (Inspector should compute the quantity removed by the average-end-area method). Such measurements and computations for all measured excavation must be included in the project records.

The rounding of the top of the cut slope is customarily shown on the plans. Although the radius of this curve is specified, the curve may be modified to meet local conditions and benefit the control of erosion. The radius of rounding throughout the length of the cut slope may also be modified to advantage by using a longer radius as the height of the cut decreases.

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Borrow Excavation and Select Borrow

Borrow must be obtained from approved sources and should not be placed until authorized by the Engineer. The suitability of the material source must be approved by the Materials Division. Generally, the amount of borrow is measured in its original position. Survey cross-sections at the source before and after the operations should be taken and the quantity of material computed from these measurements.

Undercut Excavation

Undercut excavation, when not a bid item but authorized by the Engineer, will be paid for at twice the unit price per cubic yard for regular excavation.

In certain instances a bid item for undercut excavation will be included in the contract. Whenever this occurs, all undercut excavation encountered, irrespective of whether or not such material is shown on the plans, will be paid for at the unit price bid for undercut excavation, NOT at twice the unit price for regular excavation.

Minor Structure Excavation

Excavation for culverts having spans or openings of less than 48 inches will be included in the cost of the culvert therefore no measurement will be made. However, excavation of rock or unsuitable material which falls below the lower theoretical slab or culvert thickness or below the normal foundation excavation plane, whichever is the greater depth, will be measured and paid for as undercut excavation according to Section 303 Measurement and Payment.

Excavation for culverts having spans of 48” or greater and excavation for minor structures is measured for payment as minor structure excavation. The limits of payment are vertical planes up to 18” outside the neat lines of the culvert, the original groundline or regular excavation payline, whichever is lower and the lower excavation limit for normal earth foundations or the bottom of the lower theoretical slab, whichever is the lower. If unsuitable material is encountered below the normal excavation limits then its removal, as necessary, is to be paid for as minor structure excavation and so noted.

Excavation for wingwalls, end walls, and end sections for pipe and box culverts of 48” or larger diameter will not be measured. Payment for such excavation will be based on the ratio of the plan area of all wingwalls, end walls or end sections to the plan area of the culvert barrel. The width of the barrel will be the normal span or opening of the pipe or box culvert, and the length of the barrel will be from out to out of the culvert. The wall thickness and the 18” outside of the neatlines of the culvert will not be included in computing the ratio shown on the plans.

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The excavation quantity for the barrel section (measured from out to out of the culvert and including wall thickness and the 18" outside the two major plan view dimensions or the width in accordance with Standard PB-l from the neatline of the barrel) is to be increased by the ratio shown on the plans to give the total cubic yards of minor structure excavation.

When the length of the culvert barrel changes by 10 percent or more from the plan length, the Inspector is to re-compute the ratio to the nearest whole percent and show the calculations in the project records with the appropriate culvert.

Removal of Unsuitable Materials

Unsuitable material may be encountered either above or below the finished grade line. All unsuitable material must be removed and disposed of legally. Sometimes material which is designated as unsuitable on the plans is found to be suitable during construction because the moisture content may have changed since the material was initially tested. If it is above the normal grade line, then such material should be used in embankments in lieu of borrow. If such material is below the normal grade line but designated to be removed, then it should be left and the Inspector should immediately notify the Construction Manager and request an on site review of the material.

The method of measurement and payment for removal of unsuitable material will depend upon where it is encountered and whether it is designated on the plans as unsuitable material.

Embankments

Earth Embankments

Prior to the construction of an embankment, the area that will serve as its foundation should be carefully inspected. All areas of questionable supporting capacity should be given special attention. The presence of soft or very wet conditions may suggest the need for removal of certain unsuitable materials, installation of underdrain facilities to remove spring or seepage water, or merely the need for aeration to dry the material. Conditions of this type should always be called to the attention of the Construction Manager.

Embankments to be placed over swampy areas, composed of materials which will not support the weight of the hauling equipment, may be constructed by end-dumping successive loads in a uniformly distributed layer and of a thickness capable of supporting the hauling equipment while placing subsequent layers. The use of compacting equipment will not be required on this initial layer; however, the remainder of the embankment is to be constructed in layers and compacted in accordance with the Specifications. The initial layer should have an adequate thickness to develop a

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working platform or mat. If the initial layer is too thin, water will seep upward into the compacted layers through shear cracks in the mat.

In constructing embankments on slopes steeper than 4:l, particular attention should be given to obtaining a good interlock between the sloping foundation and the new embankment. All vegetation should be removed to prevent the formation of slippage planes. Proper interlock between the surfaces can usually be provided by “benching” the existing slope.

When embankments are placed over an existing roadway, the surface should be scarified to such a degree that ample bond will be assured between the existing surface and the embankment. When the existing surface is bituminous concrete or hydraulic cement concrete, Section 510 of the Specifications will also govern.

Hauling, Spreading and Shaping:

Prior to beginning the construction of an embankment, the limits of construction should be clearly outlined by construction stakes. The Inspector should check a sufficient number of stakes placed either by the Contractor or the Department’s survey party to be reasonably sure of their accuracy. The use of this system of checks will reduce the chances for error in embankment widths and heights. Corrective measures are difficult and costly.

Washes, holes and other low areas in the embankment foundations should be filled and compacted prior to beginning the construction of the first lift of embankment. The first lift should begin in the low areas with the intent of eventually providing an embankment layer approximately parallel to the finished grade. As the earth materials are being dumped and spread, large roots and other objectionable materials must be removed, unless they are outside the areas beneath the roadbed.

The selection of the equipment used to haul excavation is left to the Contractor’s option; however, it must conform to the requirements of Section 105.14. Material may be spread with the hauling equipment or it may be spread by the use of blade graders, bulldozers or other equipment.

Hauling over fills should not be confined to the same path or track but should be spread out over the entire width of the embankment to avoid ruts and to insure uniform compaction.

Localized “soft spots” will ruin the ability of the fill to support a roadway. Loaded equipment will often indicate these “soft spots” in compacted layers. The Inspector should watch the material under the tires of the loaded equipment. If the material “pumps” when the equipment passes over it, that particular spot should be investigated and if necessary scarified and recompacted or removed and replaced.

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At the end of each working day, the surface of the embankment should be graded to allow runoff of rain water. Then, if a shower occurs during the night or the following morning, water will not be trapped on top of the fill. The fill will dry out quickly, enabling the Contractor to resume his operations. However, the Project Inspector is reminded of the provisions of Section 107.14, wherein the Contractor is required to take special precautions to prevent the siltation of our water resources (rivers, streams and impoundments).

Layer Thickness:

The Specifications restrict the depth of soil which can be placed in a single layer in an effort to ensure adequate and uniform compaction throughout each layer.

Moisture Content:

Every soil has a particular moisture content, known as optimum moisture, at which that soil can be compacted to its maximum density. Therefore, the success of compaction operations is dependent to a large extent on proper moisture control. If the proper amount of moisture is uniformly distributed throughout the embankment layer, rarely will there be any difficulty in obtaining satisfactory compaction.

Earth Embankment Compaction:

In-place density tests for checking compaction should be made using the specified equipment and procedures outlined in the *Manual of Instructions - Materials Division.*

Rock Embankments

Placing:

The construction methods for placing rock embankments will depend upon the size of the boulders or stone and the quantities involved. Ordinarily, rock embankments are constructed in layers extending over the full width of the roadway, with the layer thickness conforming to the requirements of the applicable Specifications. By exercising skill in handling, the coarse and fine materials can usually be distributed so that voids between the larger pieces will be filled with small pieces and earth to make the embankments as dense as possible.

When material is placed in the fill by the end-dumping method, each load should be dumped on top of the previous layer and pushed into place. Allowing material to roll into place by dumping over the edge of completed work shall not be permitted. Oversize pieces of rock, not suitable for placement in a given layer should be reduced to proper dimensions or moved to a portion of the fill where large rock can be satisfactorily used.

Compaction:

Trial Use and Comment

When rock is present in the embankment material in considerable proportions, moisture control procedures are of little benefit and density tests for checking compaction are not considered feasible. When it is not possible to properly perform meaningful tests due to high rock content, this fact is to be noted on the appropriate report of field densities.

Hydraulic Embankment

There will be occasions where it may be desirable to obtain embankment material from sources under or adjacent to water. When the material selected for embankment use is beyond the reach of dragline equipment and located below the water table (river, swamp or lake bed), excavation and movement of the material can be done efficiently by hydraulic dredging. Even if the material is not covered by water but is adjacent to it, dredging equipment may prove very competitive with other types of excavation equipment. The dredge pump draws water and suspended material through a pipe line to the point of discharge. Some materials can be excavated by suction alone, but the tougher, more cohesive materials require agitation or cutting to loosen and stir them prior to pickup by the suction intake.

Frequently, the embankment foundation area contains an overburden of muck or unsuitable material which must be removed prior to placement of the excavated material. If job site conditions permit, this may be handled by the same equipment that will be used to excavate and place the embankment material. Suitable disposal areas must be provided for all unsuitable material removed from the embankment and borrow source areas.

Selection of material from within the area to be excavated must be given the same careful attention as if it were from a surface borrow source. All unsuitable material should be removed from the proposed work area before the embankment material is excavated. During production, the material being discharged on the embankment area should be observed for contamination by abnormal amounts of unsuitable material. Material such as clay balls in sand, has a tendency to settle out in the vicinity of the discharge and form a pocket of undesirable material which can produce instability. Such material should be removed prior to the completion of the work.

The embankment material is usually pumped through the pipe system directly to the embankment site where it is shaped and compacted by a bulldozer or other suitable equipment. The applicable Specifications will describe the manner of spreading, manipulating and compacting the material.

The Inspector should not permit a hydraulic fill to be placed over a portion of fill already placed by conventional methods. The hydraulic fill material may over saturate the existing material necessitating removal and replacement of the entire fill.

Trial Use and Comment

The yardage of borrow material placed by the hydraulic method is determined from cross sections of the material in its final position.

Disposal of Surplus Materials

It may be determined during the grading of a project that the required excavation will yield more suitable material than can be placed in the embankment. Generally, embankment construction should be completed before any suitable material is wasted. In any event, calculations should always be made to ensure that the remaining excavation is sufficient to complete the embankments prior to wasting material. Usually, surplus material can be used to flatten slopes or fill medians to provide for greater safety.

Tolerances

Finished grade of subgrade shall be within 1/10th foot of the theoretical grade. Slopes shall not deviate from the theoretical grade by more than 0.5 foot.

a. **Forms**:
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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

303.01—Description

This work shall consist of constructing roadway earthwork in accordance with these specifications and in conformity with the specified tolerances for the lines, grades, typical sections, and cross sections shown on the plans or as established by the Engineer. Earthwork shall include regular, borrow, undercut, and minor structure excavation; constructing embankments; disposing of surplus and unsuitable material; shaping; compaction; sloping; dressing; and temporary ESC work.

303.02—Materials

(a) **Borrow excavation** shall consist of approved material obtained from approved sources outside the project limits conforming to the requirements of AASHTO M57 and the requirements herein.

Comment [500]: Right Material

(b) Materials for temporary silt fences, geotextile fabric silt barriers, and filter barriers shall conform to the requirements of Sections 242.02(c) and 245.03(a).

Trial Use and Comment

(c) **Geotextile materials used for embankment stabilization** shall conform to the requirements of Section 245.03(e).

(d) **Mulch** shall conform to the requirements of Section 244.02(g).

303.03—Erosion and Siltation Control

Erosion and siltation shall be controlled through the use of the devices and methods specified herein or as is otherwise necessary. The Engineer reserves the right to require other temporary measures not specifically described herein to correct an erosion or siltation condition.

ESC devices and measures shall be maintained in a functional condition at all times. Temporary and permanent control measures shall be inspected after each rainfall and at least daily during periods of prolonged rainfall. Deficiencies shall be immediately corrected as approved or directed by the Engineer. The Contractor shall make a daily review of the location of silt fences and filter barriers to ensure that they are properly located for effectiveness.

Sediments shall be removed from ESC devices when capacity, height, or depth has been reduced by 50 percent. Removed sediment shall be disposed of in accordance with the requirements of Section 106.04. Sediment deposits remaining in place after the device is no longer required shall be dressed to conform with the existing grade, prepared, and seeded in accordance with the requirements of Section 603.

Geotextile fabric that has decomposed or has become ineffective and is still needed shall be replaced. Temporary erosion and sediment control devices except brush silt barriers shall be removed within 30 days after final site stabilization or after the temporary devices are no longer needed as determined by the Engineer.

(a) **Earth Berms and Slope Drains:** The top of earthwork shall be shaped to permit runoff of rainwater. Temporary earth berms shall be constructed and compacted along the top edges of embankments to intercept runoff water. Temporary Berms and temporary dikes are to be stabilized immediately following installation. Temporary slope drains shall be provided to intercept runoff and adequately secured to prevent movement. Slope drains may be flexible or rigid but shall be capable of being readily shortened or extended. A portable flume shall be provided at the entrance to temporary slope drains.

(b) **Soil Stabilization:** Soil stabilization shall be applied within 7 days after attaining the appropriate grading increment for that stage of the construction operations, or upon suspension of grading operations for an anticipated duration of greater than 15 days, or upon completion of grading operation for a specific area. Areas excluded from this requirement include areas within 100 feet of the limits of ordinary high water or a delineated wetland which shall be continuously prosecuted until completed and stabilized immediately upon completion of the work in each impacted area. Soil

Comment [501]: Right Way/ Right Time

Comment [502]: Right Time/ Right Way

Comment [503]: Right Time/ Right Materiall

Comment [504]: Right Way/Right Time/ Right Material

Comment [505]: Right Time/Right Location/ Right Way

Trial Use and Comment

stabilization includes: temporary and permanent seeding, riprap, aggregate, sod, mulching, and soil stabilization blankets and matting in conjunction with seeding. The applicable type of soil stabilization shall depend upon the location of areas requiring stabilization, time of year (season), weather conditions and stage of construction operations.

Cut and fill slopes shall be shaped and topsoiled where specified. Seed and mulch shall be applied in accordance with the requirements of Section 603 as the work progresses in the following sequence:

1. Slopes whose vertical height is 20 feet or greater shall be seeded in three equal increments of height. Slopes whose v ertical height is more than 75 feet shall be seeded in 25-foot increments.

2. Slopes whose vertical height is less than 20 but more than 5 feet shall be seeded in two equal increments.

3. Slopes whose vertical height is 5 feet or less may be seeded in one operation.

Areas that cannot be seeded because of seasonal or adverse weather conditions should be mulched to provide some protection against erosion to the soil surface. Organic mulch shall be used, and the area then seeded as soon as weather or seasonal conditions permit in accordance with the requirements of Section 303.03(e). Mulch shall be applied in accordance with the requirements of Section 603.04. Organic mulch includes: straw or hay, fiber mulch, wood cellulose, or wood chips conforming to the requirements of Section 244.02(g).

(c) **Check Dams:** As an initial item of work, required check dams shall be constructed at 25-foot intervals, unless otherwise shown on the plans, below the outfall end of drainage structures.

Synthetic check dams recorded in the Department's Approved List may be substituted for Standard EC-4, Rock Check Dams, Type II, with the approval of the Engineer at no additional cost to the Department. Synthetic check dams shall be installed in accordance with the manufacturer's recommendation.

(d) **Baled Straw Silt Barriers:** Baled straw silt barriers may be substituted for temporary filter barriers with the approval of the Engineer in noncritical areas, such as pavement areas and rock locations where filter barriers cannot be installed in accordance with the plans and specifications and locations where the Engineer determines that streams and water beds will not be affected.

(e) **Temporary Silt Fences, Geotextile Fabric Silt Barriers, and Filter Barriers:**

Comment [506]: Right Material/ Right Time

Comment [507]: Right Location/ Right Time

Comment [508]: Right Documentation

Comment [509]: Right Location

Trial Use and Comment

1. **Temporary silt fences:** Fences shall be erected at locations shown on the plans or determined by the Engineer. Geotextile fabric used for silt fences shall be provided, and posts shall not be spaced more than 6 feet apart. Posts shall be uniformly installed with an inclination toward the potential silt load area of at least 2 degrees but not more than 20 degrees. Attaching fabric to existing trees will not be permitted.

   Fabric shall be firmly secured to the post or wire fence. The bottom of the fabric shall be entrenched in the ground in a minimum 6-inch by 6-inch trench. Temporary silt fence may also be entrenched using a slicing method with a minimum of 8 inches sliced into the ground. Fabric may be spliced only at support posts and with an overlap of at least 6 inches. The top shall be installed with a 1-inch tuck or reinforced top end section. The height of the finished fence shall be a nominal 29 inches.

2. **Geotextile fabric silt barriers:** Existing fences or brush barriers used along the downhill side of the toe of fills shall have geotextile fabric attached at specified locations as shown on the plans. The bottom of the fabric shall be entrenched in the ground in a minimum 6-inch by 6-inch trench, and the top shall be installed with a 1-inch tuck or reinforced top end section. Temporary fabric silt barriers may also be entrenched using a slicing method with a minimum of 8 inches sliced into the ground.

   Brush barriers shall be installed prior to any major earth-disturbing activity and trimmed sufficiently to prevent tearing or puncturing fabric. Fabric shall be fastened securely to the brush barrier or existing fence. A 6-inch overlap of fabric for vertical and horizontal splicing shall be maintained and tightly sealed.

3. **Temporary filter barriers:** Barriers shall consist of geotextile fabric and shall be securely fastened to wood or metal supports that are spaced at not more than 3-foot intervals and driven at least 12 inches into the ground. At least three supports shall be used. The bottom of the fabric shall be entrenched in the existing ground in a minimum 4-inch by 4-inch trench.

   Temporary filter barriers may also be entrenched using a slicing method with a minimum of 6 inches sliced into the ground. The top of the fabric shall be installed with a 1-inch tuck or reinforced top end section. The height of the finished temporary filter barrier shall be a nominal 15 inches.

   Temporary filter barriers shall be installed at temporary locations where construction changes the earth contour and drainage runoff as directed or approved by the Engineer.

   After removal and disposal of the temporary silt fence, geotextile fabric silt barrier, and temporary filter barrier, the area shall be dressed and stabilized with

Comment [510]: Right Way/Right Location

Comment [511]: Right Time/ Right Way

Comment [512]: Right Time/Right Way

Comment [513]: Right Way/Right Location

Comment [514]: Right Way

Comment [515]: Right Location

Comment [516]: Right Time/ Right Way

Trial Use and Comment

a permanent vegetative cover or other approved permanent stabilization practice approved by the Engineer.

(f) **Sediment Traps and Sediment Basins:** Sediment traps are required if storm water runoff from less than 3 acres flows across a disturbed area of 10,000 square feet or more. Sediment basins are required if storm water runoff from 3 or more acres flows across a disturbed area of 10,000 square feet or more. Once a sediment trap or basin is constructed, the dam and all outfall areas shall be stabilized immediately.

(g) **Erosion Control Mulch:** This work shall consist of furnishing and applying mulch as a temporary erosion control treatment on slopes exposed to the elements but not at final grade during the period from December 1 to March 1 for periods of up to 30 days prior to final grading or to areas to receive stabilization or paved surfaces within 6 months in accordance with this provision and as directed by the Engineer.

Mulch shall be applied to exposed slopes requiring mulch or to areas to be stabilized or paved, within 48 hours after performance of grading operations. Straw or hay mulch shall be applied on bare slope areas at the rate of approximately 3 tons per acre (1.24 pounds per square yard). Straw or hay mulch shall be applied at a uniform thickness in such a manner that not more than 10 percent of the soil surface will be exposed. Straw or hay mulch shall be anchored to the slope surface by one of the following methods: spraying with cellulose fiber mulch at the rate of 750 pounds per acre (0.15 pound per square yard); disking or punching the mulch partially into the soil; using approved netting; or using other materials or methods approved by the Engineer. The Contractor may use more than one method on the same project.

303.04—Procedures

Loose rock 3 inches or larger shall be removed from the surface of cut slopes.

When slides occur, the Contractor shall remove and dispose of material as directed by the Engineer.

Where required, surface ditches shall be placed at the top of cut slopes or at the foot of fill slopes and at such other points not necessarily confined to the right of way or shown on the plans and shall be of such dimensions and grades as directed by the Engineer.

Allaying dust, when specified, shall be performed in accordance with the requirements of Section 511.

Prior to the beginning of grading operations in the area, necessary clearing and grubbing shall be performed in accordance with the requirements of Section 301.02.

Comment [517]: RightPlace/Right Time

Comment [518]: Right Time

Comment [519]: Right Time / Right Way

Comment [520]: Right Way

Comment [521]: Right Location

Comment [522]: Right Way

Comment [523]: Right Time /Right Way

Trial Use and Comment

(a) **Regular Excavation:** Existing foundations and slabs located within the construction limits shall be removed and disposed of in a location approved by the Engineer. In lieu of removal, foundations and slabs located 5 feet or more below the proposed subgrade may be broken into particles not more than 18 inches in any dimension and reoriented to break the shear plane and allow for drainage.

Cisterns, septic tanks, wells, and other such structures shall be cleared in accordance with the requirements of Section 516.

Balance points shown on the plans are theoretical and may vary because of actual field conditions.

When the material to be excavated necessitates the use of explosives, the requirements of Section 107.11 relating to the use of explosives shall apply. To prevent damage to newly constructed concrete, the Contractor shall schedule blasting operations in the proximity of proposed concrete structures so that work will be completed prior to placement of concrete.

Regular excavation shall consist of removing and disposing of material located within the project limits, including widening cuts and shaping slopes necessary for preparing the roadbed; removing root mat; stripping topsoil; cutting ditches, channels, waterways, and entrances; and performing other work incidental thereto. The Engineer may require materials in existing pavement structures to be salvaged for use in traffic maintenance.

Undrained areas shall not be left in the surface of the roadway. Grading operations shall be conducted so that material outside construction limits will not be disturbed.

Where rock or boulders are encountered, the Contractor shall excavate and backfill in accordance with the plans and contract documents.

When the presplitting method of excavation is specified for rock cuts, work shall be performed in a manner to produce a uniform plane of rupture in the rock and so that the resulting backslope face will be unaffected by subsequent blasting and excavation operations within the section. Rock shall be presplit along rock slopes at locations, lines, and inclinations shown on the plans or as determined by field conditions. A test section shall be provided to establish the spacing of drill holes and the proper blasting charge to be used in the presplitting operation. Drill holes shall be spaced not more than 3 feet apart and shall extend to the plan grade or in lifts of not more than 25 feet, whichever is less. If drilled in benches, an offset may accommodate the head of the drill, but no offset shall be more than 12 inches. Presplitting shall extend at least 20 feet ahead of the limits of fragmentation blasting within the section.

Where the project has been designed and slopes have been staked on the assumption that solid rock will be encountered and the Contractor fails to encounter solid rock at the depth indicated, he shall cease excavation in the area and immediately notify the

Comment [524]: Right Location/ Right Material/ Right Time

Comment [525]: Right Way/ Right Location

Comment [526]: Right Documentation/ Right Payment

Trial Use and Comment

Engineer. If it is necessary to redesign and restake slopes, any additional excavation necessary will be paid for at the contract unit price per cubic yard.

Topsoil stockpiled for later use in the work shall be stored within the right of way unless the working area is such that the presence of the material would interfere with orderly prosecution of the work. Stockpile areas outside the right of way shall be located by the Contractor at his expense. Topsoil used in the work shall be removed first from stockpiles located on private property. Surplus topsoil remaining on private property after completion of topsoiling operations shall be moved onto the right of way and stockpiled, shaped, and seeded as directed by the Engineer.

Comment [527]: Right Location

Stripping topsoil shall be confined to the area over which grading is to be actively prosecuted within 15 calendar days following the stripping operation. Grading operations shall be confined to the minimum area necessary to accommodate the Contractor's equipment and work force engaged in the earth moving work.

(b) **Borrow Excavation:** The Contractor shall make his own arrangements for obtaining borrow and pay all costs involved in accordance with the provisions of Section 106.03.

Comment [528]: Right Payment

If the Contractor places an excess of borrow and thereby causes a waste of regular excavation, the amount of such waste, unless authorized, will be deducted from the volume of borrow as measured at the source or computed by vehicle count as specified in Section 109.01.

Comment [529]: Right Payment

When borrow is obtained from sources within the right of way and the excavation is performed simultaneously with regular excavation, borrow excavation will be designated as regular excavation. Material secured by widening cuts beyond slope stakes, when taken from previously excavated slopes, will be designated as borrow excavation. When such a procedure is approved, slopes shall be uniform and no steeper than shown on the plans.

Comment [530]: Right Way/ Right Payment

Borrow excavation areas shall be bladed and left in a shape to permit accurate measurements after excavation has been completed.

CBR values, stipulated for borrow excavation, shall apply to the uppermost three feet of fill below the top of earthwork, as defined in Section 101 of the Specifications. Borrow excavation, installed below the top three feet shall consist of suitable fill material, available from regular excavation or borrow excavation, as defined and of a quality consistent with project requirements.

Comment [531]: Right Material/ Right Location

(c) **Undercut Excavation:** Undercut excavation shall consist of removing and disposing of unsuitable material located within the construction limits in accordance with the requirements of Section 303.06(a)3.

Comment [532]: Right Way/ Right Material

Trial Use and Comment

Undercut excavation shall be disposed of in accordance with the requirements of Section 106.04.

(d) **Minor Structure Excavation:** Minor structure excavation shall consist of removing material necessary to accommodate the structure, such as box or arch culverts, including pipe arches, structural plate arches, structural plate pipe, pipe culverts, and storm drains with a span(s) or opening(s) of 48 inches or greater. Minor structure excavation shall also include dewatering, sheeting, bracing, removing existing structures, and backfilling. Removing existing structures shall also include foundations that might be necessary to clear the site.

(e) **Removing Unsuitable Material:** Where excavation to the finished graded section results in a subgrade or slopes of unsuitable material, such material shall be excavated below the grade shown on the plans or as directed by the Engineer. Areas so excavated shall be backfilled with approved material in accordance with (f) herein.

Excavation for structures shall be carried to foundation materials satisfactory to the Engineer regardless of the elevation shown on the plans. If foundation material is rock, the Contractor shall expose solid rock and prepare it in horizontal beds for receiving the structure. Loose or disintegrated rock and thin strata shall be removed. Excavated material, if suitable, shall be used for backfilling around the structure or constructing embankments.

Material shown on the plans as unsuitable and during construction found to be suitable for use shall first be used in embankments where needed in lieu of borrow. However, the use of this material in lieu of borrow shall not alter the provisions of Section 104.02 regarding underruns.

Material shown on the plans as suitable material but found at time of construction to be unsuitable shall be disposed of as unsuitable material.

Unsuitable material shall be disposed of in accordance with Section 106.04.

(f) **Backfill for Replacing Undercut Excavation:** Backfill shall be composed of regular excavation, borrow, select material, subbase material, or other material as directed by the Engineer. Backfilling operations shall be performed in accordance with (g) herein.

(g) **Backfilling Openings Made for Structures:** Backfill shall be suitable material removed for the structure, although the Engineer may require that backfill material be obtained from a source within the construction limits entirely apart from the structure or other approved material. The opening to be backfilled shall be dewatered prior to backfilling. Backfill shall not be placed against or over cast-in-place box culverts or other structures until the top concrete slab section(s) has been in place 14 days, exclusive of days on which the average high-low ambient

Comment [533]: Right Material/ Right Way

Comment [534]: Right Time/ Right Way/ Right Location

Comment [535]: Right Material/ Right Time/ Right Way

Trial Use and Comment

temperature is below 40 degrees F in the shade or until the concrete control cylinder(s) has attained a compressive strength equal to 93 percent of the 28-day design compressive strength.

Backfill shall be compacted in horizontal layers not more than 6 inches in thickness, loose measurement, and as specified in (h) herein. Backfill shall be placed in horizontal layers such that there will be a horizontal berm of compacted undisturbed material behind the structure for a distance at least equal to the remaining height of the structure or wall to be backfilled. Backfill shall be placed in a manner to deter impoundment of water and facilitate existing drainage. Backfill around piers in areas not included in the roadway prism shall be constructed in uniformly compacted layers. However, density requirements will be waived.

Box culverts shall not be opened to construction equipment traffic until concrete has attained 100 percent of the 28-day design compressive strength and has a backfill cover of at least 4.0 feet. The minimum height of backfill cover required to protect pipe culverts from construction equipment shall be in accordance with Standard Drawing PC-1 for the type and size specified.

Comment [536]: Right Time/ Right Way

Where only one side of abutments, wingwalls, piers, or culvert headwalls can be backfilled, care shall be taken that the area immediately adjacent to the structure is not compacted to the extent that it will cause overturning or excessive pressure against the structure. When both sides of a concrete wall or box structure is to be backfilled, operations shall be conducted so that the backfill is always at approximately the same elevation on both sides of the structure.

Openings subject to flooding shall be backfilled as soon as practicable or as directed by the Engineer.

Comment [537]: Right Time

(h) **Embankments**: Work shall consist of constructing roadway embankments; placing and compacting approved material within roadway areas where unsuitable material has been removed; and placing and compacting approved material in holes, pits, utility trenches, basements, and other depressions within the roadway area.

Comment [538]: Right Material/ Right Way

Embankment shall be constructed with approved material and placed so as to be uniformly compacted throughout. Embankment shall be placed adjacent to structures in the same manner as for backfill as described in (g) herein. Embankment shall not contain muck, frozen material, roots, sod, or other deleterious material. Embankment shall not be placed on frozen ground or areas covered with ice or snow.

Unsuitable material used in widening embankments and flattening embankment slopes shall be placed in uniform layers not more than 18 inches in thickness

Trial Use and Comment

before compaction. Each layer of material placed shall be compacted to the extent necessary to produce stable and reasonably even slopes.

Wherever rock excavation is available on the project, an 8 to 15-inch layer of such materials shall be dump spread over the lower region of embankments in the immediate vicinity of stream crossings and used to cover ditches, channels, and other drainage ways leading away from cuts and fills. However, drainage ways shall be prepared to receive the rock excavation to the extent necessary to avoid reducing their cross section. If rock excavation is not available on the project, rip-rap, jute mesh or soil retention mats shall be used as the covering material and shall be installed in accordance with the requirements of Section 606.03(c). Limits of the area to be covered will be as noted on the plans or as directed by the Engineer.

Comment [539]: Right Location/ Right Material/ Right Way

Wherever sufficient right of way exists, surplus materials shall be used to widen embankments and flatten slopes as directed by the Engineer.

Rock excavation may be placed on slopes by uniform end dumping of the material from along the top of the embankment or as directed by the Engineer. Slopes that are covered with rock excavation shall not receive topsoil or seed.

When geotextile drainage fabric is required under rock fills, preparation shall be as specified in Section 245.

The Contractor shall schedule excavation and embankment work in a manner that will minimize the quantity of unsuitable material for which more than one handling is required prior to final placement. Therefore, the provisions for additional payment for each rehandling of material specified in Section 303.06(a) will not apply to placing unsuitable material for widening embankments and flattening embankment slopes.

Comment [540]: Right Payment/ Right Time

The surface area directly beneath the pavement and shoulders on which embankments of less than 5 feet in depth are to be constructed shall be denuded of vegetation. These areas shall be scarified and compacted to a depth of 6 inches to the same degree as the material to be placed thereon.

Comment [541]: Right Material/ Right Way

Areas that contain material unsuitable as foundations for embankments shall be undercut and backfilled in accordance with (e) and (f) herein.

Embankments to be placed over saturated areas that will not support the weight of hauling equipment may be constructed by end dumping successive loads in a uniformly distributed layer of a thickness capable of supporting the hauling equipment while subsequent layers are placed. The nose, or leading edge, of the embankment shall be maintained in a wedge shape to facilitate mud displacement in a manner that will prevent its entrapment in the embankment. The front slope of the embankment shall be maintained steeper than 2:1. The

Trial Use and Comment

use of compacting equipment will not be required on the original course. However, the remainder of the embankment shall be constructed in layers and compacted in accordance with these specifications.

When geotextile for embankment stabilization is required, it shall be placed as shown on the plans. Geotextile shall be spliced by sewing double-stitched seams with stitching spaced ¼ inch to ½ inch apart or as shown on the plans.

Once geotextile for embankment stabilization is placed, the initial lift of material to be placed atop shall be free draining and shall be end dumped onto the geotextile and spread to the thickness as shown on the plans. Free-draining material shall be any material of which 15 percent or less passes the No. 200 sieve. If the geotextile becomes punctured or torn, the Contractor shall repair the area with geotextile lapped at least 3 feet all around the damaged area.

Comment [542]: Right Material/ Right Way

When embankment is to be placed and compacted on an existing road, the surface shall be scarified to such degree as will permit an ample bond between old and new material. Hydraulic cement concrete and asphalt concrete pavement structures within the proposed roadway prism shall be demolished in accordance with Section 508.02(a).

Existing slopes shall be continuously benched where embankments are constructed one-half width at a time; against slopes of existing embankments or hillsides; or across existing embankments, hillsides, and depressions at a skew angle of 30 degrees or more or the existing slopes are steeper than 4:1. For slopes steeper than 4:1 but not steeper than 1-1/2:1, the bench shall be at least 6 feet in width. For slopes steeper than 1-1/2:1 but less than 1/2:1, the bench shall be at least 4 feet in width. Benching shall consist of a series of horizontal cuts beginning at the intersection with the original ground and continuing at each vertical intersection of the previous cut. Material removed during benching operations shall be placed and compacted as embankment material.

When excavated material consists predominantly of soil, embankment shall be placed in successive uniform layers not more than 8 inches in thickness before compaction over the entire roadbed area. Each layer shall be compacted within a tolerance of ±20 percent of optimum moisture content to a density of at least 95 percent of the theoretical maximum density as defined in Section 101.02.

Material having a moisture content above optimum by more than 30 percent shall not be placed on a previously placed layer for drying unless it is shown that the layer will not become saturated by downward migration of moisture in the material.

Comment [543]: Right Way/ Right Location

Field density determinations will be performed in accordance with the requirements of AASHTO T191, modified to include material sizes used in the laboratory determination of density, with a portable nuclear field density testing

Trial Use and Comment

device or by other approved methods. When a nuclear device is used, density determinations for embankment material will be related to the density of the same material tested in accordance with VTM-1 or VTM-12 and a control strip will not be required.

As the compaction of each layer progresses, continuous leveling and manipulating shall be performed to ensure uniform density. Prior to placement of subsequent layers, construction equipment shall be routed uniformly over the entire surface of each layer or the layer shall be scarified to its full depth in the area where the equipment is routed.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the thickness prescribed without crushing, pulverizing, or further breaking down the pieces resulting from excavation methods, such material may be placed in the embankment in layers that are not thicker than the approximate average size of the larger rocks. Rock not more than 4 feet in its greatest dimension may be placed in an embankment to within 10 feet of the subgrade. The remainder of the embankment to within 2 feet of the subgrade shall not contain rock more than 2 feet in its greatest dimension. Each layer shall be constructed so that rock voids are filled with rock spalls, rock /fines, and earth. Rock shall be placed, manipulated, and compacted in uniform layers. However, density requirements may be waived. Rock, rock spalls, rock fines, and earth shall be distributed throughout each embankment layer and manipulated as specified herein so that the voids are filled. Rock shall not be end dumped over the edges of the layer being constructed but shall be deposited on the layer and moved ahead so as to advance the layer with a mixture of rock, rock spalls, rock fines, and earth. The 2 feet of the embankment immediately below the subgrade shall be composed of material that can be placed in layers of not more than 8 inches before compaction and compacted as specified herein for embankments. Rock more than 3 inches in its greatest dimension shall not be placed within 12 inches of the subgrade in any embankment.

Comment [544]: Right Way/ Right Location / Right Material

Rock, broken concrete, or other solid materials shall not be placed in embankment areas where piling is to be placed or driven.

The best material shall be reserved for finishing and dressing the surface of embankments. Work necessary to ensure the reservation of such material shall be the responsibility of the Contractor. Section 303.06(a) will not apply to subsequent handling of capping material.

CBR values, stipulated for Embankment, shall apply to the uppermost three feet of fill below the top of earthwork, as defined in Section 101 of the Specifications. Embankment, installed below the top three feet shall consist of suitable fill material, available from regular excavation, borrow excavation or embankment, as defined and of a quality consistent with project requirements.

Comment [545]: Right Material/ Right Location

Trial Use and Comment

Crushed glass shall be limited within the boundaries of the embankment as follows. Crushed glass shall be a minimum of two feet inside the side slope and contain a minimum of two feet of soil embankment cap. For those areas where crushed glass is to be incorporated into the embankment, glass may constitute up to approximately ninety percent by weight of that portion of the embankment, except where 100 percent crushed glass is used for drainage purposes (including blankets).

Crushed glass shall be blended with soil and/or soil like materials as follows:

1. The embankment shall be constructed by placing alternate four-inch layers of waste glass and soil and mixing and blending by scarification or other approved methods during compaction. The thickness of uncompacted layers of soil/glass shall be a maximum of 8 inches (loose); or

2. Pugmilled in predetermined ratios to a visually consistent blend and placed in lifts of a maximum of 8 inches (loose); or

3. As directed by the Engineer.

   Compaction of the soil/glass embankment shall be to the satisfaction of the Engineer and shall be accomplished with a vibratory compactor or other approved methods. Moisture and density requirements for the soil/glass embankments shall be the same as other conventional soil embankment in accordance with the requirements of **Section 303** of the Specifications.

   Normal compaction procedures and requirements are to be used for compaction of the soil embankment "cap" above the crushed glass/soil blends.

(i) **Settlement Plates and Surcharge:** The Contractor shall expedite construction of embankment to provide the maximum time possible for settlement prior to completing grading operations.

1. **Settlement plates:** The base of settlement plates shall be firmly seated into original ground for the full depth of the steel fins. The base shall be leveled. The Engineer shall be provided time to obtain the elevation of the seated base and the top elevation of the pipe extensions prior to placement of embankment material. Pipe extensions shall not be more than 4 feet in length and shall be vertically installed as the embankment is constructed such that the top of the pipe is not covered. As each extension is added, the Engineer shall be provided time to obtain the top elevation of the existing pipe and the top elevation of the new pipe

Comment [546]: Right Material/ Right Location / Right Way

Comment [547]: Right Time

Comment [548]: Right Location/ Right Time/ Right Way

Trial Use and Comment

extension. Pipe extensions shall be properly flagged at all times. Care shall be taken while placing and compacting embankment material around pipe extensions. Settlement plates shall be maintained until no longer required, as determined by the Engineer. Upon completion of the normal embankment plus 2 feet of the specified surcharge, the Contractor shall immediately commence placing the remaining surcharge to the limits shown on the plans or as directed by the Engineer. The remaining surcharge shall be placed in lifts of not more than 1 foot in depth and compacted uniformly with construction hauling and spreading equipment. Each lift shall be completed over the entire surcharge area before the next lift is begun.

If a settlement plate is damaged, the Contractor shall notify the Engineer immediately and promptly repair it under the observation of the Engineer to the nearest undamaged pipe. Excavation, backfill, compaction, and repair of settlement plates shall be at the Contractor's expense. The Engineer shall be provided time to obtain the top elevation of the undamaged connection and the top elevation of each subsequent pipe extension.

Settlement plates shall remain in place until settlement has been completed as indicated by elevation readings taken by the Engineer at approximately 2-week intervals. Evaluation of the readings by the Engineer will be the final and sole governing factor for releasing embankments for grading operations. Upon written release by the Engineer, extensions of settlement plate pipe shall be removed to at least 2 feet below the subgrade, the pipe capped, and the area backfilled and compacted.

2. **Surcharge:** When authorized by the Engineer, surcharge shall be removed to the subgrade and embankment slopes graded to the typical section. Removed surcharge shall be placed in roadway embankments not previously brought to grade or shall be disposed of in accordance with **Section 106.04** or as directed by the Engineer.

(j) **Hydraulic Embankment:** Hydraulic embankment shall consist of dredging and pumping materials approved by the Engineer from designated areas, placing the material in embankments, and dressing and completing the embankment. Material shall be nonplastic and of such grading that not more than 7 percent will pass the No. 200 sieve.

Unless otherwise shown on the plans, material for the embankment shall not be obtained from sources closer than 300 feet from the toe of the slope of the embankment. The Engineer may reject materials considered to be unsatisfactory for use in the embankment, and such materials shall be stripped at the Contractor's expense before the embankment is built. Muck and unsuitable

Comment [549]: Right Documentation/ Right Way/Right Material/ Right Time

Comment [550]: Right Way/ Right Material

Comment [551]: Right Location

Trial Use and Comment

material shall be removed to the line, grade, and section shown on the plans. Unsatisfactory material brought to the top of the embankment shall be removed by the Contractor at his own expense, and satisfactory material shall be substituted.

In placing material in the embankment, the Contractor shall begin at the centerline and deposit material in either or both directions toward the toe of slopes. Discharge shall always be in the direction of and parallel with the centerline. The maximum distance from the bottom of the discharge pipe to the surface on which material is being deposited shall be 5 feet unless otherwise directed by the Engineer. Material shall be deposited in a manner that will maintain a higher elevation at the center of the roadway than on either side. The Contractor will not be permitted to construct retaining levees along the roadway of such dimensions as to cause damage to the foundation of the roadway. The Contractor shall conduct operations so as to ensure the completion of an embankment that will conform to the cross section shown on the plans except that he will be permitted to flatten side slopes. However, if material is deposited on private property, the Contractor shall obtain permission in writing from the affected property owner(s). No payment will be made for material beyond the limits of the net pay section.

Comment [552]: Right Way/ Right Documentation/ Right Location

The embankment shall be placed so as to ensure a minimum relative density of 80 percent of the theoretical maximum density when tested in accordance with (h) herein. If the method of placing the embankment fails to produce the required density, the Contractor shall use approved methods to obtain the specified density.

The Contractor shall take all necessary precautions to prevent placing material in streams. The Contractor shall be responsible for all damage to or caused by the hydraulic embankment. The Contractor shall provide sufficient material to maintain the embankment in accordance with the typical cross section as shown on the plans or as directed by the Engineer until final acceptance.

The Contractor's plan for support of suction or discharge pipes shall be submitted to and approved by the Engineer. Traffic shall be protected by the display of warning devices both day and night. If dredging operations damage an existing traveled highway, the Contractor shall cease operations and repair damage to the highway.

(k) **Surplus Material:** Surplus material shall not be wasted or sold by the Contractor unless authorized in writing by the Engineer. When authorization has been given for surplus material to be wasted, it shall be disposed of in accordance with the requirements of **Section 106.04**.

Comment [553]: Right Documentation/ Right Payment

Material shown on the plans as surplus material will not be considered for overhaul payment.

Comment [554]: Right Payment

Trial Use and Comment

1. **Disposal of surplus material within the right of way where the haul distance is 2,000 feet or less:** Surplus material shall be used or disposed of where directed within a haul distance of 2,000 feet of its origin. Usage in this manner will not be considered a change in the character of the work.

2. **Disposal of surplus material within the right of way where the haul distance is more than 2,000 feet:** The Engineer reserves the right to require the Contractor to use surplus material in lieu of furnishing borrow, or as otherwise directed, where the haul distance from the origin of the material is more than 2,000 feet. Disposal of surplus material at locations requiring a haul of more than 2,000 feet will be considered a change in the character of work unless otherwise noted on the plans.

When material is declared surplus during construction and must be transported more than 2,000 feet from its origin, the Department will pay the Contractor $0.03 per station per cubic yard for overhaul. The quantity of surplus excavation will be determined by vehicle measurement in accordance with the provisions of **Section 109.01** or from cross-section measurements by the average end area method. The haul distance will be measured along a line parallel with the centerline of the roadway from the center of the excavated area to the center of the placement area. Overhaul will be the product of the quantity of surplus material in cubic yards and the haul distance in excess of 2,000 feet in 100-foot stations.

303.05—Tolerances

(a) **Finished grade of subgrade** shall conform to the requirements of Section 305.03(c).

(b) **Slopes** shall be graded in the following manner:

1. Earth excavation slopes:

a. **Slopes steeper than 2:1** shall be grooved in accordance with the standard drawings and shall not deviate from the theoretical plane surface by more than 0.5 foot.

b. **Slopes steeper than 3:1 up to and including 2:1** shall be rough graded in a manner to provide horizontal ridges and grooves having no more than 0.5 foot deviation from the theoretical line of the typical cross section as is accomplished by the normal operation of heavy grading equipment.

Comment [555]: Right Documentation/ Right Payment

Comment [556]: Right Documentation/ Right Quantity/ Right Payment

Comment [557]: Right Way / Right Location

Trial Use and Comment

c. **Slopes 3:1 or flatter** shall be uniformly finished and shall not deviate from the theoretical plane surface by more than 0.5 foot.

2. **Earth embankment slopes:**

a. **Slopes steeper than 3:1** shall not deviate from the theoretical plane slope by more than 0.5 foot and shall be rough graded in a manner to provide horizontal ridges and grooves not more than 0.5 foot from the theoretical line of the typical cross section as is accomplished by the normal operation of heavy grading equipment.

b. **Slopes 3:1 and flatter** shall be uniformly finished and shall not deviate from the theoretical plane surface by more than 0.5 foot.

Comment [558]: Right Way/ Right Location

3. **Rock slopes** shall not deviate from a plane surface by more than 2.0 feet and shall not deviate from their theoretical location by more than 2.0 feet measured along any line perpendicular to the theoretical slope line.

Finished excavation and embankment slopes shall not deviate from their theoretical location by more than 0.5 foot measured along any line perpendicular to the theoretical slope line.

303.06—Measurement and Payment

Comment [559]: 303.06: Right Payment

(a) **Excavation:** Excavation will be paid for at the contract unit price per cubic yard unless otherwise specified.

Excavation requiring more than one handling prior to final placement will be paid for at the contract unit price for regular excavation for each handling approved by the Engineer unless there is a pay item for the second handling, in which case work will be paid for at the contract price for such handling.

Quantities of regular or borrow excavation used to backfill pipe, pipe culverts, and box culverts will not be deducted from quantities due the Contractor for payment.

1. **Regular excavation:** When payment is specified on a cubic yard basis, regular excavation will be measured in its original position by cross-sectioning the excavation area. This measurement will include overbreakage or slides not attributable to the carelessness of the Contractor and authorized excavation of rock, muck, root mat, or other unsuitable material except material included in undercut excavation. Volumes will be computed from cross-section measurements by the average end area method.

Trial Use and Comment

When it is impractical to measure material by the cross-section method, other acceptable methods involving three-dimensional measurements may be used.

Excavation for benching slopes to accommodate roadway embankments as specified in Section 303.04(h) will not be measured for separate payment. The cost thereof shall be included in the price for the related excavation or embankment item.
Excavation of existing roadways required to incorporate old roadway into new roadway or remove salvageable materials for use in traffic maintenance, other than those covered in **Section 508**, will be measured as regular excavation.

When "presplitting rock cuts" is shown on the plans, the work shall be considered incidental to the cost of excavation and will not be measured for separate payment.

In cut sections, excavation of topsoil and root mat and material down to a point 1 foot below the elevation of the top of earthwork or to the depth specified on the plans will be measured as regular excavation. When areas of unsuitable material are shown on the plans, excavation down to a point 1 foot below the elevation of such material shown on the plans will be measured as regular excavation.

In fill sections, excavation of topsoil and root mat and material down to an elevation of 1 foot below the bottom of topsoil and root mat will be measured as regular excavation. When areas of unsuitable material are shown on the plans, excavation down to a point 1 foot below the elevation of such material shown on the plans will be measured as regular excavation.

Comment [560]: Right Way/ Right Location

If slide material approved for measurement cannot be measured accurately, or if the removal of slide material will require different equipment than that being used in the regular excavation operations, payment therefor may be made on a force account basis when authorized by the Engineer.

Excavation of surface ditches specified on the plans or otherwise required by the Engineer will be paid for as regular excavation except that when required after the slopes have been completed and the work cannot be performed with mechanical equipment, the excavation will be paid for as undercut excavation.

2. **Borrow excavation:** Borrow excavation will be measured in its original position by cross-sectioning the area excavated. The number of cubic yards will be computed from cross-section measurements by the average end area method. When it is impractical to measure the borrow excavation, vehicular measurement in accordance with Section 109.01 may be used.

Comment [561]: Right Payment

Borrow excavation with a stipulated CBR value shall be measured and paid for as borrow excavation with the CBR value as specified.

Trial Use and Comment

Borrow excavation without a stipulated CBR value shall be measured and paid for as borrow excavation.

3. **Undercut excavation:** Measurement will be made by cross-sectioning the undercut area. The number of cubic yards will be computed by the average end area method. When it is impractical to measure material by the cross-section method because of erratic location of isolated deposits, acceptable methods involving three-dimensional measurements may be used.
When unsuitable material must be removed from an area of the project where undercut is not shown on the plans, unsuitable material removed after reaching the depth specified in (a)1. herein, or 1 foot below original ground in fill sections where topsoil and root mat are not required to be removed, will be measured as undercut excavation.

Excavation of rock or unsuitable material below the elevation of the bottom of the lower theoretical slab or culvert thickness or below the excavation limits shown on the plans or standard drawings for normal earth foundations, whichever is the greater depth, of minor structures having a span(s) or opening(s) of less than 48 inches will be measured for payment as undercut excavation. Such excavation for structures having a span(s) or opening(s) of 48 inches or greater will be measured as minor structure excavation in accordance with (a)4. herein.

Undercut excavation will be paid for at the contract unit price per cubic yard. This price shall include removal and disposal. When not a pay item, undercut excavation will be paid for at twice the unit price per cubic yard for regular excavation.

4. **Minor structure excavation:** Excavation of material above the elevation of the bottom of the lower theoretical slab or culvert thickness, or above the excavation limits shown on the plans for earth foundations, whichever is the greater depth, for culverts having a maximum span or opening of less than 48 inches will not be measured for payment.

Excavation of material for culverts having a span(s) or opening(s) of 48 inches or greater and excavation for minor structures not covered elsewhere in these specifications will be measured in cubic yards of minor structure excavation. The quantity allowed for payment will be the actual volume of material removed as bounded by the bottom of the lower theoretical slab or culvert thickness, or lower excavation limits shown on the plans for earth foundations, whichever is the greater depth; the original ground or regular excavation pay line, whichever is the lower elevation; and vertical planes 18 inches outside the neat lines of the structure (excluding wingwalls and other appurtenances) or bound by vertical planes coincident with the applicable bedding excavation limits shown on the plans. Payment for excavation for wingwalls and other appurtenances to structures will be based on the ratio of the plan area of the wingwalls or appurtenances to the plan area of the barrel. Once the ratio has been

Comment [562]: Right Way/ Right Payment

Trial Use and Comment

determined, the pay quantity for minor structure excavation will be increased accordingly.

If embankment is placed prior to installation of a minor structure, excavation of the embankment area will not be measured for payment unless the Contract requires placement of the embankment prior to the installation of the minor structure.

The volume of the interiors of culverts, drop inlets, and other existing minor structures that must be removed will not be deducted from the overall quantity of minor structure excavation allowed for payment.

The price of minor structure excavation shall include the cost of backfill above the horizontal planes of the neatlines of the Class I or Class II backfill areas to original ground. Class I and Class II backfill shall be measured and paid for in accordance with **Section 302.04**.

Comment [563]: Right Way / Right Payment

5. **Earthwork:** When a pay item, earthwork will be paid for at the contract lump sum price, wherein no measurement will be made. This price shall include regular excavation, minor structure excavation, and grading.

(b) Embankments:

1. **If embankment is not a pay item,** the cost of embankment construction will be considered incidental to other items of excavation.

2. **If embankment is a pay item and regular excavation is to be paid for on a plan quantity basis,** the quantity of embankment for which payment will be made will not be measured separately but will be computed in accordance with the following:

Comment [564]: Right Documentation/ Right Payment

   a. The regular excavation plan quantity will be adjusted in accordance with (C) Plan Quantities herein.

   b. The quantity of unsuitable material will be measured and subtracted from the adjusted regular excavation quantity determined in 2.a. herein. Quantities of unsuitable material removed from fill areas or below the subgrade in cut areas will be determined by using plan dimensions and may be adjusted for deviations based on actual measurement. Actual dimensions will be used to determine the quantity of any other unsuitable material.

   c. The total quantity shown on the plans will be adjusted for quantities not anticipated on the plans, such as changes in grade or undercut determined to be necessary during construction.

Trial Use and Comment

d. The quantity of suitable material determined in 2.b. herein will be subtracted from the adjusted total fill quantity determined in 2.c. herein. The resultant quantity will be the embankment quantity for which payment will be made.

The Contractor shall be responsible for determining the effect of the shrinkage or swell factor of the material, and no adjustment will be made in pay quantities for this factor.

Hydraulic embankment will be paid for as embankment.

3. **If embankment is a pay item and regular excavation is to be paid for on the basis of measured quantities,** the quantity of embankment will be measured in cubic yards computed by the average end area method from the dimensions of the embankment cross section.

Comment [565]: Right Payment

Cross sections of the area to be covered by the embankment will be taken after the denuding or removal of unsuitable material and before any material is placed thereon. These cross sections shall extend laterally from the centerline to the toes of slopes as indicated on the typical cross section. The elevations as determined by these sections will be considered the original ground line. The pay quantity to be measured will be the volume of material included in the section above the original ground and below the upper limits of the typical cross section.

When regular excavation is a pay item, the embankment area to be cross-sectioned will exclude that portion of the fill constructed from regular excavation. Material outside the limits of typical cross sections as shown on the plans will not be measured or paid for.

4. **Extra embankment required for subsurface consolidation** will be determined by the use of settlement plates. The total settlement recorded at each settlement plate will be allowed across 75 percent of the lateral width of each section. Volumes will be computed using the average end area method. Embankment quantities will be adjusted as specified herein to include extra embankment for subsurface consolidation.

Settlement plates will be measured and paid for in units of each, complete-in-place. This price shall include furnishing, installing, maintaining, and removing when no longer required.

Surcharge placement and removal will be measured in cubic yards as determined by the plan quantity and will be paid for at the contract unit price per cubic yard. This price shall include furnishing, placing, and removing surcharge material and disposing of surplus and unsuitable materials.

5. **If geotextile drainage fabric is a pay item,** measurement and payment will be in accordance with the requirements of Section 504.

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6. **Geotextile for embankment stabilization** will be measured in square yards complete-in-place. Overlaps and seams will not be measured for separate payment. The accepted quantity of geotextile will be paid for at the contract unit price per square yard, which price shall be full compensation for furnishing, placing, lapping, or seaming material and for all materials, labor, tools, equipment, and incidentals necessary to complete the work.

Embankment with a stipulated CBR value shall be measured and paid for as embankment with the CBR value as specified.

Embankment without a stipulated CBR value shall be measured and paid for as embankment.

(c) **Plan Quantities:** The quantity of regular excavation for which payment will be made when plan quantities are specified will be that specified in the Contract. However, borrow excavation; excavation for entrances; unsuitable material below the top of earthwork; undercut excavation; slide excavation; rock excavation that changes the slopes or causes undercut; and side, inlet, and outlet ditches not covered by plan cross sections will be measured in their original position by cross sections and computed in cubic yards by the average end area method.

Where there are authorized deviations from the lines, grades, or cross sections, measurements will be made and the volume computed in cubic yards by the average end area method for these deviations. The plan quantity will then be adjusted to include these quantities for payment.

When unauthorized deviations occur, allowances will not be made for overruns. However, if the deviation decreases the quantities specified in the Contract, only the actual yardage excavated will be allowed.

(d) **Backfill:** Furnishing and placing backfill material, including backfill for undercut, will be included in the price for excavation and will not be measured for separate payment unless specific material is a pay item for backfill or unless suitable material is not available within the construction limits. When a specific material is a pay item, the unit of measure of the material will be in accordance with the unit specified in the Contract. When suitable backfill is not available within the construction limits, the material furnished and placed by the Contractor will be paid for in accordance with the requirements of **Section 109.05.**

(e) **Erosion Control Items:**

1. Limiting the scope of construction operations, shaping the top of earthwork, and constructing temporary earth berms and brush silt barriers for temporary ESC will not be measured for payment but shall be included in the price for other appropriate pay items.

Comment [566]: Right Material/ Right Location/ Right Payment

Comment [567]: Right Payment

Trial Use and Comment

2. **Erosion control riprap** will be measured and paid for in accordance with the requirements of **Section 414.04**.

3. **Temporary protective covering** will be measured and paid for in accordance with the requirements of **Section 606.04**.

4. **Check dams** will be paid for at the contract unit price per each. This price shall include furnishing, excavating, constructing, maintaining, and removing check dams when no longer required.

   Synthetic check dams may be substituted for Type II Rock Check Dams (Standard EC-4) at no additional cost to the Department.

5. **Temporary silt fences** will be measured in linear feet, complete-in-place, excluding laps, and will be paid for at the contract unit price per linear foot. Decomposed or ineffective geotextile fabric replaced after 6 months from the installation date will be measured in linear feet of temporary silt fence and paid for at 1/2 the contract unit price for temporary silt fence. Decomposed geotextile fabric required to be replaced prior to 6 months after installation will not be measured for payment. This price shall include furnishing, installing, and maintaining the silt fence, including wire reinforcement and posts; removing and disposing of these materials, and dressing and stabilizing the area.

6. **Geotextile fabric** attached to brush barriers or existing fence or used for another function specified on the plans and not included in other pay items will be measured in square yards, complete-in-place, excluding laps, and will be paid for at the contract unit price per square yard. The brush barrier will not be measured for payment. The cost thereof shall be included in the price for clearing and grubbing. This price shall include trimming the brush barrier; furnishing, installing, maintaining, and removing the fabric; and dressing and stabilizing the area.

7. **Temporary filter barriers** will be measured in linear feet, complete-in-place, excluding laps, and will be paid for at the contract unit price per linear foot. Decomposed or ineffective geotextile fabric replaced after 6 months from the installation date and decomposed or ineffective burlap fabric replaced after 3 months from the installation date will be measured in linear feet of temporary filter barrier and paid for at 1/2 the contract unit price for temporary filter barrier. Decomposed geotextile fabric required to be replaced prior to 6 months and decomposed burlap fabric required to be replaced prior to 3 months after installation will not be measured for payment. When permitted, baled straw silt barrier used in lieu of temporary filter barrier will be paid for in linear feet of temporary filter barrier, complete-in-place. This price shall include furnishing, installing,

Comment [568]: Right Way/ Right Mateial/ Right Payment

Trial Use and Comment

and maintaining the filter barrier, including filter barrier material and posts; removing and disposing of these materials; and dressing and stabilizing the area. If the Contractor is permitted to use baled straw silt barrier in lieu of temporary filter barrier, payment will be made at the price for temporary filter barrier.

8. **Silt cleanout,** when approved or directed by the Engineer, will be measured as siltation control excavation in cubic yards of vehicular measurement in accordance with the requirements of **Section 109.01** for the full volume of the vehicle.

   Silt removal and sediment cleanout will be paid in cubic yard of siltation control excavation. Payment shall be full compensation for removal of silt and sediment approved or directed by the Engineer and for transportation and disposal of the material.

   If approved or directed by the Engineer, the installation of additional temporary silt fence and temporary filter barrier in lieu of silt cleanout will be measured in linear feet as specified in (e)5. and (e)7. herein.

9. **Seeding materials** will be measured and paid for in accordance with the requirements of **Section 603**.

10. Temporary erosion and siltation measures required to correct conditions created because of the Contractor's negligence, carelessness, or failure to install permanent controls in accordance with the plans and sequence for performance of such work will not be measured for payment.

11. **Slope drains** will be measured in units of each, per location regardless of size or length and will be paid for at the contract unit price per each. Raising of the slope drain and addition of pipe lengths will not be measured as a new location. This price shall include furnishing, installing, maintaining, and removing the drain and end section or portable flume.

12. **Sediment traps and basins** will be measured in cubic yards of sediment basin excavation and will be paid for at the contract unit price per cubic yard. This price shall include excavation, maintenance, and backfill or removing to original ground when no longer needed.

13. **Storm water management basin excavation** will be measured in cubic yards and will be paid for at the contract unit price per cubic yard. The price shall include excavation, maintenance, and shaping of basin.

14. **Temporary sediment basin excavation** will be measured in cubic yards and will be paid for at the contract unit price per cubic yard. The price shall include

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excavation, maintenance and when no longer required the removal of dam, pipe, riser pipe, trash rack, backfill and site restoration.

Drop inlet silt trap will be measured in units of each and paid for only one time during the life of the project.

Dewatering basin will be measured and paid for at the contract unit price per each. This price shall include furnishing, installing, maintaining, and when no longer required, removing the dewatering basin; backfill; and site restoration.

Erosion control mulch shall be paid for per square yard or acre. This includes all materials and equipment necessary for the application.

Payment will be made under:

Pay Item	**Pay Unit**
Regular excavation	Cubic yard
Borrow excavation	Cubic yard
Borrow excavation (CBR [value])	Cubic yard
Sediment basin excavation	Cubic yard
Siltation control excavation	Cubic yard
Undercut excavation	Cubic yard
Minor structure excavation (Item)	Cubic yard
Earthwork	Lump sum
Embankment	Cubic yard
Embankment (CBR [value])	Cubic yard
Settlement plate	Each
Surcharge placement and removal	Cubic yard
Geotextile (Embankment stabilization)	Square yard
Check dam (Type) (Log, rock, or straw)	Each
Temporary silt fence	Linear foot
Geotextile fabric	Square yard
Temporary filter barrier	Linear foot
Slope drain	Each
Storm water management basin excavation	Cubic yard
Temporary sediment basin excavation	Cubic yard
Drop inlet silt trap (Type)	Each
Dewatering basin	Each
Erosion control mulch	Square yard or acre

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

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- Review specification requirements, planes, standards, survey data, and source of material, construction procedures, measurement and payment, hold and witness points, Contractor's DCR certification, approved equipment, Approved disposal Area, private property agreement, target density.

Start:

- Verify material storage, site access, verify traffic control plan, locate and verify Temporary & Permanent ESC devises are installed correctly, material delivered is approved, and compaction equipment is adequate, Verify settlement place is located & Positioned as per plan, verify limit of grading operation is properly marked and restricted to where it is needed, Verify the area to be graded is properly cleared and grubbed.

Continuous inspection:

- Visual monitoring of material, verify material placement, compacted density, lift thickness, ESC devices (condition, adequacy, efficiency & storage capacity), take settlement plate elevation, take measurements.

Final Inspection:

- Verify final grade is placed as per plan profile and within acceptable tolerance, Payment quantity, site restoration, disposal of excess material, traffic pattern restoration, verify the top 2 feet pipe of settlement plate is removed, removal of temporary ECS devices, repair Permanent ESC devices

Documentation Required:

- Contractor's approved material C-25.
- Measurements for payment.
- Payment computations
- Contractor's DCR certification,
- Approved equipment,
- Approved disposal Area,
- Private property agreement
    - Restoration Release
    - Site Plan
    - Owner's release
- Engineers Approval/Authorization

IV. REVIEW QUESTIONS

Spec Ref.

303.01	On projects being constructed under the No Plan and Minimum Plan concept, is the work in accordance with the specifications for No Plan and Minimum Plan projects? (special provision)
303.03(b)	Has incremental seeding been performed in accordance with the sequences specified in this section?

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303.04(a)01	Has the stripping of top soil been confined to the area over which excavation is to be actively prosecuted within 15 days?
303.04(a)02	Have underground tanks, existing foundations, and slabs located within the construction limits been removed and disposed of in an approved manner?
303.04(a)03	Have foundations and slabs located 5 feet or more below subgrade been broken into particles not more than 18 inches in any dimension and reoriented to break the shear plane and allow for drainage?
303.04(a)04	Have cisterns, septic tanks, and other structures been demolished and backfilled in accordance with Section 516, Demolition of Buildings and Clearing Parcels?
303.04(a)05	Have wells been closed in accordance with Section 516, Demolition of Building and Clearing Parcels?
303.04(a)06	Did the Contractor schedule the excavation work so that blasting operations in the proximity of proposed concrete structures would be completed prior to initial placement of concrete?
303.04(a)07	Is the roadway being graded in such a manner that will provide adequate drainage?
303.04(a)08	In areas where rock or boulders were encountered during excavation, were they graded in accordance with specified methods for standard RU-1 undercut?
303.04(a)09	Did the Contractor immediately stop excavation and notify the Engineer when solid rock was not encountered at the depth indicated on the plans?
303.04(a)10	Have grading operations been confined to the minimum area necessary to accommodate the Contractor's equipment and work force engaged in the earth moving work?
303.04(C)	Is undercut excavation being removed, measured and paid for in accordance with this section and material to be disposed of and removed in accordance with Section 106.04 of the general provisions on disposal areas?
303.04(e)2	Has the excavation for structures been carried to foundation materials satisfactory to the Engineer?
303.04(e)3	During construction, if unsuitable material shown on the plan is found to be suitable, is it used in embankments in lieu of borrow material?
303.04(e)4	Has the unsuitable material been disposed of in accordance with Section 106.04 of the general provisions on disposal areas?
303.04(g)1	Has the opening to be backfilled been dewatered prior to placing any backfill material?
303.04(g)2	Has the backfill material been placed in horizontal layers not more than 6 inches in thickness, loose measurement, and compacted?
303.04(g)3	Has the backfill been placed in a manner to deter impoundment of water and facilitate existing drainage?
303.04(g)4	Has the required compressive strength been obtained and 4 feet of backfill cover been placed over box culverts prior to construction equipment traffic crossing them?

Trial Use and Comment

303.04(g)5	When embankment is placed on both sides of the structure, is it placed simultaneously on each side at approximately the same elevations or as specified?
303.04(g)6	Were the requirements of the Standard Drawings (PC-1) for cover and length of approach fills met before construction equipment was allowed to cross the pipe?
303.04(h)01	Is the embankment that is being placed free from muck, frozen materials, roots, sod or other deleterious materials?
303.04(h)02	If rock excavation is available on the project, has an 8 to 15 inch layer of such materials been placed over the lower region of embankments as specified?
303.04(h)03	Wherever sufficient right of way exists, were surplus materials used to widen embankments and flatten fill slopes as directed by the Engineer?
303.04(h)04	Has the placement of geotextile drainage fabric under rock fills been performed in accordance with the Section 414 / 245, Riprap?
303.04(h)05	Has the surface area directly beneath the pavement and shoulders, on which embankments of < 5' depth are to be constructed, been denuded of vegetation, scarified and compacted to a depth of 6" to the same degree as the material to be placed thereon?
303.04(h)06	Have embankments placed in saturated areas been constructed by end dumping successive loads in a uniformly distributed layer of a thickness capable of supporting the hauling equipment while subsequent layers are placed?
303.04(h)07	Is the nose, or leading edge, of the embankment being maintained in a wedge shape to facilitate mud displacement in a manner that prevents its entrapment in the embankment?
303.04(h)08	After the original course of embankment is placed in saturated areas, is the remainder of the embankment constructed in layers and compacted in accordance with the specifications?
303.04(h)09	Has the surface of the existing road been scarified to such degree that permits an ample bond between old and new materials?
303.04(h)10	Have hydraulic cement concrete and asphalt concrete pavements within the roadway prism been demolished in accordance with Section 508, Demolition of Pavement and Obscuring Roadway?
303.04(h)11	Have cement-stabilized courses underlying the demolished pavements been removed when they are 3 feet or less below subgrade elevation? [Ref.: Section 508.02(a)3 of Demolition of Pavement and Obscuring Roadway]
303.04(h)12	Have cement-stabilized courses that are located more than 3 feet below subgrade elevation been removed or broken into particles not more than 18 inches in any dimension, sufficiently displaced to allow for adequate drainage, and left in place?(Sect.508.02)
303.04(h)13	Have existing slopes been benched to receive embankment materials as specified?
303.04(h)14	Are embankments being constructed in uniform layers of specified

Trial Use and Comment

	thickness over the entire fill area?
303.04(h)15	Is the embankment being rolled to the outside of the fill and compacted at +\- 20 percent of optimum moisture content to a density of at least 95 percent of theoretical maximum density?
303.04(h)16	Has material with a moisture content more than 30 percent above optimum moisture been placed on a previously placed layer of fill?
303.04(h)17	As the compaction of each layer progresses, has continuous leveling and manipulation been performed to ensure uniform density?
303.04(h)18	Prior to the placement of subsequent layers, has construction equipment been routed uniformly over the entire surface of each layer or the layer scarified to its full depth in the area where the equipment was routed?
303.04(h)19	Are rock fills being constructed as specified?
303.04(h)2a	Has unsuitable material used to widen embankments and flatten fill slopes been placed in uniform layers not more than 18 inches in thickness and compacted to the extent necessary to produce stable and reasonably even slopes?
303.04(i1)	Has the Contractor expedited construction of embankment fills to provide the maximum time possible for settlement as specified?
303.04(i2)	Is all settlement plate and surcharge embankment construction performed in accordance with this section?
303.04(j)	Are hydraulic embankments constructed in accordance with this section?
303.04(k1)	Is the surplus material being disposed of in accordance with Section 106.04, Disposal Areas?

• Does the Contractor have a person who has a current Department of Conservation and Recreation Erosion and Sediment Control Contractor certification on the project while installing ESC devices and conducting land disturbance operations?
• Are all ESC devices being installed or constructed as required?
• Are ESC devices being maintained as required?
• Is the Contractor stripping topsoil only over an area that is to be actively worked within 15 days?
• Is incremental seeding being performed as specified?
• Is the roadway being graded in such a manner as to provide proper drainage?
• Are grading operations limited to only the area necessary to perform the work?
• Is excavation for structures accomplished to suitable foundation?
• If unsuitable material shown on the plans was found to be suitable, is it being used in embankments instead of borrow?
• Is backfill material being placed in layers not more than 6 inches, loose, and compacted?

303.05(b)	Has the finished grade of the top of earthwork and all slopes been constructed within the specified tolerances of this section?

Trial Use and Comment

• Is embankment material being placed on both sides of structures simultaneously?
• Is surplus material being used to flatten slopes if possible?
• Are existing slopes being benched to receive embankment material?
• Is embankment material being rolled to the outside of the fill and compacted at + / - 20 percent of optimum moisture content and compacted to 95 percent of theoretical maximum density?
• Is the finished grade of the top of the earthwork and slopes being constructed within the specified tolerances?

V. CRITICAL INSPECTION POINTS

• Density & moisture tests
• Settlement plate installation and periodic survey
• Final grading

Trial Use and Comment

SECTION 304 – CONSTRUCTING DENSITY CONTROL STRIPS

I. INTRODUCTION:

Density Control Strips are sections of a pavement structure that are used to determine the target density required for that particular course of the structure.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's:

304.01—Description

This work shall consist of constructing control strips in accordance with the requirements of these specifications for the purpose of determining density requirements.

304.02—Materials

Materials shall conform to the requirements for the material to be used in the course. Material used in each control strip shall be furnished from the same source and shall be of the same type as the material used in the test sections whose density requirements are established by the control strip.

304.03—Equipment

Equipment shall be approved by the Engineer prior to use. The type and weight of compaction equipment shall be such that a uniform density is obtained throughout the depth of the layer of material being compacted. Control strips shall be compacted using equipment of the same type and weight to be used on the remainder of the course.

304.04—Procedures

The subgrade or pavement structure course upon which a control strip is constructed shall be approved by the Engineer prior to construction of the control strip.

Comment [569]: Right Material

Comment [570]: Right Way

Comment [571]: Right Location/ Right Time/ Righht Way

Trial Use and Comment

One control strip shall be constructed at the beginning of work on each roadway and shoulder course and each lift of each course. An additional control strip shall be constructed when a change is made in the type or source of material or whenever a significant change occurs in the composition of the material from the same source.

The project will be divided into "control strips" and "test sections" by the Engineer for the purpose of defining areas represented by each series of tests. The size of each control strip and test section will be in accordance with the requirements of VTM-10.

Control strips shall be constructed using the same procedure to be used in the construction of the remainder of the course. Rolling of the control strip shall be continued until no appreciable increase in density is obtained by additional roller coverages.

Upon completion of rolling, the mean density of the control strip will be based on 10 tests taken at randomly selected sites within the control strip area using a nuclear testing device. Compaction of the remainder of the course shall be governed by the density obtained in the control strip.

Comment [572]: Right Way/ Right Location/ Right quantity

Each test section will be tested for required thickness. Areas that are deficient by more than the specified allowable tolerance shall be corrected in accordance with the applicable requirements of these specifications.

The Engineer may require an additional control strip after the completion of each 10 test sections.

Each control strip shall remain in place and become a section of the completed roadway.

304.05—Tolerances

Comment [573]: Right Way/ Right Location

If the mean density of a test section (roadway or shoulder) does not conform to the applicable requirements stated herein, the Contractor shall continue his compactive effort or shall rework the entire test section until the required mean density is obtained. If an individual test value does not conform to the requirements stated herein, the Contractor shall continue his compactive effort or shall rework the entire area represented by that test until the required density is obtained.

(a) **Roadway:** The density of each test section will be evaluated based on the results of five tests performed at randomly selected sites within the test section. The mean density obtained for the five tests in each test section shall be at least 98 percent of the mean density obtained in the approved control strip. In addition, each individual test value obtained within a test section shall be at least 95 percent of the mean density obtained in the approved control strip.

(b) **Shoulders:**

Trial Use and Comment

1. **Aggregate shoulders:** The density of each test section of select or aggregate material used in the construction of shoulders will be evaluated based on the results of five tests performed at randomly selected sites within the test section. The mean density obtained for the five tests in each test section shall be within 95 ± 2 percent of the mean density obtained in the approved control strip. In addition, each individual test value obtained in a test section shall be within 95 ± 5 percent of the mean density obtained in the approved control strip.

2. **Asphalt shoulders:** The density of each test section of asphalt concrete used in the construction of shoulders will be evaluated based on the results of five tests performed at randomly selected sites within the test section. The mean density obtained for the five tests in each test section shall be at least 98 percent of the mean density obtained in the approved control strip. In addition, each individual test value obtained within a test section shall be at least 95 percent of the mean density obtained in the approved control strip.

304.06—Measurement and Payment

This item is considered incidental to the cost of furnishing, placing, and compacting the specified course and will not be measured for payment. The cost of constructing density control strips shall be included in the cost of the material for which the control strip is required.

Comment [574]: Right Way/ Right Location

Comment [575]: Right Way/ Right Location

Comment [576]: Right Payment

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review the approved source of material, specification requirements, Prepare copied of TL-53A & TL-54A. Verify the contractor used material spreader capable of placing the material without segregation and uniform thickness.

Start:

- Verify the subgrade (Underlying material) to the control strip is similar to the test section and accepted by the engineer

Continuous inspection:

- Record the equipment being used for future control on test section. Control the roller pass and record the number of passes in the appropriate form.

Final Inspection:

- Verify minimum density using direct transmission (Aggregate). Determine the target density to be used in the test section.

Documentation Required:

- TL-53A
- TL-54A
- Equipment list, subgrade condition, source of material, Lab density test result.

IV. REVIEW QUESTIONS

	N/A

V. CRITICAL INSPECTION POINTS

• Subgrade condition inspection prior to placement of material for control strip
• Verify the source of material is approved
• Verify the contractor used material spreader capable of placing the material without segregation and uniform thickness.

Trial Use and Comment

SECTION 305 – SUBGRADE AND SHOULDERS

I. INTRODUCTION:

SHAPING AND COMPACTING THE SUBGRADE

The subgrade is the earth surface upon which the pavement structure or shoulder is constructed. It is most important that the subgrade be constructed of the best available materials with particular emphasis being placed on the subgrade in fill sections. The Inspector should see that satisfactory materials are placed during all stages of the grading operation. Any soft, unstable or unsuitable material encountered in cuts or fills is to be removed and replaced with satisfactory material. Measurement of unsuitable material removed in subgrade preparation should be accomplished by taking measurements before the excavation is backfilled.

The method and rate of testing shoulder materials are specified in the ***Manual of Instructions - Materials Division.***

Standard Shoulder Design and Slope - Most of the shoulder slopes in the ***Book of Standards*** are self-explanatory. The term "7 percent algebraic differences" (7% Alg. Diff.) may be more easily understood by the following example:

Find the difference in elevation between the left edge of pavement (LEP) and the right edge of pavement (REP). This can be determined from the plans or from actual field measurements and computations.

(LEP) 310.08'
(REP) 309.12'
Difference 0.96'

Divide this difference by the width of pavement (24') to determine the rate of superelevation.

$\frac{0.96'}{24'}$ =0.04 ft./ft. or 4%

Subtract the rate of pavement superelevation from 7%.

0.07		7%
-0.04	or	-4%
0.03		3%

The slope of the shoulder on the high side (LEP) should be 0.03 ft./ft. (sloping downward 3 hundredths of a foot per foot of width).

Trial Use and Comment

Shoulders should be uniform and have a pleasing appearance to the eye. Sometimes, these precise standards will require minor adjustment to maintain a pleasing appearance. Shoulder widths are often adjusted as noted on the plans to accommodate guardrail installations. Major adjustments indicate an error. Do not make major adjustments without checking the grades and calculations and consulting with the Engineer.

FINISHING SUBGRADE

At times, a small amount of additional material must be added so that the surface can be graded to plan elevation. The existing surface should be scarified before any additional material is placed. This prevents planing and slippage between the two layers. The subgrade should be recompacted according to the requirements of the Specifications.

After the subgrade preparation has been completed, it should be thoroughly checked by using a level, string line, crown board, or other means to determine that the subgrade is within Specification tolerance and conforms with the typical cross-section.

SHOULDERS

Water tends to collect under both asphalt and hydraulic cement concrete pavements, especially at sag points in the vertical grade. Cross drainage through the shoulder must be provided. Care must be taken to avoid contaminating the subbase or base course under the shoulder areas with lime, cement or excessive fines, or to over compact such areas and thus block cross drainage. Occasionally, it will be necessary to install drains at intervals through the shoulders to accommodate the amount of water which collects just beneath the pavement.

Always review the contract and plans for amendments to the specifications through special provisions, copied notes or general notes.

a) Forms:

See Construction Division Memorandum:

CD-2006-01	3/14/06	General Instructions for Materials Testing: Materials Testing Personnel Qualifications

Trial Use and Comment

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's:

305.01—Description

This work shall consist of constructing the subgrade and shoulders to the cross section and grade shown on the plans and within the specified tolerances indicated on the plans and in these specifications.

305.02—Materials

Materials may consist of material in place, treated material in place, or imported material. Imported material may be borrow material, select material, or other material as shown on the plans or specified in the Contract.

Materials other than regular excavation or borrow material that are shown on the plans or specified in the Contract shall conform to the applicable requirements of these specifications.

Geotextile materials used for subgrade stabilization shall conform to the requirements of **Section 245.03(d).**

305.03—Procedures

(a) **Shaping and Compacting Subgrade:**

1. **Subgrade consisting of material in place:** The subgrade area shall be scarified to a depth of 6 inches for a distance of 2 feet beyond the proposed edges of the pavement on each side. If sandy or other soil is encountered that will not compact readily, clay or other suitable material shall be added or water applied in such quantity and within the allowable moisture content specified herein as will permit compaction of the subgrade. Subgrade material shall be compacted at optimum moisture, within ±20 percent of optimum. The density of the subgrade when compared to the theoretical maximum density as determined in accordance with the requirements of VTM-1 shall conform to the following:

% Retained on No. 4 Sieve	Min. % Density
0-50	100
51-60	95
61-70	90

Percentages of material will be reported to the nearest whole number.

Comment [577]: Right Material

Comment [578]: Right Way

Trial Use and Comment

The subgrade shall then be shaped and checked to ensure a typical cross section and uniform grade prior to placement of any subsequent courses. If the subgrade becomes eroded or distorted prior to placement of material for subsequent courses, it shall be scarified, reshaped, and recompacted in accordance with the original requirements.

At the time of placing material for subsequent courses, the subgrade shall be compacted to the required density, free from mud and frost, and in a condition that will permit compaction of subsequent courses without distortion.

If the approved subgrade becomes unstable after placement of the subbase or base course and becomes mixed with the aggregate therein, material from the unstable area and contaminated aggregate shall be removed. The area shall then be backfilled and compacted, and the subsequent course thereon reconstructed.

2. **Subgrade consisting of treated materials in place:** Subgrade shall be treated in accordance with the requirements of the applicable provisions of **Section 306.03** and **Section 307.05** except that the tolerance for depth will be waived when lime or cement is being used to bridge or correct extremely weak areas.

If lime can be satisfactorily manipulated during initial mixing, and bridging of the weak area has been performed satisfactorily, additional mixing and compacting will not be required. Additional layers of fill may be placed without delay.

Field density determinations will be performed in accordance with the requirements of **AASHTO T191**, modified to include material sizes used in the laboratory determination of density; with a nuclear density testing device; or by other approved methods. When a nuclear device is used, the nuclear density determination for treated in-place subgrade material will be related to the density of the same material tested in accordance with the requirements of **VTM-1** or **VTM-12** and a control strip will not be required.

3. **Subgrade consisting of imported material:** The area to receive the material shall be graded to a true crown and cross section.

Material shall be placed and compacted in accordance with the requirements of the applicable specifications governing the type of material. When select material is used, material shall be placed and compacted in accordance with the requirements of **Section 308.02** except that the provision for mixing will be waived. The top 6 inches of the finished subgrade shall be compacted in accordance with the requirements of the provisions of 1. herein.

The provisions of 1. herein that are not specifically amended herein shall apply. Imported material shall be placed in approximately equal layers not more than 8 inches for commercial material and 6 inches for local material, compacted measure. Material will be tested after compaction for thickness and density. If material fails to conform to thickness requirements, it shall be corrected by scarifying, adding material if necessary, mixing, reshaping and recompacting, or removing and

Comment [579]: Right Time

Comment [580]: Right Material

Comment [581]: Right Location

Comment [582]: Right Way

Comment [583]: Right Documentation

Trial Use and Comment

replacing. If the material fails to conform to density requirements, additional rolling will be required until the required density is obtained provided the material is compacted at optimum moisture, within ±20 percent of optimum. If the moisture content is outside the allowable tolerance, the layer shall be scarified, brought to optimum moisture within the allowable tolerance, and recompacted to the specified density.

An aggregate spreader will not be required in the placement of select material and other imported materials used as subgrade and shoulder courses.

(b) **Treatment of Unsuitable Subgrade:** When solid rock occurs in cuts or the material is not suitable for subgrade or finishing purposes, the roadbed shall be excavated below the grade shown on the plans in accordance with the standard drawings.

When solid rock or other unsuitable material has been removed, excavated areas shall be backfilled in accordance with the standard drawings.

(c) **Finishing Subgrade:** **The** Contractor shall provide effective drainage for the subgrade and maintain it in a satisfactory condition until the next course is placed.

When practicable, the subgrade shall be prepared at least 500 feet ahead of placement of any subbase, base, or surface course. Material for subsequent courses shall not be placed until the subgrade has been checked and approved. The finished subgrade elevation shall be within ±0.04 foot of the plan elevation unless otherwise specified. When imported material is used, acceptance of the course will be based on the requirements of **Section 308.04.**

(d) **Geotextile (Subgrade Stabilization):** When geotextile for subgrade stabilization is required, it shall be placed as shown on the plans. Geotextile shall be spliced by an overlap of at least 2 feet or by sewing double-stitched seams with stitching spaced ¼ inch to ½ inch apart or as shown on the plans.

(e) **Shoulders:** Aggregate shoulder material shall be placed in accordance with the requirements of the applicable specifications governing the type of material or construction being used and shall be compacted at optimum moisture, within ±2 percentage points of optimum. Except when aggregate material No. 18 is used, the density of the aggregate shoulder material, when compared to the theoretical maximum density as determined in accordance with the requirements of **VTM-1** or **VTM-12**, shall conform to the following:

% Retained on No. 4 Sieve	% Density
0-50	95-100
51-60	90-100
61-70	85-100

Comment [584]: Right Way

Comment [585]: Right Time

Comment [586]: Right Location

Comment [587]: Right Way

Comment [588]: Right Material

Trial Use and Comment

Percentages of material will be reported to the nearest whole number.

When aggregate material No. 18 is used, the density, when compared to the theoretical maximum density, shall be not less than 90 percent or more than 95 percent.

Aggregate in the guardrail section of fills, 1 foot from the roadway side of the guardrail face to the outside of the shoulder, shall be compacted until a density of at least 90 percent of the theoretical maximum density has been obtained. The asphalt mixture in this area shall be sealed immediately after the hot mixture is spread. Rolling of the asphalt mixture shall continue until roller marks are eliminated and a density of at least 85 percent of the theoretical maximum density has been obtained.

Comment [589]: Right Way

Stabilized and paved shoulders shall be constructed in accordance with the requirements of the applicable specifications for pavement stabilization. If the aggregate shoulder material becomes overconsolidated prior to final finishing, it shall be scarified for the approximate depth, reshaped, and recompacted to conform to the specified grade and cross section.

Shoulders shall be constructed simultaneously with nonrigid types of base or surface courses other than asphalt concrete or in advance of the base or surface course so as to prevent spreading of base or surface materials. The area of shoulders 12 inches adjacent to the pavement shall be rolled simultaneously with the course being deposited.

Comment [590]: Right Time

Where base or surface courses are being constructed under traffic and are more than 1 inch in depth, shoulder material adjacent thereto shall be placed within 72 hours after placement of the base or surface course.

Comment [591]: Right Time

305.04—Measurement and Payment

Comment [592]: Right Quantity/Right Payment

When material in place is used for the subgrade and shoulders, no measurement will be made. Treated material in place will be measured in accordance with the method of measurement for the specified stabilizing material. When imported material is specified, it will be measured as follows:

(a) **Select material, Type I,** will be measured in tons.

(b) **Select material, Types II and III,** will be measured in cubic yards in its original position.

(c) **Borrow** will be computed in its original position by cross-sectioning the area excavated. If cross-sectioning the area excavated is not practical, the quantity will be determined from compacted measurements in the road and then converted to pit volume.

Trial Use and Comment

When cubic yard measurement is specified and the plans do not show the thickness of material required, the material will be measured in the original position by the cross-section method. Where it is impractical to cross-section the area, measurement will be made in trucks in accordance with the requirements of **Section 109.01**.

When the ton unit is specified, the quantity shall be determined in accordance with the requirements of **Section 109.01**.

Moisture in excess of optimum, + 2 percentage points, will be deducted from the net weight of both truck and rail shipments.

Allowance will not be made for unauthorized depths beyond those shown on the plans and the allowable tolerances. When tonnage measurement is used, deduction for material exceeding the allowable tolerance will be based on 110 pounds per square yard per inch of depth.

When material in place is used for subgrade and shoulders, no separate payment will be made. The cost thereof shall be included in the price for other applicable pay items.

When imported materials are used, the subgrade and shoulders will be paid for at the contract unit price per cubic yard or per ton as specified. Treated material in place will be paid for in accordance with the requirements of the applicable specification.

Stabilized or paved shoulders shown as a pay item will be measured and paid for in accordance with the requirements of **Section 306.04**, **Section 307.06**, **Section 312.05**, or **Section 315.08**, as applicable.

Geotextile for subgrade stabilization will be measured in square yards complete-in-place. Overlaps and seams will not be measured for separate payment. The accepted quantity of geotextile will be paid for at the contract unit price per square yard, which price shall be full compensation for furnishing, placing, lapping, or seaming material and for all materials, labor, tools, equipment, and incidentals necessary to complete the work.

These prices shall include furnishing, hauling, placing, manipulating, and compacting material; clearing and grubbing local pits; material royalties; and access roads.

Payment will be made under:

Pay Item	Pay Unit
Borrow excavation	Cubic yard
Select material (Type and min. CBR)	Cubic yard or ton
Aggregate material (No.)	Cubic yard or ton
Aggregate base material (Type and no.)	Cubic yard or ton

Trial Use and Comment

Geotextile (Subgrade stabilization) Square yard 1

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review plans and typical section. Discuss importance of constructing subgrade to proper grade, with approved material and achieving proper density. Discuss contractor's means and methods to achieve objectives: equipment, materials, expected progress, and limits of work. Advise the contractor of required QA and QC testing to be performed by inspection staff. Note acceptable tolerances on finished work elements.

Start:

- Materials source approved
- Proper measurement and testing equipment available
- Moisture requirements acceptable

Inspection:

- Materials conformity, proper scarification, moisture content, density, roller pattern and control strips, typical section, remedy for unsuitable areas, proper placement and lapping of geotextile material

Final Inspection:

- Density, moisture and depth requirements met, typical section and proper elevations established.

Documentation Required: Density reports and material approvals. Document inspections, adjustments, measurement and payment information in Site Manager.

IV. REVIEW QUESTIONS

Spec Ref.	
305.03(a)1	Did the Inspector check the subgrade to ensure the cross section was correct and the grade was uniform prior to the Contractor placing any subsequent course?
305.03(a)2	Have the recommended number of density tests been taken and recorded on subgrade?
305.03(a1)1	Has the subgrade been scarified to a depth of 6" for a distance of 2 feet beyond the proposed edge of the pavement on each side?
305.03(a1)2	Has all unsuitable materials been removed and replaced with suitable material that will permit compaction?

Trial Use and Comment

305.03(a1)3	Has the subgrade been compacted within plus or minus 20 percent optimum moisture and to 100% density with consideration of +4 material?
305.03(b)	When solid rock occurs in cuts or the material is not suitable for subgrade or finishing purposes, is the roadbed excavated below the grade shown on the plans and backfilled in accordance with the Standard Drawings for RU-1?
305.03(C)	Did the Contractor provide effective drainage for the subgrade and maintain it in a satisfactory condition until the next course was placed?
305.03(e)1	Was the aggregate shoulder material placed in accordance with the applicable specifications governing the type material or construction being used?
305.03(e)2	Was the aggregate material compacted within plus or minus 2 percentage points of optimum moisture to the required density?
305.03(e)3	Were the stabilized and paved shoulders constructed in accordance with the applicable specifications for pavement stabilization?
305.03(e)4	If the aggregate shoulder material became overconsolidated prior to final finishing, was it scarified for the approximate depth, reshaped, and recompacted to conform to the specified grade and cross section?
305.03(e)5	Were the shoulders constructed simultaneously or in advance with nonrigid types of base or surface courses to prevent spreading of the base or surface materials?
305.03(e)6	When the base or surface courses are being constructed under traffic and exceed one inch in depth, is the adjacent shoulder material placed within 72 hours?

V. CRITICAL INSPECTION POINTS

• **Achieve typical section and proper elevation**
• **Moisture and Density requirements met**
• **Subgrade has effective drainage and is maintained in satisfactory condition until next course is placed**

Trial Use and Comment

SECTION 306 – LIME STABILIZATION

I. INTRODUCTION:

Lime Stabilization consists of stabilizing unsuitable roadbed material (clay type soils in particular) by the addition of lime. The amount of lime necessary for stabilization will be determined by laboratory tests of samples of the soil to be treated. The rate of lime to be applied will be specified on the plans or directed by the Engineer. The depth and width of treatment will be designated on the plans.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's:

306.01—Description

This work shall consist of stabilizing roadbed material and constructing one or more courses of the pavement structure using a mixture of soil or approved aggregates, lime or lime and fly ash, and water.

306.02—Materials

(a) **Lime** shall conform to the requirements of **Section 240**.

(b) **Fly ash** shall conform to the requirements of **Section 241**. Bulk fly ash may be transported dry in bulk trucks and stored in tanks or may be transported in the dampened condition, with a maximum of 15 percent moisture, and stockpiled at the job site. Excessively wet or contaminated surface material shall not be used in mixing operations.

(c) **Water** shall conform to the requirements of **Section 216**.

(d) **Aggregate** shall conform to the applicable requirements of **Section 205**, **Section 207**, and **Section 208** or other requirements described in the Contract.

306.03—Procedures

Comment [593]: Right Material

Comment [594]: Right Material

Comment [595]: Right Material

Comment [596]: Right Material

Trial Use and Comment

Lime stabilization will not be permitted when aggregate or the surface on which the course is to be placed is frozen. Manipulation shall not be started until the surface is free from mud and frost and the temperature is at least 40 degrees F.

(a) **Preparing the Roadbed:** The surface of the roadbed shall be cut or bladed to the approximate line, grade, and cross section. However, compaction of the roadbed for the depth of the material to be treated will not be required prior to application of lime. When the course placed directly on the roadbed is to be stabilized, the surface of the roadbed shall be prepared in accordance with the requirements of the applicable provisions of **Section 305**.

Temporary ramps constructed adjacent to existing pavements, bridges, culverts, and similar items shall be removed to the depth necessary to provide the required thickness of pavement structure.

Drains shall be cut through excavated shoulder material on shoulders to drain the roadbed. Drains shall be cut through windrowed base materials at sufficient intervals to prevent ponding of water. Windrowed material shall be moved, when necessary, to permit the subgrade to dry.

(b) **Preparing Materials:** The prepared roadbed shall be scarified to the depth and width required for stabilization. The material thus prepared shall be partially pulverized. The depth of scarification and the blading operation shall be controlled in such a manner that the surface of the roadbed below the scarified material shall remain undisturbed and shall conform to the established cross section. Prior to the beginning of stabilization work, material retained on the 3-inch sieve shall be removed.

(c) **Applying Lime:** The application rate of lime shall be as shown on the plans or as directed by the Engineer. Lime may be applied to the partially pulverized material as a slurry or in a dry form. When quicklime is used in a dry form, it shall be applied at the same rate as hydrated lime.

Where quicklime is slaked on the project to produce a slurry, measurement will be calculated as indicated herein for each truckload using the certified lime purity for that load. No measurement will be made of any lime added or replaced for corrective measures during construction or for repairing damaged areas.

A = Certified weight of quicklime delivered x percent purity x 1.32

B = Certified weight of quicklime delivered x percent inert material

A + B = Total hydrated lime produced (pay quantity)

Lime applied by slurry application shall be mixed with water in approved agitating equipment and applied to the roadbed as a thin water suspension or slurry. The distributing equipment shall provide continuous agitation from the mixing site until

Comment [597]: Right Way

Comment [598]: Right Way

Comment [599]: Right Way

Comment [600]: Right Way

Comment [601]: Right Way

Comment [602]: Right Way

Comment [603]: Right Payment/Right Quantity

Comment [604]: Right Way

Trial Use and Comment

applied on the roadbed. The proportion of lime shall be such that the "Dry Solids Content" shall be at least 30 percent by weight. A lower percent solid may be authorized by the Engineer provided a uniform suspension of the slurry can be maintained. A weight and purity certification shall accompany each shipment of quicklime to be used in slurry applications.

Spreading equipment shall uniformly distribute the lime without excessive loss. No equipment except water trucks and equipment used for mixing and spreading shall pass over the spread lime until it is mixed. Any procedure that results in excessive loss or displacement of the lime shall be immediately discontinued.

When a stationary mixer is used to mix aggregate material, the lime may be added to the mix by an approved feeder.

(d) **Adding Water:** Sufficient water shall be added by means of pressure water distributors or a traveling plant to provide a moisture content at the time of compaction of not less than the optimum for the mixture or more than optimum + 20 percent of optimum.

(e) **Mixing:** Lime and water shall be mixed throughout the scarified material as thoroughly as practicable by using a disc harrow, by scarifying and blading, or by using other methods approved by the Engineer. The mixture shall then be spread over the roadbed. The surface shall be sealed with a steel wheel or pneumatic tire roller to retard the loss of moisture and then allowed to cure. Curing will be considered completed when a uniform material is produced in which at least 60 percent of the material, exclusive of aggregates, will pass the No. 4 sieve.

When a stationary mixer is used, the material may be placed, compacted, and finished immediately after mixing.

When traveling plants are used, additional mixing with blades, tillers, discs, harrows, or repeated passes of the plant may be required.

During the interval of time between application and mixing, lime that has been exposed to the open air for 6 hours or more or lime that has been lost because of washing or blowing will not be measured for payment.

(f) **Compacting and Finishing:** The mixture shall be placed and compacted to a density of at least 95 percent of the maximum density determined in accordance with the requirements of **VTM-1** or **VTM-12**. Light sprinkling may be required during placement operations to maintain the specified moisture content. Compaction shall be accompanied by sufficient blading to eliminate irregularities.

The surface shall be lightly scarified during finishing operations and bladed to eliminate imprints left by the equipment. Final rolling of the completed surface shall be accomplished with a pneumatic tire roller. Final compaction and finishing shall be completed within 12 hours after final mixing.

Comment [605]: Right Way

Comment [606]: Right Way

Comment [607]: Right Way

Comment [608]: Right Material

Comment [609]: Right Time

Comment [610]: Right Time/Right Payment

Comment [611]: Right Way

Comment [612]: Right Way

Comment [613]: Right Time

Trial Use and Comment

(g) **Tolerances:** The finished stabilized course shall conform to the specified thickness, subject to the following tolerances: Thickness will be determined in accordance with the requirements of **VTM-38A**. Areas that are deficient in thickness by more than 1 inch shall be removed or reworked with an additional amount of lime equal to 50 percent of the original amount. In the case of stabilized base courses, the Contractor may correct sections deficient in depth by applying asphalt concrete provided such correction is authorized by the Engineer. Areas that are excessive in thickness by more than 2 inches shall be reworked, and an amount of lime equal to 50 percent of the original amount added to the mixture. Replacement and corrective work shall be at the Contractor's expense.

Comment [614]: Right Way

Comment [615]: Right Payment

(h) **Protecting and Curing:** After finishing of the subgrade, no vehicles except sprinkling equipment shall be permitted on the subgrade for a curing period of 7 days or until the next course is placed, whichever is less. During the curing period, the subgrade shall be lightly sprinkled with water at frequent intervals to prevent the surface from drying and cracking. The Contractor shall plan and prosecute the work in such a manner as to place the next course during the curing period. If the Contractor has not placed the next course by the end of the curing period, he shall apply liquid asphalt and cover material at the rate specified on the plans.

Comment [616]: Right Way/Right Time

Damage to the stabilized course attributable to other phases of construction shall be repaired. At least one subsequent course shall be constructed on the stabilized course before hauling operations for the other phases of construction are permitted on the treated course. If the material loses the required stability, density, or finish before the next course is placed or the work accepted, it shall be recompacted and refinished at the Contractor's expense.

306.04—Measurement and Payment

Lime stabilization will be measured in tons of lime or fly ash, square yards of manipulation, and cubic yards or tons of aggregate material, complete-in-place, and will be paid for at the contract unit price per ton of lime or ton of fly ash, per square yard of manipulation, and per cubic yard or ton of aggregate material. Weighing shall be performed in accordance with the requirements of **Section 109.01** except that transporting vehicles shall be tared prior to each load.

Comment [617]: Right Payment

Manipulation shall include preparing the roadbed, scarifying, pulverizing, drying material, mixing, compacting, finishing, protecting, curing, and maintaining the completed course.

Comment [618]: Right Payment

Payment will be made under:

Pay Item	**Pay Unit**

Trial Use and Comment

Lime	Ton
Fly ash	Ton
Manipulation (Depth)	Square yard
Aggregate material (Type)	Cubic yard or ton

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review Specifications
- Ensure that Lime is coming from an approved source. Obtain Source of Materials form.
- Discuss the application rates and methods of placement with contractor.
- Ensure that grade has been checked prior to placement of stabilization.
- Get Equipment list from contractor that include all necessary equipment to perform this type operation.
- Go over time frames set forth in the Specifications and ensure proper labor and equipment is available to perform the work accordingly.
- Go over contractors plan on curing and sealing of the sub-grade after placement.

Start:

- Be sure that all the proper testing equipment needed for the type of operation.
- Ensure sub-grade has been properly prepared in accordance with Section 305 prior to placement of lime.

Continuous inspection:

- Take Moisture test before and during the operations.
- Test and verify the application rate of the lime.
- Test compaction of sub-grade after placement and set.
- Ensure contractor uses proper equipment to achieve the initial set and final compaction.
- Ensure that Proper equipment is being used to obtain the final compaction.

Trial Use and Comment

- Ensure that contractor cures and protects the section for the allotted time frame using the correct method.

Final Inspection:

- Ensure that the contractor either places the next course over the section or that the section is sealed with liquid asphalt and cover material.

Documentation Required:

- Summarize operation in DWR
- Document application rate requirements and test results of the section.
- Document moisture test requirements and test results of the section.
- Obtain all tickets and/or invoices for lime.
- Document the final grade checks and if approved and by whom.
- Document and keep track of cure methods and time frames.

IV. REVIEW QUESTIONS

Spec Ref.	
306.03	Has manipulation not been started until the surface is free of mud and frost and the temperature is at least 40 degrees Fahrenheit?
306.03(b)	Has the roadbed been scarified to the proper depth and width, the prepared material partially pulverized, and material retained on the 3-inch sieve removed?
306.03(c)1	Is the application rate of lime as shown on the plans or as directed by the Engineer?
306.03(c)2	Where quicklime is slaked on the project to produce a slurry, were measurements calculated in accordance with this section?
306.03(c)3	Does the distributing equipment provide continuous agitation of the slurry from the mix site until applied on the roadbed?
306.03(c)4	Does the spreading equipment uniformly distribute the lime without excessive loss?
306.03(c)5	Is no equipment, except water trucks and mixing and spreading equipment, allowed to pass over the spreaded lime until it is mixed?
306.03(d)	Is water added in accordance with the requirements of this section?
306.03(e)	Has lime and water been mixed throughout the scarified material and the surface sealed by rollers in accordance with the specifications on mixing and compacting lime stabilization?
306.03(f)	Has the material been compacted and finished in accordance with this section?
306.03(h)	Is the material protected and cured in accordance with this section?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• Ensure that all methods of placement have been approved.
• Check grade to ensure accuracy prior to starting of operations.
• Ensure Moisture test pass prior to starting operations.
• Ensure that proper application rates are being achieved and proper moisture levels are maintained during operations.
• Ensure proper compaction is achieved after placement.
• Ensure all cure time frames are met.

Trial Use and Comment

SECTION 307 - HYDRAULIC CEMENT STABILIZATION

I. INTRODUCTION:

Certain types of soil may be strengthened by the addition of cement. The increase in strength makes it possible to substitute this mixture for granular subbases and bases. This form of stabilization is commonly known as "soil cement".

The cement may be added to existing material in place. This is usually done using a self-propelled or self-powered machine. The material in place is scarified, cement and water added, and then mixed by the same machine in one pass. Other machines may be utilized that require a separate pass for each operation.

If the central plant method of adding cement is used, the material is mixed with the cement in a pugmill, then the blended material is hauled to the roadway. This method is used when cement is mixed with granular subbase or base material.

The Superintendent and the Project Inspector should discuss the construction procedure prior to starting the actual operation. This discussion should include methods for controlling traffic, the method of pulverizing the soil, distributing water, mixing, shaping, compacting, and curing the layer.

The Inspector is to inspect all equipment the Contractor intends to employ in his operation. Equipment should be in proper working order before the Contractor begins.

(l) The next course
(2) Moisture
(3) Asphalt Cover material
(4) Other approved cover material

The next course must be in place or asphalt cover material applied on or before the eighth day.

The most desirable method of curing is by application of the next course immediately after depth and density have been approved. This eliminates the necessity for moist curing and asphalt cover material.

In the event the next course is placed within 7 days after stabilization, the asphalt material specified on the plans for curing is to be eliminated from the Contract. In the event the next course is not placed within 7 days, the liquid asphalt material specified on the plans may need to be applied. Liquid asphalt used for curing will not be measured for separate payment.

a.) **<u>Forms:</u>**

Trial Use and Comment

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

307.01—Description

This work shall consist of stabilizing roadbed material as specified or as directed by the Engineer and constructing one or more courses of the pavement structure using a mixture of soil, or approved aggregates and hydraulic cement, on a prepared surface in accordance with the requirements of these specifications and in conformity with the lines, grades, typical sections, and cross sections shown on the plans or as established by the Engineer.

307.02—Materials

(a) **Cement** shall conform to the requirements of Section 214, Type I, IP, or II. Cement shall be transported, stored, and otherwise protected in accordance with the requirements of Section 217.03.

(b) **Water** shall conform to the requirements of Section 216.

(c) **Asphalt** used for curing or priming shall conform to the applicable requirements of Section 210.

(d) **Aggregate** shall conform to the applicable requirements of Section 205, Section 207, or Section 208 or other contract requirements.

(e) **Select borrow** shall consist of approved material having the specified CBR.

307.03—Field Laboratory

When a field laboratory is furnished by the Department, the Contractor shall move the laboratory to various points along the project as necessary.

307.04—Weather Limitations

Cement stabilization will not be permitted when aggregate or the surface on which the course is to be placed is frozen. Manipulation operations shall not be started until the air temperature is at least 40 degrees F in the shade and rising. When material may be

Comment [619]: 307.02: Right Material

Comment [620]: 32-33: Right Location

Comment [621]: Righttime/ Right Way

Trial Use and Comment

exposed to freezing temperatures during the first 24 hours of curing, the Contractor shall protect the stabilized material from freezing for 7 days or shall cover the stabilized surface with the next pavement course within 4 hours after the cement stabilization has been finished as specified.

307.05—Procedures

If full-width paving equipment is to be used in the subsequent placement of asphalt concrete base, the width of the stabilized course upon which the base will be placed may be extended 1 foot beyond the designed typical section on each side.

(a) **Preparing Existing Surface:** When the roadbed is to be stabilized, its surface shall be cut or bladed to the approximate line, grade, and cross section. However, compaction of the roadbed for the depth of the material to be treated will not be required prior to application of cement. When the course placed directly on the roadbed is to be stabilized, the surface of the roadbed shall be prepared in accordance with the requirements of the applicable provisions of **Section 305.03**.

Additional material needed to bring the roadway surface into compliance with the required specifications shall be obtained from within the limits of the right of way, if available. When authorized, the Contractor shall obtain such material from borrow pits as provided for in Section 303.

The surface shall be sufficiently firm to support, without displacement, the construction equipment and shall be in such condition that the compaction can be obtained as specified herein. Soft, yielding, or wet areas shall be corrected and made stable before construction proceeds.

(b) **Preparing Materials:** When the roadbed is to be stabilized, material to be treated shall be scarified and pulverized prior to application of cement. Pulverizing shall continue during mixing operations until at least 80 percent of the material, exclusive of coarse aggregate, will pass the No. 4 sieve. Any material retained on the 3-inch sieve and other objectionable objects shall be removed.

Applying and mixing cement with material in place or aggregate material shall be performed in accordance with the following methods except that aggregate subbase, aggregate base course, select material, and select borrow specified on the plans shall be mixed in accordance with the requirements of 2. herein. If the closest central mixing plant is located more than 30 road miles from the project, the Contractor may elect to mix cement with aggregate subbase, aggregate base, select material, and select borrow in accordance with the requirements of 1. herein provided an additional 1 percent cement by weight is added to the in-place mixing operation and the cement is mixed to a depth of approximately 1 inch less than the depth of the course being stabilized. No additional compensation will be allowed for the changes described herein.

Comment [622]: Right Location / Right Way

Comment [623]: Right Location / Right Way

Comment [624]: Right Way/ Right Time/ Right Material/ Right Location

Trial Use and Comment

1. **Mixed-in-place method:** Any additional material required shall be blended with the existing material prior to application of cement.

Cement shall be applied uniformly on the material to be processed. When bulk cement is used, the equipment shall be capable of handling and spreading the cement in the required amount. The moisture content of the material to be processed shall be sufficiently low to permit a uniform mixture of the aggregate material and cement. Spread cement that has been lost shall be replaced without additional compensation before mixing is started.

Mixing shall be accomplished by means of a self-propelled or self-powered machine equipped with a mechanical rotor or other approved type of mixer that will thoroughly blend the aggregate with the cement. Mixing equipment shall be constructed to ensure positive depth control. Care shall be taken to prevent cement from being mixed below the depth specified. Water shall be uniformly incorporated into the mixture. The water supply and distributing equipment shall be capable of supplying the amount of water necessary to obtain optimum moisture in the material within 1 hour. If more than one pass of the mixer is required, at least one pass shall be made before water is added. Mixing shall continue after all water has been applied until a uniform mixture has been obtained for the full depth of the course.

Any mixture that has not been compacted and remains undisturbed for more than 30 minutes shall be remixed. If rain adds excessive moisture to the uncompacted material, the entire section shall be reworked. If the Contractor is unable to finish the section within the same day, the section shall be reconstructed and an amount equal to 50 percent of the original amount of cement shall be added to the mixture at the Contractor's expense.

2. **Central plant method:** Material shall be proportioned and mixed with cement and water in an approved central mixing plant. The plant shall be equipped with feeding and metering devices that will introduce materials into the mixer in the specified quantities. Mixing shall continue until a uniform mixture has been obtained.

Mixed material shall be transported to the roadway in suitable vehicles and spread on a moistened surface in a uniform layer by a self-propelled or other approved spreader. Not more than 60 minutes shall elapse between the start of mixing and the start of compacting the cement-treated mixture on the prepared subgrade.

a. **Mixing aggregate subbase and base material:** The cement content will be determined by the titration method as described in VTM-40. Sampling and testing for determining cement content will be performed at the plant. However, nothing herein shall be construed as waiving the requirements of **Section 106.06 and Section 200.02.**

Acceptance for cement content will be based on the mean of the results of tests performed on samples taken in a stratified random manner from each lot. The rate of sampling will be four samples per lot. A *lot* of material is defined as 2,000 tons, or

Comment [625]: Right Location/ Right quantity/ Right Way/ Right Payment

Comment [626]: Right Way/ Right Location

Comment [627]: Right Time/ Right Quantity

Comment [628]: Right Quantity/ Right Way

Comment [629]: Right Time

Comment [630]: Right Way/ Right Quantity

Comment [631]: Right quantity/ Right material

Trial Use and Comment

4,000 tons for contract items in excess of 50,000 tons, of material unless the project requires less than 2,000 tons; the amount of material necessary to complete the project is less than 2,000 tons, or 4,000 tons when the contract item is in excess of 50,000 tons; a portion of the lot is rejected for deficient cement content; the job-mix formula for the aggregates is modified within a lot; or a portion of the lot is rejected for an excessive liquid limit or plasticity index.

A lot will be considered acceptable for cement content if the mean result of the test(s) is within the following process tolerance(s) of the plan design for the number of tests taken: mean of two tests, –1.1 percent; mean of three tests, –0.9 percent; mean of four tests, –0.8 percent. However, no one sample shall have a cement content more than 1.6 percent below the design cement content.

If an individual test result indicates that the cement content of the material represented by the test is deficient by more than 1.6 percent from the design cement content, the portion of the material represented by the sample will be considered a separate part of the lot and shall be removed from the road.

If the value of the test results falls below the allowable process tolerance, a payment adjustment will be applied to the contract unit price at the rate of 1.0 percent for each 0.1 percent the material is outside the process tolerance. If the total adjustment is 8.0 percent or less and the Contractor does not elect to remove and replace the material, the contract unit price paid for the material will be reduced at the rate specified herein. The adjustment will be applied to the tonnage represented by the samples.

Comment [632]: Right payment

b. **Mixing select borrow:** Cement in the mixture shall not vary more than ±7.0 percent by weight from that specified. Feeders and meters for introducing cement into the mixer shall be of such design that the amount of cement can be accurately determined before cement is introduced into the mixer.

(c) **Compacting and Finishing:** Prior to the beginning of compaction, the mixture shall be brought to a uniformly loose condition for its full depth and shall have a moisture content of not less than optimum or more than optimum + 20 percent of optimum. For subgrade stabilization, the mixture shall be compacted to a density of at least 100 percent of the maximum density as determined in accordance with the requirements of VTM-1 or VTM-12. For subbase and base stabilization, the mixture shall be compacted to conform to the density requirements of Section 309.05.

Comment [633]: Right Way

Compaction equipment shall be subject to the approval of the Engineer, and the number of such units shall be sufficient to ensure the specified density and completion of the processed section within 4 hours from the time the water is added to the mixture. Initial compaction of soil mixtures shall be accomplished with a tamping roller.

Comment [634]: Right Time / Right Way

After the mixture has been compacted, the surface shall be shaped to the required lines, grades, and cross sections.

Comment [635]: Right Location

Trial Use and Comment

If the material to be shaped is a type in which surface compaction planes will form, the Contractor shall lightly scarify the surface continuously with a drag harrow or similar equipment during the shaping operation. The surface shall then be rolled with steel wheel or pneumatic tire rollers, or both. The moisture content of the surface material shall be maintained at not less than the specified optimum during finishing operations. Compacting and finishing operations shall be completed within the specified time and carried out in a manner that will produce a smooth, dense surface, free from surface compaction planes, cracks, ridges, or loose material.

(d) **Construction Joints:** Each day's operation shall tie into the completed work of the previous day by the remixing of approximately 2 feet of the completed course prior to the processing of additional sections. An amount equal to 50 percent of the original amount of cement shall be added to such sections. When the completed section remains undisturbed for more than 24 hours, a transverse construction joint shall be made by cutting back into the completed work to form an approximate vertical face.

(e) **Tolerances:** The finished stabilized course shall conform to the specified thickness and density, subject to the following tolerances:

1. **Density:** The density of the completed work for each day's operations will be determined at representative locations. Any portion on which the density is more than 5 pounds per cubic foot less than that specified shall be removed and replaced.

2. **Thickness:** Thickness will be determined in accordance with the requirements of VTM-38A. The Contractor shall remove and replace areas that are deficient in thickness by more than 1 inch or, with the approval of the Engineer; the Contractor shall correct sections on stabilized base courses that are deficient in depth by applying asphalt concrete at his own expense. Mixed-in-place areas that are excessive in thickness by more than 1 inch shall be removed and replaced.

   When the central plant method of mixing is used, acceptance of the course will be based on the requirements of Section 308.04 except when the depth is deficient by more than 1 inch. In such event, correction shall be as specified herein.

(f) **Protecting and Curing:** The next course may be placed after the cement stabilization has been approved. In the event the next pavement course is not placed immediately, the cement-treated aggregate course shall be moist cured continually or covered by the application of liquid asphalt to prevent surface drying until the next pavement course is placed. The Contractor shall endeavor to place the next pavement course within 7 days after cement stabilization is finished. In the event this is not possible and a liquid asphalt cover has not been applied, the Contractor shall either seal the cement-stabilized layer with approved cover material or continually maintain the surface of the cement-stabilized course with moisture until the next pavement course can be successfully applied. The surface of the cement-treated aggregate course shall be maintained in such a manner that the entire surface of the course remains in a moistened condition. If

Comment [636]: Right Way

Comment [637]: Right Way/ Right Time

Comment [638]: Right material/ Right Way

Comment [639]: Right Time/ Right Way Right quantity

Trial Use and Comment

asphalt cover material is used, it shall be applied at the rate of approximately 0.25 gallon per square yard or as shown on the plans. The Engineer shall direct the exact rate of application necessary to produce full coverage without excessive runoff. If asphalt is used, it shall be applied with an approved pressure distributor as specified in Section 314.04 and the asphalt material shall be immediately covered with the specified cover material.

Prior to placing the next course or applying asphalt cover material, the surface of the cement-stabilized layer shall be lightly moistened. In no case shall the cement-treated aggregate course be allowed to dry out completely or go uncovered through the winter. The stabilized course shall be tightly knit and free from loose and extraneous material.

Comment [640]: Right Way/ Right Time

The Contractor shall maintain the cement-stabilized course, including shoulders and ditches, within the limits of the Contract in a condition satisfactory to the Engineer from the time work first starts until the work is officially accepted. Maintenance shall include immediate repairs of defects that may occur either before or after cement is applied, which work shall be performed by the Contractor and repeated as often as is necessary to keep the course continuously intact. Repairs to the course shall be performed in a manner that will ensure the restoration of a uniform surface and stability of the area repaired.

307.06—Measurement and Payment

Comment [641]: 307.06: Right Payment

Hydraulic cement stabilization will be measured in tons of hydraulic cement, cubic yards or tons of aggregate, and square yards of manipulation in accordance with the requirements of **Section 109.01** and will be paid for at the contract unit price per ton of hydraulic cement, per ton or cubic yard of aggregate, and per square yard of manipulation for the depth specified. This price shall include furnishing and applying water for moisture curing and, when grading is not a pay item, restoring shoulders and ditches.

Hydraulic cement-stabilized aggregate material or aggregate base material will be measured in cubic yards or tons and will be paid for at the contract unit price per ton or cubic yard. This price shall include furnishing and installing cement, aggregate, and moisture for curing and, when grading is not a pay item, restoring shoulders and ditches.

Cement-stabilized select borrow will be measured in cubic yards, pit measure, in accordance with the requirements of Section 109.01 and will be paid for at the contract unit price per cubic yard. This price shall include furnishing component and curing materials and hauling, placing, and curing the cement-stabilized material.

When bulk cement is used, scales capable of weighing loaded cement transports or lesser loads shall be provided at locations approved by the Engineer. Weighing shall be

Trial Use and Comment

performed in accordance with the requirements of **Section 109.01** except that transporting vehicles shall be tared prior to each load.

Manipulation, when a pay item and the Contractor elects to centrally mix the materials, shall be paid for in accordance with the quantity of manipulation shown on the plans. Manipulation shall include only the mixing operation.

Asphalt and cover material for curing will not be measured for separate payment.

Payment will be made under:

Pay Item	Pay Unit
Hydraulic cement	Ton
Aggregate material (No.)	Cubic yard or ton
Aggregate base material (Type and no.)	Cubic yard or ton
Cement-stabilized select borrow (Min. CBR)	Cubic yard
Manipulation (Depth)	Square yard
Cement-stabilized aggregate material (No.)	Cubic yard or ton
Cement-stabilized aggregate base material (Type and no.)	Cubic yard or ton

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting: Review specification requirements, planes, material documentation, construction procedures, measurement and payment, capacity of mixing & compaction equipment to complete operation in 4 hours. Review target density & moisture requirements.

Start: Verify surface preparation, grade, x-section, location & cement application rate.

Continuous inspection: Visually monitor mixing & grading; verify - moisture, density & depth.

Final Inspection: verify depth is within tolerances, measure quantity of work for payment, verify excess material is removed from site, make verify the next pavement schedule and appropriate curing & protection is applied.

Documentation Required:

- Contractor's approved material source(C-25).
- Proctors.
- Density, depth , Moisture & cement content test reports.
- Measurements for payment and or weigh tickets.
- Equipment List.
- Payment computations.

Trial Use and Comment

Engineers Approval/Authorization

IV. REVIEW QUESTIONS

Spec Ref.	
307.02(a)	Has the cement been transported, stored and otherwise protected in accordance with Section 207.03, Hydraulic Cement Concrete?
307.04(1)	Was cement stabilization performed in accordance with specified weather limitations?
307.04(2)	If there is a possibility of freezing temperatures during the first 24 hours of curing, is the stabilized material protected from freezing for 7 days or covered within 4 hours after the cement stabilization is finished?
307.05(a)1	Has the roadbed surface been graded to the approximate line, grade and cross section?
307.05(a)2	Is the surface sufficiently firm to support construction equipment and in such condition that the required compaction can be obtained?
307.05(b)1	Has the material in the roadbed to be stabilized been scarified and pulverized with any objectionable objects and material retained on the 3 inch sieve removed prior to cement application?
307.05(b)2	Has the aggregate subbase, aggregate base, select material and select borrow been mixed in accordance with the requirements of this section?
307.05(b1)1	Has the cement been applied uniformly and thoroughly blended by equipment capable of handling and spreading the cement as required?
307.05(b1)2	Has the necessary water to obtain optimum moisture been added within one hour?
307.05(b2)1	Have the mixed materials been transported and spread as required?
307.05(b2)2	Has compaction of the cement-treated mixture been started within 60 minutes of the start of mixing at the plant?
307.05(c)1	Has the subgrade stabilization been compacted to the density required?
307.05(c)2	Has the processed section been completed and compacted to the specified density within 4 hours from the time water was added?
307.05(c)3	Have the compacting and finishing operations produced a smooth, dense surface as specified?
307.05(c)4	Is the subbase or base stabilization compacted in accordance with the density requirements in specifications for aggregate base course?
307.05(d)	Have construction joints been installed as required?
307.05(e1)	Is the density of the completed work in compliance with the tolerances as specified?
307.05(e2)	Has the contractor corrected areas that are deficient in thickness by more than 1 inch?
307.05(f)	Has the stabilized course been protected and maintained in a satisfactory condition until accepted?

Trial Use and Comment

REVIEW QUESTIONS cont'd.

• Is the roadbed prepared to the required grade?
• Is cement stabilization performed in accordance with the weather limitations?
• Does the Contractor protect the stabilized material if freezing is expected during the first 24 hours of curing?
• Is the roadbed properly scarified prior to placement of the cement?
• Is the cement uniformly applied at the required application rate?
• Is optimum moisture maintained?
• Does compaction start within 60 minutes of the start of mixing at the plant?
• Is the stabilized material compacted to the required density?
• Are construction joints installed as required?
• Is the stabilized section properly protected?

V. CRITICAL INSPECTION POINTS

• **Existing surface preparation**
• **Depth check**
• **Cement application rate**

Trial Use and Comment

SECTION 308—SUBBASE COURSE

I. INTRODUCTION:

The subbase course consists of furnishing and placing one or more courses of mineral aggregate on a prepared subgrade. The purpose of the subbase course is:

1. To provide a free draining material.
2. To provide a frost resistant material on which to support other base or surface courses.
3. To prevent pumping of underlying soils.
4. To distribute traffic wheel loads transmitted to the embankment.

The designed thickness and width of the subbase course shown on the plans are dependent upon the geographic location, soil conditions and anticipated traffic.

CONSTRUCTION METHODS

The subgrade should be checked in accordance with **Section 305** prior to placing of subbase material.

The subbase material must be placed on the roadway by means of an approved mechanical spreader.

If the total depth of material is more than 6 inches, the material is to be placed in 2 or more equal layers and compacted. The maximum depth in any one lift is not to exceed 6 inches unless vibrating or other type of approved compaction equipment is used. In this case, the depth may be increased to 10 inches compacted, if approved by the Construction Manager.

The Inspector should check the grade and the shape of the finished surface. This can be performed in one of several ways.

The string line method is applicable when distances are not so great that the sag of the line is excessive. First, mark the correct grades on stakes situated on the edges of the work. Stretch a string line taut between the stakes and raise the string in the center the same amount that the center of the plan cross section is crowned. The vertical distance between the string and the actual grade will be the same at all points if the cross section is correct.

Trial Use and Comment

These checks should be made at the roadway centerline, each travel lane centerline, and edges of pavement, at each Station (every 30 meters for Metric projects). If checks indicate that the surface is out of tolerance, more frequent checks should be made.

a) Forms:

- Intentionally Left Blank

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

308.01—Description

This work shall consist of furnishing and placing one or more courses of mineral aggregate on a prepared subgrade in accordance with the required tolerances within these specifications and in conformity with the lines, grades, typical sections, and cross sections shown on the plans or as established by the Engineer.

308.02—Materials

Material shall conform to the requirements of Section 208.02(a) except where other types of aggregate material are specified in the Contract, in which case the applicable specifications governing the material shall apply. When material is obtained from local sources, the sources shall conform to the requirements of Section 106.03.

308.03—Procedures

Prior to placement of the subbase course, the subgrade shall be constructed in accordance with the requirements of the applicable provisions of Section 304 and Section 305.

Subbase material shall be mixed in an approved central mixing plant of the pugmill or other mechanical type in accordance with the requirements of Section 208.05. The mixed material shall be placed on the subgrade by means of an approved aggregate spreader, except that the use of such spreader will not be required where the material is being applied solely for the temporary maintenance of traffic or where the width of the course shown on the plans is transitional and impracticable to place with a spreader box.

Where the required thickness is more than 6 inches, the material shall be spread and compacted in two or more layers of approximately equal thickness. The compacted thickness of any one layer shall be not more than 6 inches. When vibrating or other

Comment [642]: Right Material

Comment [643]: Right Time/Right Way

Comment [644]: Right Way

Comment [645]: Right Quantity/Right Way

Trial Use and Comment

approved types of special compacting equipment are used, the compacted depth of a single layer of subbase course may be increased to 10 inches upon the approval of the Engineer.

Each layer of subbase course shall be compacted at optimum moisture, within ±2 percentage points of optimum. The density of each layer of subbase aggregate material, when compared to the theoretical maximum density as determined in accordance with the requirements of VTM-1, shall conform to the following:

% Material Retained on No. 4 Sieve	Min. % Density
0-50	100
51-60	95
61-70	90

Percentages shall be reported to the nearest whole number.

Not more than one sample in every five shall have a density less than that specified, and the density of such a sample shall be not more than 2 percent below that specified.

If the surface of the subbase becomes uneven or distorted and sets up in that condition, it shall be scarified, reshaped, and recompacted. If the subbase when compacted and shaped shows a deficiency in thickness or if depressions occur in the surface, the Contractor shall scarify such sections at his own expense before additional material is added.

Field density determinations will be performed with a nuclear field density device using the density control strip as specified in Section 304 and VTM-10 or in accordance with the requirements of AASHTO T191. The method of density determination will be as directed by the Engineer.

Comment [646]: Right Way/Right Documentation

308.04—Tolerances

Comment [647]: Right Way

The thickness of the subbase course will be determined by the depth measurement of holes dug in the subbase in accordance with the requirements of VTM-38B.

Acceptance of the subbase course for the physical property of depth will be based on the mean result of tests performed on samples taken from each lot of material placed. A *lot* of material is defined as the quantity being tested for acceptance except that the maximum lot size will be 2 miles of paver application width.

A lot will be considered acceptable for depth if the mean result of the tests is within the following tolerance of the plan depth for the number of tests taken except that each

Trial Use and Comment

individual test shall be within ±1.00 inch of the plan depth; mean of two tests, ±0.75 inch; mean of three tests, ±0.60 inch; and mean of four tests, ±0.50 inch.

If an individual depth test exceeds the ±1.00 inch tolerance, that portion of the lot represented by the test will be excluded from the lot. If the individual test result indicates that the depth of material represented by the test exceeds 1.00 inch, the Contractor will not be paid for that material in excess of the tolerance throughout the length and width represented by the test. If the individual test result indicates that the depth of the material represented by the test is deficient by more than 1.00 inch, correction of the subbase course represented by the test shall be made as specified herein.

If the mean depth of a lot of material is in excess of the allowable tolerance, the Contractor will not be paid for that material in excess of the tolerance throughout the length and width represented by the test.

If the mean depth of a lot of material is deficient by more than the allowable tolerance, correction will not normally be required and the Contractor will be paid for the quantity of material that has been placed in the lot.

For excessive depth subbase courses, when tonnage measurement is used, the rate of deduction from the tonnage allowed for payment as subbase material will be calculated at a weight of 110 pounds per square yard per inch of depth in excess of the tolerance. Areas that are deficient in depth by more than 1.00 inch and areas that do not provide a smooth uniform surface shall be scarified, material added or removed; reshaped; and recompacted to the specified density so as to conform with the depth tolerance and provide a smooth, uniform surface.

Comment [648]: Right Payment

308.05—Measurement and Payment

Comment [649]: Right Quantity/Right Payment

Subbase course will be measured in cubic yards or tons as specified and will be paid for at the contract unit price per cubic yard or ton. When the cubic yard unit is specified, the quantity will be determined by compacted measurements on the road unless otherwise specified. When the ton unit is specified, the quantity shall be determined in accordance with the requirements of Section 109.01.

This price shall include furnishing, hauling, placing, manipulating, and compacting subbase course; clearing and grubbing local pits; material royalties; and access roads.

Moisture in excess of optimum + 2 percentage points will be deducted from the net weight of both truck and rail shipments.

Payment will be made under:

Pay Item	Pay Unit

Trial Use and Comment

Aggregate material (No.)	Cubic yard or ton
Aggregate base material (Type and no.)	Cubic yard or ton

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review specification requirements,
- Verify source of material
- Review construction procedures
- Review measurement and payment.

Start:

- Perform roller pattern moisture and density control strips
- Monitor compaction

Intermittent inspection:

- Visual monitoring of material for any change in source
- Monitor for any change in compaction equipment
- Monitor compaction efforts per control strip, see Section 304.

Final Inspection:

- Verify Depth Tolerances, Payment
- Ensure surface of aggregate base is kept free from contamination and verify area stays protected for subsequent layers.

Documentation Required:

- Contractor's approved source of material, 208.02(a)
- Measurements for payment and or weigh tickets
- Contractor Furnished Sources, 106.03
- Payment computations

Engineers Approval/Authorization

Trial Use and Comment

IV. REVIEW QUESTIONS

Spec Ref.	
308.04	Does the depth of the subbase course meet the tolerances of the plan depth as specified?
308.03(1)	Has the material been placed on the subgrade using an aggregate spreader as specified?
308.03(2) [13000100]	Has the subbase course been compacted at specified moisture plus or minus 2 percentage points and to the minimum of 100% density with consideration of +4 material?
308.03(3)	If the surface of the subbase becomes uneven or distorted and sets up in that condition, was it scarified, reshaped, and recompacted?
308.03(4)	If the subbase when compacted and shaped shows a deficiency in thickness or if depressions occur in the surface, did the Contractor scarify the subbase before adding additional material?
	Is the material placed on subgrade using an aggregate spreader as specified?
	Is the subbase course compacted at specified moisture?
	Is the subbase surface scarified, reshaped and re-compacted if the surface became uneven or distorted?
	If the thickness is deficient, does the Contractor scarify the subbase prior to adding more material?

V. CRITICAL INSPECTION POINTS

- **Prior to placement-Ref. sect. 304/305**
- **Verification of depth-Ref. section 308.04**
- **Measurement and payment-Ref sect. 308.05**
- **Gather tickets and weigh sheet**

Trial Use and Comment

SECTION 309 - AGGREGATE BASE COURSE

I. INTRODUCTION:

The purpose of the aggregate base course is to:

- Provide a free draining material.
- Provide a frost resistant material on which to support other base or surface courses.
- Distribute traffic wheel loads transmitted to the embankment.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

309.01—Description

This work shall consist of furnishing and placing one or more courses of aggregates and additives, if required, on a prepared surface in accordance with the requirements of these specifications and in conformity with the lines, grades, and typical sections and cross sections shown on the plans or as established by the Engineer.

Comment [650]: Right Location

309.02—Materials

(a) **Aggregate material** shall conform to the requirements of Section 208.02(b) except where other types of aggregate material are specified, in which case the applicable specifications governing the material shall apply.

(b) **Calcium chloride and sodium chloride** shall conform to the requirements of Section 239.

Comment [651]: Right Material

309.04—Procedures

The surface or course upon which the base course is to be placed shall be prepared in accordance with the requirements of the applicable provisions of Section 304 and Section 305.

Comment [652]: Right Way

Trial Use and Comment

Base course material shall be mixed in an approved central mixing plant of the pugmill type. The mixed material shall be placed by means of an approved aggregate spreader.

A. Placing

Prior to placing aggregate material, the course upon which the material is to be placed should be carefully examined. Soft spots, ruts, and grade deficiencies should be corrected by removing, replacing, or regrading material where necessary. The Contractor should direct his hauling activity so that truck traffic is distributed over the entire width of the surface and not concentrated in one area.

The material should be placed according to the requirements of the Specifications. The aggregate is not to be dumped in piles, but is to be spread by use of spreaders. Precautions should be taken to avoid segregation; that is, the large stone separating from the fine portions. When segregation occurs, the Contractor must remove and replace the aggregate material or remix the material to conform to the requirements of the Specifications.

The maximum thickness of material which may be placed in one layer is limited to 6 inches compacted, unless approved by the Engineer. If vibratory compaction equipment is used, the thickness of the layers may be increased with the approval of the Construction Manager. If the specified thickness of the base course exceeds the maximum layer which can be effectively compacted in one spread, the course is to be constructed in at least two equal layers.

It is very important that the moisture content of the material be at or near optimum, at the time the aggregate is spread and compacted. Water added to the surface aids only the material near the surface. The material at the bottom of the layer does not receive the additional moisture; therefore, ultimate compaction will be less at that level.

The Inspector must perform density and moisture tests in accordance with the Manual of Instructions - Materials Division and Section 200 of this Manual.

309.05—Density Requirements

Where the required thickness is more than 6 inches, the material shall be spread and compacted in two or more layers of approximately equal thickness. The compacted thickness of any one layer shall not exceed 6 inches except when vibrating or other approved types of special compacting equipment are used. In such event, the compacted depth of a single layer of the base course may be increased to 10 inches upon the approval of the Engineer.

After mixing and shaping, each layer shall be compacted at optimum moisture within ±2 percentage points of optimum. The density of each layer of base aggregate material,

Comment [653]: Right Way

Comment [654]: Right Time

Comment [655]: Right Way/Right QuantityRight Documentation

Comment [656]: Right Documentation

Comment [657]: Right Way

Trial Use and Comment

when compared to the theoretical maximum density as determined in accordance with the requirements of VTM-1, shall conform to the following:

% Material Retained on No. 4 Sieve	Min. % Density
0-50	100
51-60	95
61-70	90

Percentages shall be reported to the nearest whole number.

Not more than one sample in every five shall have a density less than that specified, and the density of such sample shall be not more than 2 percent below that specified. The surface of each layer shall be maintained during the compaction operations in a manner such that a uniform texture is produced and the aggregates are firmly keyed. Water shall be uniformly applied over the base materials during compaction in the amount necessary to obtain proper density.

Irregularities in the surface shall be corrected by scarifying, remixing, reshaping, and recompacting until a smooth surface is secured. The surface shall thereafter be protected against the loss of fine materials by the addition of moisture, when necessary, and shall be maintained in a satisfactory and smooth condition until accepted by the Engineer.

The base course will be tested in place for depth and density. Field density determinations will be performed with a nuclear field density device, using a density control strip as specified in Section 304 and VTM-10, or in accordance with the requirements of AASHTO T191. The method of density determination will be as directed by the Engineer.
Acceptance of the aggregate base course for depth will be based on the requirements of Section 308.

Comment [658]: Right Way

309.06—Measurement and Payment

Comment [659]: Right Payment

Aggregate base course will be measured in cubic yards or tons, as specified, and will be paid for at the contract unit price per cubic yard or ton. When the cubic yard unit is specified, the quantity will be determined by compacted measurements on the road unless otherwise specified. When the ton unit is specified, the quantity shall be determined in accordance with the requirements of Section 109.01 and moisture, in excess of optimum + 2 percentage points, will be deducted from the net weight of both truck and rail shipments.

Calcium chloride and sodium chloride will be measured in tons and will be paid for at the contract unit price per ton.

These prices shall include preparing and shaping the subgrade or subbase and shoulders, adding moisture, removing and replacing unstable subgrade or subbase and constructing the base course thereon, and filling test holes.

Trial Use and Comment

Payment will be made under:

Pay Item	Pay Unit
Aggregate base material (Type/no.)	Cubic yard or ton
Aggregate material (No.)	Cubic yard or ton
Calcium chloride	Ton
Sodium chloride	Ton

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review specification requirements
- Verify source of materials
- Review construction procedures
- Review measurement and payment.

Start:

- Perform roller pattern moisture and density control strips
- Monitor compaction efforts per control strip, see Section 304.
- Monitor for any change in compaction equipment

Intermittent inspection:

- Monitoring material for any change in source of materials

Final Inspection:

- Verify Depth Tolerances
- Verify Payment
- Ensure aggregate base is kept free from contamination and verify area stays protected for subsequent layers.

Documentation Required:

- Contractor's approved source of material, 208.02
- Measurements for payment and or weigh tickets
- Contractor Furnished Sources, 106.03
- Payment computations

Engineers Approval/Authorization

IV. REVIEW QUESTIONS

Spec Ref.	
308.04	Does the depth of the subbase course meet the tolerances of the plan depth as specified?
308.03(1)	Has the material been placed on the subgrade using an aggregate spreader as specified?

Trial Use and Comment

308.03(2) [13000100]	Has the subbase course been compacted at specified moisture plus or minus 2 percentage points and to the minimum of 100% density with consideration of +4 material?
308.03(3)	If the surface of the subbase becomes uneven or distorted and sets up in that condition, was it scarified, reshaped, and recompacted?
308.03(4)	If the subbase when compacted and shaped shows a deficiency in thickness or if depressions occur in the surface, did the Contractor scarify the subbase before adding additional material?
	Is material visually inspected for segregation when delivered to the project?
	Is the material placed on a properly graded and compacted course?
	Is the material placed using an approved aggregate spreader?
	Is the material placed in layers that meet the requirements of the Specifications?
	Is the material shaped to the proper grade?
	Is the material placed and compacted at optimum moisture?
	Are weigh tickets, Forms TL-102As and density reports filed as part of the project records?

V. CRITICAL INSPECTION POINTS

• **Prior to placement**
• **Verify density tolerances in accordance with VTM-1**
• **Verify field density per VDOT R&B spec. 304 and VTM-10 or in accordance with AASHTO T191**

Trial Use and Comment

SECTION 310 – TACK COAT

I. INTRODUCTION:

A tack coat consists of applying an asphalt material, usually at a specified rate per square yard, upon an existing pavement surface to ensure a thorough bond between the old and new courses. Tack coats are used primarily in connection with asphalt pavements and are most important in helping to prevent slippage or pushing of the new surface under the strain of daily traffic.

Tack coats should be applied over the surface evenly in a thin mist or fog. A very light coverage is adequate. Too much tack will cause slippage rather than adhesion between the two layers. Excessive tack will also bleed and cause flushing at the surface along construction joints.

The Contractor should be cautioned against applying tack coats too far in advance of the placement of the next layer or course. If this is allowed, the tack coat will collect a film of dust and result in poor adhesion.

METHOD OF MEASUREMENT

Tack coat will not be considered for separate payment unless specified in the contract as a pay item.

a.) Forms:

- C-25 – Source of Materials

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

310.01—Description

This work shall consist of preparing and treating an existing asphalt or concrete surface with asphalt in accordance with the requirements of these specifications and in conformity with the lines shown on the plans or as established by the Engineer.

310.02—Materials

Asphalt for tack coat shall be CRS-1, CRS-2, CRS-1h, or CSS-1h and shall conform to the requirements of Section 210. CMS-2, conforming to the requirements of Section 210, may

Comment [660]: Right Location

Comment [661]: Right material

Comment [662]: Right material

Trial Use and Comment

be used during the winter months. With the exception of CMS-2, asphalt for tack coat may be diluted with 50 percent water provided that resulting material produces a uniform application of the tack.

310.03—Procedures

Equipment for heating and applying asphalt shall conform to the requirements of Section 314.04(b). The maximum application temperature of liquid asphalt shall conform to the requirements of Table III-1.

TABLE III-1
Liquid Asphalt Application Temperature

Grade	Max. Temperature (°F)
RC-70	180
RC-250	220
RC-800	225
RC-3000	290
MC-70	180
MC-250	220
MC-800	255
MC-3000	290
AC-5	300
AC-10	300
AC-20	300
AC-40	300
RS-2	175
SS-1h	180
AE-4	150
CRS-2	175
CSS-1h	180
CMS-2	200
CRS-1h	175
CRS-1	175

The existing surface shall be patched, cleaned, and rendered free from irregularities to the extent necessary to provide a reasonably smooth and uniform surface. Unstable corrugated areas shall be removed and replaced with suitable patching materials. The edges of existing pavements that are to be adjacent to new pavement shall be cleaned to permit adhesion of asphalt.

Tack material shall be uniformly applied with a pressure distributor conforming to the requirements of Section 314.04(b). Hand spray equipment shall not be used except in areas inaccessible by a pressure distributor. Undiluted asphalt shall be applied at the rate

Comment [663]: Right Way

Comment [664]: Right Way

Comment [665]: Right Way

Comment [666]: Right Quantity

Trial Use and Comment

of 0.05 to 0.10 gallons per square yard. Diluted asphalt shall be applied at the rate of 0.10 to 0.15 gallons per square yard.

The tack coat shall be applied in a manner to offer the least inconvenience to traffic and permit one-way traffic without pick up or tracking of the asphalt.

The tack coat shall not be applied immediately prior to the course being placed. The tack coat shall be applied in accordance with the same weather limitations that apply to the course being placed. The quantity, rate of application, temperature, and areas to be treated shall be approved prior to application.

During the application of asphalt, care shall be taken to prevent spattering adjacent items. The distributor shall not be cleaned or discharged into ditches or borrow pits, onto shoulders, or along the right of way. When not in use, equipment shall be parked so that the spray bar or mechanism will not drip asphalt on the surface of the traveled way.

310.04—Measurement and Payment

Tack coat, when a pay item, will be measured in gallons and will be paid for at the contract unit price per gallon. When not a pay item, the cost thereof shall be included in the price for other appropriate pay items.

Patching will be paid for at the contract unit price for the various items used unless a reconditioning item is included in the Contract.

Payment will be made under:

Pay Item	**Pay Unit**
Tack coat	Gallon

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting: Review specification requirements, material documentation, construction procedures, measurement and payment.

Start: Check Source of Materials (Form C-25) and Bill of Ladings for correct materials, and ensure existing surface is clean and dry, liquid asphalt is at correct temperature, and application rate is uniform.

Comment [667]: Right Quantity

Comment [668]: Right Payment

Comment [669]: Right Payment

Trial Use and Comment

Continuous Inspection: Monitor temperature of the liquid asphalt, application rate, and coverage area.

Final Inspection: Prior to covering with asphalt ensure that tack is not damaged or contaminated and that there is proper coverage on the existing surface and joints.

Documentation Required:

- Source of Materials (Form C-25)
- Invoices (Bill of Ladings)

IV. REVIEW QUESTIONS

Spec Ref.	
310.02	Does the type and grade of liquid asphalt comply with contract requirements?
310.03(1)	Does the liquid asphalt material application temperature conform to the requirements of table for Liquid Asphalt Application Temperature?
310.03(2)	During the application of asphalt, has care been taken to prevent spattering adjacent items?
310.03(3)	When not in use, has the distributor(s) been parked so that the spray bar or mechanism will not drip asphalt on the surface of the traveled way?
310.03(4)	Has the existing surface been patched, cleaned, and rendered free from irregularities to the extent necessary to provide a reasonably smooth and uniform surface?
310.03(5)	Have the vertical edges of the existing pavements that are adjacent to new pavements been cleaned to permit adhesion of the asphalt?
310.03(6)	Has asphalt been applied at the specified rate per square yard?
310.03(7)	Has the tack coat been applied in accordance with the same weather limitations that apply to the course being placed?
314.04	Do the spreaders, distributers, and rollers conform to the requirements for equipment in the specifications for surface treatments?
315.05(b)3	Have all contact surfaces and cold joints of asphalt been painted as required prior to asphalt placement?
315.05(b1)1	Has a tack or prime coat of asphalt been applied as specified?
315.05(b1)2	Have asphalt cutbacks or emulsions been applied and allowed to form a tacky residue prior to placing the paving mixture?
315.05(b1)3	Have tack or prime coats which have become damaged or contaminated been repaired prior to placing the paving mixture?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Verify proper materials**
• **Verify temperature of liquid asphalt**
• **Verify application rate and coverage area**

Trial Use and Comment

SECTION 311- PRIME COAT

INTRODUCTION:

A) FORMS:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

This work shall consist of preparing and treating an existing surface with asphalt, and cover material if required, in accordance with the requirements of these specifications and in conformity with the lines shown on the plans or as established by the Engineer.

311.02—Materials

(a) **Asphalt** may be changed one viscosity grade by the Engineer during construction at no change in the contract unit price. Asphalt shall conform to the applicable requirements of Section 210

(b) **Cover material** shall conform to the applicable requirements of **Section 202 or Section 203**. Lightweight aggregate shall conform to the requirements of **Section 206**. Cover material shall not be hauled directly from a washing plant for immediate use in the work.

311.03—Procedures

The rates of application of materials shall be determined in accordance with the method described in Education Series No. 12 of the Asphalt Institute entitled *Asphalt Surface Treatments Construction Techniques.*

The weather limitations of Section 314.03 shall apply to asphalt prime coat work. When asphalt is to be used as a cover for cement stabilization or as a primer for asphalt concrete, the weather limitations specified for these particular operations shall apply.

Equipment for heating and applying asphalt and cover material shall conform to the requirements of Section 314.04. The maximum application temperature of the liquid asphalt shall conform to the requirements of Table III-1 in Section 310.03.

Comment [670]: Right Material

Comment [671]: Right Way

Comment [672]: Right Time / Right Way

Trial Use and Comment

The surface to be primed shall be shaped to the required grade and section; rendered free from ruts, corrugations, segregated material, or other irregularities; and uniformly compacted.

Delays in priming may necessitate reprocessing or reshaping to provide a smooth, compacted surface.

Asphalt shall be applied by means of a pressure distributor in a uniform continuous spread. When traffic is maintained, not more than 1/2 the width of the section shall be treated in one application. Care shall be taken that the application of asphalt at junctions of spreads is not in excess of the specified amount. Excess asphalt shall be removed from the surface by a squeegee. Skipped areas or deficiencies shall be corrected.

During the application of asphalt, care shall be taken to prevent spattering adjacent items. The distributor shall not be cleaned or discharged into ditches or borrow pits, onto shoulders, or along the right of way. When not in use, equipment shall be parked so that the spray bar or mechanism will not drip asphalt on the surface of the traveled way.

When traffic is maintained, one-way traffic shall be permitted on the untreated portion of the roadbed. When the asphalt has been absorbed by the treated surface and will not pick up, traffic shall be transferred to the treated portion and the remaining width of the section primed.

The quantity, rate of application, temperature, and areas to be treated shall be approved before application of the prime coat.

If after application of the prime coat the asphalt fails to penetrate within the time specified and the roadway must be used by traffic, cover material shall be spread at the Contractor's expense in an amount that will prevent pick up of the asphalt.

311.04—Measurement and Payment

Prime coat will be measured and paid for at the contract unit price per gallon for asphalt and per ton for cover material.

Payment will be made under:

Pay Item	Pay Unit
Prime coat	Gallon
Cover material (Type)	Ton

Comment [673]: Right Way

Comment [674]: Right Way

Comment [675]: Right Way

Comment [676]: Right Time

Comment [677]: Right Way

Comment [678]: Right Way

Comment [679]: Right Payment

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Approved Equipment-3.14.04, materials are approved, Asphalt Technician on site. Work Zone set correctly- Flaggers / follow truck, PPE all personnel.

Start:

- Weather conditions- 314.03, Temperature-limits, application rates and material spec., tested per Spec.202, 203, 206, 210.
- Work Zone correct, material checked,

Continues inspection:

- 1 Inspector- start up- daily per spec, Test reports- Asphalt/ cover material, Delivery Tickets, TL-102, Daily Sq Yd. quantities converted gallons- Asphalt adjustment?

Final Inspection:

- Prior to open to traffic

Documentation Required:

- Daily tickets, daily quantities for materials used, Delivery Tickets, TL-102, Daily Sq yd. quantities converted gallons- Asphalt adjustment? Sketches and calculations should be shown, and documented. Was there any material left in Distributor verify /quantify, All documentation agreed to daily and signed by inspector and contractor.

IV. REVIEW QUESTIONS

• Do the cover materials conform to the requirements of Specifications on aggregate materials?
• When asphalt is used as a cover for cement stabilization or as a primer for asphalt concrete, are the weather limitations specified for these particular operations met?
• Has the surface to be primed been shaped to the required grade and section; rendered free from ruts, corrugations, segregated material, or other irregularities; and uniformly compacted?
▪ Has the surface to be primed been shaped to the required grade and section; rendered free from ruts, corrugations, segregated material, or

Trial Use and Comment

other irregularities; and uniformly compacted?
▪ Has excess asphalt been removed at the junction of spreads?
▪ Has the prime been protected from traffic until the asphalt has penetrated and will not pick up?

V. CRITICAL INSPECTION POINTS

• Prior to Start up; Engineer preapproval of Equipment, certified Technician, materials, temperature, appl. Rates tested. Approval to start in writing.
• Correct work zone setup, certified flaggers if required.
• Surface prep been complete // Density

Trial Use and Comment

SECTION 312 - SEAL COAT

INTRODUCTION:

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

312.01—Description

This work shall consist of applying asphalt followed by applying cover material in accordance with the requirements of these specifications and in conformity with the lines shown on the plans or as established by the Engineer.

312.02—Materials

Comment [680]: Right Material

(a) **Asphalt** may be changed one viscosity grade by the Engineer during construction at no change in the contract unit price. Asphalt shall conform to the applicable requirements of **Section 210.**

(b) **Cover material** shall conform to the applicable requirements of Section 203. Lightweight aggregate shall conform to the requirements of **Section 206**. Cover material shall not be hauled directly from a washing plant for immediate use in the work.

312.03—Equipment

The following equipment or its equivalent is required:

(a) equipment for heating and applying asphalt conforming to the requirements of **Section 314.04(b)**

(b) a rotary power broom

(c) at least one pneumatic tire roller. Additional rollers that may be required may be tandem steel wheel or three-wheel rollers weighing at least 8 tons. The pneumatic tire roller shall be self-propelled, and the gross load adjustable to apply 200 to 350 pounds per inch of rolling width as directed. Tires shall be designed for a tire pressure of at least 90 pounds per square inch. Steel wheel rollers shall be

Comment [681]: Right Equipment

Trial Use and Comment

operated at a maximum speed of 3 miles per hour, and pneumatic tire rollers at a maximum speed of 5 miles per hour.

(d) a mechanical roller-type hopper or a self-propelled aggregate spreader of an approved design

312.04—Procedures

The rates of application of materials shall be determined in accordance with the method described in Education Series No. 12 of the Asphalt Institute entitled *Asphalt Surface Treatments Construction Techniques.*

The weather limitations specified in Section 314.03 shall apply to seal coat work.

Seal coating operations shall not be started until the surface is thoroughly compacted and cleaned of dust, mud, and foreign matter and the section to be sealed has been approved by the Engineer.

Asphalt shall be applied by means of a pressure distributor in a uniform continuous spread over the section to be treated and within the temperature range given in Table III-1. A strip of building paper at least 3 feet in width and having a length equal to that of the spray bar of the distributor plus 1 foot shall be used at the beginning of each spread. If the cutoff is not positive, the use of paper may be required at the end of each spread. The paper shall be removed and disposed of legally. The distributor shall be moving forward at the proper application speed at the time the spray bar is opened. Skipped areas and deficiencies shall be corrected. Junctions of spreads shall be carefully made to ensure a smooth riding surface.

The length of the spread of asphalt shall be regulated by the quantity of cover material in loaded trucks on the project.

The spread of asphalt shall be not more than 6 inches wider than the width covered by the cover material from the spreading device. Asphalt shall not be allowed to chill, set up, dry, or otherwise impair retention of the cover material.

During asphalt application, care shall be taken to prevent spattering adjacent items. The distributor shall not be cleaned or discharged into ditches or borrow pits, onto shoulders, or along the right of way. When not in use, equipment shall be parked so that the spray bar or mechanism will not drip asphalt material on the surface of the traveled way.

Immediately following asphalt application, cover material shall be applied in full-lane widths up to 12 feet. Laps shall be made only at lane dividers or at the crown of the roadway. Successive laps at lane dividers and the roadway crown shall be staggered from 3 to 6 inches. Spreading shall be accomplished in a manner so that the tires of the truck or aggregate spreader do not contact the uncovered and newly applied asphalt.

Comment [682]: Right Way

Comment [683]: Right Way

Comment [684]: Right Way / Right Material

Comment [685]: Right Way

Comment [686]: Right Way

Trial Use & Comment

If directed, cover material shall be moistened with water to eliminate or reduce dust coating of aggregate. Moistening shall be done the day before the use of aggregate.

Immediately after cover material is spread, deficient areas shall be covered by additional material. Rolling shall begin immediately behind the spreader and shall consist of at least three complete coverage's.

After application of cover material, the wearing surface shall be lightly broomed or otherwise maintained until cured as directed. Maintenance of the surface shall include distributing cover material over the surface to absorb free asphalt and cover any area deficient in cover aggregate. Maintenance shall be conducted so as not to displace embedded material. Excess material shall be swept from the surface by means of rotary brooms as required or as directed by the Engineer.

Comment [687]: Right Way

312.05—Measurement and Payment

Comment [688]: Right Payment

Seal coat will be paid for at the contract unit price per gallon for liquid asphalt and per ton for cover material.

Liquid asphalt will be measured in gallons.

Cover material will be measured in tons, complete-in-place, in accordance with the requirements of Section 109.01. These prices shall include furnishing and applying materials and maintaining the treatment.

Payment will be made under:

Pay Item	Pay Unit
Liquid asphalt	Gallon
Cover material (Type)	Ton

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Are their asphalt adjustments in the contract? (Per contract and asphalt adjustment.)
- Are materials and equipment preapproved, and tested. Correct application rates checked.
- Are materials being stored correctly? (Approved Location)
- Certified asphalt technician on site? (Copy of certification)

Trial Use and Comment

- TMP / Traffic / Work Zone / Flaggers, copies of certifications.
- Has areas been prepped correctly.

Start:

A. **Continuous inspection:** The final "pay" quantity of liquid asphalt material will be the quantity of gallons shown on the delivery tickets for full loads distributed, plus the converted quantities for partial loads. (Correction factors based on material at 60^0 F can be found in the *Manual of Instructions - Materials Division.*)

B. Records for documentation should include the following:

1. Test reports covering liquid asphalt material.
2. Test reports on cover aggregate used.
3. Delivery tickets of liquid asphalt material used.
4. TL-102 weigh sheets and certified delivery tickets for cover aggregate used. Quantities agreed to daily.

Final Inspection:

- Was area lightly broomed, after surface prep completed, if needed?

Documentation Required:

- **Daily documentation agreed to by Contractor and Inspector,sketches and calculations in hand and signed.**

Comment [689]: Right quantity,/payment

IV. REVIEW QUESTIONS

- Does the cover material conform to the Specification requirements for aggregate material?
- Are temperature limitations adhered to if asphalt is used as a cover material?
- Is the surface to be primed shaped to the required grade and section, free from ruts, corrugations, segregated material or other irregularities; and uniformly compacted?
- Is the prime protected from traffic until the asphalt penetrated?
- Was cover material applied immediately after liquid asphalt.(312.04)
- Shall be rolled immediately after cover material is applied.(312.04)

Trial Use and Comment

- Area to be lightly broomed.

V. CRITICAL INSPECTION POINTS

• Prior to startup; authorization to start by engineer, prior public awareness, work zone layout discussed and correct, material and equipment storage meets requirements,
• Documentation and daily quantity agreed to by contactor - inspector

Trial Use and Comment

SECTION 313 ASPHALT-STABLIZED OPEN-GRADED MATERIAL

I. INTRODUCTION:

a) <u>Forms</u>:

- Will be received from asphalt plant as load tickets and TL-102.

II. <u>2007 ROAD & BRIDGE SPECIFICATION and the 7R's</u>

313.01—Description

This work shall consist of furnishing and placing a course of asphalt-stabilized open-graded material on a prepared subbase or subgrade in accordance with the required tolerances in these specifications and in conformity with the lines and grades shown on the plans or established by the Engineer.

313.02—Materials

Asphalt-stabilized open-graded material shall conform to the requirements of Section 211 except as noted herein:

(a) **Coarse aggregate** shall be Grade A crushed stone conforming to the requirements of Section 203 and shall conform to the soundness requirements of surface course stone.

(b) **Fine aggregate** shall conform to the requirements of the Section 202.

(c) **Asphalt cement** shall be PG 70-22.

(d) **Reclaimed asphalt pavement** shall not be used as component material.

313.03—Proportioning

Stabilized open-graded material shall be designed to have an in-place coefficient of permeability of at least 1,000 feet per day when tested in accordance with VTM-84.

The following design range shall be used for asphalt-stabilized open-graded material:

Comment [690]: -Right Material

Comment [691]: Right Way

Trial Use and Comment

Sieve	% Passing	
	Min.	Max.
1 in	100	100
¾ in	88	100
½ in	70	90
No. 8	0	15
No. 200	0.5	4.5
Asphalt Content 4.3 ± 0.3%		

Hydrated lime shall be used in all mixtures at the rate of at least 0.5 percent by weight of the total dry aggregates. Chemical additives may be used in addition to or in lieu of lime with the approval of the Engineer. Such approval will be based on previous approvals of chemicals used with the same aggregates in asphalt concrete mixes of other types as detailed in Section 211.

The mix temperature shall be between 250 degrees F and 280 degrees F.

Design test data will not be required.

Drain down testing shall be performed in accordance with the requirements of VTM-100. Drain down shall not exceed 0.3 percent.

313.04—Acceptance

Acceptance of aggregate coating in asphalt-stabilized open-graded material shall be 100 percent surface coverage of the aggregate as verified by visual inspection by the Engineer.

313.05—Placing limitations

Stabilized open-graded material shall not be placed when weather or surface conditions are such that the material cannot be properly handled, finished, or compacted.

Asphalt-stabilized open-graded material shall be placed only when the atmospheric temperature is above 40 degrees F and the surface temperature upon which it is to be placed is no less than 35 degrees F.

The surface upon which mixtures are to be placed shall be free of standing water at the time such materials are placed.

Asphalt-stabilized open-graded course shall not be cooled with water.

Comment [692]: Right Material -Right Way

Comment [693]: Right Way

Comment [694]: Right Quantity

Comment [695]: Right Way

Comment [696]: Right Way

Comment [697]: Right Way

Trial Use and Comment

Vibratory rollers shall not be used on the asphalt-stabilized open-graded course.

313.06—Procedures

Stabilized open-graded material shall not be placed until the surface upon which it is to be placed has been approved by the Engineer. Preparation shall include provision for surface drainage away from the material to prevent contamination from surface water in the event of rainfall.

The Contractor shall prevent contamination of the stabilized open-graded material. Material that has been contaminated shall be removed and replaced promptly by the Contractor at no additional expense to the Department. Likely indications of contamination include, but are not limited to, the surface being clogged by dirt or other foreign material or observable material damaged as in the cases of loss of material stability.

The finished surface of the stabilized open-graded material shall be uniform and shall not vary at any point more than 0.5 inch above or below the grade shown on the plans or established by the Engineer.

Stabilized open-graded material with a surface higher than 0.5 inch above the grade shown on the plans or established by the Engineer shall be removed and replaced with material within the proper tolerance. If permitted by the Engineer, the high spots may be removed to within specified tolerance by any method that does not produce contaminating fines or damage the base to remain in place, except that grinding will not be permitted.

Stabilized open-graded material with a surface lower than 0.5 inch below the grade shown on the plans or established by the Engineer shall be removed and replaced with stabilized open-graded material that complies with these specifications to the proper tolerance or, if permitted by the Engineer, low areas may be filled with the next pavement course in the same operation in which the pavement is placed at no additional cost to the Department.

The Contractor shall not use the open-graded course as a haul road or storage area. Construction traffic will not be permitted on the open-graded course except for equipment required to place the next layer. Haul vehicles that are overweight or that have not had a legal load determination will not be permitted on the open-graded drainage course for any purpose.

Comment [698]: Right Way

Asphalt-stabilized open-graded material shall be placed in one layer by approved equipment conforming to the requirements of Section 315.03. Compaction shall begin when the internal mat temperature is approximately 150 degrees F to 200 degrees F. A static, steel, two-wheel roller shall compact the material in one to three passes in an established pattern approved by the Engineer. An 8- to 10-ton roller is recommended for

such use. The mat shall be compacted sufficiently to support the placement of the next layer but not to the point that it is not free draining or that the aggregate is crushed.

Placement of the next higher pavement layer shall be suspended if any damage to the stabilized open-graded material is visible. Construction of the next layer shall not proceed until directed by the Engineer.

Comment [699]: Right Way

313.07—Measurement and Payment

Comment [700]: Right Payment

Asphalt-stabilized open-graded material will be measured in tons and paid for at the contract unit price per ton, complete-in-place. This price shall be full compensation for furnishing and placing asphalt material including aggregate, lime, or other anti-stripping admixture.

Payment will be made under:

Pay Item	Pay Unit
Asphalt-stabilized open-graded material	Ton

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:
Work Zone planned and Safe-- certified traffic person on site , Approved asphalt installer/ technician, Approved equipment, Approved Materials, correct locations identified, Test batch been completed at plant.(NO STANDING WATER on sub grade) Weather conditions, haul equipment clean and correct number of trucks for continues placement to meet 1,000 ft. minimum. Roller Compaction rate known (NO VIBRATORY PASSES, No water to assist cooling).
Public awareness notification of work zone, call EOC.

Start:
Check grade, no density test required—consolidation is required, temperatures, and document that it meets specifications.
Recheck Traffic plan and safe work area. EOC notification of work zone!
All equipment on site and ready! Technicians on scene!

Continuous inspection:
1 inspector Surface Treatment
2 inspectors Open Graded Asphalt

Final Inspection:

Trial Use and Comment

Have all the areas been repaired or corrected of contaminated material- within .5 inch of established grade. Protect asphalt section from being used for a haul road or storage area. Is the drainage layer free draining?

Documentation Required:

- Delivery Tickets, TL- 102, Daily Quantity reports checked and quantified.
- Sketches and calculation are to be shown in project records. Did they meet the 1000Ft.mimium?

IV. REVIEW QUESTIONS

• Has the asphalt stabilized open-graded coarse been placed in accordance with the specifications?
• Does the Asphalt Cement Stabilized Open-Graded Material conform to the requirements of this section?
• Has the Asphalt Stabilized Open-Graded Material been placed in accordance with the weather limitations referenced in this section?
• Is the surface upon which the Stabilized Open-Graded Material is to be placed free of standing water at the time of placement?
• Has Asphalt Cement Stabilized Material not been cooled with water?
• Have vibratory rollers not been used on the Asphalt Cement Stabilized Material?
• Has the surface upon which the Open-Graded Material is to be placed been properly graded to drain away from the Material to prevent contamination fro surface water in the event of rainfall?
• Has contaminated material been promptly removed and replaced in accordance with this section?
• Is the finished surface of the Asphalt Stabilized Open-Graded Material uniform without varying more than .5 inch above or below the grade shown on the plans or established by the Engineer?
• Has Asphalt Stabilized Open-Graded Material that is higher or lower than .5 inch of the established grade been corrected in accordance with this section?

V. CRITICAL INSPECTION POINTS

• Screed and Material Temperatures - continues
• Material depth, before and after compaction to meet tolerance. • (on Grade)--- Continuously.

Trial Use and Comment

SECTION 314 - PENETRATION SURFACE COURSE

I. INTRODUCTION:

Penetration surface courses are typically used for low volume roadways or temporary traffic situations to minimize the continual maintenance of unpaved surfaces. Penetration courses consist of placement of liquid asphalt of a designated grade and covering the asphalt with natural or manmade aggregate of a described particle size.

a) Forms:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

314.01—Description

This work shall consist of constructing a wearing surface of crushed stone, slag, or crushed gravel penetrated with asphalt in accordance with the requirements of these specifications and in conformity with the lines shown on the plans or as established by the Engineer.

314.02—Materials

(a) **Asphalt** may be changed one viscosity grade by the Engineer during construction at no change in the contract unit price. Asphalt shall conform to the applicable requirements of Section 211.

(b) **Aggregate** shall be crushed stone, slag, or crushed gravel that conforms to the applicable requirements of Section 203. Aggregate shall not be hauled directly from a washing plant and used in the work.

(c) **Fine aggregate** shall be Grading B sand conforming to the requirements of Section 202.

314.03—Weather Limitations

Penetration courses shall not be placed when surfaces are wet, when the air temperature is below 50 degrees F, or when the surface temperature is below 70 degrees F. The Contractor shall furnish a properly calibrated infrared instrument for the purpose of measuring the surface temperature and shall measure the surface temperature prior to placement.

Comment [701]: Right Time

Trial Use and Comment

314.04—Equipment

Comment [702]: Right Way

Equipment shall be approved prior to performance of the work. Equipment that will handle the materials and produce the completed course or courses in accordance with the requirements of these specifications is acceptable.

(a) **Spreaders:** Spreaders for coarse aggregate shall be self-propelled spreading and leveling machines or spreader boxes equipped with shoes or runners of sufficient width and length to preclude damage or displacement of the subgrade or other courses.

The mechanical spreader for the fine aggregate shall conform to the requirements of Section 312.03.

(b) **Distributor:** The distributor shall be so designed, equipped, maintained, and operated that asphalt at the specified temperature range may be applied uniformly on variable widths of surface up to 15 feet at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard, with uniform pressure, and with an allowable variation from any specified rate not to exceed 0.02 gallon per square yard. Distributor equipment shall include a tachometer, pressure gages, accurate volume-measuring devices, or a calibrated tank and a thermometer for measuring temperatures of the contents of the tanks. Distributors shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically. The distributor shall be equipped with a positive shutoff control that will prevent lapping at the junction of two applications. When necessary, the distributor shall be equipped with a positive means of deflecting the spray to prevent coating of adjacent structures and appurtenances. A connection shall be provided and hand-spraying equipment shall be used to cover variable-width areas, patches, and other areas where spray bar application is impractical or would result in excessive asphalt material.

(c) **Rollers:** The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density.

314.05—Procedures

Cover material shall be applied in full-lane widths up to 12 feet. Laps shall be made only at lane dividers or at the crown of the roadway. Successive laps at lane dividers and the crown of the roadway shall be staggered from 3 to 6 inches.

Comment [703]: Right Way

Conditioning of the road surface shall conform to the requirements of Section 312.04.

(a) **Rates of Application:**

Trial Use and Comment

	Asphalt (gal/sq yd)	Aggregate (lb/sq yd)
Light Courses		
Coarse aggregate No. 56		60-139
Asphalt for penetration	0.75-1.20	
hoke aggregate		
No. 68, or		20-30
No. 78, or		22-28
No. 8, or		18-25
Grading B sand		10-15
Asphalt for seal	0.15-0.30	
Seal aggregate, No. 78, or		22-28
Seal aggregate, No. 8		18-25
Heavy Courses		
Asphalt for tack coat	0.10-0.20	
Coarse aggregate, No. 56		140-200
Asphalt for penetration	1.30-1.80	
Choke aggregate, No. 68		20-30
Asphalt for seal	0.20-0.35	
Seal aggregate, No. 78 or		22-28
Seal aggregate, No. 8		18-25

(b) **Sequence and Methods:**

1. If deemed necessary or specified, a tack coat shall be applied in accordance with the requirements of Section 310 immediately prior to the application of coarse aggregate.

2. The coarse aggregate shall be uniformly spread on the prepared base or surface at the specified rate of application. This application shall be mixed and shaped by the use of multiple-blade road planers or other approved equipment.

   Immediately following mixing and shaping operations, the surface shall be rolled with a 10-ton three-wheel or tandem steel wheel roller and, for a heavy penetration surface course, uniformly choked with No. 68 aggregate. The surface will be tested by the Engineer using a 10-foot straightedge. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall be not more than 1/4 inch. Humps or depressions exceeding the specified tolerance shall be corrected. For a light penetration course, the coarse aggregate shall be uniformly choked with the fine aggregate.

3. The prepared course shall be penetrated with asphalt at the rate specified and immediately covered with the choke aggregate. Rolling operations shall immediately follow the application of covering aggregate and shall continue until the treatment is

Comment [704]: Right Time

Comment [705]: Right Time

Comment [706]: Right Way

Comment [707]: Right Time

Trial Use and Comment

bonded. Subsequent rolling and applications of covering aggregate, if required, shall be performed on successive days following the application.

4. After the penetration course has cured, a seal coat shall be applied and rolled.

Comment [708]: Right Time

314.06—Measurement and Payment

Comment [709]: Right Quantity, Right Payment

Asphalt will be measured in gallons.

Aggregate and **cover material** will be measured in tons, complete-in-place, in accordance with the requirements of Section 109.01.

Penetration surface course will be paid for at the contract unit price per gallon for asphalt and per ton for aggregate and cover material.

These prices shall include furnishing and applying materials and maintaining the treatment.

Payment will be made under:

Pay Item	Pay Unit
Liquid asphalt	Gallon
Cover material (Type)	Ton
Aggregate (No.)	Ton

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Have prior approval of base (width, depth, compaction and typical section) on which course will be placed.
- Correct type of liquid asphalt.
- Correct type of cover material.

Start:

- Test application rates of liquid and aggregate.
- Check surface temperature in “cool” spots on area to be treated.
- Ensure all traffic control is in place and functioning properly

Continuous inspection:

- Monitor application by random check (is asphalt distributor covering anticipated length of pull); use of proper traffic control in accordance with VWPM and/or contract.
- Liquid is covered by aggregate while asphalt is still viscous.

Final Inspection:

- Review for proper cover, Is asphalt “bleeding” through cover.

Documentation Required:

- Certified asphalt tickets, aggregate tickets and weighsheets.*
- Ensure all measurements are recorded and documented for items that require them.
- *Portions of this section are applicable to maintenance contracts where quantity is measured by square yard.

IV. REVIEW QUESTIONS

Spec Ref.	
314.03	Is the Contractor complying with the weather limitations for application of various surface treatments?
314.04	Do the spreaders, distributors and rollers conform to the requirements for equipment in the specifications for surface treatments?

• Need equipment to monitor application rates of stone and aggregate.
• Need calibrated scales and metal templates for monitoring process.
• Contractor is required to furnish infrared thermometer for checking surface temperature.

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Pre-approval of base on which penetration course is to be placed.**
• **Weather and temperature are adequate for application**
• **Continuous application at proper rate and timely placement of aggregate**

Trial Use and Comment

SECTION 315 - ASPHALT CONCRETE PAVEMENT

I. INTRODUCTION:

Follow: Contract and Special Provision Copied Notes shown in contract. (Known as Volume 2 of PLANT MIX schedules)

a) Forms:

- **TL-54 , TL-56 , TL-57 , TL-58 , TL-60**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

315.01—Description

This work shall consist of constructing one or more courses of asphalt concrete on a prepared foundation in accordance with the requirements of these specifications and within the specified tolerances for the lines, grades, thicknesses, and cross sections shown on the plans or as established by the Engineer.

315.02—Materials

Comment [710]: Right Way / Right Materials

(a) **Asphalt concrete** shall conform to the requirements of Section 211. If SUPERPAVE design densities begin to exceed 98 percent of the theoretical maximum density during construction, the Contractor shall alter the design.

(b) **Asphalt for tack coat and prime coat** shall conform to the requirements of Section 310. Asphalt may be changed one viscosity grade by the Engineer at no change in the contract unit price.

(c) **Curb backup material** shall be asphalt concrete conforming to any surface or intermediate mixture listed in Table II-13 and Table II-14.

(d) **Liquid asphalt coating (emulsion) for rumble strip** shall conform to the requirements of Section 210.

315.03—Equipment

Comment [711]: Right Way

Trial Use and Comment

(a) **Hauling Equipment:** Trucks used for hauling asphalt mixtures shall have tight, clean, smooth metal bodies equipped with a positive locking metal tailgate. Metal surfaces in contact with asphalt mixtures shall be given a thin coat of an aliphatic hydrocarbon invert emulsion release agent (nonpuddling), a lime solution, or other material on the Department's list of approved release agents. Except where a nonpuddling release agent is used, the beds of dump trucks shall be raised to remove excess agent prior to loading. Only a nonpuddling agent shall be used in truck beds that do not dump. Each truck shall be equipped with a tarpaulin or other cover that will protect the mixture from moisture and foreign matter and prevent the rapid loss of heat during transportation.

(b) **Asphalt Pavers:** The asphalt paver shall be designed and recommended by the manufacturer for the type of asphalt to be placed and shall be operated in accordance with the manufacturer's recommendations. Written recommendations pertaining to handling and placing the mix shall be made readily available on the project site to the Engineer. In the absence of the manufacturer's recommendations, the recommendations of the National Asphalt Pavement Association shall be followed. The paver, including when screed extensions are used, shall be capable of producing a smooth uniform texture, dense joints, and a smooth riding surface.

(c) **Rollers:** Rollers shall be steel wheel, static or vibratory, or pneumatic tire rollers and shall be capable of reversing without backlash. Rollers shall be operated at speeds slow enough to avoid displacement of the mixture. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. The use of equipment that results in excessive crushing of aggregate or marring of the pavement surface will not be permitted.

If during construction the equipment being used mars the surface to the extent that imperfections cannot satisfactorily be corrected or produces permanent blemishes, the use of the equipment shall be discontinued and the equipment shall be replaced with satisfactory units.

(d) **Rotary Saw:** A gasoline-powered rotary saw with a carbide blade shall be furnished for cutting test samples from the pavement. The Contractor shall furnish gasoline, oil, additional carbide blades, and maintenance for the rotary saw. The Contractor shall cool the pavement prior to sawing the sample. In lieu of a rotary saw, the Contractor may furnish the necessary equipment for coring and testing 4-inch core samples in accordance with the requirements of VTM-22.

315.04—Placement Limitations

Comment [712]: Right Way

upon which asphalt mixtures are to be placed shall be free of standing water, dirt, and mud and the base temperature shall conform to the following:

Asphalt concrete mixtures shall not be placed when weather or surface conditions are such that the material cannot be properly handled, finished, or compacted. The surface

Trial Use and Comment

(a) **When the base temperature is above 80 degrees F,** mixture laydown will be permitted at any temperature conforming to the limits specified in Section 211.

(b) **When the base temperature is between 40 degrees F and 80 degrees F,** the Nomograph, Table III-2, shall be used to determine the minimum laydown temperature of the asphalt concrete mixes. At no time should the minimum base and laydown temperatures be less than the following:

Comment [713]: Right Time

Mix Designation	Minimum Base Temperature	Minimum Laydown Temperature
A	40˚F	250˚F
D	50˚F	270˚F
E	50˚F	290˚F
M	50˚F	290˚F
S	50˚F	290˚F

The maximum temperature of the mixture shall conform to the requirements of Section 211.08.

(c) **When the laydown temperature is between 301 degrees F and 325 degrees F,** the number of compaction rollers will be the same number as required for 300 degrees F.

Intermediate and base courses that are placed at rates of application that exceed the application rates shown in Table III-2 shall conform to the requirements for the maximum application rate shown for 8-minute and 15-minute compaction rolling as per number of rollers used.

Should the Contractor be unable to complete the compaction rolling within the applicable 8-minute or 15-minute period, the placing of asphalt mixture shall either cease until sufficient rollers are used or other corrective action is taken to complete the compaction rolling within the specified period.

Compaction rolling shall be completed prior to the mat cooling down to 175 degrees F. Finish rolling may be performed at a lower mat temperature.

The final asphalt pavement finish course shall not be placed until construction pavement markings are no longer required.

315.05—Procedures

Comment [714]: Right Way

Trial Use and Comment

(a) **Base Course:** The subgrade or subbase shall be prepared as specified in Section 305. The course upon which the pavement is to be placed, including the area that will support the paving equipment, shall be graded and compacted to the required profile.

(b) **Conditioning Existing Surface:** When the surface of the existing pavement or base is irregular, it shall be brought to a uniform grade and cross section as directed by the Engineer. The surface on which the asphalt concrete is to be applied shall be prepared in accordance with the requirements of the applicable specifications and shall be graded and compacted to the required profile and cross section.

When specified, prior to placement of asphalt concrete, longitudinal and transverse joints and cracks in hydraulic cement concrete shall be sealed by the application of an approved joint sealing compound.

Comment [715]: Right Way

Contact surfaces of curbing, gutters, manholes, and other structures projecting into or abutting the pavement and cold joints of asphalt shall be painted with a thick, uniform coating of asphalt prior to placement of asphalt mixture.

1. **Priming existing surface:** A tack or prime coat of asphalt shall be applied between the existing surface and each asphalt course placed thereafter. The tack or prime coat shall conform to the applicable requirements of Section 310 and Section 311.

Comment [716]: Right Way

Asphalt classed as cutbacks or emulsions shall be applied ahead of the paving operations, and the time interval between applying and placing the paving mixture shall be sufficient to ensure a tacky residue providing maximum adhesion of the paving mixture to the base. The mixture shall not be placed on tack or prime coats that have been damaged by traffic or contaminated by foreign material. Traffic shall be excluded from such sections.

On rich sections or those that have been repaired by the extensive use of asphalt patching mixtures, the tack coat shall be eliminated when directed by the Engineer.

Priming: When asphalt concrete to be placed has a total thickness of 4 inches or more, priming with asphalt material will not be required on aggregate subbase or base material.

Tacking: Application of tack at joints, adjacent to curbs, gutters, or other appurtenances, shall be applied with a hand wand at the rate of 0.2 gallon per square yard. At joints, the tack applied by the hand wand shall be 2 feet in width with 4 to 6 inches protruding beyond the joint for the first pass. Tack for the adjacent pass shall completely cover the vertical face of the mat edge, so that slight puddling of asphalt occurs at the joint, and extend a minimum of 1 foot into the lane to be paved. Milled faces that are to remain in place shall be tacked in the same way for the adjacent pass. Use of tack at the vertical faces of longitudinal joints will not be required when paving in echelon.

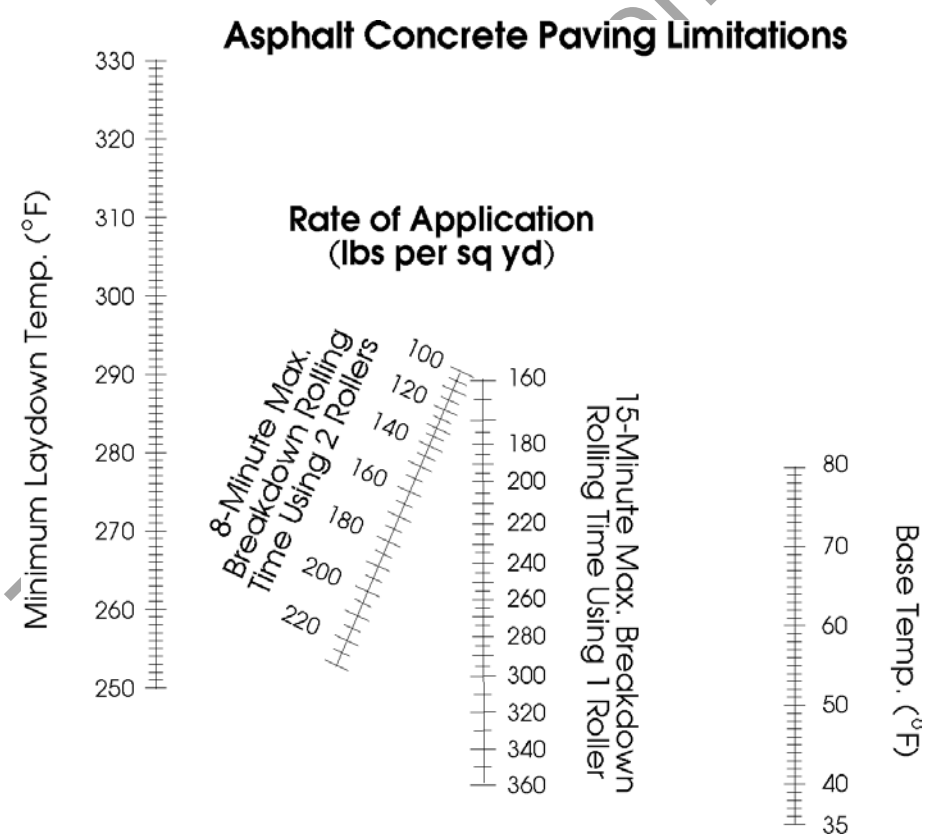
Trial Use and Comment

2. **Removing depressions and elevating curves:** Where irregularities in the existing surface would result in a course more than 3 inches in thickness after compaction, the surface shall be brought to a uniform profile by patching with asphalt concrete and thoroughly tamping or rolling until it conforms with the surrounding surface. The mixture used shall be the same as that specified for the course to be placed.

When the Contractor elects to conduct operations to eliminate depressions, elevate curves, and place the surface course simultaneously, he shall furnish such additional spreading and compacting equipment as required to maintain the proper interval between the operations.

TABLE III-2

Cold Weather Paving Limitations



(c) **Placing and Finishing:** Asphalt concrete shall not be placed until the surface upon which it is to be placed has been approved by the Engineer.

The edge of the pavement shall be marked by means of a continuous line placed and maintained a sufficient distance ahead of the paving operation to provide proper control of the pavement width and horizontal alignment.

An asphalt paver shall be used to distribute asphalt concrete over the widest pavement width practicable. Wherever practicable and when the capacity of sustained production and delivery is such that more than one paver can be operated, pavers shall be used in echelon to place the wearing course in adjacent lanes. Crossovers, as well as areas containing manholes or other obstacles that prohibit the practical use of mechanical spreading and finishing equipment, may be constructed using hand tools. However, care shall be taken to obtain the required thickness, jointing, compaction, and surface smoothness.

The longitudinal joint in one layer shall offset that in the layer immediately below by approximately 6 inches. However, the joint in the wearing surface shall be at the centerline of the pavement if the roadway comprises two traffic lanes or at lane lines if the roadway is more than two lanes in width. Offsetting layers will not be required when adjoining lanes are paved in echelon and the rolling of both lanes occurs within 15 minutes after lay down.

The Contractor shall have a certified Asphalt Field Technician present during paving operations where more than 100 tons of material is placed in a single location. Immediately after placement and screeding, the surface and edges of each layer shall be inspected and straightedge by the technician and necessary corrections performed prior to compaction. The finished pavement shall be uniform and smooth.

The placement of asphalt concrete shall be as continuous as possible and shall be scheduled such that the interruption occurring at the completion of each day's work will not detrimentally affect the partially completed work. Material that cannot be spread and finished in daylight shall not be dispatched from the plant unless the use of artificial lighting has been approved. When paving is performed at night, sufficient light shall be provided to properly perform and thoroughly inspect every phase of the operation. Such phases include cleaning planed surfaces, applying tack, paving, compacting, and testing. Lighting shall be provided and positioned such as to not create a blinding hazard to the traveling public.

During compaction of asphalt concrete, the roller shall not pass over the end of freshly placed material except when a construction joint is to be formed. Edges shall be finished true and uniform.

Asphalt concrete SUPERPAVE pavement courses shall be placed in layers not exceeding 4.0 times the nominal maximum size aggregate in the asphalt mixture. The maximum thickness may be reduced if the mixture cannot be adequately placed in a single lift and compacted to the required uniform density and smoothness. The

Comment [717]: Right Time / Right Material

Comment [718]: Right Way /Right Quantity

Trial Use and Comment

minimum thickness for a pavement course shall be no less than 2.5 times the nominal maximum size aggregate in the asphalt mixture. Nominal maximum size aggregate for each mix shall be defined as one sieve size larger than the first sieve to retain more than 10 percent aggregate as shown in the design range specified in Section 211.03, Table II-13. Base courses to be placed in irregularly shaped areas of pavement, such as transitions, turn lanes, crossovers, and entrances, may be placed in a single lift.

Overlays in excess of 165 pounds per square yard or with a milled depth greater than 1 1/2 inches shall be squared up prior to opening to traffic.

The milled roadway areas that are to be opened to traffic, excluding curb and gutter sections, shall have drainage outlets cut through the shoulder at locations designated by the Engineer. The Contractor shall plan and prosecute the milling operation to avoid the trapping of water on the roadway. Drainage outlets shall be restored to original grade, unless otherwise directed by the Engineer. The cost for cutting and restoring the drainage slots in the roadway shoulder shall be included in the price bid for other items of work.

Comment [719]: Right Way

The Contractor shall plan and prosecute a schedule of operations so that milled roadways will be overlaid with asphalt concrete as soon as possible. In no instance, shall the time lapse exceed 10 days after the milling operations, unless otherwise specified. The milled areas of the roadway shall be kept free of irregularities and obstructions that may create a hazard or annoyance to traffic in accordance with the requirements of Section 104.

A short ski or shoe shall be used to match the grade of the newly overlaid adjacent travel lane on primary, interstate, and designated secondary routes. Unless otherwise directed by the Engineer, a 24-foot minimum automatic grade control ski shall be used on asphalt mixtures on divided highways, with the exception of overlays that are less than full width and the first course of asphalt base mixtures over aggregate sub bases. Care shall be exercised when working along curb and gutter sections to ensure a uniform grade and joint.

The Contractor shall construct the final riding surface to tie into the existing surface by an approved method, which shall include the cutting of a notch into the pavement. In addition to notching, the Contractor may use an asphalt design containing a fine-graded mix to achieve a smooth transition from the new asphalt concrete overlay to the existing pavement, with the approval of the Engineer. The material shall be of a type to ensure that raveling will not occur. The cost for constructing tie-ins in the asphalt concrete overlay shall be included in the price bid for asphalt concrete.

(d) **Compacting:** Immediately after the asphalt mixture is placed and struck off and surface irregularities are corrected, the mixture shall be thoroughly and uniformly compacted by rolling.

Comment [720]: Right Way / Right Time

Trial Use and Comment

The surface shall be rolled when the mixture is in the proper condition. Rolling shall not cause undue displacement, cracking, or shoving.

The number, weight, and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. The sequence of rolling operations and the selection of roller types shall provide the specified pavement density.

Immediately after the hot mixture is placed, it shall be sealed with rollers. Thereafter, rolling shall be a continuous process, insofar as practicable, and all parts of the pavement shall receive uniform compaction.

Comment [721]: Right Way

Rolling shall begin at the sides and proceed longitudinally parallel with the center of the pavement, each trip overlapping at least 1/2 the roller width, gradually progressing to the crown of the pavement. When abutting a previously placed lane, the longitudinal joint shall be rolled first, followed by the regular rolling procedure. On super elevated curves, rolling shall begin at the low side and progress to the high side by overlapping of longitudinal trips parallel with the centerline.

Comment [722]: Right Way

Displacements occurring as a result of reversing the direction of a roller or other causes shall be corrected at once by the use of rakes or lutes and addition of fresh mixture when required. Care shall be taken in rolling not to displace the line and grade of the edges of the asphalt mixture.

To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with a very small quantity of detergent or other approved material. Excess liquid will not be permitted.

Along forms, curbs, headers, walls, and other places not accessible to rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or mechanical tampers. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.

Edges of asphalt pavement surfaces shall be true curves or tangents. Irregularities shall be corrected.

The surface of the compacted course shall be protected until the material has cooled sufficiently to support normal traffic without marring.

(e) **Density:** Density shall be determined in accordance with the following:

Comment [723]: Right Way

1. The Contractor shall perform roller pattern and control strip density testing on surface, intermediate, and base courses in accordance with the requirements of VTM-76. The Contractor shall have a certified Asphalt Field Technician perform all density testing.

Comment [724]: Right Way

Density shall be determined by the backscatter method of testing using a thin-lift nuclear gage with printer, conforming to the requirements of VTM-81. Density test locations for

Trial Use and Comment

the control strip and test sections shall be marked and labeled in accordance with the requirements of VTM-76. The Contractor shall furnish and operate the nuclear gage, which shall have been calibrated within the previous 12 months by an approved calibration service. In addition, the Contractor shall maintain documentation of such calibration service for a 12-month period. The required density of the compacted course shall be not less than 98.0 percent and not more than 102.0 percent of the target control strip density.

Comment [725]: Right Way

Nuclear density roller pattern and control strip density testing shall be performed on asphalt concrete overlays placed directly on surface treatment roadways and when overlays are placed at an application rate less than 125 pounds per square yard, based on 110 pounds per square yard per inch, on any surface. In these situations, sawed plugs or core samples will not be required and the minimum control strip densities as specified in Table III-3 will be waived. The required density of the compacted course shall be not less than 98.0 percent and not more than 102.0 percent of the target control strip.

Comment [726]: Right Way

TABLE III-3
Density Requirements

Mixture Type	Min. Control Strip Density (%)[1]
SM-9.5A, 12.5A	92.5
SM-9.5D, 12.5D	92.2
SM-9.5E, 12.5E	92.2
IM-19.0A	92.2
IM-19.0D	92.0
BM-25.0A, BM-25.0D	91.5

[1]The control strip density requirement is the percentage of theoretical maximum density of the job-mix formula by SUPERPAVE mix design or as established by the Engineer based on two or more production maximum theoretical density tests.

The project will be divided into "control strips" and "test sections" by the Engineer for the purpose of defining areas represented each series of tests.

a. **Control Strip:** Control strips shall be constructed in accordance with the requirements of these specifications and VTM-76.

Comment [727]: Right Way

The term *control strip density* is defined as the average of 10 nuclear determinations selected at stratified random locations within the control strip.

One control strip shall be constructed at the beginning of work on each roadway and shoulder course and on each lift of each course. An additional control strip shall be constructed when a change is made in the type or source of materials or compaction

Trial Use and Comment

equipment; whenever a significant change occurs in the composition of the material being placed from the same source; or when there is a failing control strip**.** During the evaluation of the initial control strip, paving operations may continue. However, paving and production shall be discontinued during construction and evaluation of additional control strips. In the event that two consecutive control strips fail, subsequent paving operations shall cease until corrective action(s) has been taken with the approval of the Engineer. If it is determined with the Engineer's approval that the density cannot be obtained because of the condition of the existing pavement structure, the target control strip density shall be determined from the roller pattern that achieves the optimum density and shall be used on the remainder of the roadway that exhibits similar pavement conditions.

Either the Engineer or Contractor may initiate an additional control strip at any time.

The length of the control strip shall be approximately 300 feet, regardless of the width of the course being placed. On the first day of construction or beginning of a new course, the control strip shall be started between 500 and 1,000 feet from the beginning of the paving operation. The control strip shall be constructed using the same paving, rolling equipment, procedures, and thickness as shall be used on the remainder of the course being placed.

One nuclear reading shall be taken at each of 10 stratified random locations. No determination shall be made within 12 inches of the edge of any application width for surface and intermediate mixes or within 18 inches of the edge of any application width for base mixes. The average of these 10 determinations shall be the control strip density recorded to the nearest 0.1 pound per cubic foot. The minimum control strip density shall be determined in accordance with the requirements of VTM-76.

The control strip shall be considered a lot. If the control strip density conforms to the requirements specified in Table III-3, the control strip will be acceptable and the control strip density shall become the target control strip density. If the density does not conform to the requirements specified in Table III-3, the tonnage placed in the control strip and any subsequent paving prior to construction of another control strip will be paid for in accordance with Table III-4 on the basis of the percentage of the Table III-3 value achieved. The Contractor shall take corrective action(s) to comply with the density requirement specified in Table III-3.

TABLE III-4
Payment Schedule for Lot Densities

% of Target Control Strip Density	% of Payment
Greater than 102.0	95
98.0 to 102.0	100
97.0 to less than 98.0	95
96.0 to less than 97.0	90
Less than 96.0	75

Trial Use and Comment

b. **Test section (lot):** For the purposes of acceptance, each day's production shall be divided into lots (test sections). The standard size of a lot shall be 5,000 linear feet of any pass made by the paving train regardless of the width of the pass of the thickness of the course. Pavers traveling in echelon will be considered as two passes. Each lot shall be divided into five sublots of equal length. When a partial lot occurs at the end of a day's production or upon completion of the project, the lot size shall be redefined as follows: If the partial lot contains one or two sublots, the sublots will be added to the previous lot. If the partial lot contains three or four sublots, the partial lot will be redefined to be an entire lot. Each lot shall be tested for density by taking a nuclear density reading from two random locations selected by the Engineer within each sublot. Readings shall not be taken within 12 inches of the edge of any application width for surface and intermediate mixes or within 18 inches of the edge of any application width for base mixes. The average of the sublot nuclear density readings will be compared to the target nuclear control strip density to determine the acceptability of the lot. Once the average nuclear density of the lot has been determined, the Contractor will not be permitted to provide additional compaction to raise the average. If two consecutive sublots produce nuclear density results less than 98 percent or more than 102 percent of the target nuclear control strip density, the Contractor shall immediately notify the Engineer and institute corrective action. By the end of the day's operations, the Contractor shall furnish the test data developed during the day's paving to the Engineer.

The tonnage of each lot will be based on the lot's width and length and the mixture application rate as designated in the Contract or as revised by the Engineer. Payment will be made in accordance with the requirements of Table III-4.

The Engineer at any time on any project may perform lot density verification testing. Lot density verification can be performed by using either a nuclear gage or plugs. The Contractor shall be responsible for taking plugs for testing. Testing of the plugs will be done by or in the presence of the Engineer.

Surface, Intermediate, and Base mixes:

When a nuclear gage is used, the Engineer will take 10 stratified random readings per lot. If, based on the average of the 10 readings, the density does not meet the requirement for 100 percent pay or the same pay percentage determined by the Contractor's testing for that lot, the Engineer will take readings at the 10 Contractor sites and then average the readings of the 20 sites. If the density still does not conform to the requirements for 100 percent pay, payment for that lot will be in accordance with Table III-4 on the basis of the Engineer's average of the 20 test results. If the Contractor questions the payment for the lot, the Contractor can request the referee procedure.

Comment [728]: Right Way

Trial Use and Comment

The referee procedure shall consist of the Department taking five plugs from the five sites closest to the average of the Engineer's readings of the Contractor and Department sites. The density of the plugs will be determined. If the average density of the plugs does not conform to the requirements for 100 percent pay for the lot in question, payment for that lot will be in accordance with the specifications in Table III-4 on the basis of the percentage of the Table III-3 value achieved.

When plugs are used for lot density verification, five plugs shall be taken per lot. If the density of the plugs does not conform to the requirements for the lot in question, payment for that lot will be in accordance with the specifications in Table III-4 on the basis of the percentage of the Table III-3 value achieved.

2. **Surface, intermediate, and base courses** not having a sufficient quantity of material to run a nuclear density roller pattern and control strip shall be compacted to a minimum density of 91.5 percent of the theoretical maximum density as determined in accordance with the requirements of VTM-22. The Contractor shall be responsible for cutting cores or sawing plugs for testing by the Department. If the density is less than 91.5 percent, payment will be made in accordance with the requirements of Table III-5.

TABLE III-5

Payment Schedule for Surface, Intermediate and Base Courses (Not sufficient quantity to perform nuclear density roller pattern and control)

% TMD	% of Payment
Greater than 91.5	100
90.2-91.4	95
88.3-90.1	90
Less than 88.2	75

Any section in which a mixture (e.g., SM-9.0) is being placed at an application rate of less than 125 pounds per square yard, based on 110 pounds per square yard per inch, that does not have a sufficient quantity of material for a nuclear density roller pattern and control strip shall be compacted by rolling a minimum of three passes with a minimum 8-ton roller. No density testing will be required.

(f) **Joints:** Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course. A coat of asphalt shall be applied to contact surfaces of transverse joints just before additional mixture is placed against the previously rolled material.

Joints adjacent to curbs, gutters, or adjoining pavement shall be formed by hand placing sufficient mixture to fill any space left uncovered by the paver. The joint shall then be set up with rakes or lutes to a height sufficient to receive full compression under the rollers.

Trial Use and Comment

- **Rumble Strips:** This work shall consist of constructing rumble strips on mainline shoulders of highways by cutting 1/2-inch-deep concave depressions into existing asphalt concrete surfaces as shown on the detail drawings and as directed by the Engineer.

  Rumble strips shall be installed in accordance with detail drawings for rumble strips (asphalt shoulder). The depressions shall have a concave circular shape with a minimum 1/2-inch depth at center and maximum 5/8-inch allowable depth at center. Depressions shall have a smooth finish with a maximum 1/16-inch variance between peaks and valleys of the depression.

  Prior to beginning production work on mainline shoulders, the Contractor shall demonstrate to the Engineer the ability to achieve the desired surface regarding alignment, consistency, and conformity with these specifications and the plans. The test site shall be approximately 25 feet longitudinally at a site mutually agreed upon by the Contractor and Engineer.

  Following cutting and cleaning depressions of waste material, the entire rumble strip area shall be coated with liquid asphalt coating (emulsion) using a pressure distributor at an approximate rate of 0.1 gallon per square yard. Overspray shall not extend more than 2 inches beyond the width of the cut and/or shall not come in contact with pavement markings.

  Rumble strips shall not be installed on shoulders of bridge decks, in acceleration/deceleration lanes, on surface drainage structures, or in other areas identified by the Engineer.

  Waste material resulting from the operation shall be removed from the paved surface and shall not be disposed of where waterways may be at risk of contamination.

(h) **Saw-Cut Asphalt Pavement:** This work shall consist of saw-cutting the existing asphalt pavement to a depth shown on the plans and as directed by the Engineer.

315.06—Pavement Samples

The Contractor shall cut samples from the compacted pavement for testing for depth and density. Samples shall be taken for the full depth of the course at the locations selected by the Engineer. The removed pavement shall be replaced with new mixture and refinished. No additional compensation will be allowed for furnishing test samples and reconstructing areas from which they were taken.

315.07—Pavement Tolerances

Comment [729]: Right Payment

Comment [730]: Right Way

Trial Use and Comment

(a) **Surface Tolerance:** The surface will be tested by using a 10-foot straightedge. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall be not more than 1/4 inch. Humps and depressions exceeding the specified tolerance shall be corrected or the defective work shall be removed and replaced with new material.

(b) **Finished Grade Tolerance**: After placement of the final pavement layer, finished grade elevations shall be within +/–0.04 foot of the elevations indicated in the plans, unless otherwise specified, provided that the actual cross slope does not vary more than 0.20 percent from the design cross slope indicated in the plans and the pavement thickness conforms to the thickness tolerances specified herein.

If determined by the Engineer that either the finished grade elevations or cross slope exceed the tolerances specified, the Contractor shall submit to the Engineer for approval a plan of corrective action.

(c) **Thickness Tolerance:** The thickness of the base course will be determined by the measurement of cores as described in VTM-32B.

Acceptance of asphalt concrete base course for depth will be based on the mean result of measurements of samples taken from each lot of material placed. A *lot* of material is defined as the quantity being tested for acceptance except that the maximum lot size will be 1 mile of 24-foot-width base course.

A lot will be considered acceptable for depth if the mean result of the tests is within the following tolerance of the plan depth for the number of tests taken except that each individual test shall be within ±0.60 inch of the plan depth: mean of two tests, ±0.45 inch; mean of three tests, ±0.35 inch; mean of four tests, ±0.30 inch.

If an individual depth test exceeds the ±0.60-inch tolerance, that portion of the lot represented by the test will be excluded from the lot. If an individual test result indicates that the depth of material represented by the test is more than 0.60 inch, the Contractor will not be paid for that material in excess of the tolerance throughout the length and width represented by the test. If an individual test result indicates that the depth of the material represented by the test is deficient by more than 0.60 inch, correction of the base course represented by the test shall be made as specified hereinafter.

If the mean depth of a lot of material is excessive, the Contractor will not be paid for that material in excess of the tolerance throughout the length and width represented by the tests.

If the mean depth of a lot of material is deficient by more than the allowable tolerance, correction will not normally be required and the Contractor will be paid for the quantity of material that has been placed in the lot.

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For excessive depth base courses, the rate of deduction from the tonnage allowed for payment as base course will be calculated at a weight of 115 pounds per square yard per inch of depth in excess of the tolerance. For sections of base course that are deficient in depth by more than 0.60 inch and less than 1.50 inch, the Contractor shall furnish and place material specified for the subsequent course to bring the base course depth within the tolerance. This material will be measured on the basis of tonnage actually placed, determined from weigh tickets, and paid for at the contract unit price for the base course material. Such material shall be placed in a separate course. If the deficiency is more than 1.50 inches, the Contractor shall furnish and place base course material to bring the base course thickness within the tolerance. Corrections for deficient base course depth shall be made in a manner to provide a finished pavement that is smooth and uniform.

When the Contract provides for the construction or reconstruction of the entire pavement structure, the surface and intermediate courses shall be placed at the rate of application shown on the plans within an allowable tolerance of ±5 percent of the specified application rate for application rates of 100 pounds per square yard or greater and within 5 pounds per square yard for application rates of less than 100 pounds per square yard. The amount of material exceeding the allowable tolerance will be deducted from the pay quantities.

When the Contract provides for the placement of surface or intermediate courses over existing pavement, over pavements constructed between combination curb and gutter, or in the construction or reconstruction of shoulders, such courses shall be placed at the approximate rate of application shown on the plans. However, the specified rate of application shall be altered where necessary to produce the required riding quality.

315.08—Measurement and Payment

Comment [731]: Right Payment

Asphalt concrete base will be measured in tons and paid for at the contract unit price per ton. This price shall include preparing and shaping the subgrade or subbase, constructing and finishing shoulders and ditches, and removing and replacing unstable subgrade or subbase.

Asphalt concrete will be measured in tons and paid for at the contract unit price per ton. Net weight information shall be furnished with each load of material delivered in accordance with the requirements of Section 211. Batch weights will not be permitted as a method of measurement unless the Contractor's plant is equipped in accordance with the requirements of Section 211, in which case the cumulative weight of the batches will be used for payment.

Asphalt used in the mixtures, when a pay item, will be measured in tons in accordance with the requirements of Section 109.01 except that transporting vehicles shall be tared prior to each load. The weight shall be adjusted in accordance with the percentage of asphalt indicated by laboratory extractions.

Tack coat shall be included in the price for other appropriate pay items.

Trial Use and Comment

Asphalt curb backup material will be measured in tons and will be paid for at the contract unit price per ton. This price shall include placing, tamping, and compacting.

Liquid asphalt cement, when a pay item, will be measured in tons and will be paid for at the contract unit price per ton.

Rumble strips will be measured and paid for in linear feet of shoulder where the rumble strips are actually placed and accepted, excluding the test site. This distance will be measured longitudinally along the edge of pavement with deductions for bridge decks, acceleration/deceleration lanes, surface drainage structures, and other sections where the rumble strips are not installed. This price shall be full compensation for application; disposal of waste material; and all labor, tools, equipment, and incidentals necessary to complete the work. The test site will not be measured for payment but shall be included in the unit price for rumble strip.

Liquid asphalt coating (rumble strips) will be measured and paid for in square yards as described herein. This price shall be full compensation for cleaning rumble strips prior to application of the coating; furnishing and applying coating as specified herein; and all labor, tools, equipment, and incidentals necessary to complete the work.

Saw-cut asphalt concrete pavement will be measured in linear feet for the depth specified and will be paid for at the contract unit price per foot, which price shall be full compensation for saw-cutting the asphalt pavement to the depth specified.

These prices shall include heat stabilization additive, furnishing samples, and maintaining traffic.

Payment will be made under:

Comment [732]: Right Payment

Pay Item	**Pay Unit**
Asphalt concrete base course (Type)	Ton
Asphalt concrete (Type) (Class)	Ton
Asphalt concrete curb backup material	Ton
Liquid asphalt cement	Ton
Rumble strip (Asphalt)	Linear foot
Liquid asphalt coating (Rumble strips)	Square yard
Saw-cut asphalt concrete (depth)	Linear foot

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- *Public advised of lane closures etc. ahead of schedule.

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- Permit required for work project.(VSMP)
- Night work or day work requires different equipment. Do we have the right equipment
- PPE and new Work Area Protection Manual followed. “Safety is Priority ONE”
- Work Zone layout follows TMP plan and / or contract; is Arrow Board and Attenuator required in work zones. Approved work zone technician or ATTSA certified person on site. (Certified flaggers when required)
- Environmental or permit needs installed and approved. Emergency action Plans, SWPPP etc.
- Staging zone for equipment, approved by residency engineer if staged on VDOT right of way.
- Will State Police be required on site? Who pays cost? Have they been notified?
- All paving equipment; Asphalt distributor, paver, MTV-shuttle buggy, rollers, milling equipment, haul trucks, saws, broom / vacuum truck, signs, barrels, light towers, etc. approved for use and have been checked and have certifying documentation in hand. Haul trucks to have clean approved tarp.
- Temperature limits meets specification and /or Manufactures specification.
- Pavement markings discussed permanent and temporary.
- Rumble strip equipment approved, if required.
- Approved mix design. Test section been performed, (Roller Pattern Control Strip accepted) before actual pavement start up. All materials used on project approved.
- Joints- lateral and longitudinal have been discussed, how created, how left to open to traffic.
- Tack – trackless; removal from off site locations if residual is tracked off site.
- Tack application correct temperature and documented.
- Emergency Action plan, break downs, accidents, traffic backups, joint clean up etc.
- Certified asphalt technician on site for density testing, or cutting cores. Has the materials section made aware of startup for core cuts for payment, if required?
- Agreed start date and time, weather permitting.
- All sub contractors approved to work.
- RIDEABILITY---YES or NO, discussed and agreed.
- Engineer’s approval to start in hand.

Start:

- Work Zone is set up correctly and at the right time per contract.
- State Police on seen if required.
- Materials technician on site, or has given locations of cores for payment.
- Document all temperatures; truck loads, screed.
- Roller compaction documented and verified.

Continuous inspection:

- 5 +1 office engineer inspectors --FHWA during interstate work, Work Zone Monitor, Mill, Pave, Line Striping, all in one work zone.
- 2+1 low volume primaries and secondary high traffic volumes.

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Final Inspection:

- Rideability, line striping, Straight edge joints, Test reports approved.
- Rumble strips, guard rail, (RPM's) Raised Plow Markers, and other items if in contract.
- Was contract and Special provisions followed?

Documentation Required:

. All weigh tickets must be checked by the Project Inspector. Numbering each ticket will help maintain the trucks in the proper sequence, recording temperature and signing each load ticket.

All delivery tickets should include: (l) name of Contractor; (2) project number(s) (3) date; (4) truck identification number; (5) load number; (6) type of material and (7) net weight.

Any portion of a load not used must be returned to the plant and weighed. The weigh master should record the corrected weight on Form TL-102a and notify the Project Inspector. The Inspector should record the weight of material returned on the appropriate delivery ticket.

A copy of the approved mix design on file and on hand.

Copy of depth measurements recorded from cores, and density reports.

Location-station material was placed= Mile marker – intersection etc.
Pavement marking –C85 signed. Sketches and calculations required "Milling "
Liquid –Asphalt/ tack tickets
Fuel and Asphalt adjusts, included in estimate. (as contract allows per contract)
Rideability – incentive / disincentive?

IV. REVIEW QUESTIONS:

• Do the trucks hauling asphalt have tight, clean, smooth metal bodies?
• Are trucks equipped with operable backup alarms?
• Are the trucks hauling asphalt equipped with the proper cover to protect the mixture?

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• Are the trucks bumping MTV or paver?
• Truck Drivers and equipment operator's all ground people wearing PPE?
• Does the asphalt paver produce a finished surface as required?
• Are rollers working, per specification, right behind paver?
• Do the rollers leave the surface in an acceptable condition?
• Are the weather and surface conditions during placement of the asphalt mixture as required?
• Are the minimum lay down temperatures as specified?
• Are intermediate and base courses exceeding the application rate given in Table III-2 placed as specified?
• Has the surface of existing pavement or base that is irregular been corrected as required?
• Have longitudinal and transverse cracks in hydraulic cement concrete been sealed prior to placement of asphalt?
• Have all contact surfaces and cold joints of asphalt been painted as required prior to asphalt placement? Are curb stacked?
• Is a tack or prime coat of asphalt applied as specified?
• Are asphalt cutbacks or emulsions applied and allowed to form a tacky residue prior to the *application of the paving mixture?*
• Is tack or prime coats which have been damaged or contaminated been repaired prior to placing the paving mixture?
• Have irregularities in the existing surface that would result in a compacted thickness of over 3 inches been repaired as specified?
• Has a continuous line been placed and maintained to control pavement width and alignment?
• Has the longitudinal joint of each layer been offset approximately 6 inches or as

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specified?
• Is the certified Asphalt Concrete Paving Technician inspecting and straight edging each layer as required prior to compaction? When (BM, IM, Toping) overlays are being placed, on projects stager joints.
• Are the specified rates and depth adhered to when placing asphalt concrete base, intermediate and surface course?
• Does rolling begin immediately after placement and continue until the mixture is thoroughly and uniformly compacted?
• Are there sufficient rollers to obtain the required compaction of the mixture?
• Has the rolling of the mixture been accomplished as required by the Specifications?
• In areas not accessible to rollers, has the material been compacted as required?
• Are the edges of the pavement surface true curves or tangents as required?
• Are the surfaces of the compacted courses protected until the material has cooled sufficiently to support traffic without marring?
• Does the density of the compacted course meet the requirements as specified?
• Did the Contractor furnish and operate a nuclear density gage, which had been calibrated within the previous 12 months by an approved calibration service, in accordance with the requirements of this section?
• Has a control strip been constructed for each roadway, shoulder course, and each lift of each course as required?
• Have the required number of density tests been taken by the Contractor on specified courses?
• Have the rollers continued until roller marks are eliminated and the required density has been obtained?
• Has a transverse joint been cut on the previous run as specified?
• Has a coat of asphalt been applied to transverse joints as directed?
• Have joints adjacent to curbs, gutters, or adjoining pavement been set up to a

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height sufficient to receive full compression under the rollers?

- Has the Contractor cut the testing samples and replaced the material as required?

- Has Materials Division received their cores for payment?
- Has the Contractor taken corrective actions to fix surface areas out of tolerance prior to determining the pavement thickness?
- Does the thickness of the base course meet the requirements?
- Check condition and adjustment of paving machines and rollers.
- See that traffic control is organized and functioning properly; make sure required signs are in place.

- Check application of tack coat; be certain adjoining surfaces such as gutter, curbs, manholes, are properly tacked. All surfaces should be clean before tack is applied. Tack coats should be applied evenly over the pavement surface.
- Examine pavement base, see that required patching and pre-leveling is done; make check on paving depths or spread before paving begins.
- See that paver guide lines are set properly.
- Check transverse joint for smoothness and appearance.
- Watch trucks dumping into paver hopper for adverse effect on paver operation. Each truck should empty completely and material should not accumulate in corners.
- Check temperature of the mixture.
- Maintain constant inspection of mat behind paver for signs of roughness or non-uniformity of mixture.
- See that longitudinal joints are raked and compacted properly.
- Make frequent checks of the spread.
- Watch rolling operations; see that best rolling sequence is used to fit conditions; watch for excessive speed of rollers. Check to assure that the desired pavement contour is being achieved.
- Inspectors should ensure that the finished grade elevations and design cross slopes are within specified tolerances. The finished grade elevations should be checked at the roadway centerline, each travel lane centerline, edge of pavement, and edge of shoulder at each station. If checks indicate that the surface is out of tolerance, more frequent checks should be made more often, documented and advise foreman about tolerances.
- Keep records of truckloads used each day.
- Make sure the project is in good order before you leave at the end of the day; check warning lights, channelizing device. Drive through or approach the work and attempt to view the situation through the eyes of an out-of-state motorist who is totally unfamiliar with the route and construction work being performed.

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IV. REVIEW QUESTIONS (cont'd)

• Has the Contractor cut the testing samples and replaced the material as required?
• Do the trucks hauling asphalt have tight, clean, smooth metal bodies?
• Are the trucks hauling asphalt equipped with the proper cover to protect the mixture?
• Does the asphalt paver produce a finished surface as required?
• Do the rollers leave the surface in an acceptable condition?
• Were the weather and surface conditions during placement of the asphalt mixture as required?
• Are the minimum lay down temperatures as specified?
• Are intermediate and base courses exceeding the application rate given in Table III-2 placed as specified?
• Has the surface of existing pavement or base that is irregular been corrected as required?
• Have longitudinal and transverse cracks in hydraulic cement concrete been sealed prior to placement of asphalt?
• Have all contact surfaces and cold joints of asphalt been painted as required prior to asphalt placement?
• Has a tack or prime coat of asphalt been applied as specified?
• Have asphalt cutbacks or emulsions been applied and allowed to form a tacky residue prior to the application of the paving mixture?
• Have tack or prime coats which have been damaged or contaminated been repaired prior to placing the paving mixture?
• Have irregularities in the existing surface that would result in a compacted thickness of over 3 inches been repaired as specified?
• Has a continuous line been placed and maintained to control pavement width and alignment?
• Has the longitudinal joint of each layer been offset approximately 6 inches or as specified?
• Has the certified Asphalt Concrete Paving Technician inspected and straightedge each layer as required prior to compaction where more than 100 tons of material placed of a single type of material?
• Are the specified rates and depth adhered to when placing asphalt concrete base, intermediate and surface course?
• Does rolling begin immediately after placement and continue until the mixture is thoroughly and uniformly compacted?
• Are there sufficient rollers to obtain the required compaction of the mixture?
• Has the rolling of the mixture been accomplished as required by the specifications?
• In areas not accessible to rollers, has the material been compacted as

Trial Use and Comment

required?
• Are the edges of the pavement surface true curves or tangents as required?
• Are the surfaces of the compacted courses protected until the material has cooled sufficiently to support traffic without marring?
• Does the density of the compacted course meet the requirements as specified?
• Did the Contractor furnish and operate a nuclear density gage, which had been calibrated within the previous 12 months by an approved calibration service, in accordance with the requirements of this section?
• Has a control strip been constructed for each roadway, shoulder course, and each lift of each course as required?
• Have the required number of density tests been taken by the contractor on specified courses?
• Has a transverse joint been cut on the previous run as specified?
• Has a brush coat of asphalt been applied to transverse joints as directed?
• Have joints adjacent to curbs, gutters, or adjoining pavement been set up to a height sufficient to receive full compression under the rollers?
• Has the Contractor taken corrective actions to fix surface areas out of tolerance prior to determining the pavement thickness?
• Does the thickness of the base course meet the requirements?

V. CRITICAL INSPECTION POINTS

• Review Work Zone, Review all Milling surface operations
• Prep of mill surface, and tacking operation.
• Verify Roller Compaction operation.
• Density testing, Take cores for material section for payment.
• Joints inspections
• Safety First

Trial Use and Comment

SECTION 316 - HYDRAULIC CEMENT CONCRETE PAVEMENT

I. INTRODUCTION:

The construction of concrete pavement is a highly mechanized operation which requires inspection of a vast quantity of material and a start of paving work, a meeting should be held working knowledge of numerous types of equipment. Inspectors assigned to this work should be thoroughly familiar with the Specifications, Special Provisions, construction details, and sequence of operations. Prior to the between the Contractor's supervisory personnel and the Project Inspector to discuss the sequence of operations.

MATERIALS

The Inspector must be familiar with the source and type of aggregate intended for use, mix proportions, moisture content determination, method of determining scale weights, batching equipment, tests and reports. (IA review of the Manual of Instructions - Materials Division and the Study Guide for the Hydraulic Cement Concrete Certifications School will be helpful.

Comment [733]: Right Material

All sources supplying concrete to the Department shall be required to have present during the batching operations, a Certified Concrete Batcher or a Certified Concrete

EQUIPMENT

The Inspector should familiarize himself with the mechanical features of all machinery used on the project so that an intelligent appraisal of the condition and adjustment of each machine can be made. Handbooks of operation instructions are available from equipment manufacturers which explain various adjustments and operating procedures.

CONCRETE PAVEMENT - SLIP FORM METHOD

The Contractor may elect to use the slip form method of paving in lieu of the conventional form type method. Prior to beginning slip form operations, the base material must be uniformly compacted and free from irregularities.

Comment [734]: Right Material

Caution should be taken to avoid paving when rain is imminent. A sudden shower can produce serious consequences in the quality of the paving texture.

TEST SPECIMENS

Trial Use and Comment

The Manual of Instructions - Materials Division outlines the procedures that apply to concrete test beams.

STRIKE-OFF OF CONCRETE AND PLACEMENT OF REINFORCEMENT

The concrete spreader should be adjusted so that concrete is struck off uniformly across the entire width of spread.

When wire mesh is used, the mesh may be placed by means of two layer construction of the concrete or by the use of an approved placing machine which vibrates the reinforcement into proper position after full thickness of concrete is placed. When mesh is placed by means of two layer construction no more than 30 minutes is to elapse before placing the top layer of concrete. If an approved placing machine is used, it must be checked for proper adjustment to assure that all reinforcement is positioned at the proper depth and that it does not move out of position during the remaining finishing operations. A continual check should be maintained for the location of reinforcement regardless of the method of installation.

JOINTS

Dowel Supporting Assemblies

When dowel supporting assemblies are required for transverse joints, they must be laid out and marked in such a manner that the exact centerline of the assembly can be reestablished. Generally, they are held in correct position by the use of metal stakes or pins that are left in the base material. It is very important that all dowels in a dowel assembly be parallel to each other and form a straight line.
Prior to placement, dowel assemblies should be visually inspected for acceptability.

Comment [735]: Right Location , right material Right Way

The free end of all dowel assemblies should be painted with an approved coating material or tar paint. In addition, before placing, the free end of the bars should be coated with asphalt or other approved lubricant. Dowel caps are required for the free end of all expansion joints. The spacing of all joints should be in accordance with the requirements of the plans, Standards, and Specifications.

Comment [736]: right material, Right Location, Right Way

Tie Bolts

Tie bolts used for multiple lane paving must be placed in proper position on the face of the roadway forms, as shown in the Standards.

Comment [737]: Right Location, Right Way

Sawing

Slight raveling is not objectionable and generally is an indication that sawing is being done at the proper time. Joints must be sawed over the exact center of load transfer

Comment [738]: Right Location Right Time

Trial Use and Comment

devices and perpendicular to the surface. If sawing is not performed at the proper time, random or uncontrolled cracks will occur.

FINAL STRIKE-OFF, CONSOLIDATION AND FINISHING

Immediately after spreading, the concrete should be screeded and consolidated by means of approved mechanical finishing and vibrating equipment.

Comment [739]: Right Material,

The purpose of the finishing machine is to not only provide some additional consolidation of the

STATION NUMBERS AND DATES

Stenciling Station Numbers and Dates - Before concrete takes its final set and after finishing operations are completed, the Contractor shall stencil station numbers and dates into the pavement in accordance with the standard drawings. The dies for numbering and dating will be furnished by and remain the property of the Department. Dies or numerals lost or damaged by the Contractor shall be replaced at his expense.

Comment [740]: Right Time, Right Location, Right Way

CURING

The "curing of concrete" is the operation which is performed to assist the cement hydration process to take place in such a manner that the concrete will be strong, durable and reasonably impervious.

When the rate of evaporation at the surface exceeds the rate at which water escapes (bleeds) to the surface, plastic shrinkage cracking is likely to occur.

The ability of an approved curing material to prevent the escape of moisture from the concrete is related primarily to the promptness and completeness of the application. Curing material must be applied as soon as practicable after the surface has been textured.

Comment [741]: Right Location

Comment [742]: Right Time

Liquid Membrane

Curing compound is to be applied uniformly at the specified rate.

Comment [743]: right material

As soon as possible after concrete has been placed, the surface should be checked with a straightedge or other specified device. All irregularities varying by more than the Specification requirements should be corrected. The Inspector should consult with the Construction Manager before ordering surface corrections.

REMOVING FORMS

Side forms should not be removed from freshly placed concrete until the concrete has set for the specified time. The concrete should be hardened to the extent that spalling

Comment [744]: Right Time, Right Way

Trial Use and Comment

or other damage will not occur. Immediately upon removal of forms, any honeycomb must be patched and the edges of pavement cured in an approved manner.

SEALING JOINTS

Joints, whether sawed or formed, must be cleaned and surface dry at the time of sealing. The sealing of joints with approved material should be completed prior to opening the pavement to any traffic including the Contractor's equipment.

TOLERANCE IN PAVEMENT THICKNESS

Prior to final acceptance, the Materials Division will core the pavement to determine the actual thickness. The thickness will be determined by the average caliper measurement specified in Section 316 of the Specifications.

If pavement thickness is not within the allowable tolerance, deductions for deficient pavement will be made in accordance with the specified method of adjusting unit price. However, the adjusted unit price for deficiencies need not appear on the monthly progress estimate unless specified instructions to do so are issued by the District Office.

BASIS OF PAYMENT

Normally, pavement is measured in square yards. The width for calculations may be taken from the typical cross sections. The length should be measured horizontally along the centerline of pavement.

All paving records and reports should be kept current and complete. The project records must include sufficient test reports or certifications to cover the material used:

1. Wire mesh.
2. Steel reinforcing bars.
3. Tie bars.
4. Dowel assemblies.
5. Expansion joint material.
6. Joint sealing material.
7. Curing compounds or materials.

Comment [745]: Right Time.

Comment [746]: Right Time, Right Way

Comment [747]: Right Documentation

Comment [748]: Right Quantity

Comment [749]: Right Documentation

Comment [750]: Right Payment

Comment [751]: Right Documentation

Trial Use and Comment

8. Other materials for which test are required.

The following information should be included in the "Inspector's Daily Report".

Comment [752]: Right Documentation

1. The amount of concrete received and used. If a batch or load of concrete is wasted or rejected, then a reason should be noted on the appropriate ticket and in the "Inspector's Daily Report".

2. Stations between which pavement was placed and the number of square yards placed.

3. Record of Test Beams made or broken as outlined in the Manual of Instructions - Materials Division.

4. Contractor's labor and equipment.

5. Concrete pavement curing temperature ranges

6. The location of any joints which are not placed according to plans.

Documentation is to be maintained for the daily paving train tests and measurements. The following tests and checks are to be located by time and station and initialed by the Inspector:

1. Air content test.

2. Consistency test.

3. Concrete and air temperatures.

4. Reinforcement cover checks.

5. Pavement depth checks.

a) Forms:

- **Intentionally Left Blank**

Trial Use and Comment

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

316.01—Description

This work shall consist of constructing reinforced, non-reinforced, or continuously reinforced hydraulic cement concrete pavement and approach slabs composed of hydraulic cement concrete, with or without reinforcement as specified, on a prepared subgrade or base course in accordance with the requirements of these specifications and within the specified tolerances for the lines, grades, thicknesses, and cross sections shown on the plans or as established by the Engineer.

316.02—Materials

Comment [753]: Right Material

(a) **Concrete** shall be central mixed and shall conform to the requirements specified in Table II-17 for Class A3 paving concrete except that the slump shall not be more than 2 inches for placement by the slipform method. Concrete for placement by the slipform method shall be sufficiently cohesive to prevent detrimental sloughing at the pavement edges as the forms advance. Transit mixed concrete may be furnished for use in constructing approach slabs, ramps, transitions, connections, crossovers, and other miscellaneous pavement. Aggregate used in concrete for pavement and approach slabs that are used as riding surfaces shall be nonpolishing aggregate.

(b) **Reinforcing steel dowels, tie bars, hook bolts, and welded wire fabric** shall conform to the requirements of Section 223.

(c) **Wide flange beams** used in the anchor slab of continuously reinforced pavement shall conform to the requirements of ASTM A36.

(d) **Joint sealer and filler** shall conform to the requirements of Section 212.

(e) **Load transfer devices** shall be fabricated of steel and shall be of an approved type and design.

(f) **Curing materials** shall conform to the requirements of Section 220.

316.03—Equipment

Comment [754]: Right Material

Equipment and tools necessary for handling materials and performing the work shall be subject to the approval of the Engineer.

The Contractor shall provide the equipment and tools specified herein, or their approved equivalent, and they shall be of such capacity that the rate of placing concrete and

Trial Use and Comment

finishing pavement will be continuous. If any piece of equipment does not have sufficient capacity to keep pace with the other operations, the Contractor shall limit the size of the batch or otherwise limit the rate of production to preclude poor workmanship or frequent delays.

(a) **Forms:** Straight side forms shall be made of metal at least 7/32 inch in thickness and shall be furnished in sections at least 10 feet in length. Forms shall have a depth at least equal to the prescribed edge thickness of the concrete, without horizontal joints, and a base width equal to at least the depth of the forms. Flexible or curved forms of proper radius shall be used for curves with a radius of 100 feet or less. Flexible or curved forms shall be of a design acceptable to the Engineer. Forms shall be provided with adequate devices for secure placement so that when set they will withstand the impact and vibration of consolidating and finishing without visible springing or settlement. Flange braces shall extend outward on the base at least 2/3 the height of the form. Forms that are bent, twisted, or broken or that have battered top surfaces shall be removed. Repaired forms shall not be used until inspected and approved. Built-in forms shall not be used except where the total area of pavement on the project is less than 2,000 square yards. The top face of the form shall not vary from a true plane more than 1/8 inch in 10 feet, and the vertical side shall not vary from a true plane more than 1/4 inch. Forms shall have provisions for locking the ends of abutting form sections together tightly and for secure setting.

Comment [755]: Right Material

(b) **Subgrade Machine:** The machine shall be of an approved mechanical type, capable of preparing the subgrade to within 1/4 inch of the grade shown on the plans or established by the Engineer.

Comment [756]: Right Material,

(c) **Subgrade Roller:** The roller shall be of an approved type and capable of obtaining the required density.

(d) **Bulkheads:** Bulkheads for construction joints shall be of sufficient strength to prevent deformation of the joint and shall be constructed to permit dowels or other reinforcement to extend through the joint.

(e) **Work Bridges:** Work bridges shall be provided by the Contractor.

(f) **Mechanical Spreader:** The mechanical spreader shall be a self-powered, self-propelled unit capable of placing the concrete mechanically on the subgrade over the full width and depth of the pavement.

The spreader shall be equipped with a hopper or other type of spreading equipment that will distribute the concrete over the subgrade without segregation. The concrete shall not be placed directly on the subgrade from the hauling equipment except in areas where hand labor must be performed.

(g) **Vibrators:** Vibrators for full-width vibration of concrete pavements shall be internal vibrators with multiple spuds. They may be attached to the spreader or mounted on a

Trial Use and Comment

separate carriage operating directly behind the spreader. The frequency of vibrators shall be at least 7,000 impulses per minute.

When spud internal vibrators, either hand operated or attached to spreaders, are used adjacent to forms, they shall have a frequency of at least 3,500 impulses per minute.

Vibration shall be controlled by the forward movement of the spreader so that vibration automatically ceases when the forward movement of the spreader is stopped.

(h) **Spraying Equipment:** When liquid membrane-forming compound is used for curing concrete pavement, the Contractor shall provide mechanical spraying equipment mounted on movable bridges. The equipment shall be the full atomizing type equipped with a tank agitator and a gage to measure the quantity of material applied. The equipment shall be capable of continuously agitating the membrane during application.

(i) **Concrete Saw:** When sawing joints is elected or specified, the Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions and at the required rate with a water-cooled, diamond-edged saw blade or an abrasive wheel.

(j) **Slipform Paver:** The paver shall be designed to consolidate, screed, and float finish the freshly placed concrete in one complete pass of the machine and in a manner so that a minimum of hand finishing will be necessary to provide a dense and homogeneous pavement. The paver shall be equipped to vibrate the concrete thoroughly for the full width and depth of the strip of pavement being placed.

316.04—Procedures

(a) **Concrete Base Course:** The subgrade or subbase upon which the base course is to be placed shall be prepared in accordance with the requirements of the applicable provisions of these Specifications for such course.

The construction of a hydraulic cement concrete base course shall conform to the requirements of these Specifications except for floating and final finishing of the surface. The surface shall be finished so that there will be no deviation of more than 1/4 inch between any two contact points when tested with a 10-foot straightedge placed parallel with the centerline. A heavy broomed texture shall be applied.

(b) **Preparing Grade:** The subgrade shall be prepared as specified in Section 305. The course upon which the concrete pavement will rest, including the area that will support the paving equipment, shall be graded and compacted to the required profile.

Before or after side forms have been securely set to grade, the subgrade or subbase course shall be brought to the proper cross section. The finished grade shall be maintained in a smooth and compacted condition until pavement is placed.

Comment [757]: Right Time

Comment [758]: Right Location

Trial Use and Comment

The subgrade or subbase course shall be uniformly moist when concrete is placed. However, the method of moistening shall not be such as to form mud or pools of water.

(c) **Placing Reinforcing Steel for Continuously Reinforced Pavement:** At each location where five or more consecutive days will elapse between placement operations, a "leave out" joint shall be installed as detailed on the plans. Longitudinal bars shall be positioned in the finished pavement within ±1/2 inch of the specified vertical position and ±1 inch of the specified horizontal position with a cover of at least 2 inches.

Prebent deformed tie bars, Grade 40 or 60, may be used in the joint between the mainline and ramp pavement to facilitate the use of the slipform paver. Bars shall be prebent with equipment designed especially for fabricating 90-degree bends in 5/8-inch deformed bars without damage to the bars. Side forms of the slipform paver shall be designed in a manner so that the prebent tie bars can be inserted in an appropriate slot and will pass between the edge of the pavement and the inside face of the trailing forms as the paver advances.

When reinforced concrete pavement is placed in two layers, the entire width of the bottom layer shall be vibrated and struck off to such length and depth that the sheet of fabric or bar mat may be placed full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly on the concrete, after which the top layer of concrete shall be placed, struck off, and screeded. Any portion of the bottom layer of concrete that has been placed more than 30 minutes without being covered with the top layer shall be removed and replaced with freshly mixed concrete at the Contractor's expense. When reinforced concrete is placed in one layer, the reinforcement may be positioned in advance of concrete placement or placed by approved mechanical or vibratory means in fresh concrete after spreading.

Reinforcing steel shall be straight, and its surface condition shall conform to the requirements of Section 406.03(b).

(d) **Setting Forms:** The foundation under forms shall be compacted to grade so that forms, when set, will be firmly in contact for their entire length and at the specified grade. Any foundation grade that is found to be low shall be filled to grade with granular material in lifts of 1/2 inch or less for a distance of 18 inches on each side of the base of the form and thoroughly compacted. Imperfections or variations above grade shall be corrected by tamping or cutting as necessary.

Forms shall be set at least 500 feet in advance of concrete placement. Where local conditions make this requirement impracticable, it may be waived. After the forms have been set, the grade shall be thoroughly tamped at the inside and outside edges of the base of forms. Forms shall be staked into place with a sufficient number of pins of sufficient length for any section to hold the form at the correct line and grade. Form sections shall be tightly locked, free from play or movement. The top of the form, when tested with a 10-foot straightedge, shall not deviate more than 1/8 inch and the longitudinal

Comment [759]: Right Way

Comment [760]: Rigth taime, Right Way, Right Location

Comment [761]: Right Time, Right Location

Comment [762]: Right Way

Comment [763]: Right Time and Right Location

Trial Use and Comment

axis of the vertical face shall not vary more than 1/4 inch from the straightedge. No excessive settlement or springing of forms under the finishing machine will be allowed. Forms shall be cleaned and oiled prior to concrete placement.

The alignment and grade elevation of forms shall be checked and corrections made by the Contractor immediately before concrete placement. If any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.

(e) **Placing Concrete:** Concrete shall be placed on the grade in a quantity that will provide a uniform and adequate supply for the finishing equipment. Spreading shall be accomplished with a mechanical spreader. Necessary hand spreading shall be performed using square-faced shovels. The use of rakes or hoes will not be permitted. Workers shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with soil or foreign substances.

Where concrete is placed adjoining a previously constructed lane and mechanical equipment will be operated from the existing lane, the concrete in that lane shall have attained a modulus of rupture strength of at least 450 pounds per square inch. Test specimens for this purpose shall conform to the requirements of ASTM C31 and shall be tested in accordance with the requirements of ASTM C293. Equipment that will damage the surface of the existing pavement will not be permitted.

Concrete shall be thoroughly consolidated against forms and joint assemblies by means of full-width vibration. Vibrators will not be permitted to come in contact with a joint assembly, reinforcement, or side forms. The vibrator shall not be operated for more than 15 seconds in any one location. When fabric or bar mat reinforcement is placed by mechanical equipment that uses vibration or a tamping action, other vibratory equipment may be eliminated except in areas adjacent to side forms.

Concrete shall be placed as close to expansion and contraction joints as is possible without disturbing the joints. Concrete shall be placed over and around dowels in a manner so that dowels are fully embedded without displacement.

Concrete for continuously reinforced pavement shall be placed through the openings in the steel in one lift and vibrated with an internal vibrator for the entire width and depth. Special attention shall be given to the consolidation of the concrete in the immediate vicinity of construction joints and other areas where the performance of vibrators mounted on the paving equipment is questionable.

Following concrete placement, concrete shall be struck off to conform to the cross section shown on the plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement shall conform to the tolerances specified herein for the elevation and grade shown on the plans or as established by the Engineer.

Comment [764]: Right Way

Comment [765]: Right Way , Right Time

Comment [766]: Right Time

Comment [767]: Right Way, Right Location

Trial Use and Comment

If concrete operations are permitted to extend after sunset, adequate lighting shall be provided.

(f) **Test Specimens:** The Contractor shall furnish the concrete necessary for casting test beams in accordance with the requirements of (o) herein. Beams shall be cured by a designated method as specified for the pavement in accordance with the requirements of ASTM C31.

(g) **Jointed Pavement:** Joints shall be installed in a manner and at such time to prevent random or uncontrolled cracking. If random or uncontrolled cracking occurs, sufficient concrete shall be removed and replaced on each side of the cracking to form a slab at least 10 feet long. Transverse construction joints shall be constructed at each end of the slab in accordance with the requirements of the applicable provisions of 4. herein.

1. **Longitudinal joints:** Deformed tie bars of the specified length, size, spacing, and material shall be placed perpendicular to the longitudinal joints. They shall be placed by approved mechanical equipment and rigidly secured by chairs or other approved supports to prevent displacement or by the insertion of bars with an approved hand tool. When adjacent lanes of pavement are constructed separately, approved two-piece connectors shall be used.

   Longitudinal joints shall be sawed, formed, or created using a strip insert. Longitudinal center joints shall be installed in a manner so that full contact is made at intersections with transverse joints.

   a. **Formed joints:** Formed joints shall consist of a groove extending downward from, and normal to, the surface of the pavement and shall be formed by an approved nonmetallic or removable device that consistently demonstrates its ability to produce in fresh concrete a joint having the dimensions and line indicated on the plans. The groove shall be sealed with a premolded or poured joint material as required.

   b. **Strip insert joints:** A longitudinal weakened plane joint may be furnished at traffic lane lines in multilane monolithic concrete pavement in lieu of forming or sawing such joints. Strip insert joints shall be formed by placing a continuous strip of plastic or other approved material. The insert strip shall be of sufficient width to form a weakened plane to the depth shown on the plans. The thickness of the insert material shall be at least 20 mils. Strip insert joints shall not be sawed.

      The insert strip shall be inserted with a mechanical device that places the material in a continuous strip. Splices will be permitted provided they are effective in maintaining the continuity of the insert strip. The top edge of the insert strip shall be positioned flush with the finished surface. The insert strip shall not be deformed from a vertical position during installation or in subsequent finishing operations performed on the concrete. The alignment of the finished joint shall be uniformly parallel with the centerline of the pavement and free from local irregularities in alignment that are more than 1/2 inch in 10 feet. The mechanical installation device shall vibrate the concrete during the

Comment [768]: Right Documentation

Comment [769]: Right Material

Comment [770]: Right Location

Comment [771]: Right Way, Right material

Trial Use and Comment

insertion of the strip in a manner to cause the disturbed concrete to return evenly along the sides of the strip without segregating or developing voids.

If the Contractor is unable to furnish a satisfactory strip insert joint consistently, he shall, upon being notified by the Engineer, discontinue furnishing such joints and furnish other approved formed or sawed joints without additional compensation.

c. **Sawed joints:** Longitudinal sawed joints shall be cut with approved concrete saws. Suitable guidelines or devices shall be used to ensure cutting the longitudinal joint on the true line as shown as soon as the concrete has hardened sufficiently to permit sawing without chipping, spalling, or tearing. Concrete faces of the saw cut shall be protected from drying until the end of the specified curing period. Sawed joints shall be thoroughly cleaned and dried prior to being sealed.

Comment [772]: Right Time

2. **Transverse expansion joints:** Transverse expansion joints shall be formed in accordance with the requirements of 1.a. herein and shall be sealed using Type D material. Expansion joint filler shall be continuous from form to form, shaped to the subgrade. Preformed joint filler shall be furnished in lengths equal to the pavement width or the width of one lane. Damaged or repaired joint filler shall not be used.

Comment [773]: Right Way

Expansion joint filler shall be held in a position perpendicular to the subgrade. An approved installing bar, or other device, shall be used, if required, to secure preformed joint filler at the proper grade and alignment during placing and finishing of concrete. Finished joints shall not deviate more than 1/4 inch in the horizontal alignment from a straight line. If joint filler is assembled in sections, there shall be no offsets between adjacent units.

3. **Transverse contraction joints:** Transverse contraction joints shall consist of planes of weakness created by cutting grooves in the surface of the pavement and, when shown on the plans, shall include load transfer assemblies.

Edges of concrete adjacent to the joint may be rounded or beveled to a radius or length approved by the Engineer. Any joint having an insufficient opening shall be resawed or ground to the proper size. Where a joint opening is larger than that specified, the Contractor may be required to build up the joint with epoxy mortar or to furnish a larger size seal as determined by the Engineer. The cost of any such additional work or material shall be borne by the Contractor.

4. **Transverse construction joints:**

a. **Jointed pavement:** Unless specified expansion joints occur at the same points, transverse construction joints shall be constructed at the end of each day's work or when there is an interruption of more than 30 minutes in the concreting operations. A transverse construction joint shall not be constructed within 10 feet of an expansion joint, contraction joint, or plane of weakness. If sufficient concrete has not been mixed at the time of interruption to form a slab at least 10 feet long, the excess concrete back

Comment [774]: Right Time, Right Location

Trial Use and Comment

to the last preceding joint shall be removed and disposed of as directed. An approved header board, cut to the required cross section, shall be used to form joints. Deformed dowel bars shall be used in transverse construction joints whose location does not coincide with the specified location of a transverse expansion or contraction joint.

b. **Continuously reinforced concrete pavement:** Transverse construction joints shall be formed by the use of an approved header board in accordance with the requirements of 4.a. herein. The header shall consist of two sections, one being placed above and one being placed below the reinforcing mat, and shall be furnished with openings to accommodate the longitudinal steel and additional reinforcement required.

At any location where a "leave out" is necessary for a detour, at least 100 feet shall be maintained between transverse construction joints.

5. **Load transfer devices:** Plain dowels shall be held in position parallel with the surface and centerline of the slab by a metal device that is left in the pavement.

The entire free end of each dowel shall be painted with one coat of approved paint. When the paint has dried and immediately before dowels are placed in position, the free end shall be thoroughly coated with an approved lubricant. A metal or plastic dowel cap of approved design to cover 2 inches, ±¼ inch, of the dowel, with a closed end, and with a suitable stop to hold the end of the sleeve at least 1 inch from the end of the dowel bar shall be furnished for each dowel bar used in expansion joints. Caps or sleeves shall fit the dowel bar tightly, and the closed end shall be mortartight. Dowels, plastic coated in accordance with the requirements of Federal Specification L-C-530 C or epoxy coated in accordance with the requirements of ASTM A775, may be used in lieu of painted and lubricated dowel bars.

In lieu of using dowel assemblies at contraction joints, dowel bars may be placed in the full thickness of pavement by an approved device.

6. **Isolation joints at structures:** Isolation joints shall be formed by placing a strip of 1/2-inch preformed expansion joint filler around each structure that extends into or through the pavement before concrete is placed at that location.

(h) **Final Striking Off, Consolidating, and Finishing:** The sequence of operations shall be as follows: (1) striking off, (2) consolidating, (3) floating, (4) removing laitance, (5) straightedging, and (6) finishing. If the application of moisture to the surface is permitted, it shall be applied as a fog spray by means of approved spray equipment.

1. **Finishing at joints:** Concrete adjacent to joints shall be mechanically vibrated to prevent voids and segregation from occurring against the joint material. Concrete under and around load transfer devices, joint assembly units, and other features designed to extend into the pavement shall also be mechanically vibrated.

Comment [775]: Right Way

Comment [776]: Right Location

Comment [777]: Right Way, Right Location

Comment [778]: Right Material, Right Location,

Comment [779]: (Right Location, Right Material)

Comment [780]: (Right Time, Right Way)

Comment [781]: (Right Way, Right Location

Trial Use and Comment

a. **Machine finishing:** Concrete shall be spread as soon as placed, struck off, and screeded by an approved finishing machine. Vibration for the full width of the paving slabs shall be provided in accordance with the requirements of Section 316.03(g). The machine shall be operated over each area of pavement as many times and at such intervals as are necessary to result in proper consolidation and develop a surface of uniform texture. Excessive manipulation of a given area shall be avoided.

During the first pass of the finishing machine, a uniform roll of concrete shall be maintained ahead of the front screed for its entire length.

If a uniform and satisfactory density of concrete is not obtained at joints, along forms, at structures, and throughout the pavement, the Contractor will be required to furnish equipment and use methods that will produce pavement conforming to the requirements specified herein.

b. **Hand finishing:** Hand finishing will be permitted only under the following conditions: (1) to finish concrete already deposited on the grade in the event of a break down of mechanical equipment; and (2) to finish narrow widths, approach slabs, or other areas of irregular dimensions where the operation of mechanical equipment is impractical.

Concrete shall be struck off as it is placed and screeded with an approved portable screed. If reinforcement is required, the bottom of concrete shall be screeded prior to placement of reinforcement.

Consolidation shall be attained by the use of an approved vibrator or other approved equipment.

Hand finishing shall be kept to the absolute minimum necessary to attain a surface that has a uniform texture, is true to the approximate grade and cross section, and has a closed surface.

2. **Floating:** After concrete has been struck off and consolidated, it shall be further smoothed and made true by means of a float using one of the following methods as specified or permitted:

a. **Mechanical method:** A mechanical float shall be adjusted so that its full length will be in continuous contact with the surface of the pavement.

If necessary, long-handled floats having blades at least 5 feet in length and 6 inches in width may be used to smooth and fill in open-textured areas in the pavement. Long-handled floats shall not be used to float the entire surface of the pavement in lieu of, or supplementing, the prescribed method of floating.

b. **Hand method:** This method will be permitted only in those instances specified in 1.b. herein. Following strike off by an approved screed, concrete shall be smoothed with a darby to level raised spots or fill depressions. Long-handled floats or hand floats of

Comment [782]: Right Time

Comment [783]: Right Location

Comment [784]: Right Time

Comment [785]: Right Time, Right Way

Trial Use and Comment

wood or metal, as the area dictates, may be used in lieu of darbies to smooth and level the concrete surface. Excessive bleed water shall be wasted over the side forms after each pass of the float.

3. **Straightedge testing and surface correction:** After floating has been completed and excess water removed, but while concrete is still fresh, the surface of the concrete shall be tested for trueness with a 10-foot straightedge. The Contractor shall furnish and use an accurate 10-foot straightedge swung from handles 3 feet longer than 1/2 the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel with the pavement centerline, and the entire area shall be gone over from one side of the slab to the other as necessary. Advancement along the pavement shall be in successive stages of not more than 1/2 the length of the straightedge. Depressions shall be immediately filled with freshly mixed concrete, stuck off, consolidated, refinished, and retested. High areas shall be cut down and refinished. Special attention shall be given to ensure that the surface across joints conforms to the requirements for smoothness. Straightedge testing and surface corrections shall continue until the entire surface is free from observable departures from the straightedge and the slab conforms to the required grade and cross section.

4. **Final finish (texture):** Prior to grooving, multi-ply damp fabric shall be dragged over the pavement surface to provide a gritty texture on ridges between grooves. The roadway pavement riding surface shall be textured with (1) uniformly pronounced grooves approximately 1/8 inch in depth and 1/8 inch in width on approximately 3/4-inch centers and transverse to the pavement centerline or (2) a combination of uniformly pronounced grooves approximately 1/8 inch in depth and 1/8 inch in width on approximately 3/4-inch centers and longitudinal to the pavement centerline and additional grooves 1/8 inch in depth and 1/8 inch in width on grooves 1/8 inch in depth and 1/8 inch in width on approximately 3-inch centers and transverse to the pavement center line.

(i) **Stenciling Station Numbers and Dates:** Before concrete takes its final set and after finishing operations are completed, the Contractor shall stencil station numbers and dates into the pavement in accordance with the standard drawings. The dies for numbering and dating will be furnished by and remain the property of the Department. Dies or numerals lost or damaged by the Contractor shall be replaced at his expense.

(j) **Curing:**

1. **Membrane-forming compounds:** The entire surface of the pavement shall be sprayed uniformly with a white-pigmented membrane-forming compound immediately following the texturing operation.

The compound shall be applied under constant pressure at the rate of 100 to 150 square feet per gallon by mechanical sprayers mounted on movable bridges. On textured surfaces, the rate shall be as close to 100 square feet as possible. Application shall be such that an even, continuous membrane is produced on the concrete surface. At the time of use, the compound shall be in a thoroughly mixed condition, with the pigment uniformly

Comment [786]: (Critical Right Time and Right Way)

Comment [787]: Right Time, Right Way

Comment [788]: Right Time, Right Way

Comment [789]: Right Time, Right Material

Trial Use and Comment

dispersed throughout the vehicle. During application, the compound shall be continuously and effectively agitated. Hand spraying of odd widths or shapes and concrete surfaces exposed by removing forms and sawing joints will be permitted.

The membrane shall harden 30 minutes after application. Personnel and equipment shall be kept off the freshly applied material to prevent damage to the seal. If the membrane becomes damaged within the initial 72 hours, damaged portions shall be repaired immediately with additional compound.

Upon removal of side forms, sides of exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface.

If the slipform method of paving is used, edges of pavement shall be cured in the same manner and at the same time as the surface.

2. **PE film:** When PE film is used for curing, it shall be white. However, from November 1 to April 1, clear or opaque PE film will be permitted.

Comment [790]: Right Time, Right Material

3. **Protection in cold weather:** The Contractor shall prevent the temperature at the surface of the concrete from falling below 40 degrees F during the first 72 hours immediately following concrete placement. Protective material shall be left in place for an additional 48 hours if freezing air temperatures are expected to continue. Such protection shall be furnished in addition to the curing material required elsewhere in these specifications. The Contractor shall be responsible for the quality of the concrete placed during cold weather. Concrete damaged by the action of frost or by freezing shall be removed and replaced at the Contractor's expense.

4. **Curing in hot, low-humidity, or windy weather:** Care shall be taken in hot, dry, or windy weather to protect the concrete from shrinkage cracking by applying the curing medium at the earliest possible time after finishing operations and after the sheen has disappeared from the surface of the pavement.

(k) **Surface Test:** As soon as concrete has hardened sufficiently, the pavement surface will be tested by the Engineer with a 10-foot straightedge. Areas showing high spots of more than 3/16 inch on mainline pavement and approach slabs but not exceeding 1/2 inch in 10 feet shall be marked and, after the concrete has attained the design compressive strength, cut down with an approved cutting tool to an elevation where the area or spot will not show surface deviations in excess of 3/16 inch. Areas showing high spots of more than 3/8 inch on ramps when tested with a 10-foot straightedge shall be marked and, after the concrete has attained the design compressive strength, corrected to within the 3/8-inch tolerance by removing and replacing or by cutting as specified herein. If the slipform method of paving is used, a straightedge tolerance of ±1/4 inch in 10 feet will be permitted for the area within 6 inches of the slipformed edge except for pavement adjacent to connections and ramps. Equipment for cutting shall be designed to cut the surface of the pavement in a longitudinal direction parallel with the centerline and in a uniform planing action. However, the cutting operation shall not produce a polished pavement surface. The equipment shall be

Comment [791]: (Right Time, Right Way

Trial Use and Comment

adjustable so as to vary the depth of the cut as required. Bush hammering, rubbing with carborundum stone, or hand grinding will not be permitted. Where the departure from the specified cross section exceeds 0.20 percent on mainline pavement, the pavement shall be removed and replaced by and at the expense of the Contractor.

(l) **Removing Forms:** Forms shall not be removed from freshly placed concrete until it has set for at least 12 hours. Forms shall be removed carefully to avoid damage to the pavement. After forms are removed, the sides of the slab shall be cured as specified by one of the methods described herein. Major honeycombed areas will be considered defective work and shall be removed and replaced. Any area of section removed shall be not less than 10 feet in length or less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 10 feet in length shall also be removed and replaced.

Comment [792]: Right Time, Right Way

(m) **Sealing Joints:** Before pavement is opened to traffic, including the Contractor's equipment, and as soon after completion of the curing period as practicable, joints required to be sealed shall be filled with joint-sealing material. Just prior to sealing or resealing, each joint shall be thoroughly cleaned by brushing, routing, sawing, grinding, blast cleaning, or any combination thereof to eliminate oil, grease, existing joint material, membrane-forming compound, laitance, protrusions or hardened concrete, dirt, or other foreign material that cannot be removed by means of compressed air to a depth at which the sealer and backup material, if required, are to be installed. Dust and loose material shall be removed from the joint with oil-free and water-free compressed air delivered at a minimum of 120 cubic feet of air per minute and a nozzle pressure of at least 90 pounds per square inch. Existing joint material extending outside the joint shall be removed.

Comment [793]: Right Time

Joint material shall be installed in accordance with the manufacturer's recommendations. However, in the absence of specific recommendations or plan details, the following provisions shall apply.

Comment [794]: Right Way

1. Preformed seals shall be installed by machines that are designed especially for such installation and shall not damage the seal. Types A and D material shall be installed by machine. The seal shall be installed with its vertical axis parallel with the interfaces of the joint.

2. The method of installing preformed seals shall be such that the seal is not stretched more than 5 percent of the length of the joint.

The method of installation shall be checked for stretching, using transverse joint sealer. The check shall consist of installing sealer in five joints, the full width of the pavement, and removing the sealer immediately after installation and checking the length. If the measured length of any of the five sealers is less than 95 percent of the minimum theoretical length required to seal the joint, the installation method shall be modified so that stretching greater than 5 percent no longer occurs. Once sealing operations have started, 1 joint per every 100 shall be removed and checked for stretch in excess of 5 percent. If a stretched condition is detected, the joint sealers on either side shall be removed until the condition

Trial Use and Comment

disappears. Affected joints shall be resealed in a satisfactory manner at the Contractor's expense.

3. For rounded or beveled joints, seal or sealant shall be installed in a depth of at least 1/8 but not more than 1/4 inch below the bottom edge of the rounding or bevel. For joints with vertical sides, seals or sealant shall be installed at a depth of 1/4 inch, ±1/16 inch, below the level of the pavement surface.

4. Hot-poured sealer shall be applied to a completely dry joint. The ambient air temperature shall not be below 40 degrees F. The joint shall be filled with hot-poured sealer by means of a sealing device that will not cause air to be entrapped in the joint. Sufficient passes shall be made to achieve the filled joint requirement.

5. Material for hot-poured sealer shall be stirred during heating so that localized overheating does not occur.

6. Sealer shall not be placed directly on the filler but shall be prevented from bonding to the filler by a carefully placed strip of waxed or silicone paper, plastic tape, aluminum foil, or other suitable material placed over the filler before sealer is applied. Masking tape or other means shall be used to avoid spilling sealer onto adjacent concrete surfaces. Excess sealer on such surfaces shall be cleaned off before the material has set without damaging the material in the joint.

7. Silicone sealer shall not be applied when the air temperature is below 40 degrees F. Sealer shall fill the joint and shall be applied inside the joint from the bottom up by means of an application device that will not cause air to be entrapped. Immediately after application, sealer shall be tooled to form a recess below the pavement surface in accordance with the standard drawings. The use of soap, water, or oil as a tooling aid will not be permitted. Primer, if used with silicone sealer, shall be applied to the joint faces prior to installation of backup material. Backup material shall be approximately 25 percent larger than the joint width and shall be installed in the joint such that it is not displaced during the sealing application.

Sealing material shall be applied in a manner so that it will not be spilled on the exposed surfaces of the concrete. Excess material on the surface of the concrete pavement shall be removed immediately, and the pavement surface cleaned. The use of sand or similar material as a cover for the seal will not be permitted.

(n) **Protecting Pavement:** The Contractor shall protect the pavement and its appurtenances against public traffic and traffic caused by his employees and agents. This shall include furnishing watchpersons and flaggers to direct traffic and erecting and maintaining warning signs, lights, pavement bridges, or crossovers.

In order that the concrete may be properly protected against the effects of rain before it has attained final set, the Contractor shall have covering material available at the work site, such as burlap, cotton mats, curing paper, or plastic sheeting.

Comment [795]: Right Way, Right Location

Trial Use and Comment

If the slipform method of paving is used, the Contractor shall also have material available at all times for protecting the edges of unhardened concrete. Protective materials shall consist of standard metal forms or wood planks having a nominal thickness of at least 2 inches and a nominal width of at least the thickness of the pavement at its edges.

When rain appears imminent, concrete placement operations shall be halted and available personnel shall assist in covering the surface of unhardened concrete.

A layer of coarse burlap shall be applied to the surface of fresh concrete prior to the application of PE film or other protective coverings that tend to "wipe out" or reduce the texture upon contact.

The Engineer will carefully consider any damage to the pavement occurring prior to final acceptance and may allow the Contractor to repair such damage or require the damaged pavement to be replaced.

(o) **Opening to Traffic:** Pavement shall not be opened to traffic until specimen beams conforming to the requirements of (f) herein have attained a modulus of rupture strength of 600 pounds per square inch when tested by the center point loading method in accordance with the requirements of ASTM C293. In the absence of such tests, pavement shall not be opened to traffic until 14 days after concrete is placed. Prior to opening to traffic, pavement shall be cleaned and joints sealed and trimmed.

Comment [796]: Right Time

Comment [797]: Right Documentation

(p) **Saw-Cut Hydraulic Cement Concrete Pavement:** This work shall consist of saw-cutting the existing hydraulic cement concrete pavement to a depth shown on the plans and as directed by the Engineer.

316.05—Thickness and Finished Grade Tolerances

The thickness of pavement will be determined by average caliper measurements of cores taken therefrom in accordance with the requirements of VTM-26.

Comment [798]: Right Way

Areas found to be deficient in thickness by more than 1.00 inch will be evaluated by the Engineer, and if in his judgment the deficient areas warrant removal, they shall be removed and replaced with concrete of the thickness specified on the plans. The deficient area shall be the product of the full width of the slab or lane of pavement multiplied by the sum of the distances in each direction from the deficient core along the centerline of the pavement to the first actual cores found not deficient in thickness by more than 1.00 inch.

The Contractor shall fill test holes with the same type of concrete as in the pavement.

After placement of the final pavement layer, finished grade elevations shall be within +/– 0.04 foot of the elevations indicated in the plans, unless otherwise specified, provided that the actual cross slope does not vary more than 0.20 percent from the design cross

Trial Use and Comment

slope indicated in the plans and the pavement thickness conforms to the thickness tolerances specified herein.

If determined by the Engineer that either the finished grade elevations or cross slope exceeds the tolerances specified, the Contractor shall submit to the Engineer for approval a plan of corrective action.

Finished grades shall be constructed to the proposed cross sections, and cross slopes shall be constructed to the proposed typical section slopes indicated on the plans. Areas found to deviate from the indicated cross slopes by 0.20 percent or more shall be corrected or replaced by the Contractor at no additional cost to the Department.

Comment [799]: Right Location

316.06—Measurement and Payment

Hydraulic cement concrete pavement will be measured in square yards of concrete pavement, complete-in-place, and will be paid for at the contract unit price per square yard. This price shall include furnishing and placing materials, including dowels, reinforcement, and joint material, provided that for any pavement found deficient in average thickness, as described in VTM-26, by more than 0.20 inch but not more than 1.00 inch only the reduced price stated herein will be paid. The width of measurement will be the width of the pavement shown on the typical cross section of the plans, additional widening where called for, or as otherwise directed in writing by the Engineer. The length will be measured horizontally along the centerline of each roadway or ramp.

Comment [800]: Right Documentation, Right payment, Right Quantity

Concrete entrance pavement, concrete launching ramps, and anchor slabs will be measured in square yards of surface area, complete-in-place, and will be paid for at the contract unit price per square yard.

Comment [801]: (Right documentation, Right payment, Right Quantity)

Bridge approach slabs, when a pay item, will be measured in cubic yards of concrete and pounds of reinforcing steel, complete-in-place, and will be paid for at the contract unit price per cubic yard of concrete and per pound of reinforcing steel.

Comment [802]: Right Documentation, Right Payment, Right Quantity

Bridge approach expansion joints will be measured in linear feet of transverse measure, complete-in-place, and will be paid for at the contract unit price per linear foot. This price shall include subslab excavating and furnishing and placing materials.

Comment [803]: (Right Way, Right Quantity

No additional payment over the contract unit price will be made for any pavement that has an average thickness in excess of that specified on the plans.

Resealing joints, when a pay item, will be paid for at the contract unit price per linear foot. This price shall include joint preparation, furnishing and placing sealer, and removing and disposing of debris.

Comment [804]: (Right Way, Right Payment)

Saw-cut hydraulic cement concrete pavement will be measured in feet for the depth specified and will be paid for at the contract unit price per foot, which price shall be full

Comment [805]: Right Way, Right quantity

Trial Use and Comment

compensation for saw-cutting the hydraulic cement concrete pavement to the depth specified.

Price adjustments: Where the average thickness of pavement is deficient by more than 0.20 but not more than 1.00 inch, payment will be made at an adjusted price as specified by the following:

Comment [806]: Right Quantity

Deficiency in Thickness (in)	% of Contract Unit Price Allowed
0.00-0.20	100
0.21-0.30	80
0.31-0.40	72
0.41-0.50	68
0.51-0.75	57
0.76-1.00	50

When the thickness of pavement is deficient by more than 1.00 inch and the Engineer determines that the area of such deficiency should not be removed and replaced, there will be no payment for the area retained.

Payment will be made under:

Pay Item	Pay Unit
Hydraulic cement base course (Depth)	Square yard
Plain hydraulic cement concrete pavement (Depth)	Square yard
Reinforced hydraulic cement concrete pavement (Depth)	Square yard
Continuously reinforced hydraulic cement concrete pavement (Depth)	Square yard
Concrete, Class A4, bridge approach slab	Cubic yard
Reinforcing steel, bridge approach slab	Pound
Bridge approach expansion joint	Linear foot
Concrete entrance pavement (Depth)	Square yard
Concrete launching ramp (Standard)	Square yard
Anchor slabs (Type)	Square yard
Resealing (Type) joints (Material)	Linear foot
Saw-cut hydraulic cement concrete pavement (depth)	Linear foot

Comment [807]: Right Quantitiy, Right Way

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting: Review Specification requirements, Materials requirements and documents, Construction Procedures and method of payment

Trial Use and Comment

Start: Contact and meet with contractor to discuss their schedule of work and clarify requirements' and what access and advanced time to what inspection phases are needed to assure there are minimal delays. Clarify that no concrete will be placed until forms and structures are approved by inspection staff.

Continuous inspection: Make sure Inspector and Contractor are aware of what items need to have continuous inspection such as Concrete placement, finishing and curing.

Final Inspection: Ensure finish tolerances, texture of concrete and curing are performed as required.

Documentation Required: Delivery tickets for concrete placed and all incidental items that are affiliated with item. Record where material has been placed, what kind of material is placed, Time placed and any comments made to contractor.

IV. REVIEW QUESTIONS

Spec Ref.	
316.02(a)	Is the concrete sufficiently cohesive to prevent detrimental sloughing of the edges when the slip form method is used?
316.03(a)(d)	Do the forms and bulkheads meet the requirements of this sections?
316.03(g)	Do the vibrators being used meet the requirements of this section?
316.04(a)	Does the surface of the concrete base course meet the requirements when tested under a 10 foot straightedge and also have a heavy broomed texture?
316.04(c)1	Have "leave out" joints been installed when required and as detailed on the plans?
316.04(c)2	Are the side forms of the slip form paver designed so that tie bars can be placed as specified?
316.04(d)1	Have the forms been pinned sufficiently and locked in place to hold line and grade as required?
316.04(d)2	Prior to concrete placement, have the forms been cleaned and oiled?
316.04(d)3	Has the alignment and grade of the forms been checked and corrected as required by the contractor?
316.04(e)1	Is the concrete placed and finished in accordance with this section?
316.04(e)2	Has the concrete in an adjoining lane attained the strength requirements before mechanical equipment is operated on it?
316.04(g)	If random or uncontrolled cracking occurs, have concrete joints or slabs been repaired as specified?
316.04(g1)	Have the deformed tie bars and longitudinal joints been installed as specified?

Trial Use and Comment

316.04(g1a)	Are approved devices used to form the joints and the groove sealed with joint material as required?
316.04(g1b)	Has the material for strip insert joints been approved and installed in accordance with requirements?
316.04(g1c)	Are saw cut joints in accordance with the requirements of this section?
316.04(g2)	Are transverse expansion joints properly formed and sealed with filler placed at the proper grade and elevation?
316.04(g3)	Have transverse contraction joints been installed as specified?
316.04(g4ab)	Have transverse construction joints been constructed as required in this sections?
316.04(g5)1	Are the plain dowels held in place as required?
316.04(g5)2	Has the free end of each dowel been treated as specified?
316.04(g6)	Have isolation joints been formed for structures in the pavement as required?
316.04(h1)	Has concrete been mechanically vibrated to prevent voids and segregation from locations specified?
316.04(h4)	Does the riding surface have a gritty texture and has it been grooved as required?
316.04(j1)	Has the surface and sides of the pavement been sprayed uniformly with curing compound which was continuously and effectively agitated during application?
316.04(j2)	Is the PE film being used for curing the type specified for the time of the year?
316.04(j3)	Has the contractor maintained the surface temperature of the concrete as specified?
316.04(j4)	Has the curing material been placed as early as possible in hot, low humidity or windy weather?
316.04(k)	Is the paved riding surface in compliance with the requirements of this section?
316.04(l)1	Are the forms left in place for the required time before removal?
316.04(l)2	Have major honeycombed areas been removed and replaced?
316.04(m)	Have all joints been thoroughly cleaned and sealed prior to opening the pavement to traffic?
316.04(m1)	Have preformed seals been installed by machines that do not damage the seal and checked in accordance with this section?
316.04(m3)	Have rounded or beveled joints had the seal or sealant installed as specified?
316.04(m4)	Is the joint for hot-poured, or silicone sealer sealed only if the air temperature is at least 40 degrees F.?
316.04(m5)	Has the hot-poured sealer material been stirred during heating and prevented from bonding to the filler as specified?
316.04(m7)	Has the sealer been applied and tooled to form a recess as specified?
316.04(n)1	Has the contractor protected the pavement from the effects of rain

Trial Use and Comment

	and all traffic as specified?

- Does the Contractor have a Certified Concrete Field Technician present during placement of pavement?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• Inspector must understand and review Contractors schedule so they can be there when needed and shall assure proper material is being used as per Contract requirements
• Ensure foundation in which concrete is being placed is acceptable, form placement is to be approved prior to placement of reinforcing steel and concrete.
• Curing is to be observed and approved prior to concrete losing its' initial sheen.
• Document type of material, measurements for payment and clearly identify them and communicate them to the contractor daily.

Trial Use and Comment

SECTION 317— STONE MATRIX ASPHALT CONCRETE PAVEMENT

I. INTRODUCTION:

Stone matrix asphalt (SMA) has been used in Europe for over 30 years. SMA was first used in Europe as a mixture that would resist the wear of studded tires; however, an additional benefit found with SMA was that it was durable and highly rut resistant. Because of the success of SMA in Europe, five state agencies within the U.S. constructed SMA pavements during 1991. These agencies designed the SMA mixtures using a recipe adopted from European practices. The recipe generally consisted of a single aggregate gradation band that followed the.60-30-10" rule. This rule indicates that 60 percent of the aggregate gradation was made up of a coarse aggregate, 30 percent was a fine aggregate, and 10 percent was mineral filler.

a) Forms:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's:

317.01—Description

This specification covers the furnishing, installation, and acceptance criteria for stone matrix asphalt (SMA) concrete pavement.

317.02—Materials

Comment [808]: Right Material

(a) **Coarse aggregate** shall conform to the requirements of **Section 248.02(a):**

(b) **Fine aggregate** shall conform to the requirements of **Section 248.02(b**).

(c) **Asphalt binder** shall conform to the requirements of **Section 248.02(c)**.

(d) **Mineral filler** shall conform to the requirements of **Section 248.02(d).**

(e) **Fiber additive** shall conform to the requirements of **Section 248.02(e).**

317.03—Composition of SMA Mixture

Comment [809]: Right Material / Right Way

Trial Use and Comment

This section shall conform to the requirements of **Section 248**.

317.04—Acceptance

This section shall conform to the requirements of **Section 248**.

317.05—SMA Mixing Plant

(a) **Mineral filler handling** shall be in accordance with the requirements of **Section 248.05(a)**.

(b) **Fiber addition** shall be in accordance with the requirements of **Section 248.05(b)**.

(c) **Hot-mixture storage** shall conform to the requirements of **Section 248.05(c)**.

(d) **Mixing temperatures** shall conform to the requirements of **Section 248.05(d)**.

317.06—Weather Restrictions

SMA mixture shall be placed only when the ambient and surface temperatures are 50 degrees F or above.

317.07—Placing and Finishing

The mixture temperature in the truck shall not be less than 300 degrees F for mixtures containing PG 70-22 and 310 degrees F for mixtures containing PG 76-22. The temperature immediately behind the screed shall not be less than 290 degrees F for mixtures containing PG 70-22 and shall be not less than 300 degrees F for mixtures containing PG 76-22.

A continuous paving operation that provides for constant steady movement of the paver shall be maintained. In the event that excessive stop and go of the paver is occurring, production and laydown of the mixture shall be stopped until the Contractor has made satisfactory changes in the production, hauling, and placement operations resulting in a constant steady movement of the paver.

A Material Transfer Vehicle (MTV) shall be used during the placement of SMA mixes. The paving operation shall have remixing capability in either the MTV or a paver-mounted hopper to produce uniform, nonsegregated mix with uniform temperature. The MTV and paver combination shall have a minimum storage capacity of 15 tons. In the

Comment [810]: Right Material / Right Way

Comment [811]: Right Way

Comment [812]: Right Way

Comment [813]: Right Way / Right Time

Comment [814]: Right Way

Comment [815]: Right Way

Trial Use and Comment

event of a break down, paving shall be discontinued and no more material shall be shipped from the hot-mix plant.

317.08—Compaction

Immediately after the mixture has been spread and struck off, it shall be thoroughly and uniformly compacted by rolling. Rolling shall be accomplished with steel wheel roller(s) with a minimum weight of 10 tons. A minimum of three rollers shall be available at all times for compaction and/or finish rolling.

Comment [816]: Right Way / Right Time

To minimize coarse aggregate fracture/breakage in the aggregate skeleton of SMA mixes, the use of vibratory rollers on SMA should be approached with caution. If a vibratory roller is used, the mat shall receive not more than three vibratory passes. The roller shall use only the highest frequency and lowest amplitude setting.

Comment [817]: Right Way

Rolling procedures shall be adjusted to provide the specified pavement density. Rollers shall move at a uniform speed not to exceed 3 mph with the drive wheel nearest the paver. Rolling shall be continued until all roller marks are eliminated and the minimum density has been obtained. The Contractor shall monitor density during the compaction process by use of nuclear density gages to ensure that the minimum required compaction is being obtained. During the trial section, The Department will randomly select 3 plugs or cores locations to determine the in-place density in accordance to VTM-22.

Comment [818]: Right Way / Right Time

To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water that may be mixed with very small quantities of detergent or other approved material.

Comment [819]: Right Way

The Contractor shall perform acceptance testing for density for each day's production by obtaining one sawed specimen, 4 by 4 inch, or a 4-inch-diameter core at three stratified random locations specified by the Engineer. The three cores or plugs shall be obtained and the in-place density determined in accordance with the requirements of VTM-22. Core locations shall be numbered sequentially per roadway, marked on the pavement, filled with SMA mixture, and compacted prior to completion of each day of production. The average density of the three cores as determined in accordance with the requirements of VTM-22 shall be 94 to 98 percent for 100 percent pay. Cores or plugs shall be bulked in the presence of the Department. The Department reserves the right to have the cores or plugs bulked on the project site. The payment for density will be in accordance with the following:

Comment [820]: Right Time / Right Way

Payment Schedule

% Density Achieved	% of Payment
More than 98.0	97
94.0 to 98.0	100
92.0 to 93.9	85

Trial Use and Comment

90.0 to 91.9	65
Less than 90.0	Remove and replace

317.09—Trial Section

A trial section(s), a maximum of 300 tons, shall be constructed at a site approved by the Engineer at least 1 week prior to, but not more than 30 days prior to, roadway construction to examine the mixing plant process control, mixture draindown characteristics, placement procedures, SMA surface appearance, and compaction patterns and to calibrate the nuclear density device. In addition, the percentage of flat and elongated particles will be calculated on the SMA material produced for the trial section in accordance with the requirements of VTM-121 and compared to the maximum limits specified in the Coarse Aggregate Table in Section 248.02(a). A passing F&E sample is required for acceptance of the trial section. Acceptance of trial section shall be in accordance to **section 317.04**.

Comment [821]: Right Time / Right Way

The material placed in the trial sections shall be placed at the specified application rate using the same equipment that will be used during production.

Comment [822]: Right Way

317.10—Prepaving Conference

Prior to the start of production, the Department will hold a prepaving conference. Those attending shall include the Contractor's production supervisor and laydown supervisor, a representative of the fiber supplier, and a representative of the asphalt binder supplier.

Comment [823]: Right Time

317.11—Measurement and Payment

Comment [824]: Right measurement / Right Payment

Stone matrix asphalt will be measured in tons and paid for at the contract unit price per ton for the mix type specified, which price shall include all materials, additives, and equipment as described herein.

The initial trial section will be paid for at the contract unit price for the mix type specified. With the approval of the Engineer, up to one additional trial section of the mix type specified will be paid for at the contract unit price. The Department will pay for a maximum of two trial sections at the contract unit price. If more than two trial sections are needed, the Department and Contractor shall negotiate the price based on a reduced percentage of the contract unit price, and the subsequent trial sections shall be constructed at sites approved by the Engineer.

Payment will be made under:

Pay Item	Pay Unit
Stone matrix asphalt, SMA-9.5 (70-22)	Ton

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review contract requirements, materials documentation, construction procedures, measurement and payment.
- Discuss *critical* points.
- Review the necessary submittals.
- Review contractors equipment.
- Attend prepaving conference as described in 317.10 prior to commencement of production.

Start:

- Review first arrival of material and equipment to ensure appropriate placement operations.
- Review the trial section placement for acceptance.
- Ensure appropriate traffic control measures are in place.

Continuous inspection:

- Monitor material temperature and equipment to ensure appropriate compaction and constant steady movement of the paver.
- Monitor the mix for uniformity. Monitor finished surfaces for possible stripping or flushing of asphalt material.

Final Inspection:

- Ensure mix placed at required locations.
- Verify pavement marking placement within the required timeframes and at required base temperatures.

Documentation Required:

- List personnel and equipment on a daily basis.
- Maintain materials tickets for proof of payment along with any materials pay adjustment sheets.

IV. REVIEW QUESTIONS

See inspection manual objectives and activities listed above.

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Placement of test sections**
• **Start of production**
• **Continuous during production**

Trial Use and Comment

SECTION 401 - STRUCTURE EXCAVATION

I. INTRODUCTION:

Foundations are a very important part of bridge construction. The Inspector should pay particular attention to the type and condition of material encountered during excavation. The materials encountered should be compared with the substrata shown on the plans. Significant variations should be reported to the Construction Manager.

Preservation and protection of adjoining property is the Contractor's responsibility. Bring the possibility of property damage to the Contractor's attention, leave the necessary corrective measures to his initiative and document such notification in the Inspector's Daily Report.

PREPARATION OF FOUNDATIONS FOR FOOTINGS

Stability is the key to a good foundation. Generally, dense sands or gravels have the desired stability. Clays may be acceptable. However, muck and soft clays should be removed.

Rock, if sound, will provide a satisfactory foundation. Sedimentary types of rock may have voids and should be investigated by probing, sounding or drilling before any concrete is placed. Rock surfaces upon which concrete is to be placed should be relatively level. When sloping rock is encountered at or near footing elevation, the rock should be stepped or serrated.

Not only rock, but all foundation materials must be thoroughly examined. If there occurs a large difference in the types of soil or combination of soil and rock within a footing, advise the Construction Manager. Abnormal conditions encountered during excavation are to be noted in detail in the diary along with a description of the physical characteristics of the material upon which the footing is placed. Normally, the Construction Manager is to examine and approve all foundations prior to the placing of concrete in footings. The name of the person approving the foundation and the date of approval should be noted in the diary.

Ground water is often encountered above the desired foundation elevation. This water must be prevented from saturating the foundation soils. Water from foundations is to be pumped and filtered by an approved method.

Before the Contractor can begin work on, over, or under Railway property, approval must be obtained. The Contractor must submit to the Department his plan of operations for shoring, sheeting, or cofferdaming for construction of pier foundations and other excavation adjacent to the railway tracks. This information should be submitted to the ACE for their review and approval.

Trial Use and Comment

COFFERDAMS AND SHORING

A cofferdam is a structure constructed for the purpose of keeping water and earth out of the excavation area. Normally a cofferdam is placed before excavation begins. A simple type of cofferdam is a box-like enclosure of sheet piling within which the excavation is made, pumped dry, and the foundation constructed.

Cofferdams must be of sufficient size to accommodate the necessary form work, drainage details such as sumps, clearance for batter piles and clearance for minor deviations that occur in the installation of the walls.

Shoring refers to temporary support of the sides of an excavation and must conform to the Federal OSHA Standards and Virginia OSHA Standards. It is a wall type structure constructed of wood or steel and is installed as the excavation proceeds. Although the Contractor is responsible for the adequacy of shoring used, any seemingly unsafe condition should be brought to the attention of the Contractor and the Construction Manager.

BACKFILL MATERIAL

The key to a stable backfill is the use of good materials and proper placement techniques. Intermittent inspection is essential to the obtainment of a properly constructed backfill.

Seek the cooperation of the Contractor in selecting and using the best material available for backfill. Generally, the material excavated will be accepted for backfilling. If there is reason to believe such material is not acceptable, consult the Construction Manager for a decision. Suitable material may be available elsewhere on the project. Refer to the plans, special provisions, Standards and Specifications for the specific requirements for backfill material.
Special backfill is now shown on most bridge abutments.

PLACEMENT

The importance of proper placement of backfill material cannot be overemphasized. Care should be given to the sequence and method of placing.

Backfill shall be performed in accordance with **Section 401.03(i)**.

BACKFILLING WEEPHOLES

Weepholes permit water to escape from the backside of an abutment or wall. If water is trapped and allowed to accumulate behind the wall, the abutment will be subject to high

Trial Use and Comment

thrust type forces. Weepholes should be kept clear of all obstructions when the backfill is placed and remain clear after the backfill is complete.

Weepholes should be backfilled as shown on the plan. If the backfill is not clearly defined, consult the Construction Manager.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

401.01—Description

This work shall consist of excavating and backfilling or disposing of material necessary for constructing substructures and superstructures of new bridges and altering existing bridges in accordance with the requirements of these specifications and in conformity with the lines and grades shown on the plans or as established by the Engineer.

401.02—Materials

(a) **Backfill** shall be approved by the Engineer and shall be free from large or frozen lumps, wood, or rocks more than 3 inches in their greatest dimension or other extraneous material. Porous backfill shall conform to the requirements of Section 204.02(c).

(b) **Pipe underdrains** shall conform to the requirements of Section 232.02.

401.03—Procedures

Excavated material shall generally be used for backfilling and constructing embankments over and around the structure. Surplus or unsuitable material shall be disposed of in a place and manner such that it will not affect or re-enter streams or otherwise impair the hydraulic efficiency or appearance of the structure or any part of the roadway.

Where practicable, substructures shall be constructed in open excavation and, where necessary, the excavation shall be sheeted, shored, braced, or protected by other means. If footings can be placed in the dry without the use of sheeting or cofferdams, forms may be omitted with the approval of the Engineer and the entire excavation filled with concrete to the required elevation of the top of the footing. When forms are eliminated,

Comment [825]: Right Material

Comment [826]: Right Material

Comment [827]: Right Way

Trial Use and Comment

measurement and payment for structure excavation and concrete will be on a plan quantity basis wherein no adjustments will be made.

Unless tremie placement of concrete is specified, foundations for footings shall be kept free from standing or surface water until concrete and backfill operations have been completed. However, if the foundation is rock or the footing is supported on piles, other than for shelf abutments, dewatering need be performed only during concrete and backfill operations.

(a) **Preserving the Channel:** Excavation shall not be performed outside caissons, cribs, cofferdams, or sheet piles. The natural streambed adjacent to the structure shall not be disturbed. Material deposited in the stream area because of the Contractor's operations shall be removed, and the stream area shall be freed from obstructions caused by the Contractor's operations.

Prior to beginning work, the Contractor shall submit a plan that shall include the specific location of temporary structures or other obstructions that will constrict the stream flow, a description of construction activities that will contribute to constricting the stream flow, the dimensions and number of temporary structures and constrictions that are to be placed in the stream at any one time, and a dimensional elevation view of the stream and proposed temporary structures and constrictions.

(b) **Depths of Foundations:** Elevations denoting the bottom of footings shown on the plans shall be considered approximate only. Foundations shall not be considered satisfactory until approved by the Engineer.

When requested, the Contractor shall explore foundations by rod soundings or drillings to determine, to the satisfaction of the Engineer, the adequacy for the foundations to support the structure. If explorations indicate that satisfactory foundations can be obtained, variations from plan depths to foundations of open column abutments and solid or column piers shall be made only by adjusting stem lengths. Footing depths shown on the plans shall be considered minimum depths. Plan depths of concrete for footings may be increased not more than 24 inches at points of local irregularity over solid rock foundations.

Variations from plan depths to foundations of solid or deep curtain-wall abutments shall be made only by adjusting the depths of footings. Plan depths shall be considered minimum depths and shall not be exceeded by more than 3 feet.

If explorations reveal that foundations or subfoundations are inadequate for the structure, or are not within the limits of permissible variation from the bottom of footing elevations, the Engineer shall be consulted for instructions for further action or redesign.

(c) **Preparing Foundations for Footings:** Hard foundation material shall be freed from loose material; cleaned; and cut to a firm surface, either level, stepped, or serrated as

Comment [828]: Right location

Comment [829]: Right documentation

Comment [830]: Right Way, Right Time

Comment [831]: Right Way

Trial Use and Comment

directed by the Engineer. Seams shall be cleaned out and filled with concrete as directed by the Engineer.

When concrete is to rest on an excavated surface other than rock, the bottom of the excavation shall not be disturbed. The final removal of foundation material to grade shall not be performed until just prior to concrete placement.

When the elevation of the bottom of a footing is above the level of the original ground, the footing shall not be placed until the approach embankment has been placed and compacted to the elevation of the top of the footing and excavation has been performed through the embankment to the elevation of the bottom of the footing. When a footing is to be placed over material subject to movement because of pressure from overlying or adjacent fill, the footing or piles for the footing shall not be placed until after the fill has been placed and compacted. Excavation for shelf abutment footings shall be limited to a perimeter extending not more than 18 inches outside the neat lines at the bottom of the footing.

When the material on which a foundation is to be placed using piles is declared unsatisfactory by the Engineer, the excavation shall be undercut for a depth of 6 to 12 inches as directed and backfilled with crusher run aggregate, select borrow, or other material approved by the Engineer.

(d) **Holes for Drilled-In Caissons:** Foundation bearing areas shall be cut to an approximately level surface except that they may be stepped or serrated on hard rock. If material is encountered that is not sufficiently cohesive to maintain the proper diameter of the hole, casing shall be used.

Comment [832]: Right Way

(e) **Cofferdams:** Cofferdams for foundation construction shall be as watertight as practicable and carried to a depth that will allow them to function properly without displacement. The interior dimensions of cofferdams shall be such as to give sufficient clearance for the construction of forms and inspection of their exteriors and permit pumping from outside the forms. Cofferdams that are tilted or moved laterally during sinking shall be realigned to provide the required clearance.

If conditions are encountered that render it impracticable to dewater the foundation, the Contractor may be required to construct a concrete foundation seal of the dimensions necessary to ensure that the balance of the concrete can be placed in the dry. When weighted cofferdams are employed and the weight is used to overcome the hydrostatic pressure acting against the bottom of the foundation seal, anchorage, such as dowels or keys, shall be provided to transfer the entire weight of the cofferdam into the foundation seal. Cofferdams that are to remain in place shall be ported at the low water level.

Cofferdams shall be constructed in a manner to prevent damage to fresh concrete from a sudden rising of the stream and prevent damage to the foundation by

Trial Use and Comment

erosion. Timber or bracing left in cofferdams shall not extend into the substructure concrete.

Cofferdams, including sheeting and bracing, shall be removed after completion of the substructure in a manner that will not disturb or damage the finished concrete.

(f) **Pumping:** Pumping from the interior of a foundation enclosure shall be performed in a manner to preclude the possibility of water moving through any fresh concrete. Pumping will not be permitted during concrete placement or for at least 24 hours thereafter unless it is performed from a suitable sump separated from the concrete work.

(g) **Protecting Existing Structures or Utilities:** When foundations are located such that excavation may endanger or interfere with an existing structure or utility, the location of bracing and method of protection shall be subject to approval by the owner of the structure or utility.

(h) **Inspection:** After each excavation has been completed, the Contractor shall notify the Engineer and request his inspection and approval. Concrete shall not be placed until the depth of the excavation and the character of the foundation material have been approved.

(i) **Backfilling:** Excavated spaces that are not occupied by abutments, piers, or other permanent work shall be backfilled with soil to the surface of the surrounding ground. Backfill shall be uniformly compacted, and the top surface shall be neatly graded.

The fill around the perimeter of abutments, wingwalls, and retaining walls shall be placed in horizontal layers not more than 6 inches in loose thickness and compacted at ±20 percent of optimum moisture to a density of at least 95 percent as compared to the theoretical maximum density as defined in Division I. Tests for compliance with density requirements will be performed in accordance with the requirements of VTM-12. As the work progresses, backfill in front of units shall be placed and compacted in horizontal layers to the same elevation as the layers behind units until the final elevation in front is reached. Backfill shall be placed in a manner to prevent wedging action against the concrete. Slopes bounding excavation for abutments, wingwalls, or retaining walls shall be destroyed by stepping or serrating. Jetting of the fill behind abutments, wingwalls, or retaining walls will not be permitted.

Fills and backfills around piers not included in the roadway prism shall be constructed in uniformly compacted layers and placed alternately to maintain a uniform elevation on both sides of the structure. However, the density requirement will be waived.

Comment [833]: Right Way

Comment [834]: Right Time

Comment [835]: Right Documentation

Comment [836]: Right Way

Comment [837]: Right Way

Trial Use and Comment

Provision shall be made for drainage of backfill. Two-inch crusher run aggregate, conforming to the requirements of Section 205, shall be placed at the back of weep holes to extend 18 inches behind the entrance to the hole, 18 inches above the elevation of the bottom of the hole, and 18 inches laterally on each side of the centerline of the hole. Where crushed glass is used as porous backfill, No. 78 and/or No. 8 aggregate an 18-inch by 18- inch swatch of drainage fabric meeting the requirements of Section 245.03(c) shall be used to cover the #4 mesh at each weep hole opening exposed directly to crushed glass, or as approved by the Engineer.

Backfill shall not be placed against abutments or wingwalls until concrete has been in place 14 days, exclusive of days on which the average high-low air temperature is below 40 degrees F in the shade or until test cylinders have attained a compressive strength equal to 93 percent of the required 28-day design compressive strength.

Comment [838]: Right Time

Backfill shall be placed as soon as practicable following attainment of the required compressive strength but not later than 30 days after concrete placement. Excavation openings shall be maintained as dry as practicable at the time of backfilling. Backfill shall be placed in a manner to deter impoundment of water and facilitate existing drainage.

(j) **Filled Spandrel Arches:** Fill for spandrel arches within 1 1/2 times the height of the arch shall be placed in a manner to load the ring uniformly and symmetrically. Fill material shall be homogeneous soil and shall be placed in horizontal layers not more than 6 inches in loose thickness, compacted in accordance with the requirements of Section 303.04(h), and brought up simultaneously from both haunches. Wedge-shaped sections of fill material against spandrels, wings, or abutments will not be permitted.

Comment [839]: Right Way, Right Time

(k) **Approach Embankment:** Approach embankment shall be constructed in accordance with the requirements of Section 303.04(h).

401.04—Measurement and Payment

Structure excavation will be measured in cubic yards of material removed from the limits of vertical planes within 18 inches outside the neat lines of footings or of neat work that does not have footings directly beneath it, such as curtain walls or cantilevered wingwalls. It will be measured from the surface of the original ground or approach roadway down to the bottom of the foundation shown on the plans or such foundation as the Engineer may approve, down to 18 inches below the bottom of the neat work not directly over footings, or to the top of existing concrete where excavation is to permit placing new concrete over existing concrete.

Comment [840]: Right quantity

Trial Use and Comment

When specified on the plans, structure excavation will include material removed outside the limits specified for the substructure, in the vicinity of the substructure on which a superstructure rests, and to a depth of 18 inches below the lowest beam or bottom of the slab of the superstructure or to such depth as shown on the plans. The width of such excavation shall be limited to 18 inches outside the exterior beams or edges of the slab or as shown on the plans.

Excavation above the bottom of a proposed channel change or roadway template or an overpassed road will not be included as structure excavation.

Structure excavation will be paid for at the contract unit price per cubic yard. This price shall include clearing and grubbing, sheeting, shoring, bracing, placing and compacting backfill, dewatering, furnishing and placing aggregate for weep holes, disposing of unsuitable or surplus material, and clearing the channel of obstructions caused by construction operations.

Excavation for drilled-in caissons will be measured in linear feet of drilled hole from the existing ground to the bottom of the finished hole as measured along the centerline of the hole and will be paid for at the contract unit price per linear foot. This price shall include drilling, under reaming, casing, and preparing the hole.

Furnishing and placing backfill will be included in the price for structure excavation and will not be measured for separate payment unless specific material is required by the Engineer and no suitable material is available within the construction limits. When specific material is required for backfill by the Engineer, measurement and payment will be in accordance with the requirements of Section 104.03.

Porous backfill, when a pay item, will be measured in cubic yards of material within the limits shown on the plans or as otherwise directed by the Engineer and will be paid for at the contract unit price per cubic yard.

Pipe underdrains, when a pay item, will be measured in linear feet and will be paid for at the contract unit price per linear foot.

Unsuitable materials removed below the plan foundation will be measured and paid for as structure excavation.

Foundation seals required by the Engineer and that are properly placed for structural adequacy as a part of the planned footing will be accepted as part of the permanent footing. Measurement and payment will be in accordance with the requirements of Section 404.08. Foundation seals that are not required by the Engineer will be included in the price for structure excavation.

Clearing and grubbing within the area defined by lines connecting the extremities of the substructure units, regardless of whether excavation is involved, shall be included in the price for structure excavation unless otherwise specified in the Contract.

Trial Use and Comment

Cofferdams will be measured in units of each per foundation and will be paid for at the contract unit price per each. This price shall include furnishing, erecting, maintaining, and removing.

Payment will be made under:

Pay Item	Pay Unit
Structure excavation	Cubic yard
Drilled holes	Linear foot
Porous backfill	Cubic yard
Pipe underdrain (Size)	Linear foot
Cofferdams	Each

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Proper layout (should be checked and verified by survey using field control points),
- Pre-excavation survey of existing ground elevations. Sketch should have sufficient details to accurately compute final quantity.
- Silt control in place before excavation, procedure established for pumping/de-watering if necessary

Start:

- Offset stakes in place to allow for reestablishment of correct location of proposed foundation.
- Material excavated is being properly stocked or disposed of.

Continuous inspection:

- Not necessary, but site should be monitored for erosion control and overview material removal for potential issue.
- Excavation safety utilized if employees enter excavation.
- Proper and approved backfill material.
- Monitor de-watering if pumping is needed.

Final Inspection:

- Sounded in accordance with specification before concrete placement
- Side slopes stable and in accordance with trenching Codes (OSHA). Shoring in place if required by constraints.
- Foundation approved by proper authority or designee.

Documentation Required:

- Excavation sketch with direct measurement or elevations for computation of quantity.
- Calculation of quantity if not a plan quantity item or plan quantity is adjusted by design engineer due to change in elevation, dimension, etc.
- Backfill densities (if required)

IV. REVIEW QUESTIONS

401.03(a)1	Has excavation been performed inside caissons, cribs, cofferdams, or sheet piles?
401.03(a)2	Prior to beginning work, did the contractor submit a plan including location, description, number, and dimensions of temporary structures or other

Trial Use and Comment

	obstructions that will constrict stream flow?
401.03(a)3	Was material deposited in the stream area because of the Contractor's operations removed, and the stream area freed from obstructions caused by the Contractor's operations?
401.03(b)1	When requested, was the foundation explored by rod soundings or drillings to determine the adequacy of the foundations to support the structure?
401.03(b)2	Has the Engineer been consulted when explorations reveal that foundations or subfoundations are inadequate for the structure, or are not within the limits of permissible variation from the bottom of footing elevations?
401.03(c)2	Was the foundation cleaned of all loose material before concrete was placed?
401.03(c)3	Were approach embankments placed and compacted to top of footing elevation prior to excavation for and placement of footings installed above original ground?
401.03(c)4	If the footing is subject to movement because of pressure from overlying or adjacent fill, was the fill compacted in place before the footing was placed?
401.03(c)5	When the material on which a foundation is to be placed using piles, is declared unsatisfactory by the engineer, was the excavation undercut and backfilled in accordance with this section?
401.03(e)	Were cofferdams installed according to this section and/or other applicable requirements?
401.03(f)	Were restrictions on pumping enforced?
401.03(i)2	Are the excavated spaces backfilled in uniform lifts and compacted as required by this section - 6" loose measurement?
401.03(i)3	Have the concrete strength requirements been met prior to form removal and subsequent backfill?

RECORDS

• The project records are to include the following field information and calculations:
• Original ground level notes including sketch indicating location of irregularities.
• The actual elevation of the footing bottom.
• The actual horizontal dimensions of the excavated area. (Pay quantity is to include the actual material excavated limited to 18 inches outside of footing neatlines.)
• When the footing is to be keyed into rock, record the actual dimensions of the excavated area.
• The vertical limits of excavation are from the bottom cross sections of the footing to the original ground cross sections. When structure excavation is in a fill area, excavation above the original ground will not be included for payment. When footing is on piles, fill to top of footing and excavate to bottom.

- Structure excavation calculations.

Trial Use and Comment

• Date, name and title of person who approved the foundation.
• Is an area staked off 18 inches around the neatlines of the footing and record original ground elevations, including irregularities, prior to excavation operations?
• Does the Inspector verifiy the Contractor's layout of excavation area?
• Does the Contractor install the required erosion and siltation control devices?
• Does the Contractor verify the need for cofferdams or shoring to retain the embankment in compliance with applicable safety codes during excavation?
• Does the Inspector check the plans for the bottom elevation of the footing and notify the Contractor not to exceed this elevation?
• Does the Contractor examine the foundation for proper location, dimensions, grade and stability? The Contractor is to explore at least five feet below the contemplated foundation elevation. Usually, three to five drilled holes or rod soundings are sufficient to determine the adequacy of the sub-foundation. Note location of exploration in project records.
• Does the Inspector notify the Construction Manager and/or District Bridge Engineer for inspection and approval of foundation?
• Does the Inspector record foundation irregularities and computed excavation quantities?
• Is the foundation cleaned of loose materials prior to placement of concrete?
• Are the concrete strength requirements met prior to form removal and subsequent backfill?
• Is the backfill placed in uniform lifts and compacted properly?
• Has the material used for backfill been approved by the Engineer?

<u>Before Excavation</u>

- Has line and grade been verified?
- Elevations of existing ground taken and recorded.
- Approved disposal or stockpile site.
- Shoring approved if necessary.
- Cofferdam in place in accordance with permits (if required)
- On shelf abutments – proper compaction of fill to top elevation is required.

<u>During excavation</u>

- Silt control functioning
- Proper disposal or storage of material
- Shoring in place
- If groundwater or infiltration from a body of water, is proper dewatering occurring?
- Observe and note type of material removed from excavation.

<u>At grade</u>

- Check for elevation as related to plan grade.

Trial Use and Comment

- Sounded with rock drill 5 foot as per spec.
- Reviewed and approved by Engineer.
- Record actual depths of excavation for quantity (if not shown as plan or for payment if plan is not estimated properly).

<u>After concrete placement and cure</u>

- Area approved for backfill (dry and clean).
- Backfill placed properly (if area in roadway prism)

V. CRITICAL INSPECTION POINTS

• Proper erosion control in place. If applicable, all permit conditions are met before excavation.
• Proper horizontal and vertical control in place and secure
• Excavation safety measures approved and placed in accordance with design or manufacturers requirement.
• Approval of foundation and elevation of excavation. The approval shall be noted in the diary and include the name and title of person approving foundation.

Trial Use and Comment

SECTION 402 – SHEET PILING

I. INTRODUCTION:

Sheet piling is typically used as a temporary supportive structure that is driven into a slope or excavation in order to prevent soils from collapsing into a work area from above. Sheet piling are typically made of timber, concrete, or steel.

Examples of where sheet piling are typically used include:

- Retaining Walls
- Bridge Abutments and Footings
- Cofferdams
- Waterfront Structures
- Excavations and Trenches
- Slope Stabilization

a) Forms:

- Intentionally Left Blank

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

402.01—Description

This work shall consist of furnishing and installing the type of sheet piles shown on the plans or specified by the Engineer to be left in place or removed as part of the finished structure.

402.02—Materials

(a) **Timber sheet piles** shall conform to the requirements of Section 236 and may be of any species of wood that can be driven satisfactorily. Piles shall be free from worm holes, loose knots, wind shakes, decayed or unsound portions, or other defects that might impair their strength or tightness.

(b) **Concrete and reinforcing steel for concrete sheet piles** shall conform to the requirements of Sections 217 and 223.

(c) **Steel sheet piles** shall conform to the requirements of Section 228.

402.03—Procedures

Comment [841]: Right Place

Comment [842]: Right Material

Comment [843]: Right Way

Trial Use and Comment

(a) **Timber Sheet Piles:** Piles shall be sawed with square corners and provided with tongues and grooves of ample proportions, either cut from the solid material or made with three planks securely fastened together. Piles shall be drift sharpened at the lower ends to wedge the adjacent piles tightly together.

The top of piles shall be cut off to a straight line. Piles shall be braced with waling strips that are lapped and joined at splices and corners. Wales shall be in one length between corners and bolted near the top of the piles.

(b) **Concrete Sheet Piles:** Concrete sheet piles shall be manufactured in accordance with the requirements of Section 403, 404, or 405, as applicable. Installation shall be in accordance with the requirements of Section 403.

(c) **Steel Sheet Piles:** When assembled in place, pile sections shall be practically watertight at the joints. Painting of steel sheet piles shall be performed in accordance with the requirements of Section 403. Piles shall be provided with tongues and grooves of ample proportions for securely fastening together. Wales and structural supports shall be provided as necessary to ensure structural integrity.

(d) **Temporary Sheet Piling:** When shown on the plans or directed by the Engineer, temporary sheet piling will be measured in square feet. The horizontal dimensions will be measured continuously along the outer face of the sheet piling. The bottom limit will be the bottom of the excavation shown on the plans or as authorized. The top limit will be the original ground line or, in areas adjacent to traffic, 3 feet above the original ground line, or as otherwise shown on the plans.

Comment [844]: Right Location

402.04—Measurement and Payment

Comment [845]: Right Payment / Right Quantity / Right Time

Sheet piles will be measured in square feet of piles remaining in place and will be paid for at the contract unit price per square foot. The horizontal dimensions will be measured continuously along the outer face of the piling. For steel sheet piles, the horizontal dimension used shall be not more than the sum of the laying widths or driving dimensions of the individual piles.

Payment for **temporary sheet piling** will be made at the contract unit price per square foot, which price shall be full compensation for furnishing, driving, and removing the piling. Sheet piles used for the convenience of the Contractor in his method and means will not be measured for separate payment but will be considered incidental to the work.

Payment will be made under:

Pay Item	Pay Unit

Trial Use and Comment

Sheet piles (Type)	Square foot
Temporary sheet piling	Square foot

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review Plans, Contract, and Specification requirements.
- Review measurement and payment requirements.
- Review environmental permit requirements if sheet piling installation is adjacent to, or within environmentally sensitive areas.

Start:

- Observe contractor's operation to ensure sheet piling is being installed at the location detailed in the plans, and in accordance with environmental permitting documentation, if applicable.

Intermittent Inspection

- Make sure that the contractor is handling and protecting the piling so as to ensure proper structural integrity and/or water tightness of the sheet piling is not compromised.

Final Inspection:

- Make sure that the installed sheet piling are in the proper location and to the dimensions detailed in the plans, or as directed by the Engineer.

Documentation Required:

- Plans
- Contract
- Specification
- Measurements for area of sheet piling paid for.
- Detailed diary explanation when sheet piling is not measured and paid for because the sheet piling has been installed for contractor convenience.
- Design, Calculations, and Certification from a Professional Engineer (when applicable)

Trial Use and Comment

IV. REVIEW QUESTIONS

N/A

V. CRITICAL INSPECTION POINTS

- Ensure that sheet piling work adjacent to, or within, environmentally sensitive areas are within permit requirements.

Trial Use and Comment

SECTION 403 – BEARING PILES

I. INTRODUCTION:

Bearing piles are utilized to create strong foundations when existing foundations are not strong enough to support the structure being placed. Piles are made of numerous types of material, such as but not limited to Steel, Concrete and Timber.

a) Forms:

- http://insidevdot/C19/Forms/Document Library/Scheduling and Contract/C1.doc
- http://insidevdot/C19/Forms/Document Library/Scheduling and Contract/C-4.doc

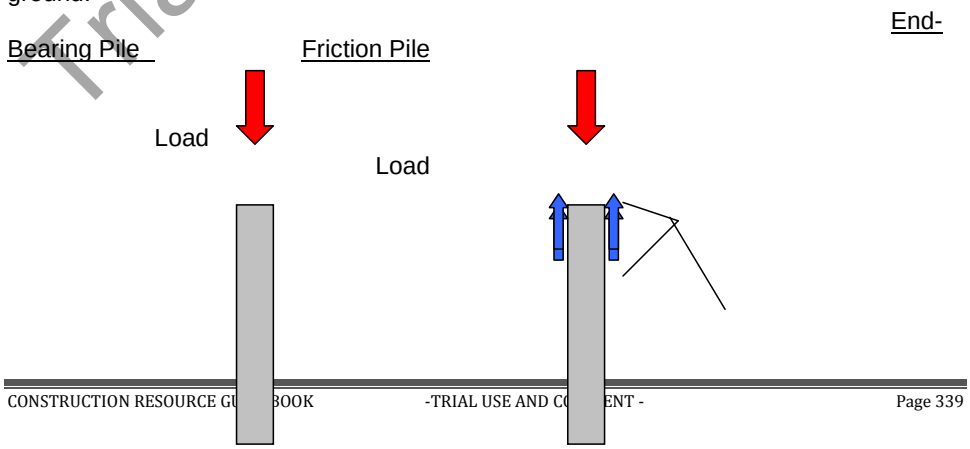
Section 403 – Bearing Piles

DESCRIPTION

When the near-surface soil or rock is too weak to support the load of a structure plus the load to be carried by a structure by means of a spread footing, deep foundations are typically used to transfer the load to deeper soil or rock that is capable of providing adequate support. The most common type of deep foundation system used by VDOT is driven piles. Driven piles can be classified generally as either end-bearing piles or friction piles.

End-bearing piles transfer the load from the head of the pile directly to a competent stratum (such as bedrock) located near the tip (bottom) of the pile

Friction piles transmit the foundation load to the ground by means of frictional resistance that develops along the sides (shaft) of the pile as the pile is driven into the ground.



Trial Use and Comment

Prior to beginning pile driving work, the Inspector should review the anticipated work plan with the Contractor. He/she should be sure that the Contractor is fully aware of all pertinent Specifications, Special Provisions, and the notes on the plans. This kind of communication will help reduce conflicts and misunderstandings that may occur between the Contractor and the Inspector.

SUITABILITY OF FOUNDATION

During foundation excavation work, it might be determined that piles are not required under a portion of (or the entire) foundation. If so, explore the bearing layer according to the Specifications and submit the findings to the Construction Manager. The Construction Manager should contact the District Bridge Engineer for direction regarding this condition.

ORDER LISTS

When precast (prestressed) piles or timber piles are being used, the Contractor is required to submit an order list to the Engineer for review and approval prior to placing an order with the pile supplier.

METHODS USED TO ESTIMATE BEARING PILE BEARING CAPACITIES

a) **Loading Tests**: When required, a load test involves the incremental application of a static load to the top of a pile (usually a test pile) and the measurement of the movement of the pile as the load is applied. The maximum load applied to the pile is usually 200% to 300% of the load required for design, unless failure of the pile occurs first. This test is usually a compressive load test.

The Inspector is responsible for completing Form C-4 Pile Loading Test Data and recording all load test data, as well as all pertinent observations and occurrences during the test.

b) **Pile Driving Analyzer (PDA):** While the load test is performed on a pile <u>after</u> it has been fully driven into the ground, the PDA (also referred to as Dynamic Pile Test) is a

Trial Use and Comment

test that is performed on a pile (usually a test pile) during its installation into the ground. Before pile driving begins, strain gauges and accelerometers are attached near the top of the pile. Wires connect these gauges to a computer located nearby. As the pile is driven into the ground, the PDA is able to measure numerous parameters and estimate several important values, including the static capacity of the pile, the driving stresses that occur within the pile, the performance of the hammer, and possible pile damage. This work is performed by one of the companies on the Department's list of approved PDA firms.

For friction piles, after the test pile is initially driven, the Contractor is usually required to wait a minimum of five days, after which a restrike is usually required. The reason for this requirement is that the capacity of a friction pile changes over time. In other words, the process of driving a pile into the ground causes tremendous changes within the soil that surrounds the pile and the water within the soil. Over time, these changes gradually reach some condition of equilibrium, and it is this long-term equilibrium condition that we want to measure. The PDA is used during the restrike of the pile as well.

GLOSSARY OF TERMS

Leads: The leads, which are supported by a crane, are the framework that is used to support the pile and the hammer and to keep them in proper position during pile driving.

Helmet: (Also called the drive head, bonnet, anvil block, or pile cap) The helmet, which is usually made of steel, is designed to help distribute the hammer blows evenly across the top of the pile. It is important that the helmet fit the pile correctly.

Template: A template is a temporary steel frame that is mounted on the ground, or the bottom of a river or stream, and is used as a guide to ensure that the pile is placed in proper position.

Hammer: The hammer is composed of numerous parts, including the ram, anvil base, striker plate and capblock. The different hammers types are:

Pile Cushion: For prestressed concrete piles, a pile cushion is placed between the helmet and the pile. The pile cushion, which is typically made up of layers of plywood, is used to help cushion the impact from the hammer. It helps reduce the damage to the pile head and helps reduce driving stresses within the pile. (Do not confuse pile cushion with hammer cushion. The hammer cushion (sometimes called the capblock or cushion block) is a device contained within the hammer assembly.)

Trial Use and Comment

Ram: The ram is the part of the hammer that drives the pile. It basically is the moving part (striking part) of the hammer. **The manner in which the ram is raised and lowered is the main feature that distinguishes the different hammer types.**

Stroke: The stroke is the distance over which the ram travels as it falls (from the highest point to the lowest point). If the ram freefalls by gravity, the stroke is the actual distance of the fall. However, if the ram is "pushed" downward as it travels downward, an equivalent freefall stroke must be determined.

Energy: There are numerous ways to refer to the energy (or equivalent energy) that a hammer imparts to a pile. The simplest way is to state that energy is equal to the weight of the ram multiplied by the hammer stroke [E = (W)(H)]. This relationship is only applicable to drop hammers and single-acting hammers, not for double-acting hammers. For double-acting hammers, an equivalent free fall stroke must be determined based on the pressure that is built-up within the bounce chamber of the hammer. The Contractor should provide the Inspector with information that correlates bounce chamber pressure to equivalent freefall stroke. For double-acting hammers, the energy is considered "equivalent" energy because it is calculated using the equivalent freefall stroke [Equivalent Energy = (W)(Equivalent H)]. A list of pile hammers is provided at the end of this Section.

The previous two references to energy (E and Equivalent E) are the terms used in the driving formulas previously presented. It should be noted that these values do not represent the energy that actually reaches the pile. There are numerous losses of energy that occur during each stroke of the hammer. These losses include the friction that the ram experiences as it travels downward and the losses that occur as the impact energy passes from the ram (through the hammer cushion, the helmet and pile cushion) to the top of the pile. The numbers (0.1 and 1.0) in the driving formulas represent an attempt to account for these energy losses. On projects where PDA is used, the measured energy will be significantly lower than the energy that is computed by multiplying W and H, because the PDA is measuring the energy that actually reaches the gauges mounted near the top of the pile.

Drop Hammer: This type of hammer, sometimes called a gravity hammer, involves raising a weight (ram) by a cable and allowing the weight to freefall, striking the pile. This type of hammer is rarely used nowadays, primarily because it is an inefficient method of driving piles. Additionally, if great care is not used, there is a high risk that this type of hammer will overstress the pile causing damage during driving. The

Trial Use and Comment

drop hammer should only be used for low capacity piles and only with approval of the Engineer.

PREPARATION PRIOR TO PILE DRIVING

Prior to pile driving operations, the Inspector should do the following:

1. Download Forms C-1 and C-4 from FILE:\\0501coconst\public\FORMS

2. Become familiar with the type, size and location of piles that are being used on the project

3. If prestressed concrete piles or timber piles are used, obtain a copy of the Contractor's Pile Order List. Confirm that the production piles (size and length) provided by the Contractor meet the requirements of the order list.

4. Confirm that the pile has been marked in one-foot increments so the Inspector can determine when the driving criteria have been satisfied. Confirm that the Contractor will be lifting the pile from the ground and placing it into the leads in an appropriate manner
5. Position every pile as shown on the plans. The Contractor is responsible for pile layouts, and the Inspector is responsible for checking these layouts.

6. Confirm that the pile is oriented correctly (either plumb or battered). If battered, confirm that the Contractor is installing the pile at the correct batter.

7. Confirm that the Contractor is using a hammer that meets the minimum energy and ram weight requirements that are indicated in the Specifications, listed on the plans, and the requirements of the Special Provisions.

OBSERVATIONS DURING PILE DRIVING

1. Record the blow count and stroke.

2. Record all noteworthy occurrences, including pile rebound.

3. Never overdrive a pile that has attained the driving criteria, unless directed to do so by the District Bridge Engineer. In some cases, a minimum pile tip elevation must be reached. In some cases, if driving becomes excessive, the District Bridge Engineer may direct or approve preboring or jetting to enable the pile to reach a certain tip elevation.

4. If a pile refuses at a tip elevation that is higher than expected, this might be an indication that an obstruction was encountered (boulder, debris, etc.). A pile that

Trial Use and Comment

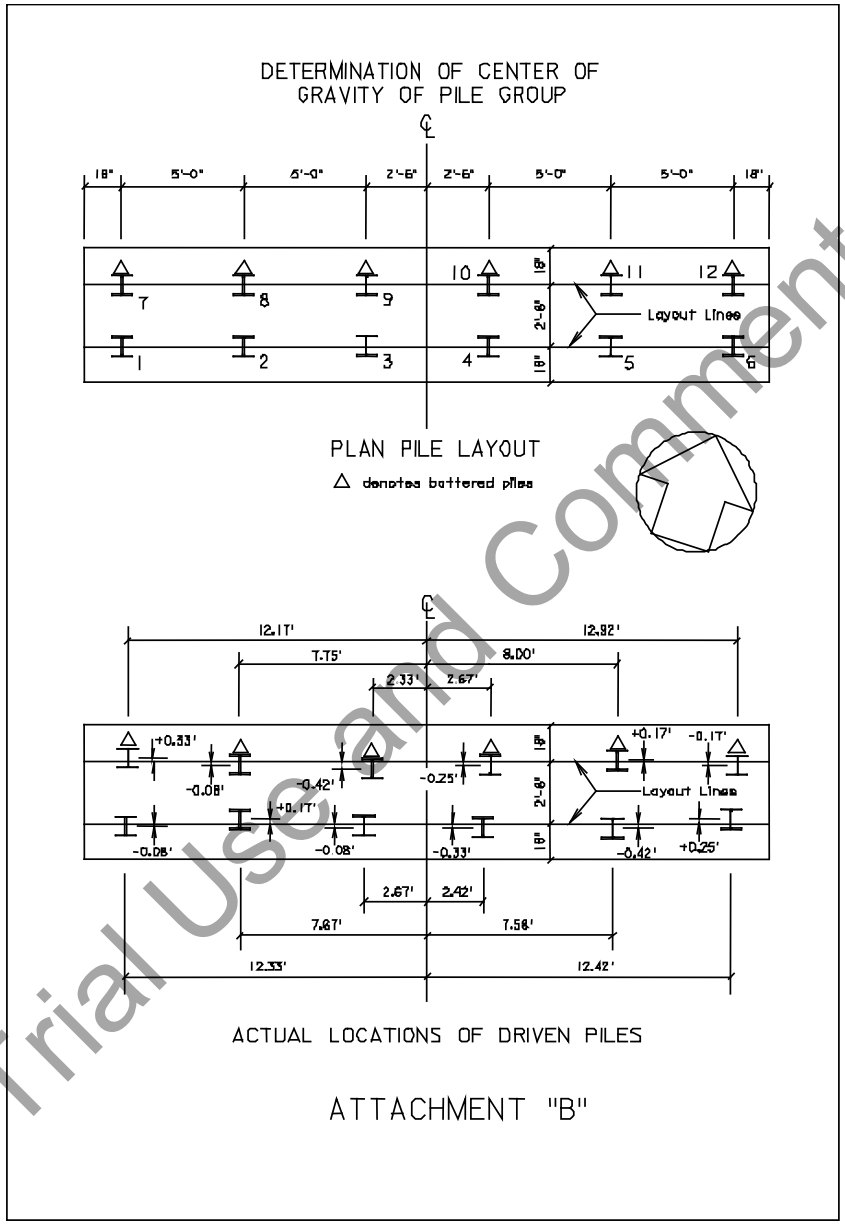
bears on such an obstruction might not be able to carry the required load, and the Construction Manager should be contacted.

5. When driving concrete piles, the pile cushion should be examined regularly to determine that it still meets the requirements of the Specifications.

The following sketches, Determination of Center of Gravity of Pile Group, show a typical steel pile layout for a bridge abutment. The upper sketch shows the locations of the piles as indicated on the plans. The lower sketch shows the piles locations after they were driven into the ground.

Since this foundation consists of steel piles supporting an abutment, each individual pile must be within 6 inches of plan location. All piles satisfy this requirement.

Trial Use and Comment



With respect to the required tolerance of the center of gravity (C.G.) of the pile group, the Specifications state that the C.G. of the group shall be either 3% of the distance

Trial Use and Comment

between the extremes or 1½ inches, whichever is greater. "Extremes" is defined as the distance between the centerlines of the outermost rows of piles. The distance between centerlines of the outermost rows is 2½ ft., and 3% of 2½ ft. is 0.075 ft., or 0.9 inches. Since 1½ inches is greater than 0.9 inches, the C.G. of the group (after driving) must be less than 1½ inches from the C.G. of the pile group as planned.

The Specifications indicate that the C.G. of the group must be checked along the long axis of the footing, which in this case, runs parallel to the face of the abutment. The actual pile locations are shown on the lower. Any pile that deviates to the north of the pile layout line was arbitrarily designated with a positive (+) distance, and any pile that deviates to the south of the layout line was arbitrarily assigned with a negative (-) distance.

In order to find to location of the C.G., add the distances by which each pile deviates from its plan location (keeping track of the signs), then divide by the number piles.

Pile No.	Deviation Distance
1	-0.08 ft.
2	+0.17 ft.
3	-0.08 ft.
4	-0.33 ft.
5	-0.42 ft.
6	+0.25 ft.
7	+0.33 ft.
8	-0.08 ft.
9	-0.42 ft.
10	-0.25 ft.
11	+0.17 ft.
12	-0.17 ft.
Total	**-0.91 ft.**

Dividing -0.91 ft. by 12 (number of piles) equals –0.076 ft. (or –0.91 inches). The minus sign simply indicates the direction in which the actual center of gravity deviates from the plan center of gravity (in this case, minus means "south"), and is of little importance here. Since the absolute value of the deviation (0.91 inches) is less than 1½ inches, the C.G. of the group is within tolerance.

The Inspector need not show the computations for the C.G. of the pile group in the diary if such computations are kept with the pile driving record. However, a note must appear in the project diary indicating that the pile group is within the required tolerance.

The center of gravity for a pile group under a column pier footing would be figured in a similar manner about both major axes.

a) Forms:

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Trial Use and Comment

III. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

403.01—Description

This work shall consist of furnishing, driving, cutting off and when required, load-testing piles of the type and dimensions specified on the plans.

403.02—Materials

(a) **Timber piles** shall conform to the requirements of **Section 236.02(b)**.

(b) **Steel piles** shall conform to the requirements of **Section 228**.

(c) **Steel shells for cast-in-place piles** shall conform to the requirements of **Section 228**.

(d) **Concrete** shall conform to the requirements of **Section 217**. Concrete exposed to tidal water shall contain slag or silica fume.

(e) **Reinforcing steel,** Grade 40 or 60, for use in precast or cast-in-place piles, shall conform to the requirements of **Section 223**.

403.03—Pile Types

(a) **Timber Piles:**

1. **Storing and handling:** Care shall be taken to avoid breaking the surface of treated piles. Cant hooks, dogs, or pike poles shall not be used. Cuts or breaks in the surface of treated piles shall be given three brush coats of the preservative used to treat the pile. Preservative shall be poured into bolt holes.

2. **Cutoffs:** The tops of piles shall be cut off at the elevation shown on the plans or as directed by the Engineer. Piles that support timber caps or grillage shall be cut off to conform to the plane of the bottom of the superimposed structure. In general, the length of pile above the elevation of the cutoff shall be sufficient to permit removing material damaged by driving. Piles driven to or near the cutoff elevation shall be trimmed or otherwise freed from splintered or damaged material.

(b) **Precast Concrete Piles:** Precast concrete piles with conventional reinforcement shall be furnished in accordance with the requirements of these specifications. Prestressed concrete piles shall be furnished in accordance with the requirements of Section 405.

Comment [846]: Right Material

Comment [847]: Right Way

Comment [848]: Right Location

Comment [849]: Right Material

Trial Use and Comment

Piles shall be manufactured to conform to the requirements of Section 404. Class A3 concrete shall be used.

1. **Casting:** Forms shall conform to the requirements of Section 404 and shall be accessible for vibrating, tamping, and consolidating concrete. Care shall be taken to place concrete to produce a satisfactory bond with the reinforcement and avoid segregation of components, honeycomb, or other defects.

   Concrete shall be continuously placed in each pile form and consolidated by vibrating. Forms shall be overfilled, the surplus concrete screeded off, and the top surface finished to a uniform, even texture similar to that produced by forms.

2. **Curing:** As soon as piles have set sufficiently, side forms shall be removed and the piles moist cured for at least 7 days. Piles shall not be driven until the concrete has reached the minimum 28-day compressive strength specified in Section 217. Concrete piles for use in brackish or tidal water or alkali soils shall be moist cured for at least 30 days before use.

3. **Finishing:** As soon as forms are removed, piles shall be pointed with mortar that conforms to the requirements of Section 218. Trestle piles exposed to view shall be finished above the ground line with a Class I finish in accordance with the requirements of Section 404.07(a). Foundation piles, that portion of trestle piles that will be below the ground surface, and piles for use in tidal water or alkali soils shall not be finished except by pointing as specified herein. Piles to be used in tidal water shall be protected in accordance with the requirements of Section 404.03(i).

4. **Storing and handling:** Storing, transporting, and handling shall be performed in a manner to prevent bending stresses, cracking, spalling, or other damage. The method of handling shall not induce stresses in the reinforcement of more than 12,000 pounds per square inch or a concrete stress of more than 0.4 f'_c, where f'_c is equal to the compressive strength of a control test cylinder at the time of handling. Concrete stress shall be not more than 1,200 pounds per square inch.

   Piles shall be supported or picked up only at pickup points shown on the plans or at a greater number of properly spaced pickup points as may be necessary to comply with stress requirements.

5. **Splicing:** Splicing will not be permitted unless deemed necessary by the Engineer. When splicing is permitted, it shall be performed as specified herein. Splicing shall be performed only with the piles in their normal driving position. The final locations of splices shall be below the ground line.

   Splices shall be made by providing dowels cast into the upper section of the pile. Dowels shall have a total area of at least 1 1/2 percent of the gross cross-sectional area of the pile and extend at least 30 bar diameters on each side of the splice. At

Comment [850]: Right Way

Comment [851]: Right Way

Comment [852]: Right Time, right materials

Comment [853]: Right Way

Comment [854]: Right Way

Comment [855]: Right Location

Comment [856]: Right material

Trial Use and Comment

least four dowels shall be used. Dowels shall be bonded into holes drilled or formed into the lower section of the pile. Holes shall be serrated to provide a mechanical bond. At least one dowel hole shall be provided with a bleeder vent near the bottom.

Ends of both sections shall be prepared to ensure that the concrete adjacent to the splice is sound material free from material that would interfere with the action of the bonding agent.

The bonding agent shall be a plasticized cement or other approved compound that can be placed or otherwise forced into the spaces around dowels and between ends of pile sections. The bonding agent shall have a compressive strength equal to that of the concrete and an adhesive strength equal to the shear and tensile strength of the concrete. The agent shall be able to withstand impact and driving stresses and shall have the same resistance as concrete to damaging water and soil conditions. These properties shall be obtained within a time limit consistent with the driving requirements. If compounds require heating, the manufacturer's recommendations shall be followed. The temperature of the concrete and the ambient temperature shall be not less than 50 degrees F at the time the splice is made.

Pile sections shall be held in such a manner that there will be a space of approximately 1/2 inch between the ends to permit free flow of the bonding agent. A splice form extending approximately 18 inches on each side of the splice shall be placed around the ends of the pile sections. The form shall have at least four ports for pouring of the bonding agent and allowing the escape of air. The bonding agent shall be poured simultaneously through two opposing ports. Driving may be resumed after sufficient time has elapsed to permit the bonding agent to develop its required properties.

6. **Build-ups:** When necessary, build-ups shall be made as follows: After driving is completed, the concrete at the end of the pile shall be cut away, leaving the reinforcing steel or strand exposed for a length of 40 diameters. The final cut of the concrete shall be perpendicular to the axis of the pile. Reinforcement similar to that used in the pile shall be securely fastened to the projecting steel, and the necessary forms shall be placed, with care taken to prevent leakage along the pile. The concrete shall be of the same quality as that used in the pile. Just prior to concrete placement, the top of the pile shall be thoroughly wetted and covered with a thin coating of neat cement or other suitable bonding material. Forms shall remain in place at least 7 days and then carefully removed. The exposed surface of the pile shall be finished as specified for precast concrete piles.

Comment [857]: Right Way , Right Location

Comment [858]: Right Time

(c) **Cast-in-Place Concrete Piles:**

Trial Use and Comment

1. **Construction:** Piles shall be cast in previously driven metal shells that shall remain permanently in place. The diameter shown on the plans shall be the nominal diameter of the uppermost section of shell. Shells shall be classified into the following types:

   a. **For driving without mandrels:** Type A, fluted, uniform taper; Type B, straight pipe.

   b. **For driving with mandrels:** Type C, corrugated, step taper: when conditions require its use, the lower section may consist of pipe conforming to the requirements for Type B, Type D, corrugated, straight, or uniform taper.

   The shell, including the tip, shall be of a design and thickness that are adequate to hold the original shape and prevent distortion of the shell resulting from driving it and any adjacent shell.

   The Contractor shall determine whether self-supporting or mandrel-driven shells will be used and the necessary shell thickness.

   If the steel shells collapse, the Contractor shall increase the shell thickness or furnish prestressed concrete piles as shown on the plans at his own expense.

   Concrete shall be Class A3.

2. **Reinforcement:** Reinforcement shall consist of a cage of No. 6 longitudinal bars tied with a 0.24-inch or greater spiral bar having a 6-inch pitch. If the thickness of the shell wall is less than 0.12 inch, six longitudinal bars shall be used. If the thickness of the shell wall is 0.12 inch or greater, four longitudinal bars shall be used. The depth to which the reinforcement is extended below the top of the shell at the cutoff elevation shall be at least 1/3 the length of the shell, 10 feet below the elevation of material providing firm lateral support, or, in any case, 10 feet, except for shells less than 15 feet in length. The reinforcement shall not extend closer than 5 feet to the tip. If the thickness of the shell is 0.188 inch or more, the length of longitudinal reinforcement required herein may be reduced to 5 feet below the top of the shell provided any splices occurring within the length are made sufficient to develop the full strength of the pile shell. In all cases, the longitudinal reinforcement shall extend 15 inches above the top of the shell and shall be provided with standard hooks.

3. **Inspection of metal shells:** The Contractor shall have available a light suitable for the inspection of each shell throughout its entire length. Improperly driven, broken, or otherwise defective shells shall be removed and replaced. No shell will be accepted whose diameter at any section is altered by more than 25 percent.

4. **Placing concrete:** Concrete shall not be placed until all driving within a radius of 15 feet is completed unless this is not practicable, in which case driving shall be discontinued until the concrete in the last cast pile has been in place at least 7 days.

Comment [859]: Right material

Comment [860]: Right Material

Comment [861]: Right Material

Comment [862]: Right Payment, Right Material

Comment [863]: Right Material

Comment [864]: Right Material, Right Way

Comment [865]: Right Time, Right Location

Comment [866]: Right Time

Trial Use and Comment

Concrete shall be placed continuously and consolidated by vibrating. Accumulations of water in shells shall be removed before concrete is placed.

(d) **Steel Piles or Steel Pile Shells:**

1. **Cutoffs:** The use of cutoffs will be permitted as extensions to driven or undriven piles, or as complete piles in themselves, provided the length of each cutoff is equal to or greater than the length of the extension or full-length pile required.

2. **Welding:** Splices, points, or point reinforcement shall be welded in accordance with the requirements of Section 407.04(a) except that welder certification will be required only for the particular welds performed as required for H-pile splices, built-up point reinforcement, and shell splices that require the full strength of the shell to be developed.

3. **Splicing:** For locations requiring pile lengths of 40 feet or less, one splice per pile will be permitted. For lengths over 40 feet up to and including 80 feet, two splices will be permitted. For lengths exceeding 80 feet, one splice per 40 feet will be permitted. Sections less than 10 feet in length shall not be spliced except as a final (top) section of the pile.

   Splices on steel H-piles shall be made by means of butt joints with full penetration welds. Piles spliced in a vertical position shall receive a single-bevel groove weld. Piles spliced in a horizontal position shall receive a single vee or V-groove weld. Abutting ends of piles to be spliced shall be properly prepared for welding, including removing damaged material and squaring the two ends. The two sections of pile shall be securely clamped in proper position and alignment prior to welding.

   Each splice between abutting pile shell sections shall be welded or adequately connected by mechanical means approved by the Engineer to give a complete seal and shall be of adequate strength to withstand handling, driving, and design stresses. If the diameters of abutting shell sections to be spliced are not the same, the shells shall be telescoped at least 6 inches at splices. When splices are required to develop the full strength of the shell, the top of the outside shell at the splice shall be scalloped to provide sufficient fillet welds. Sections of shell less than 5 feet in length shall not be spliced to another shell except as a build-up after driving is completed. More than one splice shall not be used within any 15-foot length of completed pile.

4. **Protection by painting:** When steel piles or steel pile shells extend above the ground or water surface, they shall be protected by one coat of No. 14 primer and one coat of epoxy mastic as specified in **Sections 231.03(b)** and **231.03(c).** The coating thickness shall be as specified in **Section 411**, **Table IV-6**. Protection shall extend from an elevation 2 feet below the lowest ground or water surface up to a level 2 inches into the concrete in which their tops are to be embedded.

5. **Variations in length:** Where steel H-piles are driven in limestone areas or where extreme variations in length are likely to be encountered, the following procedure shall be used: Wherever a pile has been driven to a depth requiring a length exceeding by 30 percent or

Comment [867]: Right Way

Comment [868]: Right material

Comment [869]: Right material

Comment [870]: Right material, right documentation

Comment [871]: Right Location

Comment [872]: Right way

Comment [873]: Right Way

Comment [874]: Right Material, Right Material

Comment [875]: Right Payment, Right Time

Trial Use and Comment

15 feet, whichever is greater, the length determined in accordance with the requirements of Section 403.04 or as indicated by the borings or piles already driven, the pile shall not be driven further until all other piles in the pier, abutment, or retaining wall have been driven or until a sufficient number has been driven to indicate clearly the trend of lengths. The Engineer will then determine the method to be used.

403.04—Determination of Pile Lengths

For cast-in-place piles, the Contractor shall determine the type, thickness, and driving criteria of the steel pile shell. Lengths shall be determined by performing driving tests.

A driving test shall be performed by driving a pile of the same type and size as that required or proposed for the specific structure at each location shown on the plans or otherwise approved by the Engineer.

Driving test piles that are not to be load tested or dynamically analyzed shall be driven their full length or until practical or absolute refusal is reached.

403.05—Order List

The Contractor shall submit to the Engineer for approval an itemized list for precast concrete and timber piles prior to placing the order with the supplier. The list shall include the lengths required for each pile location and the corresponding full or partial lengths of piles to be ordered.

Driving tests, dynamic pile tests, loading tests, and refined wave equation analyses shall be completed for a substructure element prior to submission of an order list for the substructure element.

403.06—Procedures

(a) **Suitability of Foundation:** If there is any indication that piles cannot be driven in accordance with the requirements of these specifications or if the foundation material appears to be capable of supporting footings without piles, the foundation shall be explored in accordance with the requirements of Section 401.03(b) and the results of the exploration submitted to the Engineer for review to determine whether piles will be omitted and the substructure adjusted to give adequate bearing on a firm foundation.

(b) **Preparation for Driving:** Piles shall not be driven until excavation is complete. Material forced up between piles shall be removed to correct the foundation elevation before concrete for the foundation is placed.

Comment [876]: Right material

Comment [877]: Right Time, Rght Material

Comment [878]: Right Documentation

Comment [879]: Right Documentation

Comment [880]: Right Time

Trial Use and Comment

Piles for supporting abutments on very soft or swampy original ground or on newly placed fill shall not be driven until the approach embankment, including any fill in front of the abutment, has been completed to the elevation of the top of the earthwork and compacted as specified in Section 303.

Piles shall not be driven in proximity to uncured concrete.

(c) **Protection During Driving:** Heads of concrete piles shall be protected by caps of an approved design, with a suitable cushion equivalent to at least 4 inches of plywood or a sufficient amount as site-specific conditions dictate, next to the pile head and fitting into a casing that supports a shock block. During driving, the cap block and cushion shall be changed if compressed more than 50 percent or as required to prevent damage to the pile. When the area of the head of any timber pile is greater than that of the face of the hammer, a suitable cap shall be provided to distribute the blow of the hammer throughout the cross-section of the pile.

For special types of piles, driving heads, mandrels, or other devices shall be used in accordance with the manufacturer's recommendations so that the pile may be driven without damage.

For steel piles, heads shall be cut squarely and a driving cap provided to hold the axis of the pile in line with the axis of the hammer.

Timber piles that are not enclosed in concrete shall be protected as specified in **Section 418.03(d).** Collars, bands, or other devices to protect timber piles against splitting and brooming shall be provided when specified by the Engineer.

Tips for timber piles shall be sharpened. When specified, timber piles shall be provided with steel or cast iron points conforming to the requirements of **Section 236.02(b)**. When points are used, the tips of the piles shall be carefully shaped to secure an even and uniform bearing on the points.

When specified, steel H-piles shall be provided with cast steel points. Points shall be welded as recommended by the manufacturer, but the length of the weld shall be not less than twice the width of the flange.

If during the driving of a precast concrete pile a reduction in blow count indicates that the point of the pile has passed from a harder material into a softer material that offers little or no resistance to penetration, the energy per blow shall be reduced to an amount specified by the Engineer. When firm-bearing material is reached, the energy per blow shall be returned to normal.

Steel piles and steel pile shells shall be painted as specified in **Section 403.03(d)4.**

(d) **Driving:** The capability of the hammer to drive piles properly will be verified from records of the test piles. If the required penetration is not obtained in the driving test by the use of a

Comment [881]: Right Location

Comment [882]: Right Material

Comment [883]: Right Documentation

Trial Use and Comment

hammer complying with the requirements, the Contractor shall provide a heavier hammer or use other approved means at his own expense. The method of driving shall not produce deformed piles. Where determined necessary by the Engineer in order to obtain the required tip elevation, design bearing capacity, or minimum penetration, driving shall be supplemented by jetting or preboring. After driving is completed, voids existing as a result of preboring, soil consolidation, or movement shall be filled with dry sand and consolidated to provide adequate lateral pile support. Damaged piles shall be removed and replaced.

1. **Hammers for timber and steel H-piles:** Hammers may be either gravity or power hammers. Striking parts of gravity hammers for driving timber piles shall weigh at least 2,000 pounds and for driving steel piles at least 3,000 pounds. In no case shall the weight of the striking parts of gravity hammers be less than the combined weight of the pile and any device used on the pile head for protection during driving. The hammer fall shall be regulated to avoid damage to piles. The fall shall be not more than 15 feet.

   Power hammers shall be capable of developing at least 7,000 foot-pounds of energy per blow when driving timber piles and at least 15,000 foot-pounds of energy per blow when driving steel piles.

2. **Hammers for concrete piles:** Precast concrete piles or shells for cast-in-place piles shall be driven with a power hammer that shall develop an energy per blow of at least 0.2 foot-pound per pound of the design bearing capacity of the pile being driven. Power hammers shall develop an energy *(E)* in foot-pounds per blow of at least 1 foot-pound per pound of pile weight *(W)* for piles weighing up to 25,000 pounds. For piles weighting more than 25,000 pounds, *E* shall be at least 25,000 + 0.6 (W – 25,000). The value of *E* shall be at least 15,000 foot-pounds per blow.

3. **Leads:** Pile driver leads shall be constructed in a manner that will afford freedom of movement of the hammer and shall be held in position by guys or stiff braces to ensure support of the pile during driving. Except where piles are driven through water, leads shall be of sufficient length so that a follower will not be necessary.

   Inclined leads shall be used in driving battered piles.

4. **Followers:** Followers shall be used only with the written permission of the Engineer. When followers are used, 1 pile from every group of 10 shall be a long pile driven without a follower and shall be used as a test pile to determine the average bearing capacity of the group.

5. **Water jets:** The volume and pressure of water at the jet nozzles shall be sufficient to erode freely the material adjacent to the pile. A pressure of at least 100 pounds per square inch shall be delivered at the nozzles. At least two jet nozzles having a diameter of at least 3/4 inch shall be used and placed symmetrically about the circumference of the pile. Before the desired penetration is reached, the jets shall be withdrawn and the piles driven at least 5 feet or to the depth determined by the Engineer to be necessary to secure the final penetration.

Comment [884]: Right Material

Trial Use and Comment

6. **Preboring:** The area of each prebored hole shall be approximately 10 percent more than the area of the pile but not more than 20 percent of the area.

(e) **Penetration:** In general, the penetration for any pile shall be at least 10 feet. In soft material, the penetration shall be at least 20 feet. Where piles are driven through fills, they shall penetrate at least 5 feet into undisturbed original ground under the fill. Friction piles, other than steel H-piles, in fills shall be driven through prebored holes extending to the elevation of the original ground.

(f) **Accuracy of Driving:** Piles shall be driven to within the tolerances specified in Table IV-1 for positions at cutoff elevations.

Piles shall not be driven with a variation of more than 1/4 inch per foot from the vertical or batter specified.

Steel and concrete piles shall not be subjected to force in order to place them in correct alignment or a horizontal position. The position of a timber pile that lies within the tolerance allowed for the driven position as specified in Table IV-1 under pile type No. 4, Condition (a) or (b), shall be corrected to the tolerance given for pile type No. 5, Condition (a) or (b), respectively, by the application of horizontal force wherever conditions will permit such corrective work without damage to the pile.

If the distances between the actual and theoretical pile centers or centers of gravity are more than the specified tolerances, the piles will be considered unacceptable unless the Contractor submits a satisfactory working plan showing the corrective work proposed. Such work shall not proceed until the plan has been approved by the Engineer.

The clear distance between the heads of piles and edges of footings shall be at least 6 inches. Additional concrete and reinforcement required to maintain the required minimum clear distance shall be placed only with the prior approval of the Engineer and shall be furnished at the Contractor's expense.

Timber piles driven below the cutoff elevation specified on the plans or by the Engineer or otherwise driven outside the limits for the driven position specified herein shall be withdrawn, and a replacement pile driven in the correct position at the Contractor's expense. Other types of piles driven to below the required elevation may be spliced or built up as otherwise provided for in these specifications.

(g) **Bearing Capacities:** Piles shall be driven to the following capacity:

1. **Steel H-piles** shall be point bearing and shall be driven to practical or absolute refusal. Steel H-piles designated as friction piles shall be driven to a safe bearing capacity of at least 3 tons per inch of nominal size.

2. **Timber piles** shall be driven to a safe bearing capacity of at least 20 tons per pile.

Comment [885]: Right Location

Comment [886]: Right Way

Comment [887]: Right Documentation

Trial Use and Comment

3. **Precast concrete piles and shells for cast-in-place concrete piles** shall be driven to a safe bearing capacity of at least 3 1/2 tons per inch of the nominal diameter or side dimension.

TABLE IV-1
Pile Tolerance Criteria

Pile Type	Condition	Tolerance for Position of Single Pile (in)	Center of Gravity for Pile Group[1]	
			Direction	Tolerance
1. Steel and Concrete	Column supports for bent caps	±3	About long axis of footing	3% of distance between extremes[2] or 1 1/2 in, whichever is greater
2. Steel and Concrete	(a) Footing supports for box culverts	±6		
	(b) Footing supports for column piers	±6	About both major axes	3% of distance between extremes[2] or 1 1/2 in, whichever is greater
	(c) Footing supports for abutments, retaining walls, and piers other than column piers	±6	About long axis of footing	3% of distance between extremes[2] or 1 1/2 in, whichever is greater
	(d)			
3. Timber	Footing supports for box culverts	±9		
4. Timber	Footing supports for column driven through material that will permit correction of position without damage to pile	±9	About both major axes	4 1/2% of distance between extremes[2] or 2 1/4 in, whichever is greater
	Footing supports for abutments, retaining walls, and piers other than column piers driven through material that will permit correction of position without damage to pile	±9	About long axis of footing	4 1/2% of distance between extremes[2] or 2 1/4 in, whichever is greater
5. Timber	(a) Footing supports for column piers driven through material that will not permit correction of position	±6	About both major axes	4 1/2% of distance between extremes[2] or 2 1/4 in, whichever is greater
	Footing supports for abutments, retaining walls, and piers other than column piers driven through material that will not permit correction of position	±6	About long axis of footing	4 1/2% of distance between extremes[2] or 2 1/4 in, whichever is greater
6. Timber	Fender systems and other uses requiring non-load bearing piles	As required for proper attachment of wales, bracing, etc., or tying of groups for dolphins		

Piles under a separate footing of individually constructed units shall be considered a separate group. The tolerances expressed as a percentage of "distance between extremes" will be allowed only about the axis for which it is computed.

[2] If the group consists of a single row of piles, the distance shall be measured from the centerline of the row to the centerline of the footing.

Comment [888]: Right Location Right Documentation

Trial Use and Comment

(h) **Disposing of Pile Cutoffs:** Upon completion of pile driving operations for structures on the project, pile cutoffs left in storage, including precast concrete and timber cutoffs, shall become the property of the Contractor and shall be disposed of off the project.

403.07—Determination of Bearing Capacities

(a) **Loading Tests:** When required, the safe bearing capacities of piles shall be determined in accordance with 72-hour or quick load tests as specified herein.

The loading test shall commence no sooner than 5 days after the pile to be tested has been driven. Telltales consisting of steel rods 1/2 inch in diameter shall be lubricated and inserted in plastic pipe 3/4 inch in inside diameter. Individual sections of telltales shall be joint coupled flush so that each rod is of uniform diameter throughout its length.

Where necessary, the unsupported length of the test pile shall be braced to prevent buckling without influencing the test results.

The clear distance from the reaction frame to the test pile shall be at least 5 times the maximum diameter of the test pile or as approved by the Engineer.

Loading shall be applied through a hydraulic jack with spherical bearings jacked against a platform load. The loading apparatus shall have a capacity of at least that required for the test. If more than one jack is used, the jacks shall have the same piston diameter, be connected to a common manifold and pressure gage, and be operated by a single hydraulic pump.

The method of determining test loads shall be by using a pressure gage or load cell. The pressure gage, hydraulic ram, and hydraulic pump shall be calibrated as a unit to an accuracy of at least 5 percent of the applied load. If a multiple jacking system is used, each jack shall be fitted with a pressure gage in addition to the master gage. Load-measuring devices shall have been calibrated not more than 3 months prior to the loading test and shall be recalibrated when directed by the Engineer.

Loads shall be applied uniformly with no impact. The load cell or pressure gage shall be continuously monitored, and the jacking pressure adjusted to maintain a constant load.

The load shall be applied to a steel test plate of appropriate thickness for the loads involved and of a size not less than the size of the pile butt and not less than the area covered by the base(s) of the hydraulic jack rams. The plate shall be set in high-strength, quick-setting grout to ensure a uniform bearing. Provision shall be made for the telltale rod to extend through the test plate.

Movement of the pile butt and telltale relative to the pile butt shall be measured with dial gages to an accuracy of 0.001 inch. Dial gages shall have a travel of at least 2 inches, and

Comment [889]: Right Time

Comment [890]: Right Location

Comment [891]: Right Way,Right material

Trial Use and Comment

gage blocks shall be provided to record measurements as required. The pile butt shall be measured by dial gages attached to an independently supported frame. Movement shall be measured by a secondary system consisting of a scale, mirror, and piano wire. The scale and mirror shall be attached parallel with the longitudinal axis of the pile. The wire shall be properly tensioned and supported so that it passes within 1 inch of the face of the scale. The scale shall have gradations of 1/100 of an inch.

Supports for dial gage frames and wires shall be more than 7 feet clear of the pile and as far from anchor piles or reaction supports as is practicable. Supports and frames shall be checked by a surveyor's level.

Gages and measuring devices shall be protected from the weather, including direct sunlight. Adequate ventilation shall be provided to prevent fogging or frosting of the gages.

The Contractor shall provide the Engineer reasonable access to and from the site of the test pile. The Contractor shall assist the Engineer in recording load, settlement, and rebound measurements throughout the test and shall furnish complete information on the driving equipment used and the pile driving record.

Other piles of the same type and size that are not load tested shall be driven to the safe bearing capacity of at least that required for the satisfactory load-tested pile(s).

1. **The 72-hour loading test** shall be 200 percent of the design capacity applied in increments of 25 percent of the design capacity. Each load increment shall be maintained until the rate of settlement is not greater than 0.01 inch per hour or until 2 hours have elapsed, whichever occurs first. The test load shall be applied fully and continuously for at least 72 hours and shall produce no measurable settlement during the last 24 hours. After the required holding time, the test load shall be removed in decrements of 25 percent of the total test load with at least 1 hour between decrements.

   Permanent settlement of the pile after completion of the specified loading test shall be not more than 1/4 inch. If the permanent settlement is more than 1/4 inch, the Contractor shall redrive and test load the same pile or drive and test load additional piles until the loading test is satisfactory.

   Proven safe bearing capacity for piling from the 72-hour loading test is defined as 1/2 the test load for a satisfactory loading test.

2. **The quick load test** shall be 300 percent of the design capacity applied in increments of 10 percent of the design capacity with a constant time interval between increments of 5 minutes. Load increments shall be added until continuous jacking is required to maintain the test load or until the specified capacity of the loading apparatus is reached, whichever occurs first. After a 10-minute interval, the full test load shall be removed in four approximately equal decrements with 5 minutes between decrements.

Comment [892]: Right Time

Comment [893]: Right Time

Comment [894]: Right Time

Trial Use and Comment

The Contractor shall record readings of time, load, and settlement for the pile and telltale immediately before and after applying each load increment. When the maximum load has been applied, the Contractor shall record when jacking is stopped. Readings shall be repeated after 5 minutes and again at 10 minutes after jacking has stopped. Readings of time, load, and rebound shall also be recorded after each decrement during load removal and repeated 5 minutes and 10 minutes after the load has been removed.

Comment [895]: Right documentation

The ultimate bearing capacity of a pile tested under an axial compressive load is that load which produces a settlement of the pile head equal to the following:

$$S_f = S + (0.15 + 0.008D)$$

Where:
S_f = settlement at failure in inches;
D = pile diameter or width in inches;
S = elastic deformation of pile length in inches = P_tL/AE;
P_t = load on pile in pounds;
L = length of pile in inches;
A = area of pile in square inches; and
E = the modulus of elasticity of the pile [57,000 f'_c for concrete; $29(10^6)$ for steel].

Proven safe bearing capacity for piling is defined as 1/2 the ultimate bearing capacity obtained and shall be at least the required design capacity. If the proven safe bearing capacity is less than the required design capacity, the Contractor shall redrive and test load the same pile or drive and test load additional piles until the loading test is satisfactory.

(b) **Timber Piles:** If timber piles are not required to be driven to practical refusal or if their safe bearing capacity is not required to be determined by loading tests, their theoretical safe bearing capacity shall be determined by the following formulas:

$$P = \frac{2WH}{S + 0.1} \quad \text{for single-acting steam hammers}$$

$$P = \frac{2H(W + Ap)}{S + 0.1} \quad \text{for double-acting steam hammers}$$

$$P = \frac{2\,WH}{S + 1.0} \quad \text{for gravity hammers}$$

$$P = \frac{1.6E}{S + 0.1} \quad \text{for diesel hammers}$$

Where:

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P = theoretical safe bearing capacity in pounds;
W = weight in pounds of striking part of hammer;
H = height of fall in feet;
S = average penetration in inches per blow for the last 5 to 10 blows for gravity hammers and the last 10 to 20 blows for power hammers;
A = area of piston in square inches;
p = steam pressure in pounds per square inch at the hammer; and
E = equivalent energy in foot-pounds as determined by a gage attached to the hammer for hammers with enclosed rams or the weight in pounds of the ram multiplied by the length of travel in feet for hammers without enclosed rams. The value of *E* shall be not more than the manufacturer's rating for developed energy.

These formulas are applicable only when (1) the hammer has a free fall, (2) the head of the pile is not broomed or crushed, (3) the penetration is reasonably quick and uniform, or (4) a follower is not used.

If there is an appreciable bounce, twice the height of the bounce shall be deducted from *H* to determine its value in the formula.

If the Engineer determines that energy losses attributable to pile rebound exceed the nominal values assumed in these formulas, safe bearing capacity shall be reevaluated by wave equation analysis or substantiated pile formulas that rationally consider energy losses in the cap, pile, and soil.

When water jets are used in connection with driving, the capacity shall be determined by the formulas from the results of driving after the jets have been withdrawn or by application of a test load.

Theoretical safe bearing capacity for piling from the timber pile formulas shall be no less than the required design capacity.

(c) **Bearing Value of Piles:** Bearing values for concrete and steel piles shall be determined by the loading tests specified in (a) herein. In the absence of loading tests, safe-bearing capacities may be determined using a dynamic pile analyzer during pile driving or results of wave equation analysis. In the absence of loading tests, wave equation analysis, or a dynamic pile analyzer, the safe bearing capacity may be approximated by using substantiated pile formulas or the timber pile formulas given in (b) herein. The character of the soil penetrated; conditions of driving; followers; size, length, and weight of the piles; and computed load per pile shall be given due consideration in determining the safe bearing capacity.

Bearing piles shall be driven until the blow count determined to produce the required design capacity has been continuously maintained for 3 feet or to practical or absolute refusal, whichever occurs first. *Practical refusal* is defined as twice the blow count required to produce a safe bearing capacity when maintained for 1 foot. *Absolute refusal* is defined

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as 4 times the blow count required to produce a safe bearing capacity when maintained for 1 inch.

A pile shall not be driven above the blow count if wave equation analysis indicates that maximum stress levels will be exceeded.

The following are the maximum allowable driving stresses (attributable to hammer impact only):

1. **Prestressed concrete piles:**

   a. **Compression:** 0.85 f''_c – unit prestress (after losses)

   b. **Tension :** $3/f'_c$ + unit prestress (after losses)

2. **Steel piles:**

   a. **Compression:** 0.9 F_y

   b. **Tension:** 0.9 F_y

At the Contractor's option, piles reaching bearing value with heads above the cutoff grade may be driven to the cutoff grade provided driving is less than practical refusal and no damage to the pile occurs.

When required by the Engineer, a pile shall be restruck with the same hammer and cushion system used for the initial driving. Pile restrike shall be at least 24 hours after initial driving. A cold hammer shall not be used for the restrike. The hammer shall be warmed up prior to restrike by striking at least 20 blows on a pile that is at least 25 feet from the pile to be restruck. The maximum amount of penetration required during restrike shall be 6 inches or the maximum total number of hammer blows required shall be 50, whichever occurs first.

Comment [896]: Right material

403.08—Measurement and Payment

Comment [897]: Right quantity and right payment

Piles will be measured in linear feet from the tip (excluding any added pile point) to the head of the pile remaining in place in the completed structure and will be paid for at the contract unit price per linear foot. This price shall include furnishing piles; driving piles; splices; obtaining safe bearing capacity, tip elevation, or minimum penetration; jetting; performing wave equation analysis; disposing of piling cutoffs; concrete and reinforcing steel required for steel shell piles, including reinforcing steel that extends into the structure footing; painting; and waterproofing.

Precast concrete and timber cutoffs will be measured in linear feet of pile excluding that portion of the precast concrete pile the Contractor elects to furnish to facilitate driving. Only

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precast concrete and timber cutoffs will be paid for. Payment will be limited to the invoice price plus 15 percent, not to exceed the contract unit price per linear foot of pile.

Pile points for timber and steel H-piles will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each. This price shall include furnishing and attaching to the pile.

Driving tests shown on the plans or required by the Engineer will be measured in linear feet and will be paid for at the contract unit price per linear foot. Piles used in driving tests will be measured from the tip (excluding any added pile point) to the head of the pile. When a pile used in a driving test is incorporated in the completed structure at the required location, no separate measurement of the pile will be made for payment. This price shall include performing the test; furnishing, removing, and disposing of piles; and restoring the pile hole when the pile is not incorporated in the structure.

Driving tests not specified on the plans or required by the Engineer but performed to determine lengths or other required properties will not be measured as driving tests. However, when piles used for the tests are incorporated in the completed structure, they will be measured and paid for the same as other piles of the same type.

Loading tests will be measured in units of each and will be paid for at the contract unit price per each. This price shall include performing the loading test. If a loading test is terminated by the Engineer because of insufficient bearing capacity, the test will be measured for payment. If a loading test is terminated because of malfunction of the Contractor's equipment or other reasons that are the fault of the Contractor, the test will not be measured for payment.

The length of pile driven to the cutoff grade after obtaining required bearing will be measured in linear feet and will be paid for as cutoff.

Preboring fills in accordance with the requirements of **Section 403.06(e)** will not be measured for separate payment. The cost thereof shall be included in the price for pile.

Pile restrike will be measured in linear feet of pile from the tip, excluding any added pile point, to the head of the pile remaining in the structure. Payment will be made at the contract unit price for the driving test for the same size and type pile less the invoice price per foot for the pile. This price shall include the equipment and driving effort required for the restrike.

Jetting not shown on the plans and specified by the Engineer in accordance with the requirements of **Section 403.06(d)** will be measured in linear feet and will be paid for per linear foot at 30 percent of the contract unit price per linear foot for the particular size and type of pile for which the jetting was ordered. This price shall include disposing of surplus material and erosion, siltation, and water quality controls required as a result of the jetting operations.

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Preboring not shown on the plans and specified by the Engineer in accordance with the requirements of **Section 403.06(d)** will be measured in linear feet for the particular size and type of pile for which the preboring was ordered in accordance with the requirements of **Section 104.03** and **Section 109.05**. This price shall include disposing of surplus material and erosion and siltation controls when required as a result of the preboring operations.

Preboring shown on the plans will be measured in linear feet for the particular size and type of pile for which preboring was specified. This price shall include disposing of surplus material erosion and siltation controls when required as a result of the preboring operations.

Payment will be made under:

Pay Item	**Pay Unit**
Pile (Type and size)	Linear foot
Pile point for (Size and type) pile	Each
Driving test for (Size and type) pile	Linear foot
Loading test for (Size and type) pile	Each
Preboring (Size and type) pile	Linear foot

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review Contract to verify type of pilings to be used, Meet with contractor to verify submittal methods, construction methods and schedule.

Start:

- Review area where piles are to driven and assure all safety precautions have been taken and are being used as submitted. Prior to contractor working in excavation or more than 6 foot above ground. Assure all pile driving submittals (hammer submittal and pile length submittal are as required)

Continuous inspection:

- Review piles as they are being driven, lifted and when any splicing or modifications are made on them. Record blow count per foot.

Final Inspection:

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- Perform Center of Gravity review for acceptability of individual as well as pile groups. Complete Pile driving forms C-1, C-4. Note when pile met refusal or approved depth.

Documentation Required: Pile test data, pile length approval, pile driving records

IV. REVIEW QUESTIONS:

Spec. Ref.	
403.03	Is the contractor handling, storing, and protecting the piles in accordance with this section?
403.03(d2)	Is welding of splices, points, or point reinforcement performed in accordance with the section on Fabrication Procedures for Steel Structures except for noted certification requirements?
403.05(1)	Was the contractor's order list for precast concrete or timber piles submitted to the Engineer for approval prior to ordering the piles?
403.05(2)	Were driving test, dynamic pile test ,loading test and refined wave equation analyses completed for each substructure element prior to submission of an order lists?
403.06(d)1	Has the capability of the hammer to properly drive piles been verified from test pile records?
403.06(d)2	Prior to driving piles, has the Contractor furnished the Engineer for approval the completed Pile and Driving Equipment Data Form for each proposed hammer and pile type combination? (Ref.: Special Provisions)
403.06(d)3	At each driving test location, where different subsurface conditions exist, did the Contractor furnish a Wave Equation Analysis of pile driveability performed by a Professional Engineer experienced in such work? (Ref.: Special Provisions)
403.06(d)4	If the wave Equation Analysis indicates the possibility of excessive stresses, did the Contractor submit to the Engineer proposed corrective measures for approval? (Ref.: Special Provisions)
403.06(e)	Are accurate and complete records being maintained on pile driving?
403.06(f)3	Is the center of gravity of the piles within tolerance, or if not, approved corrections made?
403.06(g)	Were all piles driven to the required bearing capacity?

Has the Contractor submitted the Pile and Driving Equipment Data Form for each hammer and pile type?

• Were driving tests completed prior to the Contractor submitting his/her pile order list?
• Do the lengths of piles match the order list?
• Are the piles being handled and stored on-site properly?
• Is the location of each pile verified prior to and after driving?
• Is Form C-1 being completed for each pile driven?
• Are all piles driven to the required capacity?

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• Are all splices performed in accordance with the Specifications?
• Has the Contractor performed loading tests as required?
• Has Form C-4 Pile Loading Test Data been completed and submitted to the Construction Manager and District Bridge Engineer?
• Are steel pile shells checked after driving to determine if distortion or collapsing of the piles has occurred?
• Is the correct reinforcing steel properly installed in the pile shells?

V. CRITICAL INSPECTION POINTS

• **Verify geotechnical information is available**
• **Assure the proper and rapid submittal of testing documents**
• **Assure piles when ordered / delivered are the proper lengths as per engineers order list**
• **While driving Record driving information: Compute if individual piles and pile groups meet Center of Gravity pile group meets specifications**

Trial Use and Comment

SECTION 404 - HYDRAULIC CEMENT CONCRETE OPERATIONS

I. INTRODUCTION:

Prior to placement of Hydraulic Cement Concrete, the Inspector must verify that a current mix deign is on file for the class of concrete to be used. Concrete should be visually inspected to ensure it is mixed properly. The Inspector should then refer to Table II-17 of the Specifications to determine the minimum and maximum allowable air content and consistency (slump). The Inspector should also verify that the temperature of the concrete is within the limits specified. Attention must be paid to the batch time versus the placement time to ensure the concrete is placed within the maximum allowable time range for the temperature of the concrete. Concrete that does not meet the Specifications will be rejected and removed from the project.

MATERIALS

After checking all equipment to be used, the Inspector should make those periodic checks necessary to ensure that all materials used are within the Specifications limits and that the concrete conforms to the requirements of the structure design.

FORMS

Before placing concrete, forms must be completely checked for conformance with the plans and Specifications, and all irregularities corrected. Inspectors should verify the dimensions of the forms, proper placement of reinforcing steel and proper location of chamfer strips.

The Contractor shall perform evaporation rate testing prior to placement of the concrete.

CONSTRUCTION JOINTS

A construction joint may be placed at the junction between a footing and an abutment or column, although such joints are not generally detailed on the plans.

BEARING AREAS

The differential height between each bridge seat is more critical than the elevation of each seat. This is one of the factors that determine the bolster thickness of concrete in the deck and the ease in erection of structural steel members. Once the elevation of one seat is established in the field, that seat should be used as a bench mark for establishing the remaining seats for that pier or abutment.

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A sufficient number of depth probes must be taken while the concrete is still plastic to determine the actual thickness of the bridge deck. A minimum of twelve probes should be taken (more on long spans or in unusual conditions). The points to be probed are to be selected at random and recorded in the project records; however, depth probes are not to be taken over beams with the bolster thickness subtracted from this depth to obtain the apparent depth. When corrugated metal deck forms are used, the Inspector should exercise special care to insure that the depth probes are actually taken and measured from the top of the corrugations.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

404.01—Description

This work shall consist of furnishing and placing hydraulic cement concrete in accordance with these specifications and in conformity with the dimensions, lines, and grades shown on the plans or as established by the Engineer.

404.02—Materials

Comment [898]: Right Material

(a) **Concrete** shall conform to the requirements of **Section 217**. Aggregate used in concrete for bridge decks shall be nonpolishing.

(b) **Curing materials** shall conform to the requirements of **Section 220**.

(c) **Concrete admixtures** shall be used as specified in **Section 215** and **Section 217**.

(d) **Corrugated metal bridge deck forms** shall be galvanized steel conforming to the requirements of **ASTM A653**, Grade SS40, SS50, or SS80, and shall be coating designation G165. Supports, closures, and other fabricated parts shall conform to the requirements of **ASTM A653**, Grade SS33, SS40, SS50, or SS80, and shall be coating designation G165.

(e) **Prestressed concrete deck panels** shall conform to the requirements of **Section 405** except as specified herein.

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(f) **Anchor bolts** shall conform to the requirements of **Section 226**.

(g) **Reinforcing steel** shall conform to the requirements of **Section 223**.

(h) **Waterstops** shall conform to the requirements of **Section 212**.

404.03—Procedures

(a) **Forms:** On concrete beam bridges, the Contractor shall have the option of using corrugated metal bridge deck forms, prestressed deck panels, or wood forms to form that portion of bridge decks between beams unless otherwise specified on the plans. On steel beam bridges, the Contractor shall have the option of using corrugated metal bridge deck forms or wood forms to form that portion of bridge decks between beams or girders unless otherwise specified on the plans. However, corrugated metal forms and prestressed deck panels shall not be used to form overhangs or portions of slabs where a longitudinal joint occurs between beams or girders.

Devices for supporting forms of any type shall not be welded to steel beams or girders unless specified on the plans.

Formwork shall be mortartight and of sufficient rigidity to prevent distortion attributable to the pressure of the concrete and other loads incidental to construction operations.

Forms for exposed surfaces shall have a form liner of an approved type and shall be mortartight. Forms for exposed surfaces below the bottom of slabs of bridges, including substructures, and on endwalls and wingwalls of culverts down to an elevation of 1 foot below low water or 2 feet below the final ground line above water shall be faced with metal, plyboard, or other approved smooth-faced material constructed to provide a minimum of joints and prevent leakage. Concrete shall present a uniform and smooth surface without requiring touch-up or surface finishing upon removal of forms. Uneven joint protrusions of more than 1/8 inch shall be removed. Forms shall be filleted 3/4 inch at sharp corners and given a bevel or draft in the case of projections, such as girders and copings, to ensure easy removal.

Metal ties or anchorages within the form shall be constructed to permit their removal to a depth of at least 1 inch from the face without damage to the concrete. If ordinary wire ties are permitted, wires shall be cut back at least 1/4 inch from the face of the concrete with chisels or nippers upon removal of forms. Fittings for metal ties shall be of such design that cavities left upon their removal will be the smallest size possible. Cavities shall be filled with cement mortar, and the surface left sound, smooth, even, and uniform in color.

Comment [899]: Right Way

Comment [900]: Right Way

Comment [901]: Right Way

Comment [902]: Right Way/Right Material

Comment [903]: Right Way

Comment [904]: Right Way

Trial Use and Comment

Forms shall be set and maintained true to line. When forms appear to be unsatisfactory, either before or during concrete placement, the Engineer may order the work stopped until defects have been corrected.

The shape, strength, rigidity, watertightness, and surface smoothness of reused forms shall be maintained at all times. Warped or bulged lumber shall be resized before being reused.

For narrow walls and columns where the bottom of the form is inaccessible, the lower form boards shall be left loose so that they may be removed for cleaning immediately before concrete placement.

Forms shall be treated with an approved oil or form-coating material or thoroughly wetted with water immediately before concrete placement. For rail or other units with exposed faces, forms shall be treated with an approved oil or form-coating material to prevent adherence of concrete. Material that will adhere to or discolor concrete shall not be used.

Forms shall be maintained at a temperature that will not adversely affect curing of concrete.

Formed voids in concrete shall be of accurate dimensions and locations so that the thickness of surrounding concrete shall not be reduced from plan dimensions.

Methods of positioning void forms and placing surrounding concrete shall be subject to the approval of the Engineer prior to their use.

Bridge deck slabs shall be constructed in a manner so that the thickness of the finished slab shall be not less than the thickness shown on the plans or more than the thickness plus 1/2 inch.

1. **Corrugated metal bridge deck forms:** If the Contractor elects to use corrugated metal bridge deck forms, he shall submit details of the forms, including fabrication and erection details, to the Engineer for approval in accordance with the requirements of **Section 105.10**. Forms shall be designed and erected in accordance with the following:

   a. **Design:** The thickness of forms shall be at least 20 gage (0.037 inch). The unit working stress in the sheet metal and supporting units shall be not more than 0.725 of the specified minimum yield strength of the material furnished. In no case shall it be more than 36,000 pounds per square inch. The maximum stress under a design load equal to the weight of the forms and plastic concrete plus a construction live load of 50 pounds per square foot shall be not more than the unit working stress for the material furnished. Deflection of forms under the weight of the form, plastic concrete, and reinforcement shall be not more than 1/180 of the span of the forms or 1/2 inch, whichever is less. In no case shall the loading be less than 120 pounds per square foot total.

Comment [905]: Right Way

Comment [906]: Right Material

Comment [907]: Right Way

Comment [908]: Right Material

Comment [909]: Right Way

Comment [910]: Right Way

Comment [911]: Right Way

Comment [912]: Right Material

Comment [913]: Right Way

Trial Use and Comment

When the actual dead load attributable to the use of metal bridge deck forms is more than the design allowance for construction tolerances and methods shown on the plans, the Contractor shall strengthen the beams or girders to the extent necessary to maintain the design live load rating of the bridge and shall submit supporting information and calculations to the Engineer for review.

b. **Erection:** Forms shall be installed in accordance with reviewed fabrication and erection plans. Field cutting of forms, supports, and closures at expansion joints, diaphragms, and abutments in skewed areas or in any area where girders or beams are not parallel shall be performed with saws or shears. The outstanding leg of the support angle, channel, or other device shall be not more than 3 inches.

Form sheets shall not rest directly on the top of the stringer or floor beam flanges. Sheets shall be securely fastened to form supports and shall have a minimum bearing length of one inch at each end. Form supports shall be placed in direct contact with the stringer or floor beam flange by hangers or clips. Attachment of the forms to the form supports shall be made by permissible welds, screws, clips or other approved means. Fasteners along the ends and edges of form sheets shall be spaced at intervals not to exceed 18 inches.

Welding and welds shall conform to the requirements of **Section 407.04** except that 1/8-inch fillet welds will be permitted.

Permanently exposed form metal whose galvanized coating has been damaged shall be repaired in accordance with the requirements of **Section 233**.

Corrugated metal forms shall be positioned such that the specified cover for the reinforcing steel and minimum design slab thickness are maintained above crests of the corrugation.

Transverse construction joints shall be located at the bottom of a flute, and 1/4-inch weep holes shall be field drilled at not more than 12 inches on center along the line of the joint.

Closures at edges of forms parallel to beams or girders shall be made by crimping corrugations. Closures at skewed ends may be of the serrated or channel type.

The design span of the sheet shall be the clear span of the form plus 2 inches measured parallel to form flutes.

The permissible form camber shall be based on the actual dead load condition. Camber shall not be used to compensate for deflection in excess of the foregoing limits.

Physical design properties shall be computed in accordance with the requirements of **AISI's** specifications for the design of cold-formed steel structural units.

Comment [914]: Right Way

Comment [915]: Right Documentation

Comment [916]: Right Way

Comment [917]: Right Way

Comment [918]: Right Way/Right Material

Comment [919]: Right Material

Comment [920]: Right Way

Comment [921]: Right Way/Right Location

Comment [922]: Right Way

Comment [923]: Right Way

Trial Use and Comment

c. **Inspection:** After concrete has been in place for at least 2 days, the Contractor shall sound at least 50 percent of the area of at least 25 percent of the individual form panels using a moderate blow administered with a carpenter's hammer. Individual form panels to be sounded will be selected randomly by the Engineer. Areas of questionable soundness shall be exposed by removing forms. The amount of sounding and form removal required will be adjusted as the work progresses according to conditions detected by the investigation. When procedures, materials, or equipment used during placement of concrete warrant additional inspection of the underside as determined by the Engineer, the Contractor shall remove at least one form panel at each location selected by the Engineer. If the initial inspection reveals inferior workmanship or unsatisfactory material as determined by the Engineer, additional panels shall be removed to ascertain the extent of the deficiency. The Contractor will not be required to replace metal forms at locations where sections of forms are removed for inspection purposes. However, adjacent metal forms and supports shall be repaired to the extent necessary to render their attachment secure.

The Contractor shall provide facilities required for the safe and convenient conduct of the Engineer's inspection.

2. **Prestressed deck panel forms:** If the Contractor elects to use prestressed deck panel forms, he shall redesign the deck slab in accordance with the requirements of **AASHTO's *Standard Specifications for Highway Bridges*** and the interim specifications as modified by the Department and shall submit the redesign of the deck slab, reinforcing steel schedule, design calculations, and working drawings to the Engineer for acceptance in accordance with the requirements of **Section 105.10**. Working drawings shall show the permissible construction live load. The Contractor's submittal shall be made at least 60 days prior to the time necessary for ordering materials for the work.

a. **Design:** The following conditions shall apply to the redesign of the cast-in-place deck slab:

(1) The size, spacing, and area of transverse reinforcing steel in the top of deck slabs shall be not less than that shown on the plans. The transverse reinforcing steel shown on the plans in the bottom of the deck slab shall be eliminated.

(2) Longitudinal reinforcing steel shown on the plans in the bottom of the deck slab shall be replaced by reinforcing bars having the identical size and spacing as the main transverse reinforcing bars in the deck slab. These bars shall be placed 1/2 inch clear above the top of the deck panels. Longitudinal reinforcing steel shown on the plans in the top of the deck slab may be eliminated, except over intermediate supports of continuous spans, provided adequate tie bars having no more than 24-inch spacing are used for securing top transverse steel. The distance from the face of the concrete to the center of the top layer of main reinforcing steel shall be 2 3/4 inches.

Comment [924]: Right Time

Comment [925]: Right Way

Comment [926]: Right Way/Right Documentation

Comment [927]: Right Time

Comment [928]: Right Way

Comment [929]: Right Way

Trial Use and Comment

(3) Shear connectors on steel beams or girders and vertical reinforcement in prestressed concrete beams may be adjusted to facilitate placing prestressed deck panels.

(4) The design for deck panels shall provide for the same total slab thickness as shown on the plans.

(5) When epoxy-coated steel is specified on the plans, reinforcing steel in the cast-in-place section of the slab shall be epoxy coated.

(6) The depth of intermediate diaphragms for prestressed concrete beams shall be modified to provide clearance between the panel and diaphragm.

(7) Lifting devices installed in panels for handling may be left in place provided they do not project closer than 2 inches to the finished deck surface.

(8) Panels will not be allowed over the end supports for bridges skewed more than 15 degrees. End sections of slabs shall be cast the full depth shown on the plans.

(9) Panels shall be roughened in the direction parallel to the strands.

The following conditions shall apply to the design of the deck panels:

(1) The strand size shall be not more than 3/8 inch.

(2) A cover of at least 1 1/2 inches shall be provided on the bottom of deck panels for prestressing strands and reinforcing steel.

(3) The cracking load a unit can sustain shall be at least 1.2(D) + 1.5(L + I) without the concrete tensile stress exceeding 7.5 f'_c

Where:

D = dead load;
$L + I$ = live load + impact; and
f'_c the 28-day design compressive strength of concrete in pounds per square inch.

(4) At least 0.11 square inch per foot of reinforcing steel transverse to strands shall be provided in panels.

(5) The length of the panel in the direction of strands shall be at least 5 feet 2 inches.

(6) Strands shall project at least 3 inches from the concrete at both ends of the panel.

Comment [930]: Right Way

Comment [931]: Right Way

Comment [932]: Right Material

Comment [933]: Right Way

Comment [934]: Right Way

Comment [935]: Right Way

Comment [936]: Right Way

Comment [937]: Right Way

Comment [938]: Right Way

Comment [939]: Right Way

Comment [940]: Right Loaction

Trial Use and Comment

(7) Mild reinforcing steel in the deck panel, including tie bars and reinforcing bars used for panel-lifting purposes, shall be epoxy coated. Bar supports shall conform to the requirements of **Section 406.03(d)**.

Panel sides that are parallel to the strands may be cast to provide full-depth contact with the adjacent panel or cast with angular sides that, when installed with an adjacent panel, will form a V-shaped joint, which shall be mortartight at its base.

b. **Erection:** Precast bridge deck panels shall be erected in accordance with the accepted working drawings and with the strands transverse to the longitudinal direction of the beams. Panels shall be tightly butted together and shall be mortartight, with panel joints staggered on each side of the supporting beam. Panel joints that are not in full contact or that are not mortartight shall be sealed by epoxy mortar or other approved method at the Contractor's expense.

Prior to placement of the deck surface concrete, foreign material detrimental to achieving a bond shall be removed by sandblasting, waterblasting, or other approved methods. The top surface of deck panels shall be thoroughly and continuously water soaked for at least 1 hour prior to placement of deck surface concrete. Puddles of standing water shall be removed prior to placement of deck surface concrete. Panels shall be supported by one of the following methods to provide the same total slab thickness as shown on the plans:

(1) Nonshrink cement mortar bed 3 ± 1/4 inches in width with a thickness of at least 1/2 inch conforming to the requirements of **Section 218** except that the compressive strength shall be 5,000 pounds per square inch. When shims are used to construct the mortar bed, they shall be removed prior to placement of the deck concrete.

(2) Galvanized steel support angles having an outstanding leg width of at least 1 inch and a thickness of at least 1/8 inch or 10 gage. The unit working stress shall be not more than 72 1/2 percent of the specified minimum yield strength of the material furnished but in no case more than 36,000 pounds per square inch. A strip of 1/8-inch asphalt felt the same width as the angle shall be placed between the support angle and the deck panel. When cast-in-place slab concrete is to be used to provide permanent support for panels, concrete shall be placed in continuous strips over the girders and consolidated to ensure concrete penetrates under the panels prior to placing concrete on top of the panels. Slab overlay concrete shall penetrate under the panels to a width of 3 ± 1/4 inches and a thickness of at least 1 1/2 inches to provide the rigid support for the panels. If this method of support is used, bridge seat elevations shall be adjusted as necessary at the Contractor's expense.

(3) Welding and welds shall conform to the requirements of **Section 407.04** except that 1/8-inch fillet welds will be permitted. Welding to beam or girder flanges will not be permitted.

Comment [941]: Right Material

Comment [942]: Right Way

Comment [943]: Right Way/Right Payment

Comment [944]: Right Way

Comment [945]: Right Time

Comment [946]: Right Way

Comment [947]: Right Way/Right Material

Comment [948]: Right Way

Comment [949]: Right Payment

Comment [950]: Right Way/Right Material

Trial Use and Comment

Regardless of the method of support used, the Contractor shall ensure the stability of the deck panels until the slab overlay concrete has set.

(b) **Falsework and Centering:** The Contractor shall have a Professional Engineer (holding a valid license to practice engineering in the Commonwealth of Virginia) inspect the completed falsework assembly supporting a bridge superstructure prior to placing loads. The Professional Engineer shall provide a certification, based upon visual inspection of the completed falsework assembly, that the falsework assembly conforms to the approved working drawings. However, such certification shall not require an exhaustive inspection or testing or make the Professional Engineer liable for any deficiencies in workmanship or materials by the Contractor or for such conditions that cannot be ascertained from a visual inspection.

Comment [951]: Right Documentation

Falsework shall be designed and constructed to provide the necessary rigidity and to support the loads without appreciable settlement or deformation. The Contractor may be required to employ screw jacks or hardwood wedges to take up settlement in the formwork either before or during concrete placement. A design weight of 150 pounds per cubic foot shall be assumed for fresh concrete.

Comment [952]: Right Way

Falsework that cannot be founded on a satisfactory footing shall be supported on piles that are spaced, driven, and removed in a manner approved by the Engineer.

Comment [953]: Right Way

Falsework shall be set in a manner so that after its removal the finished structure will have the finished grade specified or indicated on the plans. Correction for dead-load deflection of cast-in-place concrete beams and slab spans shall be provided for by applying an upward parabolic camber having an ordinate at midspan of 1/8 inch per 10 feet of span length.

Comment [954]: Right Way

Falsework-supporting elements shall remain in place until concrete in the element has attained at least the minimum 28-day design compressive strength.

Comment [955]: Right Time

Arch centering shall be constructed according to centering plans approved by the Engineer. Provision shall be made by means of suitable wedges, sand boxes, or other devices for gradual lowering of centers and rendering the arch self-supporting. When directed by the Engineer, centering shall be placed on approved jacks to take up and correct settlement that may occur after concrete placement has begun.

(c) **Placement and Consolidation:** Individual placements of more than 25 yards of concrete shall be at the following rate:

Quantity (cu yd)	Min. Placement Rate
26-80	25%/hr
Over 80	20 cu yd/hr

If corrugated metal bridge deck forms are used in lieu of removable forms, concrete placement shall proceed in the direction opposite that of form placement.

Comment [956]: Right Way

Trial Use and Comment

Concrete shall be placed as soon as practicable after forms are prepared and excavation is completed. Water shall be removed from excavations before concrete is placed. Flowing water within the excavation shall be diverted outside concrete areas to a sump.

Before concrete is placed, sawdust, chips, dirt, and other debris and temporary struts and braces shall be removed from the space to be occupied by concrete. Removable forms shall be thoroughly wetted, oiled, or treated with an approved form-coating material. The depth and character of foundations and the placing of reinforcing steel shall have been approved by the Engineer.

Concrete shall be placed in forms immediately after mixing. Concrete that does not reach its final position in forms within the time specified in **Section 217** shall not be used. The method of placement shall be such as to avoid the possibility of segregating ingredients and displacing reinforcement or void forms.

The use of long chutes for conveying concrete from the mixing plant to forms will be permitted only with the written permission of the Engineer. If chutes are allowed and the quality of concrete as it reaches the forms or the methods of placing it therein are not satisfactory, the Contractor shall, upon direction from the Engineer, discontinue the use of chutes and re-equip his operation for placing concrete in a satisfactory manner.

Where steep slopes are required, chutes shall be equipped with baffle boards. When pipes are used, they shall be kept full of concrete and have their lower ends buried in fresh concrete where necessary to prevent an excessive flow rate. Chutes, troughs, and pipes shall be kept clean and free from coatings of hardened concrete by thorough flushing with water after each run. Water used for flushing shall be discharged clear of concrete in place and filtered prior to entry into state waters. Open troughs and chutes shall be metal or lined with metal and shall extend as nearly as possible to the point of deposit. When discharge must be intermittent, a hopper or other device for regulating discharge shall be provided.

Dropping concrete a distance of more than 5 feet or depositing a large quantity at any point and running or working it along forms will not be permitted. However, the 5-foot limitation will not apply to dropping concrete into forms for walls of box culverts, catch basins, drop inlets, or endwalls unless there is evidence of segregation.

Concrete placement shall be regulated so that pressures caused by fresh concrete shall be not more than those used in the design of forms.

Embedded materials shown on the plans shall be installed during each stage of concrete operations and suitably supported and maintained in the correct position. Reinforcement shall be placed in accordance with the requirements of **Section 406.03(d).**

Care shall be taken to fill each part of a form by placing concrete as near its final position as possible, working coarse aggregates back from forms, and moving concrete under and

Comment [957]: Right Way/Right Time

Comment [958]: Right Way

Comment [959]: Right Time

Comment [960]: Right Way

Comment [961]: Right documentation

Comment [962]: Right Way

Comment [963]: Right Way

Comment [964]: Right Way

Comment [965]: Right Way

Comment [966]: Right Way

Trial Use and Comment

around reinforcing bars without displacing them. After concrete has taken its initial set, care shall be taken to avoid jarring forms or placing strain on ends of projecting reinforcement.

Concrete shall be thoroughly consolidated during and immediately following placement. Consolidation shall be accomplished by mechanical vibration subject to the following provisions:

Comment [967]: Right Way

1. Vibration shall be internal to the concrete but not applied directly to reinforcement or formwork.

2. Vibrators shall be of a type and design approved by the Engineer.

3. The intensity of vibration shall visibly affect a mass of concrete over a radius of at least 18 inches.

4. The Contractor shall provide a sufficient number of vibrators to consolidate each batch immediately after it is placed in forms.

5. Vibrators shall be manipulated to work concrete thoroughly around reinforcement and embedded fixtures and into corners and angles of forms. Vibration shall be applied at the point of deposit and in the area of the freshly placed concrete. Vibrators shall not be pulled through concrete and shall be inserted and withdrawn slowly and maintained nearly vertical at all times. Vibration shall be of sufficient duration and intensity to consolidate concrete thoroughly but shall not be continued so as to cause segregation. Vibration shall not be continued at any one point to the extent that localized areas of grout are formed. Application of vibrators shall be at points uniformly spaced and not further apart than twice the radius over which the vibration is visibly effective.

6. Vibration shall not be applied directly or indirectly to sections or layers of concrete that have hardened to the degree that it ceases to be plastic under vibration. Vibration shall not be used to make concrete flow in forms, and vibrators shall not be used to transport concrete in forms.

7. Vibration shall be supplemented by such spading as is necessary to ensure smooth surfaces and dense concrete along form surfaces and in corners and locations inaccessible to vibrators.

8. These specifications shall apply to filler concrete for steel grid floors except that vibration shall be applied to the steel.

9. These specifications shall apply to precast piling, concrete cribbing, and other precast units except that the manufacturer's methods of vibration may be used if approved by the Engineer.

Trial Use and Comment

When vibrating is not practicable, concrete shall be consolidated and its faces well spaded by continuous working with a suitable tool in a manner acceptable to the Engineer.

Concrete shall be placed in continuous horizontal layers not more than 12 inches in thickness. However, slabs shall be placed in a single layer. When it is necessary in an emergency to place less than a complete horizontal layer in one operation, the layer shall terminate in a vertical bulkhead. In any given layer, separate batches shall follow each other so closely that each one shall be placed and consolidated before the preceding one has taken initial set. Each layer of concrete shall be left rough to secure efficient bonding with the layer above. A succeeding layer placed before the underlying layer has become set shall be consolidated in a manner to prohibit the tendency to produce a construction joint between layers.

Comment [968]: Right Way

Layers placed at the end of one day's work or prior to temporarily discontinuing operations shall be cleaned of laitance and other objectionable material as soon as the surface has become sufficiently firm to retain its form. The top surface of concrete adjacent to forms shall be smoothed with a trowel.

Comment [969]: Right Way

Horizontal layers located to produce a construction joint at a location wherein a feather edge might be produced in the succeeding layer shall be formed by inset formwork so that the succeeding layer will end in a body of concrete having a thickness of at least 6 inches.

Comment [970]: Right Way

The work on any section or layer shall not be stopped or temporarily discontinued within 18 inches below the top of any face unless the details of the work provide for a coping having a thickness of not more than 18 inches, in which case the construction joint may be made at the underside of the coping at the option of the Engineer.

Comment [971]: Right Way

Care shall be taken when placing concrete to avoid coating reinforcing steel, structural steel, forms, and other items that extend into areas to be involved in a subsequent placement. If coating of steel does occur, no attempt shall be made to remove the mortar until after the concrete steel bond of the earlier placement has developed sufficiently to withstand a cleaning operation. Any coating of mortar on deformed bars that cannot be removed by hand brushing with a wire bristle brush or a light chipping action will not have to be removed.

Comment [972]: Right Way

The method and manner of placing concrete shall be regulated so as to place construction joints across regions of low shearing stress and in locations that will be hidden from view to the greatest extent possible.

Comment [973]: Right Way

Placing and consolidating concrete shall be conducted to form a compact, dense, impervious mass of uniform texture that will show smooth faces on exposed surfaces. Any section of concrete found to be defective shall be removed or repaired as directed by the Engineer.

Comment [974]: Right Way

If concrete operations are permitted to extend after sunset, the work area shall be brightly lighted so that all operations are plainly visible.

Trial Use and Comment

1. **Culverts:** Sidewalls of box culverts shall be carefully bonded to the base slab in accordance with (h) herein. Each wing shall be constructed as a monolith if possible. Construction joints, where unavoidable, shall be horizontal.

2. **Girders, slabs, and columns:** Concrete shall be placed by beginning at the center of the span and working toward the ends. Concrete in girders shall be placed uniformly for the full length of the girder and brought up evenly in horizontal layers.

   The concrete floor and girders for each span of concrete through girder spans and concrete in T-beams, slab spans, and deck girders shall be placed monolithically.

   If the finished top surface of a concrete unit being placed is not level, care in the method of vibration, the use of low-slump concrete, or other means shall be taken to prevent downgrade movement of newly placed concrete. Special attention shall be given to sloping slabs.

   Concrete in columns shall be placed in one continuous operation. If cap forms are supported by falsework independent of columns or column forms or are otherwise designed so that no load is placed on columns, concrete may be placed in caps after the concrete in columns has set for at least 12 hours.

   Concrete shall not be placed in the superstructure until column forms have been stripped sufficiently to determine the character of the concrete in the columns.

(d) **Pneumatic Placement:** Pneumatic concrete placement will be permitted only when authorized by the Engineer and the method is approved by the Engineer. When permitted, placement shall be in accordance with the requirements of **Section 412**.

(e) **Pumping:** Placing concrete by pumping will be permitted only when authorized by the Engineer and provided concrete is pumped through a conduit system that is not aluminum. Equipment shall be arranged such that no vibrations that might damage freshly placed concrete will occur. Equipment shall be thoroughly cleaned prior to use. The operation of the pump shall be such that a continuous stream of concrete without air pockets is delivered. If concrete remaining in the pipeline is to be used, it shall be ejected in such a manner that there will be no contamination of concrete or separation of ingredients.

(f) **Depositing Concrete Under Water:** Concrete shall not be deposited in water except with the approval of the Engineer.

Concrete placed in water shall be Class T3. Concrete shall be carefully placed in a compact mass in its final position by means of a tremie or another approved method and shall not be disturbed after being deposited except as specifically provided herein. Still water shall be maintained at the point of placement.

Comment [975]: Right Way

Comment [976]: Right Way

Comment [977]: Right Way

Comment [978]: Right Way

Comment [979]: Right Way

Comment [980]: Right Time

Comment [981]: Right Way

Comment [982]: Right Documentation

Comment [983]: Right Way

Comment [984]: Right Material

Comment [985]: Right Way

Trial Use and Comment

A tremie shall consist of a tube having a diameter of at least 10 inches, constructed in sections having flanged couplings fitted with gaskets. The discharge end shall be closed at the start of work and entirely sealed at all times. The tremie tube shall be kept full to the bottom of the hopper. When a batch of concrete is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it in the placed concrete. Concrete seal shall be placed continuously from start to finish. Concrete shall be placed at a rate of at least one vertical foot per hour over the entire area of the seal course. The surface of concrete shall be maintained in a horizontal plane within a tolerance of 6 inches at all times during placement. The tremie shall be supported so that its discharge end is freely movable over the entire work area, or multiple tremies shall be used. Vibration shall be used only when deemed necessary by the Engineer. Supports for tremies shall permit rapid lowering of discharge ends when necessary to retard or stop the flow of concrete. The method of placing the seal shall be subject to the approval of the Engineer prior to concrete placement.

Removal of water from cofferdams or other structures may proceed when the concrete seal has attained final set. Laitance or other unsatisfactory material shall be removed from the exposed surface by scraping and chipping with pneumatic or hand tools to an extent that will expose the aggregate for good bond with the footing to be cast upon it but not to an extent that will damage the concrete.

(g) **Construction Joints:** Construction joints that are not detailed on the plans shall be placed as directed or approved by the Engineer. Shear keys or inclined reinforcement shall be used where necessary to transmit shear or bond the two sections together. Joints shall be constructed so that feather edging does not occur.

For construction joints in deck slabs, a 2 by 1 1/2-inch shear key shall be provided between mats of reinforcing steel.

Construction joints against which earth fill is placed shall be protected by a heavy coat of asphalt conforming to the requirements of **Section 213** applied for a distance of 3 inches on each side of the joint and continuous throughout its length.

In construction joints exposed to view, a waterstop conforming to the requirements of **Section 213** shall be inserted. The waterstop shall be placed at least 3 inches from the face of the concrete and shall extend at least 2 inches into each section of concrete.

Longitudinal or transverse construction joints may be used to facilitate placing concrete in continuous slab spans. Longitudinal joints shall be spaced so that each concrete placement will be at least 10 feet in width. Transverse joints shall be placed at the centerlines of piers provided they are located infrequently, permitting simultaneous longitudinal screeding of as many spans as possible. Concrete shall be placed in one continuous operation between construction joints. The volume of concrete in any one placement shall be not less than the volume of concrete in one end span.

Comment [986]: Right Way

Comment [987]: Right Way

Comment [988]: Right Way

Comment [989]: Right Material

Comment [990]: Right Location

Comment [991]: Right Material

Comment [992]: Right Location

Comment [993]: Right Way

Trial Use and Comment

(h) **Bonding Construction Joints:** In joining fresh concrete to set concrete, the work already in place shall have its surface roughened thoroughly. Shavings, sawdust, and other loose and foreign material shall be removed. The surface shall be washed and scrubbed with wire brooms when necessary to remove substances that will interfere with bonding. Concrete of the preceding placement shall be thoroughly wetted prior to placement of the next unit of fresh concrete.

For construction joints in deck slabs, the vertical face shall be sandblasted to expose the coarse aggregate. When epoxy-coated reinforcing steel is used, the epoxy coating shall be protected during sandblasting operations. Damaged areas of coated bars shall be repaired in accordance with the requirements of **Section 223**. Prior to placement of adjoining concrete, the vertical face shall be coated with epoxy, Type EP-4. After the concrete in the second placement has set, a V groove shall be formed along the top of the joint by sandblasting to a depth of at least 1/4 inch and shall be sealed with epoxy, Type EP-5, low viscosity, conforming to the requirements of **Section 243**.

To bond successive courses, suitable keys shall be formed at the top of the upper layer of each day's work and at other levels where work is interrupted. Keys shall be formed by inserting and subsequently removing beveled wood strips, which shall be saturated with water to induce swelling prior to insertion in fresh concrete. At the discretion of the Engineer, rough stone or steel dowels may be used in lieu of keys. Dowels shall extend an equal distance on each side of the construction joint. Prior to the inserting or driving of dowels into predrilled or preformed holes, holes shall be filled with hydraulic cement grout in the proportion of 1 part cement to 2 parts sand. The size and spacing of keys and dowels shall be determined by the Engineer.

(i) **Concrete Exposed to Tidal Water:** Concrete structures other than box culverts subject to the action of tidal water shall not have construction joints located within a zone 5 feet above to 5 feet below the elevation of the mean tide.

Concrete within 5 feet of the mean tide shall be cured in forms for 48 hours and allowed to dry for 5 days after forms are stripped. After drying, one coat of primer and four coats of asphalt, conforming to the requirements of **Section 213**, shall be applied during a period of 48 hours. Each coat shall be allowed to set before the succeeding one is applied. In lieu of primer and asphalt, the coating may consist of one coat of epoxy, Type EP-3B, followed by one coat of epoxy, Type EP-3T, and shall have a total thickness of at least 20 mils.

For precast concrete, protective coatings shall be applied in the same manner, but the seal coat shall be allowed to dry 4 days, or as long as necessary to harden, before handling.

Requirements for protective coating shall also apply to inside surfaces of box culverts that are subject to the ebb and flood of tidal water.

Concrete exposed to the action of ice, drift, or other forces producing shock and abrasion shall be protected by encasing that portion of the exposed surface with a special sheathing or protective armor. Provision shall be made in the size of the original cofferdam for

Comment [994]: Right Way

Comment [995]: Right Way/Right Material

Comment [996]: Right Way/Right Material

Comment [997]: Right Way

Comment [998]: Right Location

Comment [999]: Right Way/ Right Time/ Right MAterial

Comment [1000]: Right Way/ Right Time

Comment [1001]: Right Way

Comment [1002]: Right Way

Trial Use and Comment

sufficient clearance to permit access to the concrete surface for the installation and effective anchorage of the sheathing.

(j) **Removing Formwork and Forming for and Placing Superimposed Elements:** In the determination for removing formwork and constructing superimposed elements, consideration shall be given to the location and character of the structure, the weather, other conditions influencing the setting of the concrete, and materials used in the mixture. Formwork shall include forms, braces, ties, guy wires, and other instruments of stabilization.

1. **Formwork** may be removed as follows:

   a. **Side forms or elements not immediately subjected to loading** (for example: footings and walls or columns with height to width ratios less than 10:1 [h/w < 10:1]): 48 hours or 30 percent concrete strength (f'_c). For the purposes herein, width will be considered the narrowest portion of the element measured horizontally across its surface.

      The time period noted for form removal shall began at the completion of the concrete placement and is exclusive of hours when any portion of the surface of the concrete element is below 40 degrees F.

   b. **All other elements:** 60 percent concrete strength (f'_c).

2. **Forming for superimposed elements** may be as follows:

   a. **Elements not immediately subjected to loading** (for example: footings and walls or columns with height to width ratios less than 10:1 [h/w <10:1]): 48 hours or 30 percent concrete strength (f'_c). For the purposes herein, width will be considered the narrowest portion of the element measured horizontally across its surface.

      The time period noted for forming for superimposed elements shall begin at the completion of the concrete placement and is exclusive of hours when any portion of the surface of the concrete element is below 40 degrees F.

   b. **All other elements:** 60 percent concrete strength (f'_c).

3. **Placing concrete in forms for superimposed elements** shall not be done until concrete has attained 60 percent concrete strength (f'_c) except for footings, where concrete may be placed when the footing has attained 40 percent concrete strength (f'_c).

   The Contractor may submit calculations to show that lower strength requirements may be used but may not proceed to use these requirements before receiving written permission to do so from the Engineer.

Comment [1003]: Right Time/Right Way

Comment [1004]: Right Time, Right Way

Comment [1005]: Right Way

Comment [1006]: Right Documentation

Trial Use and Comment

Concrete strength (f'_c) is the design minimum laboratory compressive strength at 28 days as specified in Table II-17 for the class of concrete designated. If the time for removing formwork and forming for or placing concrete in superimposed elements is determined by control cylinder strengths, the Contractor will be permitted to perform these operations when the control cylinder strengths reach the values previously specified. Control cylinders shall be cured under conditions that are not more favorable than the most unfavorable conditions for the portion of the concrete the cylinders represent. The Contractor shall furnish molds, labor, and materials; make sufficient test specimens; and transport specimens to the testing facility. Single-use wax paper, paper, plastic, or light-gage metal molds conforming to the requirements of **ASTM C470** may be used for making control cylinders. Control cylinders shall be molded under the observation of the Engineer. Tests for compressive strengths shall be performed by or under the supervision of the Engineer.

Comment [1007]: Right Way

The concrete strengths and time periods noted herein for removing formwork or forming for or placing concrete in superimposed elements shall not apply to the use of equipment or other live loads on the structure. Stockpiling materials or using unauthorized equipment on the structure will not be permitted until conformance to the requirements of **Section 404.03(m)** has been attained.

Comment [1008]: Right Way

Methods of form removal that will overstress the concrete shall not be used. Formwork and its supports shall not be removed without the approval of the Engineer. The Contractor shall ensure that proper curing as required by the Specifications is provided immediately after form removal.

Comment [1009]: Right Way

Falsework shall conform to the requirements of **Section 404.03(b).**

(k) **Curing Concrete:** The method of curing concrete shall be subject to the approval of the Engineer prior to mixing or placing concrete. When the atmospheric temperature is above 40 degrees F in the shade, concrete surfaces that are not protected by formwork and surfaces from which forms have been removed shall be cured using approved materials applied before the sheen disappears from fresh concrete or immediately upon removal of formwork. Concrete shall be cured for 7 days, regardless of the strength obtained with control cylinders. During this 7-day curing period, a curing agent or medium shall be used.

Comment [1010]: Right Way

Comment [1011]: Right Time

PE film used for curing shall be white except that opaque or transparent PE film may be used between November 1 and April 1.

Comment [1012]: Right Time

When liquid membrane seal is used for curing grooved horizontal surfaces, the application rate shall be 100 to 150 square feet per gallon. The application rate for all other surfaces shall be 150 to 200 square feet per gallon. Application shall be such that an even, white, continuous membrane is produced on the concrete surface.

Comment [1013]: Right Way

If the atmospheric temperature falls below 40 degrees F in the shade, water curing shall be discontinued except when it is accomplished by flooding as specified herein. Curing shall be immediately resumed using insulated blankets or other approved methods that will

Comment [1014]: Right Way/Right Time

Trial Use and Comment

retain or supply moisture and maintain the temperature at the outermost surfaces of the concrete mass above 50 degrees F for at least 72 hours immediately following concrete placement and above 40 degrees F for at least 48 additional hours.

In the event the Contractor begins masonry concrete operations when the atmospheric temperature is below 40 degrees F in the shade, the method of cure and protection shall retain or supply moisture and maintain the temperature at the outermost surfaces of the concrete mass above 50 degrees F for at least 72 hours immediately following concrete placement and above 40 degrees F for at least 48 additional hours.

When concrete is cured by flooding with water and the temperature is below 40 degrees F in the shade, a depth of at least 6 inches shall be maintained above the surface of the mass until concrete has attained the minimum required design strength as determined by a test cylinder cured in the same water.

1. **Bridge Deck Curing:** Bridge deck concrete shall be moist cured with white PE sheeting with or without the use of wet burlap. The concrete shall be maintained in a moist condition by fogging after screeding and until covered with the sheeting. The concrete surface shall stay wet under the sheeting until the end of the moist-curing period. The moist-curing period shall be for at least 7 days and until 70 percent concrete strength (f'_c) is achieved. The initial temperature of the outermost surfaces of the concrete mass shall be above 50 degrees F for at least 72 hours and above 40 degrees F until the completion of the moist-curing period. When the sheeting is removed, burlap (if used) shall be removed also. White pigmented curing compound shall be applied at the rate of 100 to 150 square feet per gallon while the surface of the concrete deck is damp and free of standing water. Bridge deck overlay concrete shall be cured in accordance with the requirements of **Section 412**.

(l) **Protecting Concrete:** Protection of concrete shall begin immediately following concrete placement in the formwork and shall continue without interruption throughout the curing period.

1. **Weather:** The Contractor shall schedule the placement of structural concrete so that the date and hour decided upon reflect consideration of weather conditions.

   Concrete shall be protected from rain.

   Concrete shall not be placed against surfaces whose temperature is below 40 degrees F. Concrete shall be protected from freezing by approved coverings and, when necessary, heating the surrounding air in such a manner that the concrete will not dry.

   Protection shall be provided to prevent rapid drying of concrete as a result of low humidity, high wind, higher concrete temperatures than atmospheric temperatures, or combinations thereof. The Contractor shall perform evaporation rate testing for bridge deck placements and concrete overlays. Immediately after screeding and until the application of plastic sheeting and/or wet burlap, no surface of the freshly

Comment [1015]: Right Way/Right Time

Comment [1016]: Right Way

Comment [1017]: Right Way/Right Time/Right Material

Comment [1018]: Right Way

Comment [1019]: Right Way

Comment [1020]: Right Way

Comment [1021]: Right Way

Trial Use and Comment

mixed concrete shall be allowed to dry. Fogging with pressure sprayers acceptable to the Engineer and sufficient to maintain a moist surface shall be required. The protective measures taken shall be sufficient to maintain an evaporation rate at or below 0.10 pound per square foot per hour for normal concrete bridge deck placements or 0.05 pound per square foot per hour for concrete overlays over the exposed surface of the concrete. Other preventative measures described in **ACI 308** can be used in addition to fogging. Evaporation retardant films may be applied in a fine mist immediately after screeding to ensure that the surface remains wet until covered. If such materials are used, there shall be no disturbance of the concrete surface after placement of the retardant film and such film shall not be intermixed with the surface mortar. If plastic shrinkage cracking occurs due to the Contractor's negligence or failure to comply with specification requirements, the Engineer may direct the Contractor to make repairs by epoxy injections, concrete removal and replacement, or other methods approved by the Engineer at no additional cost to the Department.

2. **Construction activities:** Care shall be taken to avoid damage to concrete from vibration created by blasting and pile driving operations, movement of equipment in the vicinity of the structure, or disturbance of formwork or protruding reinforcement.

   Concrete shall be protected from the heat of an open fire. A watchperson shall be provided at the structure throughout any period in which open-flame heaters are operated in the vicinity of the concrete.

   After concrete in finished surfaces has begun to set, it shall not be walked on or otherwise disturbed for at least 24 hours except as provided for in (j) herein.

3. **Silicone treatment:** When unpainted weathering steel is used in a structure and no other concrete waterproofing surface finish is specified, a 5 percent solids, solvent-based, clear, water-repellent silicone treatment shall be applied in two coats to the surface of the concrete substructure on exposed concrete surfaces below and including the bridge seats, within the limits of vertical planes parallel to and 2 feet outside the extreme edges of exterior beams or girders. The first coat shall be applied at the rate of 60 to 70 square feet of surface area per gallon of treatment solution, and the second coat at the rate of 90 to 110 square feet per gallon. If the treatment is applied by spraying, the nozzle shall not be held further than 24 inches from the surface being treated. The treatment shall be applied after cleaning of exposed substructure concrete surfaces and before any structural steel is erected.

(m) **Opening to Traffic:** Structures shall not be opened to traffic, including construction traffic, or used for storing materials before the concrete has attained the 28-day design compressive strength as specified in Table II-17. Cylinders used for control purposes shall be cured under conditions that are not more favorable than the most unfavorable conditions for the portions of concrete the cylinders represent. When traffic is to be permitted on a partially completed slab span, falsework shall remain in place in

Comment [1022]: Right Payment

Comment [1023]: Right Way

Comment [1024]: Right Way

Comment [1025]: Right Time

Comment [1026]: Right Way

Comment [1027]: Right Way/Right Time

Trial Use and Comment

accordance with the strength requirements specified herein. Other structures supported on falsework from the ground shall not be opened to traffic until falsework is removed.

404.04—Bridge Deck Construction

Prior to the beginning of deck placement, screeds shall be approved by the Engineer.

When the longitudinal screed is used, the overall length shall be such as to screed independently supported spans up to and including 80 feet. The length of the screed shall be not less than the full length of the span for spans less than 80 feet. When using the longitudinal screed on independently supported spans exceeding 80 feet in length with a screed length less than the full length of the span, the center half of the span shall be completed first. Bulkheads or other substantial supports for the screed shall be placed over abutments and piers and at the terminal point of placements within the span. The surface of a previously placed section shall not be used as a bearing area for the screed track until control cylinders have attained a strength of at least 50 percent of f'_c as specified in Table II-17.

Comment [1028]: Right Way

When a transverse screed is used, the screed shall be of sufficient size to finish the full width of the deck between curbs or parapets unless a longitudinal joint in the deck is specified, in which case the portion on either side of the joint shall be placed and finished separately. Wheels of the screed shall bear on temporary rails supported on and directly above the main structural units or on form supports. With continuous spans, form supports shall be fully supported by the principal structural units supporting the deck. Rails shall be sufficiently rigid and strong to permit the screed to finish the surface of the deck within specified requirements. If rails are placed within the roadway area, they shall be elevated a sufficient distance above the deck to permit simultaneous finishing by hand of any portion not finished by the screed. Rail supports extending above the roadway surface shall be fabricated and installed in a manner to permit their removal to at least 2 inches below the top surface of the deck slab. Where rail supports are placed in that portion of the deck under curbs or parapets, supports shall be placed so that they will be at least 2 inches from the face of the curb, parapet walls, or outside edge of the slab.

Comment [1029]: Right Way

An approved positive means of permitting access to the surface of the bridge shall be provided for operations requiring access to the deck surface after passing of the screed. The means of access shall not make contact with the deck surface.

Concrete for the entire span or section to be placed shall remain workable until the entire operation of placing, screeding, patching, rescreeding, finishing, and testing is completed. Excess water or soupy material collected by a screeding operation shall be immediately removed from the deck.

Comment [1030]: Right Way

If the concrete in the deck of a continuous beam or girder span group cannot be placed in one operation, the location of construction joints and sequence of placement shall be in accordance with the approved placement schedule. After the initial placement has been

Comment [1031]: Right Way/Right Location/Right Time

Trial Use and Comment

made in any one group of continuous spans, no further placement shall be made until previously placed concrete in the deck of that group has been in place for at least 3 days or until the cylinder strength is at least 0.4 f'_c.

The deck surface shall be tested with a 10-foot straightedge and rescreeded as many times as is necessary to ensure a smooth riding surface. The straightedge shall be held in successive positions at the edges and quarter points and on the centerline, parallel thereto and in contact with the surface. Advancement along the deck shall be in successive stages of not more than the length of the straightedge. The surface shall also be checked transversely at the ends, quarter points, and center of the span. Areas showing high spots or depressions of more than 1/8 inch in 10 feet in the longitudinal direction and 1/4 inch in 10 feet in the transverse direction shall be struck off or filled with freshly mixed concrete. Attention shall be given to ensure that the surface across joints conforms to the requirements for smoothness.

Comment [1032]: Right Way

404.05—Expansion and Fixed Joints

(a) **Open Joints:** Open joints shall be constructed by inserting and subsequently removing wood strips, metal plates, or other approved material. Insertion and removal of the template shall be accomplished without chipping or breaking the corners of the concrete.

Comment [1033]: Right Way/Right Material

Edges of concrete adjacent to joints shall be finished to a radius of approximately 1/8 inch or as shown on the plans.

Comment [1034]: Right Way

(b) **Filled Joints:** Materials for filled joints shall conform to the requirements of **Section 212** and shall be installed in accordance with the requirements of **Section 316.04(m)**. When not specified or shown on the plans, filler shall be preformed asphalt joint filler and sealer shall be the hot-poured type.

Comment [1035]: Right Material

Edges of concrete adjacent to joints shall be finished to a radius of approximately 1/4 inch or as shown on the plans.

Comment [1036]: Right Way

When expanded rubber, PVC, or PE filler is used, it shall be attached to the first-placed side of the joint with an approved adhesive and the concrete on the other side shall then be placed against the filler. Care shall be taken not to displace or compress the filler.

Comment [1037]: Right Way

Other types of premolded fillers shall be similarly placed but need not be attached by an adhesive.

Comment [1038]: Right Way

Joints shall be free from cracked and spalled areas, and their faces shall be free from foreign matter, curing compounds, oil, grease, and dirt. Faces shall be sandblasted and the joint blown out with oil-free and water-free compressed air just prior to application of primer or sealer.

Comment [1039]: Right Way

Trial Use and Comment

(c) **Steel Joints:** Plates, angles, or other structural shapes shall be fabricated to conform to the section of the concrete floor. Fabrication and painting shall conform to the requirements of **Section 407** and **Section 411**. Care shall be taken to ensure that the surface in the finished plane is true and free from warping. Positive methods shall be employed in placing joints to keep them in the correct position during concrete placement so that the opening at expansion joints shall be that designated on the plans at normal temperature. Care shall be taken to avoid impairing the clearance in any manner. Normal temperature shall be considered as 60 degrees F, and correction to this temperature shall be computed using a coefficient of expansion of 0.0000065 per foot per degree F.

(d) **Waterstops:** Metal waterstops shall be spliced, welded, or soldered to form continuous, watertight joints.

Nonmetal waterstops shall be furnished full length for each straight portion of the joint without field splices. Manufacturer's shop splices shall be fully vulcanized.

Field splices for neoprene waterstops shall be vulcanized; mechanical, using stainless steel parts; or made with a splicing union of the same stock as the waterstop. Finished splices shall have a full-size tensile strength of 100 pounds per inch of width.

Field splices for PVC waterstops shall be made by heat sealing adjacent surfaces in accordance with the manufacturer's recommendations. A thermostatically controlled electric source of heat shall be used to make splices. The heat shall be sufficient to melt but not char the material.

When being installed, waterstops shall be cut and spliced at changes in direction as may be necessary to avoid buckling or distorting the web or flange.

If waterstops are out of position or shape after concrete is placed, the surrounding concrete shall be removed, the waterstop reset, and the concrete replaced, all at the Contractor's expense.

404.06—Bridge Seat Bearing Areas

Bridge seat bearing areas shall be finished plane and level and shall not deviate more than 1/16 inch from plane or more than 1/32 inch per foot from level or from the slope specified on the plans. These limits of tolerance do not necessarily represent fully acceptable construction but are the limits at which construction may become unacceptable. In general, workmanship on bearing areas shall be at a level of quality that will be well within the tolerance limits. Bearing area roughness for elastomeric pads shall conform to the requirements of **Section 408.03(g)**.

Comment [1040]: Right Way

Comment [1041]: Right Material

Comment [1042]: Right Way

Comment [1043]: Right Way

Comment [1044]: Right Way

Comment [1045]: Right Way/Right Documentatio n

Comment [1046]: Right Way

Comment [1047]: Right Payment

Comment [1048]: Right Way

Comment [1049]: Right Material

Trial Use and Comment

Bearing areas shall be cleaned and tested for planeness and levelness prior to placement of bearing pads or preparation for bearing plates. Preparation of bearing areas for placing bearing plates and setting anchor bolts shall be in accordance with the requirements of **Section 408.03(g)** and **(h).**

404.07—Finishing Concrete Surfaces

Following replacement or satisfactory repair of defective concrete, surface defects produced by form ties, honeycombing, spalls, or broken corners or edges shall be cleaned, wetted, filled with a mortar conforming to the requirements of **Section 218**, and troweled or struck off flush with the surrounding surface. If the surface cannot be repaired immediately following removal of forms or before the concrete surface has become dry, the surface shall be kept wet for 1 to 3 hours, as directed by the Engineer, prior to application of mortar. Repaired areas shall be cured in accordance with the requirements of **Section 404.03(k).**

The formed face of the following concrete items shall be given a Class 1 finish: (1) bridge items: wheel guards, the inside and outside faces of parapet walls, and concrete posts and rails; and (2) other items: curbs, raised medians, steps, and retaining walls that lie within 30 feet of the edge of the pavement.

(a) **Class 1, Ordinary Surface Finish:** Following removal of forms, fins and irregular projections shall be removed from exposed surfaces and surfaces to be waterproofed.

Immediately following removal of forms, surfaces that contain cavities having a diameter or depth greater than 1/4 inch shall be cleaned, wetted, filled with a mortar conforming to the requirements of **Section 218**, and rubbed with burlap. If the surface cannot be finished immediately following removal of forms or before the concrete surface has become dry, the surface shall be kept wet for 1 to 3 hours, as directed by the Engineer, prior to application of mortar. The finished surface shall be cured in accordance with the requirements of **Section 404.03(k)**.

Construction and expansion joints in the completed work shall be left free from mortar and concrete. Joint filler shall be left exposed for its full length.

(b) **Class 2, Rubbed Finish:** Rubbing of concrete shall be started immediately after forms are removed. Immediately before this work, concrete shall be kept wet for at least 3 hours. Sufficient time shall elapse before wetting to allow mortar used in the pointing of rod holes and defects to set thoroughly. Surfaces to be finished shall be rubbed with a medium-coarse carborundum stone with a small amount of mortar on its face. Mortar shall be composed of cement and fine aggregate mixed in the proportions used in the concrete being finished. Rubbing shall be continued until form marks, projections, and irregularities are removed; voids are filled; and a uniform surface is obtained. Paste shall be left in place.

Comment [1050]: Right Way

Comment [1051]: Right Material

Comment [1052]: Right Way

Comment [1053]: Right Time

Comment [1054]: Right Way

Comment [1055]: Right Material

Comment [1056]: Right Way

Comment [1057]: Right Way

Comment [1058]: Right Time

Trial Use and Comment

The final finish shall be obtained by rubbing with a fine carborundum stone and water. Rubbing shall be continued until the entire surface has a smooth texture and uniform color.

After final rubbing is completed and the surface has dried, the surface shall be rubbed with burlap and left free from unsound patches, paste, powder, and objectionable marks.

(c) **Class 3, Tooled Finish:** This finish shall be produced by the use of a bush hammer, pick, crandall, or other approved tool. Tooling shall not be done until concrete has set for at least 14 days and as much longer as may be necessary to prevent aggregate particles from being picked out of the surface. The finished surface shall show a grouping of broken aggregate particles in a matrix of mortar, with each aggregate particle in slight relief.

(d) **Class 4, Sandblasted Finish:** The thoroughly cured concrete surface shall be sandblasted to produce an even, fine-grained surface in which mortar has been cut away, leaving the aggregate exposed.

(e) **Class 5, Wire Brushed or Scrubbed Finish:** This finish shall be produced by scrubbing the surface of the plastic concrete with stiff wire or fiber brushes using a solution of muriatic acid in the proportion of 1 part acid to 4 parts water. As soon as forms are removed and while concrete is comparatively plastic, the surface shall be scrubbed thoroughly and evenly until the cement film or surface is removed and aggregate particles are exposed, leaving an even, pebbled texture presenting an appearance grading from that of fine granite to coarse conglomerate, depending on the size and grading of aggregate used. As soon as scrubbing has progressed sufficiently to produce the texture desired, the entire surface shall be thoroughly washed with water to which sufficient ammonia has been added to remove all traces of acid.

(f) **Class 6, Bridge Deck Finish:** Methods, procedures, and equipment shall conform to the requirements of **Section 404.03**, shall not result in segregating ingredients of the concrete; and shall ensure a smooth riding surface.

Hydraulic cement concrete bridge deck surfaces shall be textured with uniformly pronounced grooves sawed transversely to the centerline. After final screeding of the deck, a multi-ply damp fabric shall be dragged over the deck surface to provide a gritty texture. The deck concrete shall not be grooved until it has reached an age of 14 days or 85 percent of the 28-day design compressive strength. Grooves shall be sawed approximately 3/16 ± 1/16 inch in depth and 1/8 inch in width (nominal) on 3/4-inch (nominal) centers. Grooves shall terminate 12 ± 1 inches from the parapet wall or curb line. Grooves shall not be sawed closer than 2 or further than 3 inches from the edge of any joint. When the width of the cutting head on the grooving machine is such that grooves cannot be practically sawed to within the required tolerance for a skewed transverse joint, grooving shall not be closer than 2 inches or more than 36 inches from the edge of the joint. On curved decks, each pass of the grooving machine shall begin

Comment [1059]: Right Way

Comment [1060]: Right Way

Comment [1061]: Right Way

Comment [1062]: Right Time

Comment [1063]: Right Way

Comment [1064]: Right Way

Comment [1065]: Righht Way

Comment [1066]: Right Time

Trial Use and Comment

on the side of the deck having the smaller radius and the nominal spacing of grooves at the starting point shall be 3/4 inch on center.

Bridge decks should be grooved prior to opening to traffic. However, the Contractor will be permitted to delay grooving up to 6 months. The Contractor shall provide the Engineer with a plan for traffic control when working under traffic.

If a single pass of the grooving machine cannot be made across the width of the bridge, the mating ends of subsequent passes shall not overlap previous grooves or leave more than 1 inch of surface ungrooved.

After concrete has set and prior to placement of other slabs, the deck surface will be tested by the Engineer. Areas showing high spots or depressions of more than the specified tolerances will be marked as failing to conform to smoothness requirements. Levels may also be run over the surface to determine if there is any deviation from grade and cross section. Decks that do not conform to thickness and surface smoothness requirements will not be accepted until deficiencies have been corrected as directed by the Engineer. Sections that cannot be satisfactorily corrected shall be removed and replaced at the Contractor's expense.

Bridge decks that are to receive an asphalt concrete overlay of 1 inch or more in thickness shall be finished to a tolerance of 1/4 inch in 10 feet in both longitudinal and transverse directions except at expansion joints, where the finished tolerance shall be 1/8 inch in 10 feet.

(g) **Class 7, Sidewalk Finish:** After concrete has been placed, it shall be consolidated and the surface struck off with a strike board and floated with wooden or cork floats. Light metal marking rollers may be used if desired after the initial set. An edging tool shall be used on edges and at joints. The surface shall not vary more than 1/4 inch under a 10-foot straightedge and shall have a granular texture that will not be slick when wet.

404.08—Measurement and Payment

Concrete will be measured in cubic yards within the neat lines of the structure as shown on the plans and will be paid for at the contract unit price per cubic yard, complete-in-place. Deductions will not be made for chamfers 1 inch or less in width or for grooves less than 1 inch in depth. The volume of reinforcing steel or any other material or internal voids within the concrete will be deducted.

The volume of bridge deck slab concrete allowed for payment will be computed using the actual thickness of the slab, not to exceed the plan thickness plus 1/2 inch, for the area between faces of sidewalks, curb lines, railings, or parapets. The area beneath sidewalks, curbs, railings, or parapets will be based on the plan thickness. If prestressed concrete deck panel forms are used, the volume they displace will be computed using plan

Comment [1067]: Right Time

Comment [1068]: Right Way

Comment [1069]: Right Way

Comment [1070]: Right Payment

Comment [1071]: Right Way

Comment [1072]: Right Way

Trial Use and Comment

dimensions and the volume of the cast-in-place portion will be measured as provided herein.

Unless designated as pay items, this price shall include waterstops, waterproofing, damp-proofing, anchor bolts, drain assemblies, silicone treatment, protective coating for concrete exposed to tidal waters, and trial batches.

If corrugated metal bridge deck forms are used in lieu of removable forms, the price for concrete shall include furnishing and placing metal forms, additional concrete required to fill corrugations, work necessary to facilitate inspection of the underside of the deck, repairing deficiencies, and strengthening beams or girders to maintain the design live-load rating of the bridge. If prestressed deck panel forms are used in lieu of removable forms, the price shall include casting, furnishing, and placing forms.

Bridge-deck grooving will be measured in square yards of deck surface area from the faces of parapets, sidewalks, or curb lines and will be paid for at the contract unit price per square yard. No deduction will be made for drainage items and joints.

Payment will be made under:

Pay Item	Pay Unit
Concrete (Class) item	Cubic yard
Bridge-deck grooving	Square yard

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review specification requirements, material documentation, construction procedures, measurement and payment for type of operation that applies to type of work being preformed.
- Ensure that contractor is aware of the need for an Approved Source of Materials for concrete, reinforcing steel, etc.
- Discuss any special approvals that may be required in the specifications that apply to the type of work being preformed. (example – false work approvals)
- Discuss any project specific special design mixes.

Start:

- Ensure that all testing equipment is calibrated and onsite.
- Approved mix design is on the project site prior to any placement.
- Ensure the contractor has an approved plan for the pour.
- Check all concrete discharge methods to ensure proper placement, and to prevent consolidation.
- Check the contractor's plans on method of cure and protection of the pour. Make sure the methods are approved and materials used for curing are approved.
- Ensure proper test cylinder containment is provided.

Continuous inspection:

- Check foundations, grades, site preparations, formwork accuracy, formwork materials, reinforcing steel placement, placement methods.
- Check placement requirements, temperatures (air, form, surface), form treatment, cleanliness of pour area, etc.
- Test materials as required. Air test, slump test, cylinders, and temperatures.
- Inspect placement methods to prevent segregation. (vibration methods, placement layers, drop height, etc.

Trial Use and Comment

- Check concrete depths during placement.
- Inspect finishing methods to ensure required finish placement also ensure proper joint placement.
- Ensure all required curing and protection methods are applied and maintained for proper time frames.
- Ensure proper care is given when removing forms and backfilling if required.

Final Inspection:

- Check tolerances of placement and finish.
- Make final measurements.
- Ensure compaction if backfilled.

Documentation Required:

- Contractor's approved material, 208.06
- Document in DWR all checks to grades, form work, reinforcing steel, temperatures, foundations, cylinder breaks, and specified time frames.
- Summarize pour in DWR to include, temperatures, placement methods, consolidation methods, materials test performed and results, type of mix being placed, where it was placed and in what type of structure, number of loads and total yards received. Show calculations, sketches, etc. for payments.
- Measurement for payment
- Concrete Tickets
- Refer to Post Construction Manual for proper payment units and rounding.
- Contractor Furnished Sources, 106.03
- Payment computations
- Engineers Approval/Authorization

Trial Use and Comment

IV. REVIEW QUESTIONS

404.03(a)1	Did the Inspector check and approve the formwork prior to the Contractor placing concrete?
404.03(c)1	Was the concrete tested for conformity to the requirements of materials section on Hydraulic Cement Concrete and approved prior to placement?
404.07(f)	Following concrete set and prior to placement of other slabs, was the deck surface tested and approved by the Engineer and in accordance with this section?
404.03(a)2	Are devices for supporting forms of any type field welded to steel beams or girders?
404.03(a)3	Are the forms mortar tight and of sufficient rigidity to prevent distortion and set and maintained true to line and grade?
404.03(a)4	Were forms treated with an approved oil or form coating material or thoroughly wetted with water immediately before concrete placement?
404.03(a1b)1	Have corrugated metal bridge deck forms been installed in accordance with reviewed fabrication and erection plans?
404.03(a1b)2	Does welding conform to the requirements of the section on Fabrication Procedures for Steel Structures for fillet welds except that 1/8 inch fillet welds will be permitted?
404.03(a1b)3	Are form supports placed in direct contact with the stringer or floor beam flanges by hangers or clips?
404.03(a2)	If the Contractor elects to use prestressed deck panel forms, have the redesign details been submitted to the Engineer for acceptance no less than sixty (60) days prior to ordering materials for the work?
404.03(a2b)1	Are precast bridge deck panels adequately supported at panel ends with edges tightly butted together?
404.03(a2b)2	Prior to placement of deck surface concrete on precast deck panels, was all foreign material detrimental to bonding removed by sandblasting, waterblasting, or other approved methods?
404.03(a2b)3	Were deck panel top surfaces thoroughly and continuously water soaked for at least one (1) hour prior to placement of deck surface concrete?
404.03(b)	Did the Contractor have a Professional Engineer inspect and provide required certification that the falsework assembly conforms to the approved working drawings?
404.03(c)2	When individual concrete placements exceed twenty-five (25) cubic yards, were the rates in accordance with this section?
404.03(c)3	Was water and debris removed before concrete was placed?

Trial Use and Comment

404.03(c)4	Was the concrete placed in its final position in the forms within the time specified in the Materials Section under Hydraulic Cement Concrete?
404.03(c)5	Are specified measures taken to avoid dropping concrete more than five (5) feet where required?
404.03(c)6	Is the concrete placement regulated so that the pressures caused by the fresh concrete does not exceed those used in the design of the forms?
404.03(c)7	Is the concrete being vibrated in a manner to avoid segregation and in accordance with the section on concrete placement and consolidation?
404.03(c)8	Is the concrete placed in continuous layers not more than 12 inches in thickness?
404.03(c)9	Is the work not stopped or temporarily discontinued within 18 inches below the top of any face unless at the underside of copings having thicknesses of not more than 18 inches?
404.03(e)	Was pumping of concrete authorized by the Engineer and accomplished through use of non-aluminum conduit systems?
404.03(g)1	Are construction and expansion joints installed as shown on the plans or as approved by the Engineer?
404.03(g)2	Is asphalt applied to construction joints against which earth fill is placed?
404.03(h)	Are construction joints bonded as specified in the section on joints?
404.03(j)	Are the forms and form ties left undisturbed in accordance with Table IV-2 and this section?
404.03(k)1	Does curing begin before the sheen disappears from fresh concrete or immediately upon removal of formwork?
404.03(k)2	Was curing continuously maintained through the use of a curing agent or medium for not less than seven (7) days?
404.03(k)3	Is PE film used for curing of the proper type and secured to prevent wind drifts from drying the concrete?
404.03(k)4	Has the curing compound been uniformly sprayed over the surface?
404.03(k)5	When the atmospheric temperature is below 40 degrees F, does the method of curing and protecting concrete provide adequate moisture and maintain the temperature as required in this section?
404.03(l1)1	Is concrete not placed against surfaces whose temperature is below 40 degrees F.?
404.03(l1)2	Did the Contractor perform evaporation rate testing during bridge deck placements and, if necessary, use protective measures to prevent shrinkage cracking?
404.04(1)	Was the screed approved by the Engineer prior to beginning of deck placement?
404.04(2)	Are the screeds of required length and supported in accordance with this section?
404.04(3)	Was an approved positive means of permitting access to the surface of the bridge provided for operations requiring access to the deck surface

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	after passage of the screed?
404.04(4)	Was the deck surface tested with a 10 foot straightedge in accordance with this section?
404.05	Have joint openings been accurately formed with proper widths, parallel joint faces and free of spalling areas?
404.06(1)	Have the bridge seat bearing areas been finished within the specified tolerances?
404.06(2)	Are the bearing areas that are to receive elastomeric pads finished to the required roughness in accordance with the section on bearing devices?
404.07	Have the surfaces of the concrete received a finish that will satisfy the requirements of the section on finishing concrete surfaces?
404.07(a)	If the surface cannot be repaired immediately following removal of forms or before the concrete surface has become dry, was the surface kept wet for 1 to 3 hours prior to application of mortar?

V. CRITICAL INSPECTION POINTS

• Ensure that you have a current and approved mix design on file of the concrete to be used on the project. Ensure that cure method is also approved and any material used is approved. Have steel invoices on file if steel is required.
• Check foundations and grades prior to placement of formwork.
• Check formwork type, placement, and accuracy. Check reinforcement steel placement, size, type and method of placement.
• Check pour area for cleanliness and temperature requirements prior to placement.
• Ensure that all the proper tests are run on the mix as it arrives to the project. Ensure that all test cylinders taken are handled properly.
• Ensure proper placement and finishing is being obtained.
• Ensure necessary and required curing methods are being used and maintained for specified timeframes.
• Ensure form removal, and backfill if required.

Trial Use and Comment

SECTION 405 - PRESTRESSED CONCRETE

I. INTRODUCTION:

Prestressed members normally used by the Department are: I-beams, box beams, flat slab type members and concrete piles. I-beams are used to support conventional deck slab type construction. Box beams and flat type members are laid side by side to form the deck but are generally waterproofed and overlaid with a bituminous or latex concrete riding surface. Concrete piles are used as friction piles for structure supports, particularly over navigable waters.

Ordinarily, I-beams are designated by types. Type I is 28" high; Type II is 36" high; Type III is 45" high; Type IV is 54" high. Prestressed slabs and box beams are rectangular cross sections. In addition, both may have hollow centers or voids which decrease the dead weight of the members.

Prestressed concrete beams are to be stored on a firm base, in a plumb position and braced to prevent overturning. Supports must be placed in the immediate vicinity of the bearing areas (not less than 6", nor more than 2/3 the height of the beam, from the end).

After erection, concrete beams must sit flush on their bearing pads and be in acceptable vertical alignment. The Inspector can check the vertical alignment of the beam, at the bearing areas, with a plumb bob and rule. The Contractor must maintain acceptable vertical alignment when pouring struts, diaphragms and the deck slab. Acceptable vertical alignment for prestressed concrete beams as interpreted from the Specifications is $\pm$ l/8" per foot of beam height.

Sufficient spot checks are to be made to ascertain that each prestressed member conforms to the plans, Specifications and special provisions before being erected. Ordinarily, beams and piles are inspected, approved for use and stamped VDOT by the plant inspector before they are shipped. However, the job site Inspector is to check for obvious discrepancies. The following inspection checks pertain to prestressed beams and prestressed piles:

Inspect the unit for cracks. Short hairline cracks or slight chipping caused by movement of the concrete with respect to the casting forms are to be expected. Occasionally small horizontal cracks appear at the ends of the beams, but these are also acceptable. However, cracks that can be traced continuously around the member should be questioned because these cracks probably extend through the entire section. These and other apparent major faults, may affect the structural integrity of the member, are to be brought to the prompt attention of the Construction Manager.

All bearing areas are to be plane and level unless otherwise specified. Where required by Specifications, due to gradients or vertical curves, epoxy sand wedges are cast on

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each beam. The casting operation leaves the bearing areas smooth. Epoxy and grit must be applied to the smooth bearing areas to create the desired texture. If this was not done at the plant, it will be necessary to perform this operation on the job site before erection.

Pin positions and the location of all dowels are to conform to the plans.

Camber should be checked. This can be done with a level and a rod or with a very taut string line. Make checks along the bottom surface of the member.

Sweep should be determined by holding a taut string line on the concave side of a member at the ends. Once the string is taut the amount of curvature can be measured with a rule.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

405.01—Description

These specifications cover the use of prestressed or post-tensioned hydraulic cement concrete when called for on the plans.

Comment [1073]: Right Documentation

405.02—Materials

Comment [1074]: Right Materials

(a) **Concrete** shall conform to the requirements of Section 217, Class A5, with the following exceptions:

1. Concrete for piles, beams, and slabs shall contain 3.5 gallons per cubic yard of calcium nitrite conforming to the requirements of Section 215 unless granulated iron blast-furnace slag (minimum 40 percent by weight) or silica fume (minimum 7 percent by weight) conforming to the requirements of Section 215 is used.

2. Concrete for structures over tidal water, beams, and slabs within 15 feet of mean high tide and exposed piles shall contain either 5.4 gallons per cubic yard of calcium nitrite conforming to the requirements of Section 215 or 2.0 gallons per cubic yard of calcium nitrite with granulated iron blast-furnace slag (minimum 40 percent by weight) or silica fume (minimum 7 percent by weight.) conforming to the requirements of Section 215.

Comment [1075]: Right Location

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3 Fully or partially embedded attachments to the prestressed concrete members required for supporting forms or stay-in-place deck panels shall be galvanized in accordance with Section 233.

(b) **Concrete admixtures** shall conform to the requirements of Section 215.

(c) **Epoxy-resin compounds** shall conform to the requirements of Section 243.

(d) **Steel reinforcement and prestressed tendons** shall conform to the requirements of Section 223 and Section 406, respectively.

(e) **Epoxy-coated reinforcing steel** shall conform to the requirements of Section 223.

(f) **Structural steel** shall conform to the requirements of Section 226.

(g) **Bedding materials and bearing pads** shall conform to the requirements of Section 237 and Section 408.

(h) **Waterproofing** shall conform to the requirements of Section 416.

(i) **Hydraulic cement mortar and grout** shall conform to the requirements of Section 218.

405.03—Plant Review

Plants that manufacture precast, prestressed concrete elements shall have PCI certification for applicable product groups and categories except that plants supplying only deck panels and piles will not be required to be certified. PCI inspection reports shall be on file at the plant and available for review by the Department. Plants that have not previously produced products for the Department will be inspected by the Engineer prior to commencement of production. The Contractor shall provide suitable office space for use by the Engineer's representatives.

The request for plant inspection shall be made by the Contractor to the Engineer at least 3 weeks prior to the start of production. As a part of the plant inspection, a meeting will be held with the producer, Contractor, Engineer, and Inspectors to discuss plant facilities, materials, production methods, drawings, and production schedules.

In order to qualify new installations for the manufacture of prestressed units other than piles, the Engineer may require the Contractor to test a unit that is representative of each design type and size of unit to be manufactured. The acceptance test shall be as follows: Not more than one line of units shall be cast prior to the satisfactory completion of the acceptance test. A representative unit shall be tested in accordance with the requirements of VTM-20 in the presence of the Engineer prior to plant approval.

Comment [1076]: Right Way

Comment [1077]: Right Documentation

Comment [1078]: Right Time

Trial Use and Comment

The unit to be tested will be selected at random by the Engineer. Jigs and load-testing equipment shall be approved by the Engineer before use. The cost of the units selected for testing and the cost of the test shall be borne by the Contractor.

Comment [1079]: Right Documentation

Comment [1080]: Right Pay

405.04—Concrete Controls

Comment [1081]: Right Way

The Contractor shall provide concrete testing equipment and a Certified Concrete Technician to perform concrete acceptance tests.

During each concrete operation, at least two clusters of test cylinders shall be prepared. Each cluster shall consist of four 6 by 12-inch or six 4 by 8-inch cylinders, which shall be placed at quarter points of the casting bed and cured under the same conditions as the prestressed concrete units.

Concrete batches from which cylinders are made shall be tested for slump in accordance with the requirements of ASTM C143 and for air content in accordance with the requirements of ASTM C231.

Comment [1082]: Right Materials / Right Documentation

The compressive strength of the concrete at strand release, as specified in Section 405.05(b), will be based on the results obtained from tests on one cylinder from each cluster.

Average values of test cylinders from each cluster will be used to determine acceptability of compressive strengths.

The Contractor shall maintain records of tensioning operations, curing temperatures, and concrete testing in a form suitable for permanent filing. Records shall be available to the Department and maintained for 10 years.

Comment [1083]: Right Documentation

405.05—Procedures

Comment [1084]: Right Way

(a) **Forms:** Forms and centering shall be made and maintained true to the shapes and dimensions shown on the approved drawings.

Forms shall be of metal or other material that will give comparable results. Forms shall be designed and aligned so that they will not restrict the longitudinal movement of the casting when the prestressing force is transferred.

Drilled holes in bulkheads and templates shall be sized to provide for unrestricted movement of strands during tensioning.

Bulkheads may be constructed of adequately reinforced plywood. Wooden bulkheads that are warped or damaged shall not be used.

Trial Use and Comment

Form ties shall not be used without the approval of the Engineer.

Joints between panel forms shall be well aligned and tight, and adequate precautions shall be taken to prevent leakage of mortar. Corners or intersections of surfaces exposed in the completed structure shall be chamfered or rounded, with a width or radius of 3/4 inch. For square piles, corners shall be chamfered from 3/4 inch to 1 1/2 inches or rounded to a 2-inch radius. A smaller chamfer not less than 3/4 inch may be used if approved by the Engineer.

Void forms shall be anchored during concrete placement and secured by means other than being tied to strands.

Precast prestressed concrete box beams and flat slabs shall have one drain provided in each end of each void. The drain shall be located so that the void will drain after the unit has been installed in the structure. The device for forming the drain shall be of such material and design that the drain will not rust, stain, or otherwise disfigure the concrete and shall allow free drainage from the void.

(b) **Placing Strands and Wires and Applying and Transferring Pretension:** The Contractor may be required to submit for approval the detailed computations of gage pressures and elongations proposed.

Comment [1085]: Right Way / Right Documentation

Wires shall conform to the requirements herein for strands.

When indicated on the plans and approved by the Engineer, the Contractor may substitute low-relaxation strands for stress-relieved strands or stress-relieved strands for low-relaxation strands in prestressed units provided the following conditions are met:

1. The unit is redesigned by the Contractor in accordance with the design specifications shown on the plans, including modifications by the Engineer.

2. There is no mixing of low-relaxation strands and stress-relieved strands within a superstructure, substructure, or piles.

3. In addition to the requirements specified in 1. and 2. herein, in prestressed piles, the net compressive stress in the concrete after all losses shall equal the stress for such piles as shown on the plans, and the number and cross-sectional area of the strands in each pile shall equal or exceed the values shown on the plans.

   When the Contractor elects to substitute low-relaxation strands for stress-relieved strands or stress-relieved strands for low-relaxation strands, the design, camber calculations, and working drawings shall be submitted in accordance with the requirements of Section 105.10.

Trial Use and Comment

Strands with kinks, bends, nicks, broken wires, scales, rust, or other defects shall not be used. The failure of one wire in a seven-wire pretensioned strand or one wire in a parallel-wire post-tensioned cable may be accepted provided the wire is not more than 2 percent of the total number of wires. Slight rusting will not be cause for rejection provided it is not sufficient to cause visible pits. Strands shall be satisfactorily cleaned before concrete operations begin.

Strands shall be placed in proper position and first tensioned individually by a force of at least 5 but not more than 25 percent of the final stressing force. This force shall not vary by more than 5 percent in any group of strands.

The final stressing of strands shall be performed by applying tension to each strand individually or to all strands as a group. The strand or strand group shall be tensioned to the total pretensioning force as indicated on the plans, with a maximum applied stress of 70 percent of the ultimate strength for stress-relieved strands and 75 percent of the ultimate strength for low-relaxation strands.

During stressing, allowance shall be made for the amount of strand anchorage slipping. The proper allowance shall be determined during trial plant operations and satisfactorily checked periodically during actual stressing operations. Strand anchorage devices of each type and source shall be checked as specified herein.

During stressing, allowance shall be made in the amount of strand elongation for the loss or gain in tension resulting from the change in temperature in the strand between the time of stressing and time of the initial set of concrete. The magnitude and method of application of this allowance shall be in accordance with the requirements of the *PCI Manual for Quality Control* (MNL-116).

A manufacturer's corresponding recommended value for the average modulus of elasticity will be used for each order of strand supplied. Consideration shall be given to the stress-strain data of tests performed on the samples.

Strands shall not be spliced within units.

Pretensioned strands shall be secured by suitable anchorage devices capable of developing at least 90 percent of the ultimate strength of the strand.

When deflected strands are tensioned in their deflected position, they shall be supported by lubricated rollers with solid bushings or other low-friction rollers at hold-up and hold-down points. Provisions shall be made for a cover of at least 1/8 inch of concrete or epoxy mortar on metal parts of the hold-down devices remaining in beams.

The final position of strands and reinforcing steel shall be accurately maintained as shown on the plans.

Trial Use and Comment

The tensioning system shall be equipped with a pressure gage indicating the jack pressure to an accuracy of within 2 percent of the pressure corresponding to the full prestress tension in the strand. Gages shall be recalibrated at least once every 6 months and any time the gaging system appears to be giving erratic or erroneous results or if the gage indication and elongation measurements indicate materially different stresses. Gages, jacks, and pumps shall be calibrated as a system in the same manner in which they are used in tensioning operations. Calibration shall be performed by an approved testing laboratory or approved calibration service, and a certified calibration curve shall accompany each tensioning system. Load, as measured by gage pressure, shall not vary from that measured by elongation by more than 5 percent. Elongation measurements shall be taken as checks on the final pressure gage reading. Elongation shall be measured to a precision of 1/4 inch. During stressing, elongation and pressure readings shall be recorded by the Contractor.

Comment [1086]: Right Documentation

Tension in the strands shall not be transferred to the concrete in the unit until the concrete has attained a compressive strength of at least 3,500 pounds per square inch for piles and 4,000 pounds per square inch for other units. When multiple-strand detensioning is used, strands shall be transferred gradually, simultaneously, and equally to the concrete.

When the single-strand release method is used, strands shall be released by heating near the end of each unit in accordance with the Contractor's sequence and schedule. Individual jack release or burning may be used for strands at the dead or live end of the bed. Strands to be released in each step of the sequence shall be burned apart between beams before the next step is begun. No more than two strands shall be included in each step of the pattern.

Strands shall not be burned quickly but shall be heated with a low-oxygen flame played along the strand at least 5 inches until the metal gradually loses its strength and failure of the first wire in each strand occurs after the torch has been applied for at least 5 seconds.

The schedule for single-strand detensioning of units having deflected strands shall incorporate the following:

1. Straight strands located in the upper flange of the unit shall be released first.

2. Tension in the deflected strands at the ends of bed and uplift points shall be released in sequence.

3. Hold-down devices for deflected strands shall be disengaged, and hold-down bolts shall be removed from units.

4. The remaining straight strands of the pattern to be detensioned individually shall be released in sequence.

If it is desired to release hold-down devices prior to releasing tension in deflected strands, this may be permitted (1) if the weight of the prestressed unit is more than twice the total of

Trial Use and Comment

the forces required to hold strands in the low position, or (2) if weights or other approved vertical restraints are applied directly over the hold-down points to counteract uplifting forces, at least until the release of deflected strands has proceeded to such a point that the residual uplifting forces are less than 1/2 the weight of the unit.

Failure to follow these procedures may result in rejection of units.

(c) **Placing Concrete:** The procedure and equipment for handling, placing, and consolidating shall be such that a uniformly dense and high-grade concrete is obtained in all parts of the unit under all working and weather conditions.

Comment [1087]: Right Way

When placing concrete in continuous horizontal layers in forms for precast I-beams, succeeding layers shall follow the preceding layer before any initial set takes place. Concrete in bottom slabs of precast prestressed box beams shall be placed before void forms are positioned. Concrete may be placed in forms for piling and precast slab units in one continuous horizontal layer.

The use of external vibration will be at the option of the Contractor. Improper placing and vibrating may be cause for rejection.

(d) **Removing Forms:** Forms for units being moist cured may be removed when concrete reaches a strength of 1,500 pounds per square inch.

Comment [1088]: Right Way

After forms are removed, units will be inspected to determine acceptability. Patching of any surface irregularities, especially those resulting from honeycombing, shall be performed only after inspection.

(e) **Finishing:** Holes and voids in the surface of concrete resulting from bolts, ties, or large air pockets shall be wetted and filled with mortar having the same proportion of fine aggregate and cement as in the concrete, after which exposed mortar surfaces shall be finished smooth and even with a wood float.

Comment [1089]: Right Way / Right Time / Right Documentation

If finishing work is necessary, the exterior face of exterior beams shall be finished free from blemishes and then rubbed with burlap. Holes or voids having a depth or diameter greater than 1/2 inch on the interior face of exterior beams, on both faces of interior beams, or on piles shall be filled and finished.

Surfaces to be repaired and finished shall be kept wet for at least 1 hour before hydraulic cement mortar is applied. Immediately following patching work, repaired areas shall be cured for at least 48 hours. The wet cure may be accomplished by the use of steam, wet burlap, or continuous spray wetting, or liquid membrane-forming compound may be used on noncomposite surfaces. Epoxy may be used and shall be applied and cured in accordance with the manufacturer's recommendations.

Piles specified on the plans as being subject to tidal waters shall be finished in accordance with the requirements of Section 404.03(i).

Trial Use and Comment

Tops of prestressed deck panels shall receive a finish having pronounced grooves. Grooves shall be approximately 1/8 inch in depth and 1/8 inch in width, with a spacing of not more than 1 inch. Other groove patterns proposed by the Contractor that promote bonding may be used upon written approval by the Engineer.

Units that are to be made composite with subsequently placed concrete shall be finished by striking off the top of forms. As soon as the condition of the concrete permits and before it has fully hardened, dirt, laitance, and loose aggregate shall be removed from the surface by means of a wire brush, which shall leave the coarse aggregate slightly exposed or otherwise roughened. If concrete has been allowed to harden so that it is impossible to remove laitance and roughen the top surface of units by brushing, the surface shall be cleaned and prepared for bonding by chipping.

Except in piles, ends of strands shall be allowed to cool to normal temperature after cutting and then shall be covered with at least 1/8 inch of epoxy mortar or other material approved by the Engineer. After mortar is allowed to cure, the entire end of the unit shall be covered with epoxy, Type EP-3T.

Care shall be taken in cutting or burning ends of strands to prevent damaging the concrete surface.

(f) **Protecting and Curing:** Prestressed concrete shall be cured by being kept moist at temperatures that will promote hydration. Proper curing by any method requires that moisture is retained for complete hydration and the formation of surface cracks attributable to rapid loss of water is prevented while the concrete is plastic. Prior to concrete placement, procedures for retaining moisture shall be approved by the Engineer. Moist curing shall continue until such time as the compressive strength of the concrete reaches the strength for detensioning. Moist curing shall commence as soon as possible following the completion of surface finishing.

Comment [1090]: Right Way

The Contractor shall have the option of using steam curing in lieu of moist curing in accordance with the following:

1. The design concrete mixture shall be proven adaptable for steam curing using the same cure as proposed for the routine manufacture of prestressed concrete units.

2. The Contractor shall be responsible for the quality of concrete placed in any weather or atmospheric condition. At the time of placement, concrete shall have a temperature of 40 degrees F to 90 degrees F when concrete is moist cured. If accelerated curing is used, the temperature of the concrete at placement shall be 40 degrees F to 100 degrees F. Mixing limitations shall be in accordance with the requirements of Section 217.09.

3. An initial set of a nominal 500 pounds per square inch, determined by the penetration resistance test, shall be obtained prior to the introduction of steam. The penetration

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resistance test shall be performed in accordance with the requirements of ASTM C403. Forms shall be covered after surface finishing of the concrete, including the delay period before introduction of steam.

4. The temperature rise in the curing enclosure shall be uniform, with a rate rise of not more than 80 degrees F per hour. Concrete shall be cured at a steam temperature of not more than 180 degrees F, with the steam temperature uniform throughout the curing enclosure and with a variation of not more than 20 degrees F. Approved recording thermometers shall be placed so that temperatures can be recorded at a minimum of two uniformly spaced locations in each curing enclosure.

5. Steam curing shall be maintained until such time as the compressive strength of the concrete attains that specified on the plans for detensioning.

6. Steam curing shall be performed under a suitable enclosure to retain the live steam at 95 percent relative humidity and minimize heat losses. Enclosures shall allow free circulation of steam. Steam jets shall be positioned so that they will not discharge directly on concrete, forms, or test cylinders.

7. Concrete test cylinders shall be subject to the same curing conditions as the units.

8. Immediately after steam curing is terminated, forms shall be loosened and the stress load on the stressing strands shall be released while the concrete is still hot.

(g) **Waterproofing:** Units so designated on the plans shall be waterproofed in accordance with the requirements of Section 416.

Comment [1091]: Right Way

(h) **Handling, Storing, and Erecting:** Units shall be adequately separated in storage immediately following removal from beds to facilitate repair of surface blemishes and make inspection of finished surfaces possible.

Comment [1092]: Right Way

Care shall be taken in handling and storing units to avoid damage to concrete. Concrete shall have attained the minimum 28-day design compressive strength before structural units are shipped to the project site.

Piles shall not be driven until at least 7 days after the date concrete is cast and has attained the minimum design compressive strength.

Lifting and support points for units other than piles and deck panels shall be as shown on the plans or not less than 6 inches or more than 2/3 of the depth of the unit from the end of the unit. Piles and deck panels shall be supported and lifted at points shown on the plans. The Contractor shall be responsible for the design and safety of the lifting device used.

Requests to use lifting or support points other than those indicated must be accompanied by computations showing that stresses are within the allowable range using 50 percent of the dead load as an impact factor.

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Units that have been damaged in handling shall be satisfactorily repaired.

Shear keys required between adjacent units, recesses at ends of transverse ties, holes for anchor bars, and other recesses shown on the plans shall be filled with mortar conforming to the requirements of Section 218. Mortar shall be applied in one continuous operation for each span.

Where waterproofing material is to be applied to tops of units in the field, longitudinal joints shall be sufficiently smoothed to prevent damage to the material.

Struts and diaphragms between spread units may be cast separately or monolithically with the deck slab. If the Contractor casts struts and diaphragms separately from the slab, the age or compressive strength of the concrete in the struts or diaphragms shall conform to the requirements for I-beams in Section 404.03(j) before deck slab concrete is placed. If the Contractor casts struts and diaphragms monolithically with the slab, each prestressed concrete beam shall be placed and restrained in such a manner that the beam will not be canted during construction of the struts, diaphragms, and slab. The Contractor's method for maintaining acceptable vertical alignment of beams shall be subject to the approval of the Engineer.

Bearing surfaces of units shall be parallel to the bottom surface of the unit or as specified on the plans. Attached bearing assemblies shall be fabricated so that their bottom bearing surfaces shall lie in truly horizontal planes in their erected position. Metal bearing plates or bottoms of precast beams that are to bear on elastomeric pads shall be coated with epoxy, Type EP-2, EP-4, or EP-5, and then surfaced with a No. 36 to No. 46 silicon carbide or aluminum oxide grit.

Ends of beams, at ends of spans, and diaphragms shall be vertical.

405.06—Tolerances

Comment [1093]: Right Way / Right Location

The limits of tolerance do not necessarily represent fully acceptable construction; they are the limits at which construction may become unacceptable. In general, workmanship shall be at a level of quality that will be well within the tolerance limits.

(a) **Precast Prestressed Concrete I-Beams and T-Beams:**

Characteristic	Values
Depth (overall)	±1/4 inch
Width (flanges and fillets)	±1/4 inch
Width (web)	±1/4 inch
Length of beam	±1/8 inch/10 ft or 1/2 inch, whichever is greater

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Exposed beam ends (deviation from square or designated skew)	Horizontal ±1/4 inch, vertical ±1/8 inch/ft of beam height
Side inserts (spacing between centers of inserts and from centers of inserts to ends of beams)	±1/2 inch
Bearing plate (spacing from centers of bearing plates to ends of beams)	±1/2 inch
Stirrup bars (projection above top of beam)	±3/4 inch
Stirrup bars (longitudinal spacing)	:1 inch
Horizontal alignment (deviation from straight line parallel to centerline of beam)	Max. 1/8 inch/10 ft
Camber differential between adjacent beams of same type and strand pattern	1/8 inch/10 ft or max. 1/2 inch (at time of erection)
Camber differential from computed camber	:50% (at time of erection)
Center of gravity of strand group	±1/4 inch
Center of gravity of depressed strand group at end of beam	±1/4 inch
Position of hold-down points for depressed strands	±6 inches
Position of handling devices	±6 inches

(b) **Precast Prestressed Concrete Box Beams and Flat Slabs:**

Characteristic	Values
Depth (top slab)	+1/2 to –1/4 inch
Depth (bottom slab)	0 to +1/2 inch
Depth (overall)	±1/4 inch
Width of web or thickness of sidewalls	±3/8 inch
Width (overall)	+1/8 to –1/4 inch
Length	±1/8 inch/10 ft or 1/2 inch, whichever is greater
Void position (longitudinal)	1/2 inch adjacent to tie holes 1 inch adjacent to end block
Square ends (deviation from square)	±1/4 inch
Skew ends (deviation from designated skew)	
Skew angle equal to or less than 30°	±1/4 inch
Skew angle greater than 30°	±1/2 inch

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Horizontal alignment (deviation from straight line parallel to centerline of unit)	Max. 1/8 inch/10 ft
Gap between adjacent units	Max. 1/2 inch
Tie rod tubes (spacing between centers of tubes and from centers of tubes to ends of units)	±1/4 inch
Tie rod tubes (spacing from centers of tubes to bottom of beam)	±1/4 inch
Camber differential between adjacent units	Max. 1/4 inch (at time of erection)
Camber differential between high and low units in same span	Max. 3/4 inch (at time of erection)
Camber differential from computed camber on plans	±50 percent (at time of erection)
Side inserts (spacing between centers of inserts and from centers of inserts to ends of beams)	±1/2 inch
Stirrup bars (projection above top of beam)	3/4 inch
Stirrup bars (longitudinal spacing)	±1 inch
Center of gravity of strand group	±1/4 inch
Center of gravity of depressed strand group at end of beam	±1/4 inch
Position of hold-down points for depressed strands	±6 inch
Position of handling devices	±6 inch

(c) **Prestressed Deck Panels:**

Characteristic	Values
Width (perpendicular to strand)	to +1/2 inch
Length (in direction of strand)	to 1/2 inch
Distance of at least 1/2 inch shall be maintained between deck panel and shear connectors or shear reinforcing steel connecting deck panel to beam.	
Depth	to +1/4 inch
Distance between centerline of strands and bottom of panel	to –1/4 inch

(d) **Prestressed Concrete Piling:**

Characteristic	Values
Width or diameter	1/4 to +3/8 inch
Head out of square	1/16 inch/12 inch of width

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.ength of pile	1 1/2 inch
Horizontal alignment (deviation from straight line parallel to centerline of pile)	Max. 3/16 inch/20 ft of length Max. 1/8 inch in 10-ft chord Max. 1/16 inch in 1 ft
Void location	±1/4 inch
Stirrup bars or spiral position	±1 inch
Center of gravity of strand group	±1/4 inch
Position of handling devices	±6 inch

405.07—Measurement and Payment

Comment [1094]: Right Quantity / Right Payment

Prestressed concrete piles will be paid for in accordance with the requirements of Section 403.08.

Prestressed concrete structural units that are to be incorporated in the completed structure will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each.

These prices shall include manufacturing and furnishing units complete-in-place in the structure; mortar seals on ends of units; structural and reinforcing steel for connecting units to struts and diaphragms; reinforcing, structural, and prestressing steel embedded in units, including dowels in place and bearing pads or bearing devices, post-tensioning fittings, strands, and rods; grouting; joint fillers and sealers; waterproofing applied to structural units at the prestressing plant; hauling; handling; and treatment.

Prestressed concrete panels will be measured in square feet of surface area, complete-in-place, and will be paid for at the contract unit price per square foot. This price shall include manufacturing, furnishing, and installing.

Payment will be made under:

Pay Item	Pay Unit
Prestressed concrete (Shape, beam, description of cross section, and length)	Each
Prestressed concrete slab (Width, depth, and length)	Each
Prestressed concrete panel (Depth)	Square foot

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Plant Inspection (3 weeks prior to beginning production)

Start:

- Ensure Concrete Testing Equipment and a Certified Concrete Technician is in place.
- Ensure that a method for documenting test results and a filing / retention system is in place in accordance with Section 405.04.

Intermittent Inspection:

- Ensure forms are properly constructed and maintained.
- Ensure strands / wires are properly installed and tensioned.
- Ensure proper concrete placement.
- Ensure proper form removal, finishing, and curing.
- Ensure prestressed units are properly handled during storage and placement on project.

Final Inspection:

- Check installed units for proper vertical alignment, plane and level.
- Check installed units for signs of cracking.

Documentation Required:

- PCI Plant Certification documentation.
- Project Diary and Materials Notebook documentation.

IV. REVIEW QUESTIONS

405.05(h)01	Have prestressed items been checked for cracks and the Construction Manager notifed as per Section 405 of the Construction Manual?
405.05(h)02	Did the Inspector check the bearing pads and the vertical and horizontal alignment of the beams prior to the contractor installing the diaphragms?
405.06	Do the precast prestressed concrete I-beams, T-beams, box beams, flat slabs, and prestressed deck panels and piling meet the tolerances of the section?
405.05(e)	Prior to placing concrete on composite units, was the dirt, laitance, and loose aggregate removed from the surface by means of a wire brush or chipping so as to leave the coarse aggregate slightly exposed or

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	roughened to improve bonding?
405.05(g)	If so designated on the plans, was waterproofing provided in accordance with the section on Waterproofing?
405.05(h)03	Were precast piles not driven until at least 7 days after the date cast and minimum design compressive strength was attained?
405.05(h)04	Are prestressed units supported and lifted in accordance with the plans and other requirements?
405.05(h)05	Were all recesses shown on the plans filled with mortar conforming to the section on Hydraulic Cement Mortar and Grout in one continuous operation for each span?
405.05(h)06	In the event the Contractor elects to cast the struts & diaphragms separately from the slab, was the concrete cured to meet the requirements in the section on removing formwork & superimposed elements before deck slab concrete was placed?
405.05(h)07	Are bearing surfaces parallel to the bottom surface of the unit or as specified on the plans?
405.05(h)08	Have attached bearing assemblies been fabricated so that their bottom bearing surfaces lie in truly horizontal planes when erected?
405.05(h)09	Has epoxy or grit been applied to smooth bearing areas to create the desired texture?
405.05(h)10	Are ends of beams, at ends of spans, and diaphragms vertical?

V. CRITICAL INSPECTION POINTS

• Approval of Plant (Minimum of 3 weeks prior to production)
• Inspection of fabrication process at plant
• Lifting of units during storage and placement
• Inspection of units after final installation

Trial Use and Comment

SECTION 406—REINFORCING STEEL

I. INTRODUCTION:

Reinforcing steel is placed in concrete to resist such stresses as those due to flexure, tension, compression, and temperature.

Generally, the number of the bar indicates its diameter in increments of l/8". A No. 8 bar has a nominal diameter of 1"; a No. 5 bar is 5/8" diameter, etc.

Reinforcing steel shall be stored in accordance with specification requirements and as the bars are removed from storage, they should be inspected. The following conditions determine the criteria for using bars that have rusted:

1. The light rust coating (usually brown to light red in color) that initially appears on steel is of no serious consequence and can be safely disregarded.

2. Further development of the rusting process leads to a thick scale (dark red in color). This scale, if it is tight, is not detrimental to bond and may be used in concrete. It would be well at this point, however, to observe and to determine whether or not the flake, in fact, is tight and not loose.

3. Further development in the rusting process produces loose, flaky, scaling rust which can be detrimental to the bond between the concrete and the reinforcing steel. If this condition occurs, the steel is to be cleaned before use in the concrete. This cleaning operation can be accomplished either by brushing with burlap and steel brushes or sandblasting. Reinforcing steel bars which have lost their cross-sectional area during cleaning are not to be used.

   Bar supports come in many configurations and materials. Stainless steel or galvanized supports may be accepted by letter of certification from the manufacturer or supplier which certifies that the bar supports conform to the applicable material and coating requirements specified in this section of the Specifications. When it is determined that testing of the supports is necessary, one (1) support sample per type and manufacturer is to be sent to the Materials Division.

   “Standees” (A reinforcing bar support with bent legs resting on the lower mat of bars), used to support the top mat of steel in deck slabs and slab spans may be used as follows:

   On simple slab spans where the top mat of steel is considered temperature steel, not main reinforcement, “standees” may be used provided they hold the reinforcing

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steel to the requirements of Section 406.03 of the Specifications. The use of "standees" will not be permitted for the top mat of steel on any continuous slab spans. Each standee shall be firmly tied to the lower mat to prevent slippage.

a) Forms:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

406.01—Description

This work shall consist of furnishing; coating, if required, and placing reinforcing steel or wire mesh used in concrete operations, except prestressed strands and wires, in accordance with these specifications and in conformity to the lines and details shown on the plans.

406.02—Materials

(a) **Steel used for reinforcement** shall conform to the requirements of Section 223. Except for spiral bars, bars more than 1/4 inch in diameter shall be deformed bars.

(b) **Epoxy-coated bars** shall conform to the requirements of Section 223.

(c) **Welded wire fabric** shall conform to the requirements of Section 223.

(d) **Bar mat reinforcement** shall conform to the requirements of Section 223.

406.03—Procedures

(a) **Order Lists and Bending Diagrams:** Copies of order lists and bending diagrams shall be furnished the Engineer when required.

(b) **Protecting Material:** Reinforcing steel shall be stored on platforms, skids, or other supports that will keep the steel above ground, well drained, and protected against deformation.

Comment [1095]: Right Way

Comment [1096]: Right material

Comment [1097]: Right documentation

Comment [1098]: Right Way / Right material

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When placed in the work, steel reinforcement shall be free from dirt, paint, oil, or other foreign substances. Steel reinforcement with rust or mill scale will be permitted provided samples wire brushed by hand conform to the requirements for weight and height of deformation.

Upon delivery to the project site, epoxy-coated reinforcing steel shall be covered with an opaque covering. In addition, epoxy-coated reinforcing steel that has been partially embedded in concrete or placed in formwork and not covered with concrete shall have the exposed surfaces covered with an opaque covering after 30 days exposure to sunlight. The opaque coverings shall be placed in a manner to provide air circulation and prevent condensation on the reinforcing steel.

(c) **Fabrication:** Bent bar reinforcement shall be cold bent to the shape shown on the plans. Fabrication shall be in accordance with the requirements of the *Manual of Standard Practice for Detailing Reinforced Concrete Structures* (ACI 315).

Comment [1099]: Right Way

Spiral bars shall be fabricated to have the proper diameter when placed in position at the pitch shown on the plans. Each end of a spiral bar shall have 1 1/2 finishing turns at each end in a plane perpendicular to the axis of the spiral.

(d) **Placing and Fastening:** Steel reinforcement shall be firmly held during the placing and setting of concrete. Bars, except those to be placed in vertical mats, shall be tied at every intersection where the spacing is more than 12 inches in any direction. Bars in vertical mats and in other mats where the spacing is 12 inches or less in each direction shall be tied at every intersection or at alternate intersections provided such alternate ties accurately maintain the position of steel reinforcement during the placing and setting of concrete.

Comment [1100]: Right Way

Tie wires used with epoxy-coated steel shall be plastic coated or epoxy coated.

Following placement of epoxy-coated reinforcement and prior to concrete placement, the reinforcement will be inspected. All visible damage of the epoxy coating shall be repaired in accordance with the requirements of Section 223.

Comment [1101]: Right Time / Right Way / Right material

The minimum clear distance from the face of the concrete to any reinforcing bar shall be maintained as specified herein. In superstructures, the cover shall be at least 2 1/2 inches except as follows:

Comment [1102]: Right Way

1. **Bottom of slab:** 1 1/4 inches.
2. **Stirrups and ties in T-beams:** 1 1/2 inches.
3. **Rails, rail posts, curbs, and parapets:** 1 inch.

In substructures, the cover shall be at least 3 inches except as follows:

Trial Use and Comment

1. **Abutment neat work and pier caps:** 2 1/2 inches.

2. **Spirals and ties:** 2 inches.

In corrosive or marine environments or under other severe exposure conditions, the minimum cover shall be increased 1 inch except where epoxy-coated reinforcement is used. Bars that must be positioned by maintaining clearances from more than one face shall be centered so that clearances indicated by the plan dimension of bars are equalized.

Bars shall be placed so that the concrete cover as indicated on the plans will be maintained within a tolerance of 0 to +1/2 inch in the finally cast concrete.

Where anchor bolts interfere with reinforcing steel, the steel position shall be adjusted without cutting to permit placing anchors in their proper locations.

Reinforcement in bridge deck slabs and slab spans shall be supported by standard CRSI metal or precast concrete bar supports. Bar supports shall be spaced as recommended by CRSI but not more than 4 feet apart transversely or longitudinally. Precast concrete supports shall be less than 1 foot in length and staggered so as not to form a continuous line. The lower mat of steel reinforcement shall be supported by a bolster block or individual bar chair supports, and the upper mat shall be supported by high chair supports. Bar supports shall be firmly stabilized so as not to displace under construction activities. Reinforcing bar supports (Standees) may be used for the top mat of steel of simple slab spans provided they hold the reinforcing steel to the requirements specified herein and are firmly tied to the lower mat to prevent slippage. The use of standees will not be permitted for the top mat of steel on any continuous slab spans.

Comment [1103]: Right material / Right Way

Precast concrete bar supports shall have a 28-day design compressive strength of at least 4,500 pounds per square inch and shall be from the Department's list of approved products for the use specified. Supports shall be furnished with epoxy-coated or plastic ties or shaped to prevent slippage from beneath the reinforcing bar. Metal bar supports shall be fabricated from one of the following: (1) stainless steel wire conforming to the requirements of ASTM A493, or (2) cold-drawn wire protected by plastic coating conforming to CRSI standards, epoxy coating, or other protective coating as approved by the Engineer.

Comment [1104]: Right material

In reinforced concrete sections other than bridge slabs, the specified clear distance from the face of concrete to any reinforcing bar and the specified spacing between bars shall be maintained by means of approved types of stays, ties, hangers, or other supports. The use of pieces of gravel, stone, brick, concrete, metal pipe, or wooden blocks will not be permitted as supports or spacers for reinforcing steel. The use of precast concrete block supports will be permitted provided blocks are furnished in correct thicknesses and are shaped or tied to prevent slippage from beneath reinforcing bars. The clear distance between bars shall be at least 1 1/2 times the

Comment [1105]: Right Way / Right material

Trial Use and Comment

specified maximum size of coarse aggregate but not less than 1 1/2 inches. Before concrete is placed, reinforcing steel will be inspected and approved for proper position and the adequacy of the method for maintaining position.

(e) **Splicing and Lapping:** Reinforcement shall be furnished in full lengths as indicated on the plans. Except where shown on the plans, splicing bars will not be permitted without the written approval of the Engineer. Splices shall be as far apart as possible.

Comment [1106]: Right Way / Right material

Bars shall be lapped at least 30 bar diameters to make the splice. In lapped splices, bars shall be placed in contact and wired together. Mechanical butt splicing will be permitted at longitudinal joints in deck slabs and other locations shown on the plans provided the mechanical connection develops in tension or compression, as required, at least 125 percent of the specified yield strength of the bar. Reinforcing steel shall be welded only if specified on the plans. Welding shall be in accordance with the requirements of Section 407.04(a).

Laps for sheets of welded wire fabric or bar mat reinforcement shall be at least one mesh in width.

406.04—Measurement and Payment

Comment [1107]: Right measurement / Right payment

Reinforcing steel will be measured in pounds of steel placed in the structure as shown on the plans. The weight of **welded wire fabric** will be computed from the theoretical weight per square yard placed, including allowance for laps not to exceed 8 percent of the net area. Reinforcing steel or welded wire fabric will be paid for at the contract unit price per pound. These prices shall include furnishing, fabricating, and placing reinforcement in the structure. In structures of reinforced concrete where there are no structural steel contract items, expansion joints, plates, rockers, bolts, and similar minor metal parts will be paid for at the contract unit price for reinforcement.

Epoxy-coated reinforcing steel, when a pay item, will be measured in pounds of uncoated steel and will be paid for at the contract unit price per pound. The weight will be computed from the theoretical weights of the nominal sizes of steel specified and placed in the structure. Measurement will not be made for epoxy-coating material. This price shall include furnishing steel and epoxy-coating material; applying coating material; fabricating, shipping, and placing epoxy-coated reinforcement in the structure; and necessary repairing of epoxy coatings. When the Contractor elects to eliminate the epoxy coating of reinforcing steel and furnish a latex hydraulic cement concrete deck surface, payment will be made at the same contract unit price as if epoxy-coated reinforcing steel had been used.

No payment will be made for fastening devices that may be used by the Contractor for keeping reinforcing bars in their correct position. When the substitution of larger bars than those specified is allowed, payment will be made for only the amount of metal that would have been required if the specified size of bar had been used. When full-length bars are

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shown on the plans and the Contractor obtains approval to use short bars for his convenience, the weight paid for will be based on the full-length dimensions with no allowance made for splices.

Payment will be made under:

Pay Item	Pay Unit
Reinforcing steel	Pound
Welded wire fabric	Pound
Epoxy-coated reinforcing steel	Pound

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review specification requirements, material documentation, construction procedures, measurement and payment.
- Discuss storage and handling methods with Contractor.
- Appropriate delivery tickets and certifications should be received from the Contractor.
- Sample of bars should be retrieved from the on-site stock if required by the Materials Manual of Instructions.

Start:

- Verify all reinforcing steel removed from storage is acceptable and that approved tie wire is being utilized for varying types of reinforcing steel.

Intermittent inspection:

- Visual monitoring of material and installation to ensure compliance with section 406.

Final Inspection:

- Inspect in place reinforcing steel prior to placement of concrete to ensure adequate position and method of maintaining positions.

Documentation Required:

- Materials test reports on samples if required.
- Copy of invoices and manufacturer certifications from Contractor.
- Engineer approval of non-planned splices or welding of reinforcing steel.
- Record in diary appropriate pay amounts and types for reinforcing steel.

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IV. REVIEW QUESTIONS

406.03(b)1	Has the reinforcing steel been stored above ground, well drained, and protected against deformation?
406.03(b)2	When placed into work, is the reinforcement steel free from dirt, paint, oil, or other foreign matter?
406.03(b)3	Upon delivery, was epoxy coated reinforcing steel covered with an opaque covering?
406.03(b)4	Was epoxy coated reinforcing steel which was partially embedded or placed in formwork and not covered with concrete covered after 30 days exposure to sunlight?
406.03(d)01	Was the reinforcing steel checked and approved for proper position as well as adequacy of the method of maintaining position prior to placement of concrete?
406.03(d)02	Were reinforcing bars tied according to the section on placing and fastening reinforcing steel?
406.03(d)03	Were provisions made to accurately maintain the position of steel reinforcement during the placing and setting of concrete?
406.03(d)04	Were epoxy or plastic coated wires used to tie epoxy steel?
406.03(d)05	Was all visible damage to epoxy coatings repaired in accordance with the Materials Section on Reinforcing Steel to be Epoxy Coated?
406.03(d)06	Was a minimum of 2-1/2 inches clear distance maintained between the face of the concrete and the reinforcing steel in superstructures unless otherwise noted in the section on placing and fastening reinforcing steel?
406.03(d)07	Was a minimum of 3 inches cover maintained in substructures unless otherwise noted in this section?
406.03(d)08	Have all bars been placed so that the final cast concrete cover is maintained within a tolerance of 0 to +1/2 inch?
406.03(d)09	Where anchor bolts interfere with reinforcing steel, has the position of the steel been adjusted without cutting to permit the anchor bolts to be placed in the proper location?
406.03(d)10	Is reinforcing steel in bridge deck slabs and slab spans supported by standard CRSI metal or precast concrete bar supports spaced no more than 4 feet apart transversely or longitudinally?
406.03(d)11	In reinforced concrete sections other than bridge slabs, is the reinforcing steel supported and spaced in accordance with this section?
406.03(d)12	Was the minimum clear distance between bars at least 1-1/2 times the specified maximum size of coarse aggregate but not less than 1-1/2 inches?
406.03(e)1	Was written approval secured from the Engineer for bar splices not shown on the plans?
406.03(e)2	Are bars lapped at least 30 bar diameters to make the splice?

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406.03(e)3	Was welding of reinforcing steel done only if specified on the plans and in accordance with the requirements of Section 407.04(a)?
406.03(e)4	Were laps for sheets of welded wire fabric or bar mat reinforcement at least one mesh in width?

• Are samples sent to Materials Division and test reports on file?
• Is material stored as specified?
• Do the size dimensions, bends and hooks of all reinforcing bars conform to the reinforcing bar schedules shown on the plans?
• Is the surface condition free of loose mill scale, flaky rust, dirt, oil or other coatings that would inhibit concrete bond.
• Is epoxy coated reinforcing steel being used where required?
• Is epoxy coating intact and free of defects?
• Is epoxy coated steel left in sun light more than 30 days without covering?
• Was reinforcing steel tied as specified?
• Was reinforcing steel supported as specified?
• Was reinforcing steel placed as specified?
• Were splices and laps made as specified?
• Did spacing, location and edge clearances of all reinforcing bar mats conform to the plans and Specifications?

V. CRITICAL INSPECTION POINTS

• Inspect reinforcing steel upon delivery to the project to ensure appropriate documentation and storage. Obtain samples for submittal to materials for testing in accordance with Manual of Instructions.
• Inspect reinforcing steel when removed from storage and prior to placement in the work. Ensure no reduction in the cross section of the bars from rust.
• Following placement of epoxy coated reinforcing steel and prior to concrete placement, the reinforcement will be inspected. All visible damage of the epoxy coating shall be repaired.
• Before concrete is placed, reinforcing steel will be inspected and approved for proper position and the adequacy of the method of maintaining position.
• Check all splices and laps for appropriate length and connection.

Trial Use and Comment

SECTION 407- STEEL STRUCTURES

I. INTRODUCTION:

MATERIALS

When structural steel arrives on the project, sufficient spot checks are to be conducted to verify that all material bears evidence of test, conforms to the shop drawings and is not damaged. Study the match marks on the stringers and diaphragms and compare these to the shop drawings. This might eliminate some misunderstanding during erection.

SHOP DRAWINGS

Complete shop drawings of all structural steel girders and beams, bearing assemblies and anchorage devices must be submitted by the Contractor for review by the Department. A copy of shop drawings which have been reviewed by the Structure and Bridge Office are to be included in the project files. The Inspector should also review these drawings when they arrive and check them against the contract for obvious discrepancies. If discrepancies are found, they are to be brought to the prompt attention of the Construction Manager.

WELDS

Welding is the art and science of joining two pieces of metal by establishing a metallurgical bond between them. There are numerous welding processes which accomplish this; however, this discussion is limited to manual shielded metal-arc welding, since this is the process used almost exclusively by field welders.

The mechanical process of arc welding is that an electric arc is concentrated on the edges of two pieces of metal to be jointed. This electric arc generates heat in the magnitude of 6000^0 F and melts the metal. The electric arc is introduced to the metal through an electrode which also melts. The metal, commonly referred to as the base metal, and electrode form a molten pool and as the electric arc moves on, this pool solidifies and the metallurgical bond is established.

In joining two pieces of metal, we speak of a welded joint. These joints are either designated as a fillet weld or groove weld. Many refer to a groove weld as a butt weld. Welding of these joints may be performed in four positions; flat, horizontal, vertical or overhead.

Welder Qualification - The most important factor is the welder. All welders must be qualified in accordance with the American Welding Society's standards and their qualifications verified by the Materials Division. Prior to a welder performing work on a project, the Contractor must submit to the Inspector a copy of the welder's certificate of qualification, and also a certificate stating that the welder has not exceeded any period

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of three months since the date of qualification without performing satisfactory welding in the required process. These documents are to be forwarded to the structural steel section of the Materials Division to be reviewed to determine the validity of the documents before welding is performed. The pertinent information pertaining to the welder's certification is to be recorded in the project diary.

a. Forms:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

407.01—Description

This work shall consist of furnishing, fabricating, and erecting steel materials in accordance with these specifications and in conformity with the lines, grades, and dimensions shown on the plans or as established by the Engineer.

407.02—Materials

Materials shall conform to the requirements of Section 226.

407.03—Working Drawings

The Contractor shall submit for review by the Engineer working drawings of all structural steel, bearing assemblies, and anchorage devices. Details shown on the drawings shall conform to these specifications and the requirements of the Structural Steel Design Section of AASHTO's *Standard Specifications for Highway Bridges.* In addition, primary stress units shall be detailed and identified by an individual piece mark. The review of working drawings shall not relieve the Contractor of responsibility for errors on the drawings or deviations from the plans unless such changes are approved in writing by the Engineer. Shop work shall not be performed until after the working drawings have been reviewed.

The Contractor may, in writing, authorize the fabricator to act for him in matters relating to working drawings in accordance with the requirements of Section 105.10.

Comment [1108]: Right material

Comment [1109]: Right Documentation

Trial Use and Comment

Working drawings shall specifically identify each piece other than steel conforming to the requirements of ASTM A 709, Grade 36. Pieces fabricated of different grades of steel shall not be given the same piece mark, even if they have identical dimensions and details.

407.04—Fabrication Procedures

Workmanship, finish, and fabrication tolerances shall conform to AISC standards except where the standards are in conflict with these specifications. Where AISC standards allow alternate methods of fabrication, the method used shall be that which produces the higher quality of workmanship and finish.

Structural steel shall be fabricated in a shop certified by AISC, Category SBR or CBR, with endorsements for fracture critical and/or painting as appropriate.

Comment [1110]: Right Location

Fabrication and welding of structural steel bridge units shall conform to the requirements of these specifications and AASHTO/AWS Bridge Welding Code D1.5. Structural components designated in the contract documents as fracture-critical shall conform to the provisions of the AASHTO/AWS Bridge Welding Code D1.5, Section 12, Fracture Control Plan (FCP) for Non-redundant Members.

Fabrication and welding of other structural and miscellaneous steel shall conform to the requirements of these specifications and AWS Structural Welding Code D1.1.

Comment [1111]: Right way

The Contractor shall give the Engineer ample notice of the beginning of work in the shop so that an inspection can be made. Work shall not be performed in the shop before the Engineer has been notified.

Comment [1112]: Right Time

Steels shall be identified during fabrication as follows: The Contractor shall furnish a complete mill analysis showing chemical and physical results from each heat of steel for all units prior to fabrication. Each piece of steel shall be properly identified.

Comment [1113]: Right Time

Before cutting, pieces of steel other than steel conforming to the requirements of ASTM A709, Grade 36, that are to be cut to smaller-sized pieces shall be legibly marked with the ASTM A6 specification identification color code or the material specification designation. The identification color code of the latest system adopted under ASTM A6 shall be used to identify material.

Comment [1114]: Right Way, right material, Right Documentation

Upon request, the Contractor shall furnish an affidavit certifying that he has maintained the identification of steel in accordance with these specifications throughout the fabrication operation.

Comment [1115]: Right documentation

(a) **Welds:** Only welding or tack welding noted on the plans shall be performed on structural steel, reinforcing steel, or aluminum units.

Comment [1116]: Right Location

Trial Use and Comment

Structural units shall not be used as a worktable. Welding on other work shall be completed before parts are installed on units and shall conform to the following:

1. Groove welds in flange plates, cover plates, and longitudinal stiffeners shall be ground flush. Groove welds in legs of rigid frames, webs of exterior girders, and beams shall be ground flush on the exposed side. Cope holes shall not be filled. The perimeter of cope holes shall be ground smooth. Temporary erection bolt holes shall be filled with high-strength bolts and tightened in accordance with the specifications herein.

2. Electroslag and electrogas welding processes will be permitted only when pre-approved in writing by the Engineer.

3. Welds that do not conform to the requirements of the specifications, as determined by visual inspection or nondestructive testing, shall be repaired or removed and replaced by the methods permitted in the specifications or the entire piece will be rejected. Repaired or replaced welds will be reinspected in accordance with the applicable nondestructive testing method.

4. For each welder, welding operator, or tacker, the Contractor shall submit or shall have the fabricator submit to the Engineer a copy of the certificate of qualification and a certificate stating that the welder, welding operator, or tacker has not exceeded any period of 3 months since the date of qualification without performing satisfactory welding in the required process. The qualification certification shall state the name of the welder, operator, or tacker; name and title of the person who conducted the examination; type of specimens; position of welds; results of tests; and date of the examination. The qualification certification shall be made by an approved agency.

Welds for reinforcing steel, including tack welds, shall conform to the requirements of AWS D1.4.

Welding of aluminum shall conform to the requirements of AWS D1.2.

Welds for tubular structures shall conform to the requirements of AWS D1.1.

(b) **Straightening and Curving Rolled Beams and Plate Girders:**

1. **Straightening material:** Rolled material shall be straight before being laid off or worked. When straightening is required, it shall be done by methods that will not damage the metal. If straightening is performed by heating, heating shall be performed in accordance with 2. herein.

Sharp kinks or bends shall be cause for rejection of the material.

2. **Curving rolled beams and plate girders:** The Contractor shall submit a detailed procedure for the method of heat curving beams or girders.

Comment [1117]: Right documentation

Comment [1118]: Right Time,

Comment [1119]: Right documentation, Right Way

Trial Use and Comment

Heat shall be applied so as to bring the steel to the temperature required for heat curving as rapidly as possible but not to more than 1200 degrees F. When any portion of a unit is heated to a temperature in excess of 1200 degrees F, the unit will be rejected.

a. **Sequence of operations:** Units shall be cambered before heat curving and shall be heat curved in the fabrication shop before painting.

Comment [1120]: Right Time, Right Location

Longitudinal stiffeners shall be heat curved or cut separately and then welded to the curved units. When cover plates are to be attached to the rolled beams, they may be attached before heat curving if the total thickness of one flange and cover plate is less than 2 1/2 inches and the radius of curvature is more than 1,000 feet. For other rolled beams with cover plates, beams shall be heat curved before cover plates are attached. Cover plates may be either heat curved or cut separately and then welded to the curved beam.

b. **Camber compensation:** To compensate for the loss of camber of heat-curved units in service having a radius of 800 feet or less, additional camber shall be provided in the units. The amount of additional camber at the midlength of the unit shall be C_h for units having a radius less than 500 and 1/2 C_h for units having a radius from 500 feet to 800 feet. C_h shall be computed as follows:

$$C_h = \frac{0.02L^2F_y}{EY_o}$$

where:

L = the length, in inches, of the unit specified to be cambered
F_y = the specified minimum yield point of the flange in kips per square inch
E = the modulus of elasticity in kips per square inch
Y_o = the distance from the neutral axis to the extreme outer fiber in inches (maximum distance for nonsymmetrical sections).

The additional camber, C'_h, at any other point in the unit shall be computed as follows:

$$C'_h = \frac{C' \times C_h}{C}$$

where:

C = the camber specified at midlength in the design plans
C' = the camber specified at any other point in the design plans.

The additional camber provided shall be shown on the working drawings.

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c. **Type of heating:** Where heat curving is permitted by the plans, plate girders and rolled beams may be curved by either continuous or V-type heating. Heat curving shall not be performed until camber conforms to the requirements of the specifications.

(1) **Continuous method:** A strip along the edge of the top and bottom flange shall be heated simultaneously. The strip shall be of sufficient width and temperature to obtain the required uniform curvature.

(2) **V-type method:** The top and bottom flanges shall be heated in truncated triangular or wedge-shaped areas having their base along the flange edge and spaced at regular intervals along each flange. Spacing and temperature shall be as required to obtain the required uniform curvature. Heating shall progress simultaneously along the outside surface of the top and bottom flange. When the flange thickness is 1 1/4 inch or greater, heat shall be applied simultaneously to the inside flange surface (surface that intersects with the web) and outside flange surface.

d. **Position for heating:** The unit may be heat curved with the web in the vertical or horizontal position. When curved in the vertical position, the unit shall be braced or supported so that the tendency of the unit to deflect laterally during the heat-curving process will not cause the unit to overturn.

When curved in the horizontal position, the unit shall be properly supported to obtain a uniform curvature. The bending stress in the flanges attributable to the dead weight of the girder shall not exceed the allowable design stress. When the unit is positioned horizontally for heating, safety catch blocks shall be maintained at the midlength of the unit within 2 inches of the flanges at all times during the heating process.

Any method of handling, supporting, or loading that causes the unit to distort permanently (yield without the application of heat) will result in rejection of the unit.

e. **Artificial cooling:** Quenching will not be permitted. Cooling with dry compressed air will be permitted after the steel has naturally cooled to 600 degrees F.

f. **Measurement of curvature:** Prior to final acceptance of horizontal curvature, welding and heating operations shall have been completed and the unit cooled to a uniform temperature.

(c) **Camber:** Rolled beams and plate girders shall be cambered in the amount indicated on the plans. Camber shall approximate a parabolic curve. Camber for rolled beams shall be obtained by heat-cambering methods. For plate girders, the web shall be cut to the prescribed camber with a suitable allowance for shrinkage attributable to cutting, welding, and heat curving.

Tolerance for the specified camber of welded beams or girders before erection shall not exceed the greater of (A) or (B).

Comment [1121]: Right Way.

Comment [1122]: Right Time, Right Location

Comment [1123]: Right Way

Comment [1124]: Right Way, Right Location

Comment [1125]: Right Way

Comment [1126]: Right Time

Comment [1127]: Right Way, Right Documentation

Trial Use and Comment

$$(A) + 1/4 \text{ inch} \times \frac{\text{Feet of test length}}{10} \quad \text{(Not to exceed 3/4 inch)}$$

$$(B) + 1/8 \text{ inch} \times \frac{\text{Feet from nearest end}}{10}$$

Tolerance for the specified camber of rolled beams as measured at midlength shall be:

$$+1/8 \text{ inch} \times \frac{\text{Feet of Length}}{10}$$

Camber shall be measured with the beam or girder laying on its side on a flat horizontal surface.

(d) **Bolt Holes:** Bolt holes shall be punched, drilled, or reamed as specified herein. Holes shall not be flame cut or electrode cut.

Finished holes shall be 1/16 inch larger than the nominal bolt size. Oversized holes will be permitted only with the permission of the Engineer or in accordance with the requirements of Section 407.06(a). Finished holes shall be within 1/16 inch of the plan gage and match-mating holes, with no offset greater than 1/16 inch. Holes varying more than 1/16 inch from the plan gage will be rejected.

Burrs shall be removed from holes.

1. **Punched holes:** The diameter of the die shall not exceed the diameter of the punch by more than 1/16 inch.

   Holes shall not be punched in structural carbon steel conforming to the requirements of ASTM A 709, Grade 36, thicker than 3/4 inch, or in high-strength structural steel conforming to the requirements of ASTM A 709, Grade 50W, or higher, thicker than 5/8 inch. When these thicknesses are exceeded, holes shall be subdrilled and reamed or drilled full size.

   Holes may be punched full size (1/16 inch larger than bolts) in secondary units or members and their connecting plates or angles. Holes shall be clean cut, without torn or ragged edges. Structural members identified in Section 407.04(k)1 or in the plans, special provisions, or other contract documents as main (primary) members or units shall not be punched full size.

   Subpunched holes that are to be reamed shall be 3/16 inch smaller in diameter than the nominal bolt size. The location offset between subpunched holes assembled for reaming shall be not more than 1/8 inch.

2. **Reamed and drilled holes:** Holes shall be subdrilled and reamed to 1/16 inch larger than bolts. If numerically controlled drilling equipment is used, the Contractor may be required

Comment [1128]: Right Way

Comment [1129]: Right Documentation, Right size

Comment [1130]: Right Way, Right size

Comment [1131]: Right Way, Right size

Trial Use and Comment

by means of check assemblies to demonstrate that this procedure consistently produces holes that conform to the dimensions shown on the plans. Connections shall conform to the requirements of this section. Shop assembly for numerically controlled drilled connections shall conform to the requirements of AASHTO's *Standard Specifications for Highway Bridges.*

(e) **Cut Edges of Plates and Shapes:** Cut edges shall have their corners rounded to a radius of 1/16 inch.

Comment [1132]: Right Way

Sheared edges of plates more than 5/8 inch in thickness shall be planed to a depth of 1/4 inch.

Structural steel may be flame cut provided a smooth surface free from cracks and notches is achieved and that an accurate profile is achieved by the use of a mechanical guide. Free-hand cutting shall be done only where approved by the Engineer.

Comment [1133]: Right Documentation

Flame cutting in the field is prohibited.

(f) **Facing of Bearing Surfaces:** The surface finish of bearing and base plates and other bearing surfaces that are to come in contact with each other or with concrete shall conform to the following surface roughness requirements as defined in ANSI B46.1:

Comment [1134]: Right material

	Roughness Height (microinches)
Steel slabs	2,000
Heavy plates in contact in shoes to be welded	1,000
Milled ends of compression units, stiffeners, and fillers	500
Bridge rollers and rockers	250
Pins and pin holes	125
Sliding bearings	125

(g) **Bent Plates:** The radius of bends shall be such that the plate does not crack. The minimum bend radii, measured to the concave face of the metal, shall be as follows:

Comment [1135]: Right Way

Thickness (*t*) (inches)				
Up to 1/2	**Over ½ to 1**	**Over 1 to 1 1/2**	**Over 1 1/2 to 2 1/2**	**Over 2 1/2 to 4**
2***t***	2 1/2***t***	3***t***	3 1/2***t***	4***t***

Low-alloy steel more than 1/2 inch in thickness may require hot bending for small radii. If a shorter radius is essential, the plates shall be bent hot at a temperature of not more than 1200 degrees F.

Before bending, the corners of the plate shall be rounded to a radius of 1/16 inch throughout the portion of the plate at which the bending is to occur.

Trial Use and Comment

(h) **Annealing and Stress Relieving:** Structural units that are indicated on the plans, the specifications, or other contract documents to be annealed or normalized shall have finished machining, boring, and straightening done after heat treatment. Temperatures shall be maintained uniformly throughout the furnace during heating and cooling cycles so that the temperature of any two points on the unit will not differ at any time by more than 100 degrees F.

A record of each furnace charge shall identify the pieces in the charge and show the temperatures and schedule actually used. Proper instruments, including recording pyrometers, shall be provided for determining the temperature of units in the furnace at any time. The records of the treatment operation shall be available for inspection by the Engineer.

(i) **Pins and Rollers:** Pins and rollers shall be forged or fabricated of cold-finished carbon steel shafting. In pins larger than 9 inches in diameter, a hole at least 2 inches in diameter shall be bored full length along the axis. Threads for pins shall conform to the American National Coarse Thread Series, Class 2, free fit, except that pin ends having a diameter of 1 3/8 inches or more shall be threaded six threads to the inch.

Pinholes shall be bored at right angles with the axis of the unit. Boring holes in fabricated units shall be performed after welding is completed. The diameter of the pinhole shall not exceed that of the pin by more than 1/50 inch for pins 5 inches or less in diameter or by 1/32 inch for larger pins.

(j) **Stud Shear Connectors:** The diameter of the connectors shall be 7/8 inch, and the length shall be at least 4 inches. Heads shall project at least 2 inches above the plane of the bottom of the deck slab and shall be 3 inches below the plane of the top of the deck slab. In determining the required length, the computed dead-load deflection, vertical curve correction, and actual (measured) camber of the fabricated beam shall be taken into consideration. Studs 3/4 inch in diameter may be substituted for 7/8-inch studs, or vice versa, by making an adjustment in the pitch proportionally to the cross-sectional area of the studs with a spacing of not more than 24 inches. Studs shall be adjusted as necessary to provide clearance for bolts in bolted splices. When prestressed deck panels for cast-in-place concrete deck slabs are to be used, the edge distance of studs shall be adjusted to provide the necessary support areas for ends of the deck panels. Studs shall be end welded automatically or semi-automatically to the steel beams. The method and equipment used shall be as recommended by the manufacturer of the studs and shall be approved by the Engineer. Studs shall be field welded after structural steel is erected and metal decking or other walking or working surface is in place; however, structural steel with shop-applied studs may be erected provided erection is performed in accordance with the requirements of Section 107.17.

(k) **Shop Assembly:** Assembly shall be in accordance with the following:

Comment [1136]: Right Way,

Comment [1137]: Right documentation

Comment [1138]: Right Way, Right Location

Comment [1139]: Right material, Right size

Comment [1140]: Right Time

Trial Use and Comment

1. **Holes for field connections and field splices** in the following main units shall be drilled with units assembled or numerically controlled drilled. Holes shall not be punched full size in the following main units or their connecting plates and angles:

   a. Girders and rolled beams.

   b. Trusses, arches, and towers.

   c. Bent and rigid frames.

   d. Diaphragms, crossframes, or bracing attached to straight steel box girders or attached to curved rolled beams, curved I girders, or curved steel box girders.

   e. Any member designated on the plans or in other contract documents as "fracture critical."

   f. Any other main (primary) member(s) or unit(s) identified as such in the plans, special provisions, or other contract documents.

2. **Holes for floor-beam and stringer-end connections** shall be subpunched or subdrilled and reamed to a template or reamed while assembled. Templates used for connections on like parts shall be located so that the parts are identical and require no match marking.

3. **Surfaces of metal in contact** shall be cleaned before assembly. Parts shall be drawn together and securely clamped before drilling or reaming. Units shall be free from twists, bends, or other deformation.

4. **Drift pins** may be used only to bring parts into position. If any holes must be enlarged to admit bolts, the hole shall be reamed as permitted in these specifications.

5. **Connecting parts assembled in the shop** for the purpose of reaming holes shall be match marked. Miscellaneous parts that are not completely bolted in the shop shall be secured by partial bolting to prevent loss or damage in shipment and handling.

(l) **Inspection:** The Contractor shall perform quality control inspection, including, but not limited to visual inspection and nondestructive testing. Visual inspection shall be performed in accordance with the requirements of VTM-33 by inspectors qualified in accordance with the requirements of ANSI/AASHTO/AWS Bridge Welding Code D1.5 or AWS Structural Welding Code D1.1, as applicable. Radiographic and magnetic particle testing shall be performed in accordance with the requirements of VTM-29 and VTM-31, respectively. Ultrasonic testing, when specified, shall be performed in accordance with the requirements of VTM-30. Railroad structures and fracture-critical units shall be given radiographic and ultrasonic inspections in accordance with the requirements of VTM-44.

The Engineer reserves the right to perform quality assurance inspection. The Contractor shall provide and furnish a Type III field office in accordance with the requirements of

Comment [1141]: Right Time, Right Location, Right size

Comment [1142]: Right Way

Comment [1143]: Right Way

Comment [1144]: Right material, Rightway

Comment [1145]: Right Location, Right Way

Comment [1146]: Right Way, Right Time

Comment [1147]: Right Location. Right payment

Trial Use and Comment

Section 514 for use in the Engineer's inspection of material and workmanship within the shop. In addition to the requirements specified therein, the Contractor shall provide telephone service by a direct access line, a telephone, and maintenance thereof. Costs for installation of the direct access line, the telephone, maintenance, and local service shall be borne by the Contractor. The cost for long-distance will be borne by the Department. The Engineer shall be allowed free access to the necessary parts of the work. One reinspection of corrective action taken on defective material or fabrication will be performed by the Department without cost to the Contractor; the cost of further reinspections shall be borne by the Contractor. The cost of any retests made necessary by the replacement of rejected welds shall be borne by the Contractor. When requested, the Contractor shall provide working space for radiographic examination of welds and shall make such space available for at least 6 hours per inspection visit.

407.05—Handling, Storing, and Shipping Materials

Materials and units shall be placed at least 4 inches above the ground on platforms, skids, or other supports. They shall be supported in such a manner that they will not be overstressed or become deformed or otherwise damaged. High-strength bolts, nuts, and washers shall be stored in identifiable original containers in protective storage subject to the approval of the Engineer. Materials shall be kept free from dirt, grease, and other foreign materials; protected from corrosion; and properly drained.

(a) **Material Furnished by Others:** If the Contract is for erection only, the Contractor shall check the material delivered against the shipping lists and report promptly in writing any shortage or damage. The Contractor shall be responsible for the loss of any material in his care or for any damage incurred after the shipment is received.

(b) **Marking and Shipping:** Each unit shall be identified with an erection mark, and an erection diagram shall be furnished.

The Contractor shall furnish as many copies of shipping statements and erection diagrams as the Engineer may require. The weight of each unit shall be shown on the statements. Units having a weight more than 3 tons shall have the weight marked thereon. Structural units shall be loaded on trucks or cars in such a manner that they may be transported and unloaded at their destination without being excessively stressed, deformed, or damaged. Main structural units shall be supported at their bearings or at such other supports as may be approved or directed by the Engineer.

Bolts of one length and diameter and loose nuts or washers of each size shall be packed separately. Pins; small parts; and packages of bolts, washers, and nuts shall be shipped in boxes, crates, kegs, or barrels. A list and description of the contained material shall be plainly marked on the outside of each shipping container.

407.06—Erection Procedures

Comment [1148]: Right Way, Right documentation

Comment [1149]: Right Documentation, Right material

Comment [1150]: Right Way, Right Documentation

Comment [1151]: Right Documentation, Right material

Comment [1152]: Right Way

Trial Use and Comment

If the Contract is for erection only, the Contractor will receive the materials entering into the finished structure, free of charges, at the place designated and loaded or unloaded as specified. The Contractor shall promptly unload material he is required to unload and shall be responsible for demurrage charges.

Before starting the work of erection, the Contractor shall fully inform the Engineer as to the method proposed to be followed and the amount and character of equipment to be used, which shall be subject to approval. No work shall be done until such approval has been obtained. The approval of the Engineer shall not relieve the Contractor of the responsibility for ensuring the safety of his methods or equipment or performing the work in accordance with the plans and these specifications.

When new steel beams are connected to existing steel beams, the Contractor shall temporarily connect the diaphragms to the beams, in a manner to allow for the deflection of the new beams after placement of the deck slab concrete. After the deck slab concrete has cured, the Contractor shall connect the diaphragms as shown on the plans.

The Contractor shall erect steel, remove temporary construction, and perform all work required to complete the structure(s) or specified in the Contract, including removing the old structure(s), if specified, in accordance with the requirements of the plans and the specifications.

(a) **Field Welding:** When erection includes field welding, field welding and inspection shall be performed in accordance with the requirements of Section 407.04.

(b) **Misfits Field Assembly:** Correction of misfits will be considered a legitimate part of erection provided corrective work is necessary on not more than 10 percent of the holes in a continuous group of 10 or more holes or 10-percent of the number of individual pieces with fewer than 10 holes.

Drift pins may be used only to bring parts into position. Misaligned holes shall be corrected, where allowed by the Engineer, by reaming. However, no hole shall be elongated in any separate part to more than 1/8 inch larger than the nominal bolt size when a reamer not more than 1/16 inch larger than the nominal bolt size is used. The misalignment of holes before reaming shall not be more than 1/8 inch.

Necessary work exceeding these figures will be considered caused by shop errors and will be reported to the responsible party. Damage resulting from handling or transportation shall be reported to the Engineer.

When the Contract provides for complete fabrication and erection, the Contractor shall be responsible for misfits and errors and shall make the necessary corrections or replacements. When the Contract is for erection only, the Engineer, with the cooperation of the Contractor, will keep a record of labor and material used and the Contractor shall render within 30 days an itemized bill approved by the Engineer.

Comment [1153]: Right payment

Comment [1154]: Right Time, Right Documentation

Comment [1155]: Right Way

Comment [1156]: Right Way

Comment [1157]: Right Way,

Comment [1158]: Right Way

Comment [1159]: Right Way, Right Quantity

Comment [1160]: Right Documentation

Comment [1161]: Right Documentation

Trial Use and Comment

(c) **Assembly of Structural Connections Using High-Strength Bolts:** Field connections shall be made with high-strength bolts 7/8 inch in diameter fabricated in accordance with ASTM A 325 unless otherwise specified. Consideration will be given to the substitution of adequately designed welded connections if requested in writing by the Contractor.

1. **Bolts, nuts, and washers:** Bolts, nuts, and washers shall conform to the requirements of Section 226 and shall each be from one manufacturer on any one structure unless otherwise approved by the Engineer. In addition, each bolt, nut, and washer combination, when installed, shall be from the same rotational-capacity lot. Prior to installation, the Contractor shall perform a field rotational-capacity test on two nut, bolt, and washer assemblies for each diameter and length in accordance with the requirements of Section 226.02(h)3. Bolts fabricated in accordance with ASTM A 490 and galvanized bolts fabricated in accordance with ASTM A 325 shall not be reused. Retightening previously tightened bolts, which may have been loosened by the tightening of adjacent bolts, shall not be considered a reuse. Other bolts may be reused only if approved by the Engineer. Threads of plain (uncoated) bolts shall be oily to the touch when installed. Galvanized nuts shall be lubricated containing a visible dye. Threads of weathered or rusted bolts shall be cleaned of loose rust and debris and relubricated. Lubricant shall be as recommended by the fastener manufacturer.

2. **Bolted parts:** Bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible material.

   Before assembly, connecting surfaces, including areas adjacent to the washers, shall be free from scale except tight mill scale and shall be free of burrs, dirt, and other foreign material that would prevent solid seating of the parts. Surfaces for bolted splices in main units fabricated from weathering steel and joint surfaces for other connections, when required on the plans, shall be blast cleaned in accordance with the requirements of Section 411.04(a)5. The minimum area to be blast cleaned shall be 12 inches beyond the outermost row of bolts in the flanges and web and shall include the entire contact surfaces of the splice plates and filler plates. Contact surfaces shall be free from dirt, loose scale, burrs, oil, lacquer, and rust inhibitor.

3. **Installation:** Only as many fasteners as are anticipated to be installed and tightened during a work shift shall be taken from protected storage. Fasteners not used shall be returned to protected storage at the end of the shift. Bolts shall be installed with a hardened washer under the nut or bolt head, whichever is the element turned in tightening.

   When bolts fabricated in accordance with ASTM A 490 are used with steel having yield points less than 40 kips per square inch, hardened washers shall be installed under the nut and bolt head.

   An approved tension-indicating device shall be at all job sites where high-strength fasteners are being installed and tightened. Bolt tensioning devices and complete bolt assemblies shall be tested with this device at the start of construction and as required for

Comment [1162]: Right material

Comment [1163]: Right material, Right Way

Comment [1164]: Right Way

Comment [1165]: Right Way

Comment [1166]: Right quantity, right material, Right Way

Comment [1167]: Right Location

Comment [1168]: Right material, Right documentation

Comment [1169]: Right Time

Trial Use and Comment

the installation procedure. The calibrating device shall be capable of indicating actual bolt tension within a tolerance of 2 percent. The manufacturer or an approved testing agency shall have checked the device for the accuracy specified herein within the previous 12 months. When turn-of-nut or direct tension indicators are used, a representative sample of at least three complete bolt assemblies of each diameter, length, and grade shall be tested. For short grip bolts, direct tension indicators with solid plates may be used to perform the required testing. However, the direct tension indicator shall be checked with a longer grip bolt in the approved tension-indicating device prior to testing with short grip bolts.

A flat washer may be used when the surface adjacent to the bolt head or nut does not have a slope of more than 1:20 with respect to a plane normal to the bolt axis. Where an outer face of the bolted parts has a slope of more than 1:20 with respect to a plane normal to the bolt axis, a smooth beveled washer shall be used to compensate for the lack of parallelism. The threaded ends of bolts shall be placed on the inside, where practicable, for protection from weather.

Comment [1170]: Right Material

The length of bolts shall be such that the point of the bolt will be flush with or outside the face of the nut when completely installed without overtensioning the bolt.

Fasteners shall be tightened to provide, when all fasteners in the connection are tight, at least the minimum bolt tensions shown in Table IV-3 for the size of the fastener used. Tightening shall be performed by the turn-of-nut method or by the use of a direct tension indicator using a load indicator washer. Power wrenches, if used, shall be of adequate capacity and sufficiently supplied with air to perform the required tightening of each bolt in approximately 10 seconds.

Comment [1171]: Right Way

TABLE IV-3
Bolt Tension

	Required Min. Bolt Tension (lb)	
Bolt Size	**ASTM A 325 Bolts**	**ASTM A 490 Bolts**
1/2	12,000	15,000
5/8	19,000	24,000
3/4	28,000	35,000
7/8	39,000	49,000
1	51,000	64,000
1 1/8	56,000	80,000
1 1/4	71,000	102,000
1 3/8	85,000	121,000
1 1/2	103,000	148,000

If required because of bolt-entering and wrench-operation clearances, tightening by either procedure may be done by turning the bolt while the nut is prevented from rotating provided both the head and nut bear against surfaces having slopes not greater than 1:20.

Trial Use and Comment

The required minimum bolt tension is equal to 70 percent of specified minimum tensile strengths of bolts rounded to the nearest kip as specified in ASTM A 325 and ASTM A 490.

Snug tight is defined as the tightness attained when a power wrench begins to impact solidly or when the bolts are firmly hand tightened with a spud wrench such that the complete area of the connecting surfaces are brought into firm contact with each other. Snug tightening shall progress systematically from the most rigid part of the connection to the free edges, and then the bolts of the connection shall be retightened in a similar systematic manner as necessary until all bolts are simultaneously snug tight and the connection is fully compacted.

a. **Turn-of-nut tightening:** When the turn-of-nut method for tightening high-strength bolts is used, bolts shall be installed in all holes and tightened to a snug tight condition to ensure that all parts of the joint are brought into contact with each other. Bolts shall be given a suitable match-mark and tightened additionally by the applicable amount of nut rotation specified in Table IV-4, progressing systematically from the most rigid part of the joint to its free edges. During this operation, there shall be no rotation of the part not turned by the wrench. Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by ½ turn and less, the tolerance is minus 0 plus 30 degrees; for bolts installed by 2/3 turn and more, the tolerance is minus 0 plus 45 degrees.

Comment [1172]: Right Way

TABLE IV-4
Nut Rotation From Snug Tight Condition

Comment [1173]: Right Way

Bolt Length Measured From Underside of Head to Extreme End of Point	Disposition of Outer Faces of Bolted Parts		
	Both Faces Normal to Bolt axis	One Face Normal to Bolt Axis and Other Face Sloped Not More Than 1:20 (Bevel Washer Not Used)	Both Faces Sloped Not More Than 1:20 From Normal to Bolt Axis (Bevel Washers Not Used)
Up to and including 4 diameters	1/3 turn	1/2 turn	2/3 turn
More than 4 but not more than 8 diameters	1/2 turn	2/3 turn	5/6 turn
More than 8 but not more than 12 diameters	2/3 turn	5/6 turn	1 turn

b. **Direct tension indicators:** When direct tension indicators are used, installation shall be in accordance with the requirements of Section 407.06(b)3. However, the indicator washer shall not be considered a substitute for the required hardened washer under

Comment [1174]: Right Way, Right material

Trial Use and Comment

the turned element but may be considered a substitute for the hardened washer required under the unturned element when bolts conforming to the requirements of ASTM A 490 are used with steel conforming to the requirements of ASTM A 709, Grade 36. Direct tension-indicator washers shall not be painted or coated with any epoxy or similar material prior to installation. The normal installation shall consist of the load indicator being placed under the unturned bolt head or unturned nut. However, if conditions required installation under the turned bolt portion, a hardened flat washer or nut face washer shall be fitted against the tension-indicating protrusions. Tension-indicating washers shall not be substituted for the hardened washers required with short-slotted or oversized holes but may be used in conjunction with them.

The initial installation shall be to a snug tight condition, after which final tightening shall be performed by progressing systematically from the most rigid part of the connection to its free edges until the tension indicators on all bolts are closed to at least the required gap.

The required gap shall be 0.015 inch or less between the indicator and the underside of the bolt head or nut when no washer is used with the indicator. If a hardened flat washer is incorporated, the required gap shall be 0.010 inch or less between the indicator and the hardened flat washer. If the indication gap is closed completely, additional tightening shall not be continued.

4. **Inspection:** The Engineer will observe the installation and tightening of bolts to determine that the selected tightening procedure is properly used and will determine that all bolts are tightened.

Comment [1175]: Right Way

The Contractor in the presence of the Engineer shall use an inspection wrench to inspect the tightening of bolts. No fewer than three typical bolts from the lot to be installed having a length representative of bolts used in the structure shall be placed individually in a calibration device capable of indicating bolt tension at least once each working day. There shall be a washer under the part turned in tightening each bolt if washers are so used on the structure. If no washer is used, the material abutting the part turned shall be of the same specification as that used on the structure.

When the inspection wrench is a torque wrench, each calibration test bolt shall be tightened in the calibration device to the minimum tension specified for its size in Table IV-3. The inspection wrench shall then be applied to the tightened bolt, and the torque necessary to turn the nut or bolt head 5 degrees (approximately 1 inch at 12-inch radius) in the tightening direction shall be determined. The average torque measured in the tests of three bolts shall be taken as the job-inspection torque. The torque wrench shall be a dial torque wrench and checked for accuracy within 1 year by the manufacturer or an approved testing agency.

When the inspection wrench is a power wrench, it shall be adjusted so that it will tighten each calibration test bolt to a tension of at least 5 but not more than 10 percent greater

Trial Use and Comment

than the minimum tension specified for its size in Table IV-3. This setting of the wrench shall be taken as the job-inspection torque.

Bolts that have been tightened in the structure shall be inspected in the presence of the Engineer by applying, in the tightening direction, the inspection wrench and its job-inspection torque to 10 percent of the bolts but not fewer than two bolts selected at random in each connection. If no nut or bolt head is turned by this application of the job-inspection torque, the connection will be accepted as properly tightened. If any nut or bolt head is turned by the application of the job-inspection torque, this torque shall be applied to all bolts in the connection. Bolts whose nut or head is turned by the job-inspection torque shall be tightened and reinspected or all the bolts in the connection may be retightened and the connection resubmitted for the specified inspection.

Comment [1176]: Right Time, Right Way

Inspection of installations using tension-indicating washers will normally be accomplished by checking the residual gap with a metal feeler gage. Installations will be considered satisfactory if the average gap per bolt installation does not exceed 0.012 inch for a tension-indicating washer installed under the bolt head or 0.010 inch for a tension-indicating washer installed in conjunction with a hardened, flat washer or if the gap has been reduced to zero at any point around the indicator.

The Engineer may verify by calibrated torque wrench that the work conforms to the requirements of Table IV-3 regardless of the method of installation.

Comment [1177]: Right documentation

(d) **Abutting Joints:** Abutting joints in compression units and in tension units where so shown on the plans shall be faced and brought to an even bearing. Where joints are not faced, the opening shall be not more than 3/8 inch.

(e) **Alignment at Bearings and Transverse Connections:** Beam ends, bearing stiffeners, and webs of girders and rolled structural shapes and other beam sections shall be vertical.

Comment [1178]: Right Way, Right material

Diaphragms or cross struts composed of channel sections not attached to bearing stiffeners may be fitted with the planes of their webs perpendicular to the planes of the flanges of longitudinal beams on gradients provided the channel flanges are turned to the downgrade side where practicable.

Rolled beams and plate girders and their bearing assemblies shall be fabricated so that their bottom bearing surfaces lie in horizontal planes when in their erected positions. Steel plates for use with flexible bearing pads shall be beveled to conform to this requirement.

(f) **Falsework:** Falsework shall be designed, constructed, and maintained for the loads that will rest upon it. The Contractor shall prepare and submit to the Engineer, for review, plans for falsework or for changes in an existing structure necessary for maintaining traffic. The Department's review of the Contractor's plans shall not relieve him of any responsibility.

Comment [1179]: Right documentation

The Contractor shall have a Professional Engineer holding a valid license to practice engineering in the Commonwealth of Virginia inspect the completed falsework assembly

Trial Use and Comment

supporting a bridge superstructure prior to placing loads. The Professional Engineer shall provide a certification based upon visual inspection of the completed falsework assembly that the falsework assembly conforms to the approved working drawings. However, such certification shall not require an exhaustive inspection or testing or make the Professional Engineer liable for any deficiencies in workmanship or materials by the Contractor or for such conditions that cannot be ascertained from a visual inspection.

(g) **Straightening Material in the Field:** Straightening plates and angles or other shapes shall be done by methods that will not produce fracture or damage. Metal shall not be heated unless permitted by the Engineer, in which case the heating shall not exceed 1200 degrees F as measured by temperature-indicating crayons or other approved means. After heating, the metal shall be cooled naturally.

Following straightening of the shape, the surface of the metal shall be carefully inspected for evidence of fracture. If the damage was caused by the Contractor, the cost of inspection shall be borne by the Contractor.

(h) **Assembling Steel:** Bearing surfaces that will be a permanent contact shall be cleaned before units are assembled.

Permanent bolts in splices of butt joints of compression units and permanent bolts in railings shall not be tightened until blocking and falsework have been removed. Immediately after erection, splices and field connections shall have at least one-half of the holes filled with bolts or cylindrical erection pins, of which one-half shall be bolts. Splices and connections carrying traffic during erection shall have holes filled with high-strength bolts that have been torqued prior to opening to traffic.

Erection bolts shall be of the same nominal diameter as the high-strength bolts, and cylindrical erection pins shall be 1/32 inch larger.

(i) **Finishing:** Unpainted weathering steel units shall be abrasive blast cleaned in the shop after fabrication. Abrasive blast cleaning shall conform to the requirements of SSPC-SP6/NACE No. 3, Commercial Blast Cleaning. Upon completion of erection and concrete work, the fascia of exterior beams and girders of unpainted weathering steel shall be cleaned in accordance with the requirements of **Section 411.04(a)3**.

Wherever a depressed area is formed whereby water can be trapped or held, such as the juncture between a beam or girder web and splice plate on a bottom flange, the area shall be completely sealed with polyurethane, or other approved sealant, conforming to the requirements of FS TT-S-00230C, Type II, Class A, prior to painting. When the sealant is used in conjunction with weathering steel, the sealant shall be integrally pigmented to a dark bronze color.

Weathering steel shall be cleaned and painted in accordance with the requirements of Section 411.

Comment [1180]: Right material

Comment [1181]: Right material

Comment [1182]: Right Way

Comment [1183]: Right size

Comment [1184]: Right Way, Right Material

Trial Use and Comment

(j) **Protective Coatings:** Non-stainless ferrous metal surfaces shall be cleaned and painted in accordance with the requirements of Section 411. Galvanizing shall conform to the requirements of **Section 233**.

When new steel beams are connected to existing steel beams, the Contractor shall temporarily connect the diaphragms to the beams in a manner to allow for the deflection of the new beams after placement of the deck slab concrete. After the deck slab concrete has cured, the Contractor shall connect the diaphragms as shown on the plans

407.07—Measurement and Payment

Structural steel, including beams, girders, and miscellaneous steel, will be paid for at the contract lump sum price or, when specified, in pounds of metal in the fabricated structure, including bolts shipped, as weighed on a shop scale. However, any weight more than 1.5 percent above the computed weight for the entire structure will not be included for payment. The weight of erection bolts, field paint, boxes, crates, and other containers used for packing and materials used for supporting units during transport will not be included.

In contracts having a pay item for structural steel, structural steel components, including shear connectors, bearing plates, bearing assemblies and pads, anchorages, expansion joints, bolts, and pedestals, whether embedded in concrete or not, and other metals or materials shall be included in the price for structural steel unless paid for as a separate pay item(s). Prices for structural steel shall include furnishing, fabricating, galvanizing, transporting, erecting, and field painting.

If specified in the Contract or permitted by the Engineer, weights may be computed, in which case the computations shall be on the following basis:

(a) The unit weights of metal shall be as follows:

	Lb/Cu Ft
Aluminum, cast or wrought	173.0
Brass	536.0
Bronze, cast	536.0
Copper alloy	536.0
Copper, sheet	558.0
Iron, cast	445.0
Iron, malleable	470.0
Iron, wrought	487.0
Lead, sheet	707.0
Steel, cast, copper-bearing, carbon, silicon, nickel, and stainless	490.0
Zinc	450.0

Comment [1185]: Right Way

Comment [1186]: Right Time

Comment [1187]: Right payment,

Trial Use and Comment

(b) The weight of rolled shapes and plates up to and including 36 inches in width shall be computed on the basis of their nominal weights and dimensions as shown on the approved working drawings, deducting for copes, cuts, and open holes except bolt holes.

The allowed percentage of overrun in weight specified in AASHTO M 160 shall be added to the nominal weights of plates more than 36 inches in width.

(c) The weight of high-strength bolt heads, nuts, and washers shall be included on the basis of the following:

Diameter (in)	Weight Per 100 (lb)
1/2	18
5/8	31
3/4	52
7/8	78
1	111
1 1/8	152
1 1/4	206

The weight of high-strength bolts includes the head, the nut, the projection of the bolt through the nut, and one flat washer per bolt.

(d) The weight of castings shall be computed from the dimensions shown on the approved working drawings, deducting for open holes. To this weight shall be added 10 percent for fillets and overrun.

(e) As an allowance for shop paint, 0.4 percent shall be added to the total computed weight of metal.

(f) The weight of metal railing shall be included unless it is a pay item.

(g) Steel grid flooring will be measured and paid for in accordance with the requirements of Section 409.

(h) The weight of steel or brass shims required shall be included.

Fabrication of structural steel, when a pay item, shall include fabricating; cleaning and shop painting structural units; bolts; nuts; washers; and transporting and storing units at the designated location.

Erection of structural steel, when a pay item, shall include equipment and incidentals required to transport units from their designated storage location to the erection site, unloading and storing, erecting, cleaning, and field painting.

The cost of testing unit(s) required by the specifications shall be included in the price for the structural unit(s).

Trial Use and Comment

Payment will be made under:

Pay Item	Pay Unit
Structural steel (Type)	Lump sum or Pound
Fabrication of structural steel (Type)	Lump sum
Erection of structural steel (Type)	Lump sum

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Project staff to meet with Contractor, and Materials Division representative to discuss methods of fabrication, type and steel requirements. At this point develop a logical progression chart of what is expected and expected time frame details. Contractor to submit for an erection plan for approval.

Start:

- Assure that Progression chart is in place: Assure a system of shop drawing submittals and follow up of same by all entities are set up. Meet with Contractor to develop a clear understanding of what is required when structural steel is being set and what methods will be used for tightening of bolts. (Tensioning devices and calibration)

Continuous inspection:

- For shop inspection continuous inspection is required during fabrication procedures by Inspection firm. During field operations Continuous inspection will occur during steel placement (observing setting of steel, connecting of steel and observe that approved safety plan is being followed). Monitor storage locations.

Final Inspection:

- Review that all connections are made properly: Review that all steel is in proper position as required and that all contact points have100% contact.

Documentation Required:

- Approved shop drawings, erection plan for structural steel, Source of Materials (Form C-25), invoices, welder's certifications, including a letter stating welder has performed welding in the process in the last 90 days, manufacturer's bolt certifications, shop inspection test reports, tension-indicating device calibration records, torque wrench calibration records, and falsework certifications.

IV. REVIEW QUESTIONS

407.06(c4)	Does the Inspector observe the installation and tightening of bolts to ensure that the selected tightening procedure is properly used and that all bolts are tightened?
407.03	Does the Inspector have copies of working drawings, shipping statements, and erection diagrams included in the project files and available at the Inspector's field office?
407.03(1)	Has the Contractor submitted working drawings for review by the Engineer of all structural steel, bearing assemblies, and anchorage devices?
407.03(2)	Do the working drawings specifically identify each piece other than ASTM A709 Grade 36 steel?

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407.04(1)	Does the welding show quality workmanship and are welds of the required size.
407.04(3)	Do the welding electrodes used in structural welding conform to the approved list?
407.04(a)1	Has welding only been performed in locations as noted on the plans or as approved by the Engineer?
407.04(a3)	Have welds that do not conform to the specifications been repaired or removed and replaced or the entire piece rejected?
407.04(a4)	Has a copy of the welder's certificate of qualification and a certificate stating that the welder has not exceeded any period of 3 months without performing satisfactory welding in the required process been submitted to the Department?
407.04(d)1	Are the bolt holes no more than 1/16 inch larger than the nominal bolt size?
407.04(d)2	Have the burrs on the outside of the bolt holes been removed?
407.04(e)	Is field flame cutting of structural steel units not done?
407.04(j)1	Are the structural steel stud shear connectors the size and spacing as shown on the plans or denoted in the specifications?
407.04(j)2	Do the shear connectors project 2 inches above the bottom of the deck slab and 3 inches below the plane of the top of the deck slab?
407.04(j)3	When prestressed deck panels for cast-in-place concrete deck slabs are used, has the edge distance of studs been adjusted to provide the necessary support areas for ends of the deck panels?
407.04(l)	Was shop\field inspection performed in accordance with this section?
407.05(1)	Have materials and units been stored at least 4 inches above ground on platforms, skids, or other supports?
407.05(2)	Has the structural steel been stored in such manner that it will not be overstressed, become deformed, or otherwise damaged?
407.05(3)	Is the structural steel kept free from dirt, grease, or other foreign material, protected from corrosion, and properly drained?
407.05(b)1	Has each unit been identified with an erection mark?
407.05(b)2	Has the Contractor furnished the materials order shipping statement and erection diagrams?
407.06	Prior to beginning erection work, did the Contractor fully inform and obtain approval from the Engineer as to the method to be followed and the amount and character of equipment to be used?
407.06(a)1	Were bolt hole misalignments of no more than 1/8 inch

Trial Use and Comment

	corrected by reaming where allowed by the Engineer?
407.06(a)2	Was damaged or misfiting steel reported to the Engineer?
407.06(b3)2	Were bolt tensioning devices and complete bolt assemblies tested with an approved tension indicating device at the start of construction and on a periodic basis as determined by the Engineer?
407.06(c)	Were all field connections made with 7/8 inch diameter high-strength bolts where specified?
407.06(c1)1	Prior to installation, did the Contractor perform a field rotational capacity test on two (2) nut, bolt, and washer assemblies for each diameter and length in accordance with the materials section on Structural Steel?
407.06(c1)2	Did bolts, nuts, and washers conform to the requirements of the Materials Section on Structural Steel, each being from one manufacturer on any one structure, unless approved by the Engineer?
407.06(c2)1	Do bolted parts fit solidly together when assembled?
407.06(c2)2	Before assembly, were all connecting surfaces, including areas adjacent to the washers, free of scale except for tight mill scale?
407.06(c2)3	When required by the plans, were surfaces for bolted splices in main units fabricated of weathering steel and joint surfaces for other connections blast cleaned in accordance with the section of Protective Coating of Metal by Preparing Surfaces?
407.06(c3)1	On whichever element is being turned during tightening, was a hardened washer installed under the bolt or nut head?
407.06(c3)2	Is the length of all bolts such that the point of the bolt will be flush with or outside the face of the nut when completely installed without overtensioning the bolt?
407.06(c3)3	Are fasteners tightened by the turn-of-nut method, or by the use of a direct tension indicator using a load indicator washer?
407.06(c3a)1	Has the device used to calibrate power and torque wrenches been checked for accuracy within the previous 12 months?
407.06(c3a)2	Was the torque indication corresponding to the calibrating tension noted and used when manual torque wrenches are used?
407.06(c3b)	Were bolts brought to a snug condition, given a suitable match mark, and then tightened additionally by the amount of nut rotation specified in Table IV-4 when the turn-of-nut method is used?
407.06(c3c)1	Is the gap 0.015 inch or less between the direct tension indicator and the bolt head or nut when no washer is used with the indicator?
407.06(c3c)2	Is the gap 0.010 inch or less between the indicator and washer if a hardened flat washer is incorporated?
407.06(e)1	Are beam ends, bearing stiffeners, and webs of girders and

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	rolled structural shapes, and other beam sections vertical?
407.06(e)2	Are channel flanges turned to the downgrade side where practicable?
407.06(e)3	Have steel plates for use with flexible bearing pads been beveled to meet the grade requirements?
407.06(j)	Have any depressed areas where water can be trapped been completely sealed with polyurethane or other approved sealant prior to painting?

V. CRITICAL INSPECTION POINTS

• **Assure material and methods of shop inspection services are approved.**
• **Verify that all steel that comes to project are match marked.**
• **Verify that all material is stored properly.**
• **Verify bolt tensioning devices are calibrated and calibration is on site. Verify that all bolt sizes have been sampled by materials and tensioning information recorded and maintained.**
• **Verify inspectors safety procedures and beam setting procedures are submitted and being followed.**
• **Verify no welding is performed on steel unless approved by structural engineer.**
• **Verify all steel is plumb, clean and misfit holes are properly corrected prior to placement of bolts.**
• **Observe all bolts have been tensioned as required.**

Trial Use and Comment

SECTION 408 -BEARING DEVICES AND ANCHORS

I. INTRODUCTION:

Bearing devices are used to align and ensure distribution of superstructure components. They must be placed as per contract and shop drawing requirements. Devices are to be kept clean and stored above ground and each assembly should be stored together.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

408.01—Description

This work shall consist of furnishing and installing bearing plates, pads, rockers, expansion devices, anchors, or other devices used in conjunction with bearings or anchorages at superstructure supports in accordance with these specifications and in conformity with the plans or as established by the Engineer.

Comment [1188]: Right material

408.02—Materials and Fabrication

(a) **Bearing material and bearing pads** shall conform to the requirements of Section 237 and those specified herein.

(b) **Metal plates, shapes, bolts, and bars** shall be of structural steel conforming to the requirements of Section 226 and those specified herein.

(c) **Metal parts** shall be fabricated in accordance with the requirements of Section 407.

(e) **Painting** shall conform to the requirements of Section 411.

(e) **Galvanizing** shall be performed in accordance with the requirements of Section 233.

408.03—Procedures

Comment [1189]: Right material

(a) **High-Load Multi-Rotational Bearings**: High-load multi-rotational bearings including sole and masonry plates shall be any type shown on the plans and shall be provided by only one manufacturer.

Comment [1190]: Right material

Trial Use and Comment

Other high-load multi-rotational bearing designs may be acceptable provided they are supported by engineering analysis, engineering calculations, data and evidence of acceptable service life for the proposed materials, tests, and proven experience for the proposed bearing designs acceptable to the Engineer for the loads, forces, movements, and service conditions specified. Engineering analysis shall be performed by a registered Professional Engineer with a current license in the Commonwealth.

Comment [1191]: Right documentation

Notations: All dimensions are in inches:

C = Clearance between pot and surface immediately above or below it.
Dp = Diameter of elastomeric disc, inside diameter of pot bearing.
Ds = Projected diameter of loaded spherical segment.
G = Depth of pot bearing cavity.
k = Depth of chamfer on pot bearing piston.
Fy = Yield strength of steel in ksi.
Lh = Horizontal design load on bearing in kips.
Lv = Vertical design load on bearing in kips.
θ = ArcTan (Lh/Lv min)
Rb = Minimum design rotation requirement of bearing in radians.
Rc = Maximum construction tolerance rotation in radians.
Rs = Minimum design rotation requirement of structure in radians.
Rma x = Maximum radius to prevent unseating of spherical surfaces.
S = Side of a square pot bearing plate.
t = Thickness of elastomeric disc.
w = Piston face width, pot bearing.
OD = Outside diameter of a round pot.

1. **Design:** High-load multi-rotational bearings shall be designed to accommodate the loads, forces, and movements specified in the bearing schedule. Particular care shall be taken to ensure that all components of the bearings provide adequate capacity for the horizontal loads and forces specified.

   Maximum design stresses for bearing components shall not exceed the allowable design stresses of the applicable issue of the AASHTO *Standard Specifications for Highway Bridges* and the applicable sections of these specifications.

   Minimum rotation capacity, Rb, shall be the sum of Rc + Rs. Rc equals 0.02 radians. Rs equals the larger of 0.01 radian or the actual design rotations.

   The minimum horizontal bearing design capacity for fixed and guided expansion bearing types shall be 10 percent of the vertical capacity or as specified in the plans. The minimum horizontal bearing design for non-guided expansion bearing types shall be equal to the frictional resistance of bearing slide surfaces or as specified in the plans.

Trial Use and Comment

Expansion bearings shall be designed for additional total movement capacity in each direction specified under "Design Movement" in the "Bearing Schedule." The additional total movement capacity shall be 10 percent of the design movement or 1 inch, whichever is greater. Spacing between the guides of the bearing does not require this additional movement capacity.

Bearings shall be designed so that rotational and sliding elements can be replaced with a minimum of jacking movement not greater than 1 inch.

2. **Rotational elements—Pot bearings:**

a. **Pot:** Pot inside diameter, Dp, shall be the same as that of the elastomeric disc.

Depth of pot cavity, G, shall be equal to or greater than:

[(DP/2) x (Rs + Rc)] + 0.1 inch + k + t + w

where:

k = 0 for flat sealing

k = 1.7 x the ring cross-section diameter for round sealing rings where rings sit 100 percent in the chamfer

k = 1.2 x the ring cross-section diameter for round sealing rings where rings sit half recessed in the elastomeric disc and half in the piston chamfer. The details for the k dimension are provided in the plans.

Section thickness of the pot beneath the elastomer shall be a minimum of 3/4 inch or Dp x 0.06 for bearings directly on concrete and 1/2 inch or Dp x 0.045 for bearings directly on steel masonry plates.

Minimum outer plan dimensions of pots shall be determined by analyzing horizontal loads, internal elastomer pressure, and piston force due to friction in shear, bending, and tension, but the wall thickness shall in no case be less than the greater of 3/4 inch, 1.02 x Lv / (Dp x Fy) or the square root of (40 x Lh x Rb/Fy).

b. **Elastomeric disc:** Thickness of elastomeric disc, t, shall be equal to or greater than Rb x Dp/0.3.

Area of elastomeric disc shall be designed for an average stress of 3,500 pounds per square inch.

When using flat sealing rings, the upper edge of the disc shall be recessed to receive the rings so that they sit flush with the upper surface of the elastomeric disc.

Comment [1192]: Right material

Comment [1193]: Right material

Trial Use and Comment

The disc shall be lubricated with a silicone compound conforming to the requirements of MIL-S-8660 (Military Specification) or other approved equal. PTFE "shear-reducer discs" shall not be used with flat rings.

c. **Piston:** Outside diameter of piston shall be Dp – 0.04 inch. Piston thickness shall be adequate to resist the loads imposed on it but shall not be less than 0.06 x Dp.

Comment [1194]: Right material

Piston thickness shall be adequate to provide clearance, C, between the top of the pot and the surface immediately above it as follows:

(1) C = Rb x (0.7 x S) + 0.12 inch for pots square in plan.

(2) C = Rb x (OD / 2) + 0.12 inch for pots round in plan.

Piston face width, w, is the part of the edge of the piston that contacts the pot wall. When designing pistons for horizontal forces, w shall not be less than the greater of 0.03 x Dp, 1/4 inch or 1.59 x Lh/(Dp x Fy).

Pistons for round seals shall have the lower corner chamfered at 45 degrees for a depth equal to 1.7 times the diameter of the seal where the seal is wholly within the piston thickness and 1.2 times the diameter where it extends into the elastomer for half its diameter.

d. **Elastomer sealing rings:**

Flat sealing rings shall conform to the following requirements:

Comment [1195]: Right material

(1) Width shall be equal to or greater than the larger of 0.02 x Dp or 1/4 inch but shall not exceed 3/4 inch.

(2) Minimum thickness of each sealing ring shall be equal to or greater than 0.2 times the width.

(3) Three rings shall be used. Rings shall be a snug fit to the pot wall and have their ends cut at 45 degrees to the vertical and to the tangent of the circumference with a maximum gap of 0.050 inch when installed. Ring gaps shall be staggered equally around the circumference of pots. Rings shall be free of nicks, burrs, or sharp edges.

Round sealing rings shall conform to the following requirements:

Comment [1196]: Right material

(1) Rings shall be rolled into a circle from rod and brazed or welded. They shall fit the pot snugly so that they are in full contact with the pot wall when installed.

(2) Ring diameters shall be equal to or greater than the larger of 0.0175 x Dp or 5/32 inch.

Trial Use and Comment

3. **Rotational elements—Spherical bearings with PTFE/stainless steel surfaces:**

Comment [1197]: Right material

a. **Rotational elements—Spherical concave surfaces—PTFE:** The spherical radius shall be determined such that the resulting geometry of the bearing is capable of withstanding the greatest ratio of horizontal load to vertical load under all loading conditions to prevent unseating the concave element. If required during construction, mechanical safety restraints shall be incorporated to prevent overturning of the bearing. Unseating of the curved surfaces relative to each other shall be prevented by transferring horizontal forces through specifically designed restraints or by control of the radius. Acceptable radius control is given when Rmax = Ds/[2 x Sin(θ + Rc + Rs)]. Calculations showing the determination of the radius shall be submitted for approval.

The projected area of the PTFE shall be designed for the following maximum average working stress:

(1) Unconfined, unfilled sheet PTFE: 2.5 ksi.

(2) Unconfined, filled sheet PTFE: 4.5 ksi.

(3) Confined sheet PTFE: 4.5 ksi.

(4) Woven PTFE over a metallic substrate: 4.5 ksi.

(5) Reinforced, woven PTFE over a metallic substrate: 5.5 ksi.

The concave shall face down whenever possible.

Thickness of PTFE fabric in the compressed state shall be a minimum of 1/16 inch when measured in accordance with ASTM D 1777. Recessed sheet PTFE shall be at least 3/16-inch thick when the maximum dimension of the PTFE is less than or equal to 24 inches and 1/4 inch when the maximum dimension of the PTFE is greater than 24 inches. Woven fabric PTFE that is mechanically interlocked over a metallic substrate shall have a minimum thickness of 1/16 inch and a maximum thickness of 1/8 inch over the highest point of the substrate.

The minimum center thickness of the spherical surfaces shall be 3/4 inch.

Vertical clearance between rotating and non-rotating bearing parts shall be no less than 1/8 inch at maximum rotation.

b. **Rotational elements—Spherical concave curfaces—Bronze:** The spherical radius shall be determined such that the resulting geometry of the bearing is capable of withstanding the greatest ratio of horizontal force to vertical load under all loading conditions to prevent unseating the concave element. If required, mechanical safety

Trial Use and Comment

restraints shall be incorporated to prevent overturning of the bearing. Bearing rotation of Rs + Rc radians shall be considered in the bearing design to prevent overturning or uplift of the bearing. Calculations showing the determination of the radius shall be submitted for approval.

The spherical element shall be made from the following or other approved bronze alloys:

Comment [1198]: Right material

(1) Type 1: ASTM B 22, Alloy C90500
(2) Type 2: ASTM B 22, Alloy C91100
(3) Type 3: ASTM B 22, Alloy C86300

The maximum design compressive stress for the projected area shall be:

- Type 1: 2,000 pounds per square inch.
- Type 2: 2,500 pounds per square inch.
- Type 3: 8,000 pounds per square inch.

The bearing surfaces shall have lubricant recesses consisting of either concentric rings, with or without central circular recesses with a depth at least equal to the width of the rings, or recesses. The recesses or rings shall be arranged in a geometric pattern so that adjacent rows overlap in the direction of motion.

The entire area of all bearing surfaces that have a provision for relative motion shall be lubricated by means of the lubricant-filled recesses. The lubricant-filled areas shall comprise not less than 25 percent of the total bearing surface. The lubricating compound shall be integrally molded at high pressure and compressed into the rings or recesses and project not less than 0.010 inch above the surrounding bronze plate.

The minimum center thickness of the spherical surface shall be 3/4 inch.

c. **Rotational elements—Spherical convex surfaces:** The convex element shall be designed for rotation, Rb = Rc + Rs.

The edge thickness shall be a minimum of 3/4 inch for bearings directly on concrete or 1/2 inch for bearings directly on steel masonry plates.

For PTFE/stainless and bronze/stainless rotational surfaces, the stainless surface shall conform to one of the following:

Trial Use and Comment

(1) Cold-formed stainless steel sheet complying with the requirements of ASTM A 167 or A 240, Type 304, 0.060- to 0.090-inch thick, with a finish equal to or less than 20 micro-inch rms, connected to a structural steel substate by a continuous weld.

(2) Solid stainless steel conforming to the requirements of ASTM A 240, Type 304 or 304L, with a finish equal to or less than a 20 micro-inch rms connected to a structural steel substate by a continuous weld.

(3) Stainless steel weld overlay a minimum of 3/32 inch thick with a finish equal to or less than 20 micro-inch rms on a structural steel substrate.

If sheet PTFE is used for guided surfaces, it shall be pigmented.

For bronze/carbon steel sliding surfaces, the surface finish shall be not more than 125 micro-inches rms.

4. **Rotational elements—Disc bearings:** Thickness of the disc, t, shall be equal to or greater than $\triangle c + [(Rs + Rc) \times Dd \times 0.5]/\varepsilon\ max$

where:

$\triangle c$ = deflection due to total compressive load
$\varepsilon\ max$ = strain due to all effects except for long-term creep.

The instantaneous deflection of the disc under total load shall not exceed 10 percent of the thickness of the unstressed disc, and the additional deflection due to creep does not exceed 8 percent of the thickness of the unstressed disc. Deflection caused by rotation shall not exceed the lesser of the instantaneous deflection under total load or 10 percent of the thickness of the unstressed disc.

The disc shall be designed for an average stress of:

(a) 3,700 pounds per square inch for Polyether Urethane Compound A.

(b) 5,000 pounds per square inch for Polyether Urethane Compound B.

The section thickness of the plate beneath the disc shall be a minimum of 3/4 inch or Dp x 0.06 for bearings on concrete and 1/2 inch or Dp x 0.045 for bearings directly on steel masonry plates.

Vertical clearance between rotating and non-rotating bearing parts shall be no less than 1/8 inch at maximum rotation.

The urethane disc shall be held in place by a shear restriction mechanism that is designed to allow free rotation of the bearing. The mechanism shall be designed to withstand the design forces on the bearing without exceeding the allowable shear stress

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of 0.4 Fy, bending stress of 0.55 Fy, and bearing stress of 0.8 Fy, not including shear resistance of the disc. The mechanism shall be connected to the bearing plates by welding, bolting, or machining out of the solid.

5. **Non-rotational bearing elements:**

a. **PTFE sliding surfaces:** The PTFE surface shall be made from pure virgin PTFE resin satisfying the requirements of ASTM D 4547. It shall be fabricated as unfilled sheet, filled sheet, or fabric woven from PTFE and other fibers. Unfilled sheets shall be made from PTFE resin alone. Filled sheets shall be made from PTFE resin uniformly blended with glass fibers or other chemically inert filler. The maximum filler content shall be 15 percent. Sheet PTFE shall be a minimum of 1/8 inch thick, epoxy-bonded into a square-edge recess 1/16 inch deep.

Comment [1199]: Right material

Woven fiber PTFE shall be made from pure PTFE fibers. Reinforced woven fiber PTFE shall be made by interweaving high strength fibers, such as glass, with the PTFE in such a way that the reinforcing fibers do not appear on the sliding face of the finished fabric. Woven fiber PTFE in the free state shall be a minimum of 1/16 inch thick when measured in accordance with ASTM D 1777 and shall be epoxy-bonded and mechanically fastened to the substrate using a system that prevents migration of epoxy through the fabric. Edges, other than the selvage, shall be oversown or recessed so that no cut fabric edges are exposed.

PTFE sliding surfaces shall be designed for the following maximum stresses:

	Average Contact Stress (ksi)	Edge Contact Stress (ksi)
(1) Unconfined, Unfilled Sheet PTFE	2.5	3.0
(2) Unconfined, Filled Sheet PTFE	4.5	5.5
(3) Confined Sheet PTFE	4.5	5.5
(4) Woven PTFE Over a Metallic Substrate	4.5	5.5
(5) Reinforced Woven PTFE Over a Metallic Substrate	5.5	7.0

b. **Stainless steel sliding surfaces:** The stainless surface shall cover the mating surface in all operating positions plus 1 inch in each direction of movement. This is to conform with the requirements of (a)1. herein. Sheet stainless steel shall be 16- to 13-gage thick and connected to the substrate by a continuous weld around the entire perimeter. The sheet shall be in full contact with the substrate. Stainless steel welded overlay shall be a minimum of 3/32-inch thick after welding, grinding and polishing and be produced using Type 309L electrodes. Stainless steel sliding surfaces shall, preferably, face down.

Comment [1200]: Right material

Trial Use and Comment

c. **Guide bars and central guide keys:** Central guide keys may be made integral by machining from the solid. Where a separate key or guide bar is used, it shall be fitted in a keyway slot machined to give a press fit and bolted or welded to resist overturning.

Guide bars may be made integral by machining from the solid or fabricated from bars welded, bolted, and/or recessed at the manufacturer's option.

Guide bars and central guide keys shall be designed for specified horizontal forces, but not for less than 10 percent of the vertical capacity of the bearing. Bolted connections shall be designed in accordance with the applicable AASHTO Specifications. Frictional resistance of bearing slide surfaces shall be neglected when calculating horizontal load capacity.

The total clearance between the key/guide bars and guided members (both sides) shall be 1/16 inch maximum. Guided members must have their contact area within the guide bars in all operating positions. Guiding off the fixed base or any extensions of it where transverse rotation is anticipated shall be avoided.

d. **Sole and masonry plates:** For masonry plates, the concrete bearing stress on the loaded area shall not exceed 0.3 f 'c. When the supporting surface is wider on all sides than the loaded area, the allowable bearing stress on the loaded area may be increased by the square root of (A2/A1), but not by more than 2. When the supporting surface is sloped or stepped, A2 may be taken as the area of the lower base of the largest frustrum of the right pyramid or cone contained wholly within the support and having for its upper base the loaded area A1 and having side slopes of 1 vertical to 2 horizontal.

Allowable bending stress in sole and masonry plates is 0.63 Fy.

The minimum thickness of sole and masonry plates shall be 3/4 inch.

When designing recesses in masonry plates for horizontal forces, the depth of the recess shall be designed assuming the contact area as one-third of the circumference and allowable compressive stress as 0.8 Fy. Minimum recess depth shall be 3/16 inch.

6. **PTFE on guiding surfaces:** PTFE on guiding surfaces, when they are used, shall be designed for stresses given in (a)5.a. herein:

PTFE, when used on guiding surfaces, shall be bonded to and recessed in their substrate. In addition, PTFE shall be at least 3/16 inch thick and mechanically fastened by a minimum of two screws to the substrate. The centerline of the screws shall be located a distance equal to twice the nominal screw diameter from the end of the PTFE strip. The top of the screws shall be recessed a minimum of 50 percent of the amount of protrusion of the PTFE above the guiding surface.

Comment [1201]: Right material

Comment [1202]: Right material , Right Location

Comment [1203]: Right material

Trial Use and Comment

Unfilled sheet PTFE used on guide bars shall contain an ultraviolet (U.V.) inhibitor/screen.

7. **Materials:** Steel, except stainless steel, steel for guide bars, and shear-restriction pins and sleeves, shall conform to the requirements of ASTM A 709, with a minimum yield stress of 36 ksi. Exposed steel surfaces shall be painted. Guide bars and shear-restriction devices shall be as specified by the manufacturer.

Property	Test Procedures	Natural Rubber	Neoprene
Tensile Strength, psi, min.	ASTM D 412	2250	2250
Elongation at Break, %, min.	ASTM D 412	450	400
Hardness, Durometer A	ASTM D 2240	50 ± 5	50 ± 5
Oven Aging, 70 hr/158°F for natural rubber, 70 hr/212°F for neoprene			
Tensile Strength, change, max. %	ASTM D 573	–25	–15
Elongation, change, max. %		–25	–40
Hardness, points change, max.		+10	+15
Compression Set, 22 hr/158°F for natural rubber, 22 hr/212°F for neoprene, max. %	ASTM D 395 Method B	25	35
Ozone Resistance, 20% strain 100°F ± 2°F, Mounting Procedure D 518, Method B			
48 hr @ 25 pphm ozone by vol.	ASTM D 1149	No Cracks	--
100 hr @100 pphm ozone by vol.	ASTM D 1149	--	No Cracks
Low-Temperature Test Brittleness @ –40°F	ASTM D 2137 Procedure B	No Failure	No Failure

Elastomeric disc for pot bearings shall be a Shore A 50 durometer and the base polymer shall be either 100 percent virgin natural polyisoprene (natural rubber) or 100 percent virgin chloroprene (neoprene) having the following physical properties as determined by the applicable ASTM tests:

PTFE sliding surfaces shall be virgin PTFE resin-filled or unfilled PTFE sheets or PTFE fabric, all made from virgin PTFE resin.

Comment [1204]: Right material

PTFE resin shall be virgin material, not reprocessed, conforming to the requirements of ASTM D 1457. Specific Gravity shall be 2.13 to 2.19. Melting point shall be 327 degrees C ± 10 degrees C. Filler material, when used, shall be milled glass fibers, carbon, or other inert filler materials.

Trial Use and Comment

Adhesive material shall be an epoxy resin conforming to the requirements of FS MMM-A-134, PEP film or equal, as approved by the Engineer.

Unfilled PTFE sheet shall be made of virgin PTFE resin and shall conform to the following requirements:

Comment [1205]: Right material

(1) Tensile strength, 2,800 pounds per square inch minimum, ASTM D 1457.

(2) Elongation, 200 percent minimum, ASTM D 1457.

Filled PTFE sheet shall be made from virgin PTFE resin uniformly blended with inert filler material and shall conform to the following:

Property	Test Procedures	15% Glass Fibers	25% Carbon
Tensile Strength, psi, min.	ASTM D 1457	2000	1300
Elongation, min. %	ASTM D 1457	150	75
Specific Gravity, min.	ASTM D 792	2.2	2.1
Melting Point	ASTM D 1457	327°C	±10°C

Fabric PTFE shall be made from virgin PTFE oriented multifilament and other fibers. The minimum thickness under the application of vertical load shall be:

a. 1/16 inch up to 3,500 pounds per square inch load

b. 3/64 inch from 3,500 pounds per square inch to 6,000 pounds per square inch load.

Where the PTFE is to be epoxy bonded, it shall be etched by an approved manufacturer by the sodium naphthalene or sodium ammonia etching process.

Stainless steel sliding surfaces shall conform to the requirements of ASTM A 167 or A 240, Type 304, with a surface finish 20 micro-inches rms or less. Welded stainless steel overlay shall be produced using Type 309L electrodes.

Sealing rings may be made only of metal and shall conform to the following:

- Flat brass rings, ASTM B 36, half hard.
- Round cross-section rings, FS QQB626, composition 22, half hard.

Bronze elements shall conform to the following:

Type 1, ASTM B 22, Alloy C90500.

Type 2, ASTM B 22, Alloy C91100.

Trial Use and Comment

Type 3, ASTM B 22, Alloy C86300.

Solid lubricant shall consist of a combination of solids having nondeteriorating characteristics, as well as lubricating qualities, and shall be capable of withstanding long-term atmospheric exposure, de-icing materials, and water. The use of molybdenum disulfide and other ingredients that may promote electrolytic or chemical action between the bearing elements shall not be used. Shellac, tars and asphalts, and petroleum solvents may not be used as binders.

Socket head cap screws shall conform to the requirements of ASTM A 574, High Strength, 1960 Series.

Adhesive material for bonding PTFE to steel shall be an epoxy resin conforming to the requirements of FS MMA-A-134, FEP film or approval equal.

8. **Construction:**

Comment [1206]: Right Way

a. **Flatness of bearings:** The flatness of bearings after welding and fabrication shall be determined by the following method:

A precision straightedge longer than the nominal dimension to be measured shall be placed in contact with the surface to be measured or as parallel to it as possible.

An attempt shall be made to insert a feeler gage having a tolerance of plus or minus 0.00l inch under the straightedge. Since layering of feeler gages tends to degrade accuracy, the least number of blades shall be used.

Flatness is acceptable if the feeler does not pass under the straightedge.

Flatness tolerances are arranged in the following classes:

(1) Class A , 0.0005 inch x nominal dimension.

(2) Class B, 0.00l inch x nominal dimension.

(3) Class C, 0.002 inch, x nominal dimension.

Nominal dimension shall be interpreted as the actual dimension of the plate, in inches, under the straightedge.

In determining flatness, the straightedge may be located in any position on the surface to be evaluated and not necessarily at 90 degrees to the edges.

b. **Rotational elements—Pot bearings:** Pot bearings may, preferably, be made from a solid plate by machining or fabricated by welding a flame cut shape to a plate.

Comment [1207]: Right material, Right Way,

Trial Use and Comment

Fabricated pots shall be manufactured in conformance with the AASHTO/AWS D1.5 Bridge Welding Code. The outside diameter of pots fitting into a machined recess shall be ±0.015 inch. For pots not so recessed, the tolerance on plan dimensions shall be +1/8 inch, –0 inch The inside diameter of pots shall be machined to a tolerance of ±0.005 inch up to and including 20 inches and ±0.007 inch over 20 inches The tolerance on the depth of the pot cavity shall be +0.01 inch, –0 inch. The underside of pots shall be machined parallel to the inside to a Class A tolerance. Machined surfaces in contact with elastomer shall have a finish of 63 rms or better. Other machined surfaces shall have a finish of 125 rms or better.

Elastomeric disc tolerance shall be:

(1) Diameters greater than 20 inches, ±3/32 inch.

(2) Diameters less than or equal to 20 inches, ±1/16 inch.

(3) Discs may be made from up to three pieces, but the thinnest piece shall not be less than 1/2 inch.

(4) Total thickness of all pieces shall be –0 inch +1/8 inch.

Piston tolerances shall be:

(1) Diameter greater than 20 inches, ±0.007 inch.

(2) Diameter less than 20 inches, ±0.005 inch.

(3) Sliding side, Class A tolerance.

(4) Elastomer side, Class B tolerance.

(5) Piston flange thickness, +1/8 inch, –1/32 inch.

(6) Piston flange diameter, +1/8 inch, –1/32 inch.

c. **Rotational elements—Spherical bearings:** Spherical bearing machined diameters shall be ±0.015 inch. Convex radius dimensions shall be +0.000 inch –0.010 inch. Concave radius dimensions shall be +0.010 inch, –0.000 inch. Mating surfaces shall be as in Design section; external edges may be as cast or flame-cut. Lower surface of convex element shall be Class C tolerance. The tolerance on the overall thickness of concave or convex plates shall be ±0.03 inch.

d. **Non-rotational elements—All bearings:**

Masonry and distribution plate tolerances shall be:

Trial Use and Comment

(1) Plan dimensions less than or equal to 30 inches, -0 inch +3/16 inch.

(2) Plan dimensions over 30 inches, –0 inch +1/4 inch.

(3) Thickness tolerance shall be -0.030 inch +0.060 inch.

Masonry plates used with pot or spherical bearings shall be Class C for the underside and Class A for the upperside tolerance.

PTFE sheet sliding surfaces shall be bonded by the bearing manufacturer under controlled conditions and in accordance with the requirements of the manufacturer of the approved adhesive system. After completion of bonding, the PTFE surface shall be smooth and free from bubbles. Filled PTFE surfaces shall be polished after bonding until smooth.

Comment [1208]: Right Way

PTFE fabric sliding surfaces shall be mechanically attached to a rigid substrate. The fabric shall be capable of carrying loads of 10,000 pounds per square inch without cold-flow.

Tolerances of PTFE surfaces shall be:

(1) Plan dimensions total design area, +5 percent –0 percent.

(2) Substrate flatness, Class A.

Stainless steel sheet**s** shall be seal-welded around the entire perimeter using techniques that ensure it remains in contact with the backing plate. Finish to be at least 20 micro-inches rms. Flatness to Class A tolerance.

Sole plates shall conform to:

Comment [1209]: Right material

(1) Plan dimensions less than or equal to 30 inches, –0 inch +3/16 inch.

(2) Plan dimensions over 30 inches, –0 inch +1/4 inch.

(3) Centerline thickness, –1/32 inch +1/8 inch.

(4) Flatness of surface in contract with steel beams, Class B, in contact with poured in place concrete, none, in contact with stainless steel sliding surface, Class A, in contact with another steel plate, Class B**.**

(5) No part shall be thinner than 3/4 inch.

(6) Bevels shall be machined to an angular tolerance of ±0.002 radian.

Trial Use and Comment

(7) Flatness of bevelled surfaces shall be Class A.

Guide bars shall conform to:

(1) Length, unless integral with plate, ±l/8 inch.

(2) Section dimensions, ±1/16 inch.

(3) Flatness where it bears on another plate, Class A.

(4) Bar-to-bar, nominal dimensions, ±1/32 inch.

(5) Not more than 1/32 inch out of parallel.

The overall bearing height shall not be more than 1/8 inch or less than 1/16 inch under nominal dimensions. Edges shall be broken and not sharp.

9. **Testing:**

a. **General:** Testing shall be performed on test bearings as specified herein to ensure compliance with the specification. As soon as all bearings have been manufactured for the project, the Contractor shall notify the Engineer, who will select test bearing(s) at random from the lot. Manufacturer's certification of conformance with applicable requirements for the steel, elastomeric pads, preformed fabric pads, PTFE and other materials used in the construction of the bearings shall be furnished along with notification of fabrication completion. Testing shall be performed at the manufacturer's plant. Bearing capacities that exceed the manufacturer's testing capacity shall be tested at an approved testing laboratory. If suitable test equipment is not available in the United States, alternative testing/inspection shall be agreed between the Engineer and the manufacturer. The Engineer may witness the testing.

Comment [1210]: Right Time, right material, Right documentation

b. **Sampling:** Tests shall be performed on randomly selected samples from the production bearings. One bearing per lot shall be tested. A lot shall be defined as the smallest number of bearings as determined by the following criteria:

Comment [1211]: Right Way

(1) One lot shall not exceed a single contract or project quantity.

(2) One lot shall not exceed 25 bearings.

A lot shall consist of those bearings of the same type within a load category. Bearing types shall be fixed type bearings or expansion type bearings. Guided and non-guided expansion bearings will be considered a single type.

One load category shall consist of bearings of differing vertical load capacity within a load range as follows:

Trial Use and Comment

- Bearings less than or equal to 1000 kips, the load category shall be based on a range of capacity of 500 kips.

- Bearings greater than 1000 kips capacity but less than or equal to 3000 kips capacity, the load category shall be based on a range of 1000 kips.

- Bearings in excess of 3000 kips capacity, the load category shall be based on a range of 2000 kips.

c. **Friction test:** A sample from each lot of expansion bearings shall be tested. Specially made bearings shall not be used; only actual bearings to be used in the project shall be tested. The test method and equipment shall be approved by the Engineer and include the following:

Comment [1212]: Right documentation, Right Way

(1) The test shall be arranged so that the coefficient of friction on the first movement of the manufactured bearing can be determined.

(2) The bearing surface shall be cleaned prior to testing.

(3) The test shall be conducted at the maximum working stress for the PTFE surface with the test load applied for 12 hours prior to measuring the friction.

(4) The first movement static and dynamic coefficients of friction shall be determined at a sliding speed of 1 inch per minute or less and shall not exceed the following:

Materials	Bearings Pressure (psi)		
	500	**2000**	**3500**
Unfilled PTFE, Fabric containing PTFE Fibers, PTFE-Perforated Metal Composite	0.08	0.06	0.04
Filled PTFE	0.12	0.10	0.08
Interlocked Bronze and Filled PTFE Structures	0.10	0.07	0.05

The bearing specimen shall be subjected to a minimum of 100 movements of at least l inch of relative movement and if the facility permits, the full design movement, at a speed of less than 12 inches per minute. After cycling, the static and dynamic coefficients of friction shall be determined again at a speed of less than 1 inch per minute and shall not exceed the specified coefficient of friction. The bearing shall show no appreciable sign of bond failure or other defects.

d. **Proof load test:** One bearing shall be tested from each production lot of fixed and expansion bearings. Load shall be applied to the test bearings equal to 150 percent of the rated design capacity of the bearing and simultaneously rotated 0.02 radians or

Comment [1213]: Right Way

Trial Use and Comment

the design rotation, whichever is greater, for 1 hour. During test or subsequently upon disassembly, the bearing shall show no sign of deformation or extrusion of elastomer or PTFE.

e. **PTFE bond test:**

Bearings with sheet PTFE primary surfaces: At the option of the Engineer, one bearing from each production lot shall have a 180-degree peel test performed on the primary PTFE sliding surface in accordance with ASTM D 903. The minimum peel strength shall be 20 pounds per inch.

Bearings with fabric PTFE primary sliding surfaces: One bearing from each production lot shall have the primary PTFE tested in shear as follows: The component carrying the fabric PTFE (or complete bearing at the option of the manufacturer) shall be subjected to the maximum vertical design load of the bearing and simultaneously, but transversely, a load equal to 13 percent of the vertical design load for a period of 1 minute. Slip or creep shall not exceed 1/8 inch during the test.

f. **Bearings represented by test specimens complying with these requirements:** Such bearings will be approved for use in the structure.

10. **Shipping and packing:** Bearing assemblies including sole and masonry plates shall be securely fixed together as units so that they may be shipped to the jobsite and stored without relative movement of the bearing parts or disassembly at any time. Bearings shall be wrapped in moisture-resistant and dust-resistant material to protect against shipping and jobsite conditions. Care shall be taken to ensure that bearings at the jobsite are stored in a dry sheltered area free from dirt or dust until installation. Each completed bearing shall have its components clearly identified and marked on its top as to location in each structure in the project in conformity with the plans.

When bearings are to be inspected on site, they shall be inspected within 1 week of arrival and may not be disassembled except under the supervision of the manufacturer. Following inspection, the wrapping shall be reapplied and the bearings kept clean until installation.

Removal of sole and top plates of bearings for separate attachment to the structure is not permitted except under the direct supervision of the manufacturer and with the permission of the Engineer.

11. **Installation:** Bearings shall be evenly supported over their upper and lower surfaces under all erection and service conditions. Bearings shall be lifted by their undersides only or specially designed lifting lugs. When installing bearings, care shall be taken to avoid damage to and contamination of bearing surfaces.

Comment [1214]: Right Way

Comment [1215]: Right Way, Right documentation

Comment [1216]: Right documentation

Comment [1217]: Right Way, Right material

Comment [1218]: Right Way, Right Location, right material

Trial Use and Comment

The centerlines of the bearing assembly shall be aligned with those of the substructure and superstructure. On guided bearings, special care must be taken to align properly the guiding mechanism with the designated expansion direction of the structure.

Bearing straps or retaining clamps shall be left in place as long as possible to ensure that the parts of bearings are not inadvertently displaced relative to each other. Care shall be taken to remove straps or clamps before normal structural movement takes place, such as post-tensioning.

The upper part of expansion and guided expansion bearings shall be located relative to the base of the bearing to compensate for deviations from normal atmospheric temperature.

When bearings will sit directly on concrete with only an elastomeric, preformed fabric or lead sheet beneath the bearing, concrete bearing seats shall be prepared at the correct elevation and bush-hammered or dressed to the following flatness tolerance:

a. Bearing seats less than or equal to 30 inches long, 1/16 inch.

b. Bearing seats over 30 inches but less than or equal to 45 inches, 3/32 inch.

c. Bearing seats over 45 inches, 1/8 inch.

d. There shall be no projecting irregularities exceeding 1/32 inch.

e. Bearing seats shall be level within 1:200 slope.

Where grouted bearing seats are used, the grout shall be the non-shrink type and of the strength specified on the contract drawings but not less than the concrete strength in the main support. Grout shall be placed at even density beneath the entire bearing surface without any voids or hard spots. Grout shall be allowed to reach optimum strength before placing any load on the bearing.

The mating surface of the superstructure shall be level within a slope of 1:200. There shall be no local projecting irregularities exceeding 1/32 inch.

The Contractor shall repair any damage to bearing finishes following installation.

Welding procedures shall be established by the Contractor to restrict the maximum temperature reached by the bonded PTFE surfaces to a maximum of 300 degrees F and to restrict the maximum temperature reached by the elastomer (neoprene or natural rubber) to 250 degrees F. Temperatures shall be determined by temperature-indicating wax pencils or other suitable means. No load shall be transmitted to the bearings until erection of structural steel for spans contiguous to the bearing is substantially complete. Field welding of bearing plates shall be accomplished under the no load condition.

Trial Use and Comment

Particular care shall be exercised to mask and protect the PTFE and polished stainless steel surfaces to protect them from blast abrasives and paint application during construction.

12. **Shop drawings:** Shop drawings shall be submitted to the Engineer for review in accordance with the requirements of Section 105.10. These drawings shall include, but not be limited to, the following:

    a. Plan and elevation view and section elevation of the bearing.

    b. Complete details of all components and sections showing all materials incorporated into the bearing.

    c. All ASTM or other material designations.

    d. Vertical and horizontal load capacity.

    e. Rotation and movement capacity.

    f. Compression stress on all sliding surfaces, and elastomeric surfaces, at maximum and minimum design loads.

    g. Complete design calculations.

    h. Shop paint or coating requirements.

(b) **Steel Plates, Shapes, and Bars:** Unless galvanizing is specified, items shall be painted in accordance with the plans.

(c) **Bronze Plates:** Sliding surfaces of bronze plates shall be polished.

(d) **Copper-Alloy Plates:** Finishing of rolled copper-alloy plates will not be required provided their surfaces are plane, true, and smooth.

(e) **Self-Lubricating Plates:** Plates shall be fabricated from cast bronze or rolled copper alloy.

Sliding surfaces of plates shall be provided with annular grooves or cylindrical recesses or a combination thereof, which shall be filled with a lubricating compound. The lubricating compound shall be compressed into recesses under sufficient pressure to form a nonplastic lubricating inset. The inset shall comprise at least 25 percent of the total area of the plate. The frictional coefficient shall be not more than 0.10. The compound shall be free from material that will cause abrasive or corrosive action on metal surfaces and able to withstand extremely high pressures and atmospheric elements over long periods of time.

Comment [1219]: Right material

Comment [1220]: Right material, Right Way

Trial Use and Comment

Items shall be the standard products of the manufacturer of such materials for the application.

Prior to assembly, the steel surface that will bear on the self-lubricating bearing plate shall be thoroughly lubricated with additional antioxidant lubricant furnished by the manufacturer. Coatings shall be removed before application of antioxidant lubricant.

(f) **Elastomeric Pads:** Care shall be taken in fabricating pads and related metal parts so that effects detrimental to their proper performance, such as uneven bearing and excessive bulging, will not occur.

(g) **Placement:** Bearing plates or pads shall have a uniform bearing over the entire area. Provision shall be made to keep plates or pads in the correct position during erection of beams or placement of concrete.

Comment [1221]: Right Way, Right material

Elastomeric pads and other flexible bearing materials shall be placed directly on masonry surfaces that have been finished to a roughness equivalent of a No. 36 to No. 46 grit. Pads, bearing areas, or bridge seats and metal bearing plates shall be thoroughly cleaned and free from oil, grease, and other foreign materials. Metal bearing plates or bottoms of prefabricated beams that are to bear on elastomeric pads shall be coated with epoxy, Type EP-4 or EP-5, conforming to the requirements of Section 243 and then surfaced with a No. 36 to No. 46 silicon carbide or aluminum oxide grit. Bearing areas shall be finished to an equivalent roughness.

Metal bearing plates shall be bedded on bridge seats as follows: The bridge seat bearing area shall be thoroughly swabbed with No. 1 paint, and three layers of duck, 12 to 15 ounces per square yard, shall be placed on it, each layer being thoroughly swabbed with paint on its top surface.

Superstructure shoes or pedestals shall be placed in position while paint is plastic. As an alternate to duck and paint, sheet lead of at least 0.1 inch in thickness or preformed fabric bedding material at least 1/8 inch in thickness may be used when called for on the plans or approved in writing by the Engineer.

Rockers or other expansion devices shall be centered and aligned so that the vertical axis will be vertical at 60 degrees F.

(h) **Anchors:** Anchor bolts, nuts, and washers shall be painted or galvanized on superstructures having steel beams or girders. When superstructure units are concrete, anchor bolts, nuts, and washers, including bearing assemblies and insert plates, shall be galvanized. Shop paint shall cover the threaded end to 1 inch below the surface of masonry. Anchors shall be positioned to provide the required fit with bearing plates. Anchors shall be cast into the masonry and positioned by means of templates or other methods that will hold them securely in the correct position until concrete has set. The method of setting shall allow for proper finishing of concrete bearing areas.

Comment [1222]: Right material, Right Way

Trial Use and Comment

Anchors that are not designed to project through bearing plates shall be checked for proper projection above the masonry bearing area immediately prior to placement of bearing plates and beams. Nuts on anchor bolts at expansion ends shall be adjusted to permit free movement of the span.

Angles for anchor assemblies to be attached to sides of concrete beams shall not be installed until beams have received their full dead load and supporting falsework has been removed.

408.04—Measurement and Payment

Comment [1223]: Right Quantity and Right Payment

Metal bearing and expansion plates and anchors will be measured by shop scales in pounds of actual material placed in accordance with the plans. When not a separate pay item, the Department will include the weights of plates and anchors in the weight of structural steel or reinforcing steel for payment. When a pay item, bearing plates will be paid for at the contract unit price per pound and shall include elastomeric and other flexible bearing pads. Bearings and anchors for prestressed concrete deck units will be paid for in accordance with Section 405. The cost of bedding and preparation for metal bearing plates shall be included in the prices for superstructure items. This price shall include furnishing material, galvanizing, painting, and lubricating.

Payment will be made under:

Pay Item	Pay Unit
Bearing plates	Pound

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Project staff to meet with Supplier, Contractor and designer discuss process of manufacturing, inspection and placement.
- Discuss and re emphasize need for early shop drawing submittals to avoid delays in approval.

Start:

- Assure that all material is match marked as required,
- Assure all bearing devices are kept with all components of each unit stored together to avoid inner mingling and are protected from contaminates.

Trial Use and Comment

Assure all entities are aware of Construction methods and inspection methods and that everyone is aware of when critical inspection times are in order to avoid delays.

Continuous inspection:

- Provide continuous inspection of placement operations verifying that all properly submitted safety procedures are being followed. Verify that anchor bolts are properly located in the assemblies as required.

Final Inspection:

- Verify that all assemblies are placed in their proper final location and meet specification requirements. Ensure area where bearing device is finished to the required tolerances.

Documentation Required:

- Form C-25, Approved Source of Material including all incidental items to the product, Shop inspection certifications, Material certifications. Assure all employees welding on assemblies have welding certification and letter stating welder has not gone more than 90 days without performing like work.

IV. REVIEW QUESTIONS

Spec. Ref.	
408.03(a10)1	Were the bearing assemblies shipped and stored as units with the components of each completed bearing clearly identified?
408.03(a10)2	Was each completed TFE bearing marked to indicate its location in each structure?
408.03(a11)1	Were concrete bearing seats prepared at the correct elevation and bush-hammered or dressed to the required flatness tolerances?
408.03(a11)2	Was erection of structural steel for spans contiguous to each TFE bearing substantially completed prior to loading the bearing?
408.03(a11)3	Was field welding of bearing plates performed under no-load conditions using temperature-indicating crayons to control maximum temperatures?
408.03(a11)4	Were the PTFE and polished stainless steel surfaces protected from blast abrasives and paint application during construction?
408.03(a12)	Did the Contractor submit shop drawings for the Engineer's review prior to fabrication of TFE bearings?
408.03(a9)	Were the TFE bearings tested and certified in accordance with this section?
408.03(e)	Prior to assembling in place, was the steel surface on which self-lubricating bearing plates will bear cleaned of all coatings and thoroughly lubricated with the anti-oxidant lubricant furnished by the manufacturer?
408.03(g)1	Do the bearing plates or pads have uniform bearing over the entire area?

Trial Use and Comment

408.03(g)2	Were provisions made to keep the plates or pads in the correct position during erection of beams or placement of concrete?
408.03(g)3	Were masonry surfaces finished with a gritty texture prior to placing elastomeric pads and other flexible bearing materials?
408.03(g)4	Were metal bearing plates or bottoms of prefabricated beams that are to bear on elastomeric pads coated with an epoxy conforming to materials section for epoxy resin systems & then surfaced with a silicon carbide or aluminum oxide grit?
408.03(g)5	Was the bridge seat bearing area that is to receive metal plates and the three layers of duck placed on it thoroughly swabbed with No. 1 paint?
408.03(g)6	Are alternate bedding methods used only when indicated on the plans or with written approval of the Engineer?
408.03(g)7	Were the rockers or other expansion devices centered and aligned so that the vertical axis will be vertical at 60 degrees F?
408.03(h)1	Have anchor bolts, nuts, and washers used with steel beams or girders been painted or galvanized?
408.03(h)2	Have anchor bolts, nuts, washers, bearing assemblies, and insert plates been galvanized when intended for use with concrete superstructure units?
408.03(h)3	Were the anchor bolts positioned to provide the required fit with bearing plates?
408.03(h)4	Were the anchors cast into the masonry and positioned by means of templates or other methods that will hold them securely in the correct position until concrete has set?
408.03(h)5	Did the method of setting allow for proper finishing of concrete bearing areas?
408.03(h)6	Was the full dead load applied and falsework removed before anchor assembly angles were attached to concrete beams?
407.04(a4)	Has a copy of the welder's certificate of qualification and a certificate stating that the welder has not exceeded any period of 3 months without performing satisfactory welding in the required process been submitted to the Department?

V. CRITICAL INSPECTION POINTS

• **Assure all materials are approved through shop drawing process and all materials approve in Source of materials.**
• **Verify all surface areas in which assemblies are being placed are finished to the required tolerances and bearing devices are being placed in the Proper locations (Pier or Cap locations). Verify that anchor bolts are located in the bearing assembly as required by shop drawings.**

Trial Use and Comment

• **Assure no welding is performed or modifications to the assemblies occur in the field unless previously approved by Engineer.**
• **Assure that once load of superstructure is completed verify that assemblies are in proper deflection location.**

Trial Use and Comment

SECTION 409 -STEEL GRID FLOORING

I. INTRODUCTION:

Steel grids are used for decking on moveable bridges to reduce the size of equipment used in lifting the span. Also used for walkway areas and access points when removal of the flooring is needed for maintenance or positive air flow.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

409.01—Description

This work shall consist of constructing a steel grid floor.

409.02—Materials

Materials shall conform to the requirements of Section 227.

409.03—Procedures

The floor shall conform to the requirements for the design of steel grid floors in AASHTO's *Standard Specifications for Highway Bridges.*

(a) **Arrangement of Sections:** Where main elements are normal to the centerline of the roadway, units shall generally be of such length as to extend over the full width of any roadway up to 40 feet. In every case, units shall extend over at least three panels. Where joints are required, ends of main floor units shall be welded at joints over their full cross-sectional area or otherwise connected to provide full continuity in conformance with the manufacturer's recommendations.

Where main elements are parallel with the centerline of the roadway, sections shall extend over at least three panels and ends of abutting units shall be welded over their full cross-sectional area or otherwise connected to provide full continuity in accordance with the approved design.

(b) **Provision for Camber:** Steel units so rigid that they will not readily follow the camber required shall be cambered in the shop. To provide a bearing surface normal to the crown of the roadway, the stringers shall be canted or provided with shop-welded beveled bearing bars. If beveled bars are used, they shall be placed along the centerline of the stringer flange, in which case the design span length

Comment [1224]: Right materials

Comment [1225]: Right Way, Right Location

Comment [1226]: Right Time, Right Location, Right material, Right Way

Trial Use and Comment

shall be governed by the width of the bearing bar instead of the width of the stringer flange.

Longitudinal stringers shall be cambered at the mill or provided with bearing strips so that the completed floor after dead-load deflection shall conform to the longitudinal camber shown on the plans.

(c) **Field Assembly:** Areas of considerable size shall be assembled before the floor is welded to its supports. Main elements shall be made continuous, and sections shall be connected together along their edges by welding of bars. Connections shall be approved by the Engineer.

(d) **Connection to Supports:** The floor shall be connected to its steel supports by welding. Before any welding is done, the floor shall be loaded to make a tight joint with full bearing or clamped down. The location, length, and size of the welds shall be as approved but in no case less than the manufacturer's standards.

Ends of main steel units of the slab shall be securely fastened together at sides of the roadway for the full length of the span by means of steel plates or angles welded to ends of main units or by encasing ends with concrete.

(e) **Welding:** Welding shall conform to the requirements of Section 407.

(f) **Damaged Galvanized Coatings:** Damaged coatings shall be repaired in accordance with the requirements of Section 233.

(g) **Concrete Filler:** Floors with open bottom flanges shall be provided with bottom forms of metal or wood to retain the concrete filler.

If metal form strips are used, they shall fit tightly to bottom flanges of floor units and be placed in short lengths extending approximately 1 inch beyond the edge of each support. The form shall be such as will result in the adequate bearing of the slab on the support.

Concrete shall be placed and cured in accordance with the requirements of Section 404 and thoroughly consolidated by vibrating the steel grid floor. The vibrating device and manner in which it is operated shall be subject to the approval of the Engineer.

(h) **Painting:** Steel grid flooring furnished without galvanizing but with a shop coat of paint shall be painted in accordance with the requirements of Section 411.

If a structural steel plate is used on the bottom of a filled floor, the bottom surface of the plate shall be painted in accordance with the requirements of Section 411.

Comment [1227]: Right Location

Comment [1228]: Right Time, Right Location

Comment [1229]: Right Time, Right Way

Comment [1230]: Right Way

Comment [1231]: Right material

Comment [1232]: Right Way

Comment [1233]: Right Way

Trial Use and Comment

409.04—Measurement and Payment

Comment [1234]: Right payment, Right Quantity

Steel grid floors will be measured in square feet of surface area, complete-in-place, and will be paid for at the contract unit price per square foot.

Payment will be made under:

Pay Item	Pay Unit
Steel grid floor	Square foot

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Meet with Project inspection team, manufacturer, Designer and approving authority to assure everyone understands what is to be submitted for approval and when.

Start:

- Check Contractors current schedule and organize inspection forces so that proper inspection occurs during construction and fabrication process. Assure all submittals are submitted in a timely manner.

Continuous inspection:

- Review the manufacturing, delivery and installation of all items associated with this structure. (The inspection may come from an offsite inspection firm therefore make sure all inspection documents are received and kept on file at site)

Final Inspection:

- Review to assure all materials are aligned and secured as per Contract and design requirements.

Documentation Required:

- Form C-25 Approved Source of materials, Steel certifications pertaining to structure. Sign off of shop inspectors sheets from offsite inspection team.

Trial Use and Comment

IV. REVIEW QUESTIONS

106.01(1)	Does the Inspector have available an approved source of materials and approved changes list on-site? (Appendix C / Form C25)
105.10C	Does the Contractor submit his shop and working drawings for timely review by the Engineer to avoid delaying the work?
407.04(a)1	Has welding only been performed in locations as noted on the plans or as approved by the Engineer?
407.04(a3)	Have welds that do not conform to the specifications been repaired or removed and replaced or the entire piece rejected?
407.04(a4)	Has a copy of the welder's certificate of qualification and a certificate stating that the welder has not exceeded any period of 3 months without performing satisfactory welding in the required process been submitted to the Department?

- Have fall protection and setting of steel submittals been provided, approved and are they being followed as submitted.

V. CRITICAL INSPECTION POINTS

- Verifying all shop drawing are submitted and approved.
- Review proper handling and storage of materials
- Review and assure lifting sequences and requirements are being met.
- Any welding or bolting of the structural unit should be observed and verified as acceptable during operations

Trial Use and Comment

SECTION 410 – RAILINGS AND PARAPETS

I. INTRODUCTION:

The object of railing and parapet, in addition to its functional purpose, is to produce a pleasing, finished appearance for bridges, wing walls, retaining walls, etc. Where metal railing is to be used, the bridge deck or parapet wall is to be prepared to receive the railing by having proper surface and alignment of the contact areas. The location of expansion joints in bridge railing, or parapet, or median barriers should coincide with the location of expansion joints in the bridge deck.

Corrosion at the base of the posts is a critical problem with metal railings. Proper drainage and surface protection for the metal should be provided.

Aluminum tubing, which has black carbon streaks after erection, is to be cleaned to remove the streaks so far as possible. The tubes are to be turned so that the least amount of streaks remaining is visible from the traffic side of the parapet wall.

When field welding of railing or support brackets is indicated, approved electrodes and procedures are to be used to produce joints of satisfactory appearance.

Metal and concrete railings are to be measured to the nearest l/10 foot for the entire superstructure, as described in **Section 410.04**. Concrete parapets are to be measured from out to out and to the nearest l/10 foot, as described in **Section 410.04**.

a. Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

410.01—Description

This work shall consist of furnishing and installing railings, bridge median barriers, and concrete parapets true to the line, grade, and dimensions shown on the plans or as established by the Engineer.

410.02—Materials

(a) **Concrete** shall conform to the requirements of Section 217. In the event the Contractor places concrete by the extrusion method, the slump may be less than 2 inches, the air content shall be no less than 4 percent, and the size of the coarse aggregate shall be no less than No. 7.

Comment [1235]: Right Materials

Trial Use and Comment

(b) **Steel reinforcement** shall conform to the requirements of Section 223.

(c) **Steel for metal parapets** shall conform to the requirements of Section 226.

(d) **Hydraulic cement mortar and grout** shall be nonshrinking and shall conform to the requirements of Section 218.

(e) **Aluminum railings and materials** shall conform to the requirements of Section 229.

(f) **Anchor bolts** shall conform to the requirements of Section 226.02(c).

(g) **Grounding materials** shall conform to the requirements of Section 238.

410.03—Procedures

(a) **Post Alignment:** Posts shall be normal with respect to the profile grade and plumb in the transverse direction regardless of the cross slope.

(b) **Metal Railings:** Fabrication and erection shall be performed in accordance with the requirements of Section 407. Working drawings shall be furnished in accordance with the requirements of Section 407. In welded railing, exposed joints shall be finished by grinding or filing to give a neat appearance.

When alternate metal railings are permitted, bridges under any one contract shall have the same type of railing.

Metal railings shall be carefully adjusted prior to being fixed in place to ensure proper matching at abutting joints and correct alignment and camber throughout their length. Holes for field connections shall be drilled wherever possible with railing in place at the proper grade and alignment.

Abutment ends of metal railings and metal parapets shall be grounded. Grounding conductor shall be bare or insulated (green) copper. Grounding electrode(s) shall be installed in accordance with the requirements of Section 700 and shall conform to the requirements of the NEC. All sections of metal railings, movable joints of metal railings, metal parapets, and the gaps in the metal railings created by the concrete pole supports or other design modifications shall be bonded internally to maintain continuity. Grounding conductors shall pass through bridge parapets and backwalls in 1 inch conduit or raceway to a point 4 to 8 inches below the finished grade and attached to a grounding electrode(s) with a minimum of 8 feet contact with soil. Each run of grounding conductor shall be provided with a 4-inch exposed loop at expansion joints and at termination points. Each metal rail section adjacent to the next metal railing shall be tested for continuity to ensure system grounding. The Contractor shall test the grounding electrode(s) after installation using the fall of

Comment [1236]: Right Way

Comment [1237]: Right Way

Comment [1238]: Right Way / Right Documentation

Comment [1239]: Right Time

Comment [1240]: Right Material / Right Documentation.

Trial Use and Comment

potential (three-point measurement) method. Testing shall be documented and the documentation submitted to the Engineer.

1. **Painting:** Steel or iron railing that is not galvanized shall be given one shop coat and three field coats of paint after erection. Painting shall be performed in accordance with the requirements of Section 411.

2. **Anchorages:** Metal-railing anchorages in concrete shall be placed in accordance with the requirements of Section 404 and Section 408.

3. **Aluminum railings:** Components of railing shall be designed for adequate structural strength. Castings shall have a thickness of at least 1/4 inch, and other units shall have a thickness of at least 3/16 inch.

   Aluminum in contact with concrete shall be coated with an approved aluminum-impregnated caulking compound. Aluminum surfaces in contact with metals other than stainless or galvanized steel shall be insulated with approved materials.

(c) **Concrete Railings, Bridge Median Barriers, and Parapets:** Concrete railings or parapets shall not be placed until centering or falsework for the span has been released, rendering the span self-supporting.

Railings, bridge median barriers, and parapets shall be constructed in accordance with the requirements of Section 404 for the class of concrete specified on the plans and shall be given a Class I finish. Care shall be taken to secure smooth and tight-fitting forms that can be rigidly held to line and grade and removed without damage to concrete. Concrete parapets and median barriers shall be constructed within an allowable tolerance of ±½ inch for overall depth and overall width, ±¼ inch for the width of the upper portion of the barrier, and ±¼ inch per 10 feet for horizontal alignment.

Forms for concrete railing shall be fabricated of single-width boards lined with approved material. Form joints in plane surfaces will not be permitted.

Moldings, panel work, and bevel strips shall be constructed with neatly mitered joints. Corners in finished work shall be true; sharp; clean cut; and free from cracks, spalls, or other defects.

Reinforcing steel shall be placed in accordance with the requirements of Section 406.

Expansion joints shall be constructed so as to permit freedom of movement. After all other work is completed, loose or thin shells of mortar likely to spall under movement shall be removed from expansion joints by means of a sharp chisel.

In the event the Contractor elects to construct railing, parapet, or median barrier by the extrusion method, construction shall conform to the following:

Comment [1241]: Right Way

Comment [1242]: Right Way

Comment [1243]: Right Way

Comment [1244]: Right Way

Trial Use and Comment

1. In the event the bridge deck needs to be widened or additional reinforcing steel placed in the railing, parapet, or median barrier to accommodate the extrusion machine, the Contractor shall submit all necessary details for approval. Widening the bridge deck or placing additional reinforcing steel shall be at the Contractor's expense.

2. The extrusion machine shall be equipped with internal vibrators to consolidate concrete along the face and adjacent joints in one complete pass of the machine. This shall be accomplished in such a manner that a minimum of hand finishing will be required to produce a dense homogenous finish, free from voids and honeycomb.

3. When the plans require horizontal drains in the railing, parapet, or median barrier, the Contractor shall submit his proposed method of forming drains to the Engineer for approval.

4. Deflection and expansion joints shall be grooved in accordance with the plans immediately after the extrusion process, and required saw cutting shall be completed the same day the concrete is placed.

Comment [1245]: Right Documentation

Comment [1246]: Right Documentation

Comment [1247]: Right Quantity / Right Pay

410.04—Measurement and Payment

Railing will be measured in linear feet along the centerline of the top rail between the extremities of each railing without deductions for breaks or interruptions. When railing is not a pay item, the cost thereof shall be included in the price for other appropriate items. When a pay item, railing will be paid for at the contract unit price per linear foot. This price shall include furnishing rails, rail posts, post bearing pads, anchor assemblies, and sleeves; furnishing and installing grounding materials; painting; galvanizing; reinforcing steel necessary; and concrete where applicable.

Parapets will be measured in linear feet along the face of the parapet, and **bridge median barrier** will be measured in linear feet along the barrier centerline. Parapets and bridge median barriers will be paid for at the contract unit price per linear foot. This price shall include furnishing and installing materials designated above the bridge deck surface, including anchorage material, reinforcing steel, junction boxes, conduits, and/or raceways used for rail grounding.

Payment will be made under:

Pay Item	Pay Unit
Railing (Type)	Linear foot
Parapet (Type)	Linear foot
Bridge median barrier (Type)	Linear foot

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting

- Review plans and specification requirements
- Review procedures
- Ensure that reinforcing steel / anchor bolts placed during the bridge deck construction phase installed correctly in order to allow for proper installation of parapet or railing.

Start:

- Observe contractor's layout to ensure proper dimensions will be obtained upon completion of railing or parapet construction.

Intermittent Inspection:

- Ensure that the contractor is correctly handling the material, and that the final product is as specified.

Final Inspection:

- Ensure metal railings are properly grounded in accordance with Section 410.03

Documentation Required:

- Plans, Contract, and Working Drawings
- Certification that grounding of the metal railing meets the requirements of NEC.

IV. REVIEW QUESTIONS:

Spec. Ref.	
410.03(b)1	Have metal railings been fabricated and installed in accordance with this section
410.03(b)2	Are metal railings or metal parapets grounded in accordance with this section?
410.03(c)1	Had the span become self-supporting before concrete railing or parapet was placed?
410.03(c)2	Have concrete railings, bridge median barriers, and parapets been given a Class I finish?
410.03(c)3	Were forms smooth, tight-fitting, rigidly held to line and grade, and removed without damage to the concrete?

Trial Use and Comment

410.03(c)4	Have all moldings, panel work, and bevel strips been constructed with neatly mitered joints and corners neatly finished and defect-free?
410.03(c)5	Was the reinforcing steel correctly spaced, supported, and in accordance with the section on reinforcing steel?
410.03(c)6	Have the expansion joints been constructed so as to permit freedom of movement?
410.03(c)7	Are concrete parapets and median barriers constructed within the allowable tolerances as required in this section?
410.03(c)8	In the event the Contractor elects to construct parapet, railing, or median barrier by the extrusion method, is it done in accordance with the requirements of this section?

V. CRITICAL INSPECTION POINTS

• **Reinforcing Steel / Anchor Bolt Installation**
• **Form Placement**
• **Concrete Placement**
• **Grounding of Metal Railings**

Trial Use and Comment

1

Trial Use and Comment

SECTION 411 - PROTECTIVE COATING OF METAL IN STRUCTURES

I. INTRODUCTION:

Due to environmental concerns, particular attention should be given to Section 411. Existing metal structures that are to be coated may contain hazardous materials.

Each structure will be properly classified on the plans so the Contractor and Inspector will be aware of any coatings which may contain hazardous material.

Type A structures do not contain hazardous materials, therefore an expendable, nondusting, silica-free abrasive can be used and the residue contained, however we do not treat it as a potential hazardous residue.

Type B structures may contain hazardous materials and must be treated as such.

Prior to beginning work on structures that may contain hazardous material, the Office of Employee Health and Safety is to be contacted so that affected Inspectors may get a health screening.

The District Environmental Manager should be contacted to answer questions, provide assistance and to obtain details on the proper handling, storage, containment, and transportation of hazardous materials.

CERTIFICATIONS

The Inspector must verify that the Contractor has the certifications required to perform the work. The Contractor is required to submit proof of certification prior to performing the work.

Contractor's Record Keeping

Section 411 specifies the requirements for the Contractor to maintain daily records. The Inspector should be familiar with the requirements specified.

ENVIRONMENTAL PROTECTION

Environmental Plan

The Contractor has a responsibility to protect the public and the environment from leaded paint and hazardous material resulting from preparation operations.

Trial Use and Comment

If surface preparation operations are required, the Contractor is required to submit a detailed site-specific environmental plan for review. Once the plan is approved, the Inspector must ensure the Contractor is in compliance with the plan.

Monitoring

The Inspector must perform continuous visual inspections of containment structures, dust collectors and abrasive recycling equipment to detect any emissions into the unconfined space.

Perimeter air monitoring shall be performed as stated in the environmental plan. Should emissions exceed the limits established in Section 411, the Contractor is required to notify the Inspector immediately and operations are to be halted until corrective actions are implemented.

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a) Forms:

- C-25 – Source of Materials

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

411.01—Description

This work shall consist of preparing and coating ferrous metal surfaces on new and existing structures, including, but not limited to, main units, diaphragms, bearing assemblies, shop and field contact surfaces, surfaces in contact with concrete, parts designed to be embedded in concrete, rails, expansion joints, drainage systems, utility lines, and attachments in accordance with these specifications.

Classification of Structures: Existing structures will be classified on the plans by the Department as follows:

Type A: Structures that have no coatings or that have coatings that do not contain hazardous materials.

Type B: Structures that have coatings that may generate hazardous wastes.

Trial Use and Comment

Should the structure require application of a coating and no classification is specified in the contract documents, the Contractor shall bid Type B.

Galvanized surfaces and surfaces protected with other coatings shall not be coated unless otherwise specified. Cast, ductile, and nodular iron castings need not be coated. Application procedures not specified herein shall be as specified by the manufacturer and approved by the Engineer.

411.02—Materials

(a) **Coating** shall conform to the requirements of Section 231.

(b) **Water used in cleaning operations** shall be potable. Recycled water shall be filtered prior to reuse. Recycled water shall be used only on the bridge from which it was generated and shall be subsequently tested in accordance with the requirements of Section 411.04(a) and disposed of.

(c) **Abrasives used in cleaning operations** shall be one of the following categories:

1. **Expendable** abrasives shall conform to the requirements of SSPC-AB 1, Type I or Type II, Class A, except that silica and quartz sands will not be allowed. The abrasive shall not contain total levels of any of the heavy metals listed in 40 CFR 261.24, Table 1, in excess of 20 times the specified regulatory leachable limits. The abrasive shall be selected from the Department's approved products list.

2. **Recyclable** abrasives, newly manufactured or re-manufactured steel, shall conform to the requirements of SSPC-AB 3. Recycled abrasive shall be examined by the Contractor for oil contamination prior to start up and at least once per 8-hour shift in accordance with the requirements of VTM-82. Recycled abrasive shall not contain non-abrasive residue in excess of the requirements of SSPC-AB 2.

411.03—Certifications

(a) **SSPC QP-1 Certification:** the Contractor shall be certified to perform coating operations on all new and existing steel structures, Types A and B. Prior to performing coating applications, the Contractor shall submit proof of certification complying with the criteria of SSPC QP-1, Standard Procedure for Evaluating Qualifications of Painting Contractors, Field Applications in Complex Structures. This certification requirement will be waived for structural steel repairs and the replacement of structural components including, but not limited to, diaphragms, bearing assemblies, cross frames, stiffeners, connector plates, and beam repairs provided such work is performed in

Comment [1248]: Right Way

Comment [1249]: Right Way

Comment [1250]: Right Way

Comment [1251]: Right material

Comment [1252]: Right documentation

Trial Use and Comment

accordance with all applicable OSHA and environmental requirements for the type and scope of work specified.

(b) **Certified Industrial Hygienist (CIH) or SSPC QP-** If the project work involves the removal of greater than 100 square feet of coating from a Type B structure, the Contractor shall maintain an SSPC QP-2 certification and assign an SSPC QP-2 Supervisor/Competent Person to oversee activities to protect the environment throughout the project. Alternatively, the Contractor may employ a Certified Industrial Hygienist currently certified by the American Board of Industrial Hygiene to perform the aforementioned oversight activities. The environmental plan described in Section 411.08 shall be prepared by the SSPC QP-2–certified organization or approved by a CIH. The SSPC QP-2 Supervisor/Competent Person or CIH shall be present during startup, surface preparations, removal operations, and waste removal/disposal activities to ensure environmental protection. The SSPC QP-2 Supervisor/Competent Person or CIH shall submit written certification at the completion of the project that the plan fully complied with all applicable regulations and was fully implemented.

(c) **Professional Engineer**: If the project involves the erection of any containment structure with the bridge serving as the primary means of support, the Contractor shall describe such system as specified in Section 411.08(a) and provide certification by a Professional Engineer, licensed in the Commonwealth of Virginia. This requirement will be waived for any containment structure with a total weight-bearing capacity of less than 1,000 pounds.

411.04—General Surface Preparation and Application Standards

Prior to being coated, surfaces shall be free from rust, loose or brittle paint, chalking, oil, grease, salt contaminants, dirt, and other substances that would prevent coating from adhering tightly. Surfaces shall be prepared in accordance with SSPC specifications. Surface conditions and finished surface profiles shall conform to SSPC-Vis Standards or National Association of Corrosion Engineers (NACE) Comparators.

Should an area of steel that has previously been cleaned become soiled, contaminated, or rusted, the Contractor shall reclean the area to the satisfaction of the Engineer prior to application of coating at no additional cost to the Department.

Regardless of the method of cleaning, surface imperfections described in the "*Procedures Following Blast Cleaning and Immediately Prior to Painting Section*" of SSPC-SP 10 and any other matter that will prohibit a smooth unobstructed surface for the application of the specified coating, shall be removed.

(a) **Application Conditions:**

Comment [1253]: Right documentation

Comment [1254]: Right Time

Comment [1255]: Right Time

Comment [1256]: Right documentation

Comment [1257]: Right Way

Comment [1258]: Right Way and right payment

Trial Use and Comment

Preparing Surfaces To Be Coated: The Contractor shall keep contaminants from coming in contact with surfaces during surface preparation and coating operations. Unsealed connections, small cracks, cavities, and depressed areas on flanges shall be filled in accordance with the requirements of Section 407.

Prior to application of coating, the surface shall be prepared in accordance with one or more of the following methods. Except as provided herein, surfaces to be coated shall be cleaned in accordance with the requirements of Method 1 prior to the use of other surface preparation methods.

1. **Method 1**: Solvent, emulsion, or steam shall remove oil, dust, dirt, grease, concrete, chalking, and salt in accordance with the requirements of SSPC-SP-1. Contaminated solvent shall be removed before it evaporates by wiping or rinsing with clean solvents to prevent a film of contaminants from remaining on the surface. Solvent wiping may be required between coats. Solvents used in the work shall be those recommended by the paint manufacturer.

2. **Method 2**: Hand-tool cleaning shall remove loose coating, loose rust, and loose mill scale in accordance with the requirements of SSPC-SP-2.

3. **Method 3**: Power-tool cleaning shall remove loose coating, loose rust, and loose mill scale in accordance with the requirements of SSPC-SP-3.

4. **Method 4**: Power-tool cleaning shall remove coating, rust, and mill scale to bare metal in accordance with the requirements of SSPC-SP-11.

5. **Method 5**: Abrasive blast cleaning shall remove visible coating, rust, and mill scale in accordance with the requirements of SSPC-SP-10/NACE No. 2. Abrasives shall be recycled unless otherwise specified or approved by the Engineer. If an expendable abrasive is used on a Type B structure, it shall be used in conjunction with a process that will allow beneficial reuse of the expended product. Recyclable abrasive containing rust that adversely affects the cleanliness of the blasted surface will not be permitted.

   After blast cleaning, the surface profile shall be from 1 to 3 mils in a dense uniform pattern of depressions and ridges as determined by a spring micrometer with surface profile replica tape in accordance with ASTM D4417, Method C. Both shop-blasted and field-blasted surfaces shall be coated within 24 hours. If rust bloom develops, blast cleaning shall be repeated at no additional cost to the Department.

6. **Method 6**: Brush-off blasting shall remove loose or brittle coating, loose rust, and loose mill scale in accordance with the requirements of SSPC-SP-7/NACE No. 4.

7. **Method 7**: Low-pressure water cleaning shall remove dust, debris, and salt contaminants. The pressure washer shall be capable of achieving 2,000 pounds per square inch at the nozzle when used prior to blast cleaning and 5,000 pounds per

Comment [1259]: Right Way

Comment [1260]: Right Time

Comment [1261]: Right Way

Comment [1262]: Right Way

Comment [1263]: Right Time

Comment [1264]: Right material

Comment [1265]: Right Way

Comment [1266]: Right Way

Comment [1267]: Right Way

Comment [1268]: Right Way

Comment [1269]: Right Way

Comment [1270]: Right Time

Comment [1271]: Right payment

Comment [1272]: Right Way

Comment [1273]: Right Way

Trial Use and Comment

square inch at the nozzle when used to remove loose or brittle coatings. When the power washing equipment is used, the nozzle shall be maintained no more than 10 inches from the surface. Any detergents or cleaners used in conjunction with this method shall be those recommended by the coating manufacturer and as approved by the Engineer. Method 7 can be used exclusively (i.e., in lieu of Method 1) for the cleaning of new shop-primed or new field-primed steel provided that no oil or grease is present or that oil and grease are removed separately by Method 1.

Regardless of which method of surface preparation is used, the Contractor shall collect and contain solid and liquid waste, except for new steel cleaned by Method 7. Any water generated from cleaning new shop-primed or new field-primed steel by Method 7, provided that no detergents or cleaners were used, shall be directed to the bridge approaches or stream bank but shall not be directly discharged into any waterway. This exception does not apply to waste generated from surface preparation of galvanized steel, which shall be captured and disposed in accordance with the requirements of Section 411.07(b). The waste material(s) generated from work performed on Type B structures shall be tested in accordance with EPA Method 1311, Toxicity Characteristic Leaching Procedure (TCLP), and corresponding EPA 6000 or 7000 series metals analytical method for, but not limited to, the following metals to determine if the waste material(s) requires management as hazardous waste: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver; the exception to this testing protocol is that waste generated from abrasive blasting with recycled steel abrasives for Method 5 shall be tested for total concentrations of the aforementioned heavy metals in lieu of the TCLP analysis. Waste material(s) shall be disposed of in accordance with all federal, state, and local regulations.

(b) **Physical Application:** Coatings shall be applied in accordance with SSPC-PA 1. Coatings shall not be applied under any of the following conditions unless recommended by the manufacturer and approved by the Engineer:

1. Air, coating, or metal temperature is below 40 degrees F.

2. Air, coating, or metal temperature is expected to fall below 40 degrees F before the coating has cured.

3. Snow, sleet, or rain is falling.

4. Moisture is visible on metal.

5. Humidity is above 85 percent.

6. The temperature of the steel or metal surface to be coated may cause blistering as indicated in the manufacturer's product data sheet.

Comment [1274]: Right material

Comment [1275]: Right Way

Comment [1276]: Right Way

Comment [1277]: Right Way

Comment [1278]: Right Way

Comment [1279]: Right Way/Right Time

Trial Use and Comment

7. The steel surface temperature is less than 5 degrees F above the dew point or is expected to fall to that point before the coating has dried or cured.

In no case shall System W as shown in Table IV-6 be applied unless the air, steel surface, and material temperature is above and maintained above 50 degrees F and rising.

Prior to application of coatings, the surface shall be dry. Coatings shall be applied in a neat and orderly manner by brushing, rolling, or spraying as recommended by the manufacturer. However, rollers, daubers, or sheepskins shall not be used to apply zinc-rich coatings.

Zinc-rich coatings may be applied by brush, limited to isolated areas of 1 square foot or less.

Coatings shall be applied in a manner to provide a tight film of specified uniform thickness well bonded to metal or underlying coating, including crevices and corners, and shall be free from laps, streaks, sags, runs, overspray, dryspray, shadow-through, skips, excessive film build-up, mud cracking, misses, and other defects.

Beam edges, bolts, washers, and nuts shall receive a stripe coat prior to the full coat application. If a multicoat system is being applied, beam edges, bolts, and nuts shall be striped prior to each coat except that a stripe coat will not be required for a zinc-rich primer. Stripe coatings shall dry or cure to touch before overcoating.

Deficient, impaired, or damaged areas of each coat shall be repaired using material from the Department's approved products list. Two-component, solvent-based, inorganic zinc shall be considered cured when only trace amounts are removed in accordance with the requirements of ASTM D4752.

Successive coatings shall not be applied until each preceding coat has dried and cured in accordance with the manufacturer's recommendations and has been approved by the Engineer. Coatings shall be applied in accordance with the requirements of Table IV-6.

TABLE IV-6
Coating Systems

System	Coat	Coating	Min. Dry-Film Thickness (DFT) (mil)
B	Primer	Zinc-rich (from Department's approved products list)	

Comment [1280]: Right Time

Comment [1281]: Right Way

Comment [1282]: Right Way

Comment [1283]: Right Way

Comment [1284]: Right material

Comment [1285]: Right Time

Comment [1286]: Right Way

Comment [1287]: Right material

Trial Use and Comment

System	Coat	Coating	Min. Dry-Film Thickness (DFT) (mil)
	Intermediate		
	Finish		
F	Primer	No. 14	5.0
	Finish	No. 14 or as specified in Section 231.03(c) or 231.03(d)	5.0
W	Primer	No. 101 Federal No. 595-30045	2.0-4.0
	Intermediate	No. 102, White	2.0-4.0
	Finish	No. 103*	2.0-4.0**

* Color as specified. If not specified, color shall be Federal No. 595-26307.

** DFT shall be no less than the specified thickness; however, it shall completely cover the intermediate coat.

Mixing: Coatings shall be mixed in accordance with the manufacturer's instructions. Zinc-rich coatings shall be applied from containers equipped with a mechanical agitator, which shall be in motion throughout the application period unless otherwise specified by the manufacturer. Coatings shall not be thinned beyond the volatile organic compound (VOC) limit or the manufacturer's recommendation, whichever is the most restrictive. Individual components of multicomponent coatings shall be mixed separately prior to mixing with other components of the kit. Mixing shall be by use of a power mixer. Multicomponent material shall not be mixed in proportions less than the packaged quantities.

(c) **Quality Control: Measuring Film Thickness:** The dry-film thickness of coating will be determined by the Engineer with a Tooke gage when the thicknesses of previous coatings are not known and with a magnetic dry-film thickness gage when the previous thickness is known. The magnetic gage will be used and calibrated in accordance with the requirements of SSPC-PA-2. The Contractor shall repair test areas at no additional cost to the Department. The method of repair shall conform to methods as outlined in this section or as approved by the Engineer.

(d) **Record Keeping and Protective Coating Identification:** The Contractor shall maintain a record that establishes and describes the location and limits of the work area where protective coating removal or application has been accomplished. Such records shall be maintained and completed on a daily basis and shall provide at a minimum the following information: Contractor's name, date, time work began, time work completed,

Comment [1288]: Right Way

Comment [1289]: Right Way

Comment [1290]: Right documentation

Comment [1291]: Right Time

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ambient air and structure temperature and relative humidity ranges during coating operation, surface cleanliness and profile measurements, and dry-film thickness and name of coating system applied. The record shall include a map indicating areas where the protective coating has been applied as accurately located on the actual bridge structure except for structures as described in Section 411.05(b)3. The daily record and map format shall meet the approval of the Engineer and shall be established prior to commencement of work. The daily records and maps shall be maintained in a three-ring binder throughout the duration of the project. Prior to final acceptance, the Contractor shall submit to the Engineer the three-ring binder complete and shall certify that all information contained therein is factual and correct.

For new steel and after recoating an existing structure, after the final coat has cured, the Contractor shall stencil on the structure a legend indicating the type of coating system(s) and the month and year in which it was applied. The legend shall be placed inside a fascia stringer near an abutment at a location approved by the Engineer and shall be black in color.

411.05—Existing Structures

Coated steel structures built before 1978 and weathering steel structures may contain mill scale.

(a) **Bare Steel:** Uncoated weathering steel shall be cleaned in accordance with the requirements of Method 5 and shall be coated with System B. The following areas of weathering steel shall be coated as indicated:

1. Areas within 5 feet of a deck joint, including, but not limited to, cross frames, diaphragms, stiffeners, connector plates, girders, and beams.

2. The entire outside surface of fascia girders and beams, including the underside of the bottom flange.

These areas shall be thoroughly cleaned to no less than 6 inches outside the area to be coated and shall be coated with System B**.**

(b) **Coating Remaining:** Coating application will be performed as follows:

1. **Prepare and spot coat existing structure:** Surfaces being coated shall be prepared in accordance with Method 1 followed by Method 7 using a pressure of 5,000 pounds per square inch at the nozzle. Rust shall be removed in accordance with Method 4 or Method 5. Prepared areas shall be spot-primed with primer from the system specified. Intermediate and finish coat shall be applied to spot-primed areas only and shall be feathered into the existing finish coat to produce a uniform homogeneous appearance with the existing structure. The coating system shall be as specified on the plans. If no system is specified, System W shall be used.

Comment [1292]: Right documentation and Right Time

Comment [1293]: Right Time

Comment [1294]: Right documentation

Comment [1295]: Right Location

Comment [1296]: Right Way

Comment [1297]: Right material

Comment [1298]: Right Location and right material

Comment [1299]: Right Location and right material

Comment [1300]: Right Way/Right Materials

Comment [1301]: Right Way and right material

Trial Use and Comment

2. **Prepare and overcoat existing structure:** Prepared areas shall be spot-primed with primer from the system specified. Intermediate and finish coat shall be applied to the entire structure. The coating system shall be as specified on the plans. If no system is specified, System W shall be used.

   The entire structure shall be cleaned in accordance with the requirements of Method 1 followed by Method 7 using a pressure of 5,000 pounds per square inch at the nozzle. Areas to be primed and coated shall be prepared in accordance with Method 5 or Method 4.

3. **Recoat existing structure:** The entire structure shall be cleaned in accordance with the requirements of Method 1 followed by Method 7 using a pressure of 2,000 pounds per square inch at the nozzle. The entire structure shall be cleaned to bare metal in accordance with Method 5. The structure shall be recoated using System B.

4. **Coating new steel members used to repair existing structure:** Unless otherwise directed or approved by the Engineer, the newly installed steel members shall be cleaned to bare metal in accordance with Method 5. Prepared areas shall extend 6 inches beyond new steel member into the existing structure at the point of repair and shall be spot-primed with primer from the system specified. Intermediate and finish coat shall be applied to spot-primed areas only and shall be feathered into the existing finish coat to produce a uniform homogeneous appearance with the existing structure. The coating system shall be as specified on the plans. If no system is specified, System W shall be used.

5. **Zone coating**: Surfaces shown on the plans or in the Contract as being zone coated shall be cleaned in accordance with the requirements of Method 1 followed by Method 7 using a pressure of 2,000 pounds per square inch at the nozzle. The entire area designated for zone coating shall be prepared in accordance with Method 5.

   Areas designated for zone coating shall be primed and coated using a coating system selected from the Department's approved zinc rich paint systems list.

If a winter season elapses between applications of coats, the structure shall be prepared again in accordance with the requirements of Method 1 prior to resuming application of additional coatings and at no additional cost to the Department.

Existing steel on structures to be widened shall not be prepared and coated unless otherwise specified. When specified on the plans for coating, the entire coating on the existing structure shall be removed in accordance with the requirements of Method 5 and the existing structure shall be coated with the same system as required on the new steel.

411.06—New Structures

Comment [1302]: Right Way and right material

Comment [1303]: Right Way

Comment [1304]: Right Way

Comment [1305]: Right material

Comment [1306]: Right Way

Comment [1307]: Right material

Comment [1308]: Right Way

Trial Use and Comment

Non-stainless ferrous metal shall be coated using System B as specified in Table IV-6.

(a) **Shop Coating:** Metal surfaces to be coated shall be abrasive blast cleaned in accordance with the requirements of Method 5 prior to application of primer. Material shall not be shipped until the primer has cured.

Machine-finished surfaces and/or areas that are to bear on other surfaces in a sliding movement shall not receive an applied protective coating as specified in Table IV-6 but shall be coated with a multipurpose grease or other specified coating prior to shipment.

Erection and weight marks shall be stenciled or painted on structural steel subsequent to application of shop primer. No other lettering shall be allowed.

The following areas of weathering steel shall be coated:

1. Areas within 5 feet of a deck joint, including, but not limited to, cross frames, diaphragms, stiffeners, connector plates, girders, and beams.

2. The entire outside surface of fascia girders and beams, including the underside of the bottom flange.

   These areas shall be thoroughly cleaned to no less than 6 inches outside the area to be coated and shall be coated with System B.

Deficiencies and nonconformities shall be satisfactorily corrected prior to shipment.

(b) **Field Coating:** Field application of coatings shall not be performed until concrete work is completed and forms are removed. Concrete deposited on coated steel surfaces shall be removed. Prior to coating, surfaces shall be cleaned in accordance with the requirements of Method 7 as described in Section 411.04(a) using a pressure of 2,000 pounds per square inch at the nozzle. Uncoated surfaces and deficient or damaged areas shall be cleaned in accordance with the requirements of the coating manufacturer and touch-up primed with a primer from System B.

If a winter season elapses between applications of coats, the structure shall be prepared again in accordance with the requirements of Method 7 at no additional cost to the Department.

After installation and approval by the Engineer, galvanized bolts or bolts protected with approved coatings shall be cleaned with water-based biodegradable cleaner followed by a potable water rinse. Other erection bolts that will be coated shall be degreased and abrasive blasted in accordance with the requirements of Section 411.04. Suitable precautions shall be taken to mask off the surrounding primed area to prevent overblasting. Cleaning agents and rinse water shall be collected and disposed of in accordance with applicable state and federal regulations. After cleaning, bolts shall be

Comment [1309]: Right material

Comment [1310]: Right Way/Time

Comment [1311]: Right material

Comment [1312]: Right Time

Comment [1313]: Right Time

Comment [1314]: Right Way

Comment [1315]: Right Way and right materials

Comment [1316]: Right Way and right payment

Comment [1317]: Right Way

Comment [1318]: Right Way

Comment [1319]: Right Way

Trial Use and Comment

coated with the identical intermediate and topcoats being applied to the rest of the structure. If additional surface preparation of galvanized bolts is required, preparation shall be as recommended by the coating manufacturer.

Surfaces that will be inaccessible after assembly and erection shall be coated prior to assembly.

When the superstructure is concrete, the color of bearing assemblies shall be Gray, Federal No. 595-26307.

When the superstructure is weathering steel the topcoat shall be Brown, Federal No. 595-20059. The topcoat color for other structures shall be Gray, Federal No. 595-26307 unless otherwise specified on the plans. When only portions of a structure are designated for coating, the edges of coated areas shall be masked to a straight line.

411.07—Galvanized Surfaces

(a) **Existing Uncoated**: The surface shall be prepared in accordance with Method 1 or Method 7. Rust shall be removed using Method 2 or Method 3. The surface shall be coated with a coating system from the Department's approved products list.

(b) **New Surface**: New galvanized surfaces that are to be coated shall not be quenched or chromate treated by the galvanizer. Prior to coating, galvanized surfaces shall be prepared in accordance with Method 1.

In the event new galvanized material is supplied to the project that has been quenched or chromate treated and the Engineer directs that such material is to be coated, the Contractor shall prepare the surface in accordance with ASTM D 2092, Method A or Method G. If surface preparation is performed in the field, the Contractor shall collect and contain solid and liquid waste. Waste shall be characterized and disposed of in accordance with the requirements of Section 411.08(c) for a Type B structure. Any additional cost for surface preparation, waste collection, waste characterization, and disposal associated with the coating of quenched or chromate-treated galvanized material as directed by the Engineer will be in accordance with the provisions of Section 109.05. The surface shall be coated with a coating system from the Department's approved products list.

411.08—Environmental Protection

In accordance with the requirements of Section 107, the Contractor shall protect the public and the environment from leaded paint or hazardous material resulting from coating preparation, cleaning, removal operations, blast abrasives, rust, and overspray.

Comment [1320]: Right Time

Comment [1321]: Right material

Comment [1322]: Right material

Comment [1323]: Right Way

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Comment [1326]: Right payment

Comment [1327]: Right Way

Trial Use and Comment

Depositing or dropping waste materials into water, onto the ground, onto roadways, or outside the containment system will not be permitted. Waterways and travel-ways shall be protected against coating drift and overspray. Equipment and containment devices shall arrive at the site in a decontaminated condition and shall be decontaminated prior to relocating or moving unless otherwise properly disposed. Residues from decontamination and any disposable items shall be properly disposed of in accordance with all applicable federal, state, and local regulations.

Comment [1328]: Right Way

The Contractor shall at all times be in compliance with these specifications and the regulations of, but not exclusive to, the following agencies: U.S. Environmental Protection Agency, U.S. Department of Transportation, Virginia Department of Environmental Quality, Virginia Department of Labor and Industry, and the U.S. Coast Guard.

(a) **Environmental Plan:** Where surface preparation operations are required, the Contractor shall submit a detailed site-specific Environmental Plan to the Engineer for Department records and review for completeness only, not approval. The Contractor shall provide one comprehensive plan that covers all facets of operation. No work shall proceed until the Engineer has notified the Contractor that the plan contains all the necessary elements. The Environmental Plan shall include controls for capture, containment, collection, storage, and transportation of waste material generated by the work. The Contractor shall use the most effective method possible for capture, collection, containment, and transportation operations. Plans shall include measures for accidental spill cleanup.

Comment [1329]: Right documentation

The Environmental Plan shall be certified by an SSPC QP-2 Supervisor/Competent Person or a CIH currently certified by the American Board of Industrial Hygiene. If the project design involves the erection of a supported containment system with a total weight-bearing capacity of greater than 1,000 pounds, the plan shall also be reviewed and certified by a Professional Engineer registered in the Commonwealth of Virginia as to the design acceptability for the structural load of the containment system on the bridge.

After project award but not less than 3 weeks prior to commencing operations covered by this plan, the environmental plan shall be submitted to the Engineer. Within 2 weeks of receipt, the Engineer will review the submitted plan for completeness. Should deficiencies in the plan exist, the plan will be returned to the Contractor for incorporation of revisions as noted by the Engineer. The Contractor shall make such revisions and submit completed plans for the Engineer's record prior to commencing operations. In no case shall the Contractor begin work prior to the Engineer's receipt and review of a satisfactorily complete plan.

Comment [1330]: Right Time

Comment [1331]: Right Time

Comment [1332]: Right Time

(b) **Monitoring:** Visual inspections of the containment structures and the dust collector and abrasive recycling equipment shall be continuously performed to detect and control any emissions into the unconfined air space. Emissions will not be permitted outside the containment system. Visual emissions outside the containment system

Comment [1333]: Right Way

Trial Use and Comment

shall immediately be corrected to comply with emission standards. Minimal visible air emissions will be allowed for properly operating vacuum-assisted power tools provided that a secondary means for collecting large particles is employed and the technology is applied using usual and customary industry practices. Excessive emissions caused by improperly operated or functioning equipment shall be immediately corrected. Adequate lighting shall be provided as necessary to aid visual inspections.

Perimeter air monitoring shall be performed, as directed by the Engineer through review comments on the environmental plan submission, using high-volume air samplers equipped for the collection of total suspended particulate (TSP) samples. The filters shall be analyzed for lead in accordance with EPA 40 CFR Part 50, Appendix G, for a minimum of 8 hours per day of operation. Samples shall be collected within 500 feet downwind of paint abatement, dust collection, and abrasive recycling equipment. Perimeter monitoring results shall be maintained below the National Ambient Air Quality Standard for lead (40 CFR Part 50) using the Adjusted Daily Allowance (ADA) procedure outlined in SSPC-Guide 6, Method D. The results of all sample analyses shall be submitted to the Engineer as soon as they are available. Should emissions exceed the limits set herein or material begins to reach the ground or enter State waters, the Contractor shall notify the Engineer and operations shall be halted until such time that corrective actions are implemented.

Comment [1334]: Right Way and Right Time

Comment [1335]: Right Time

(c) **Waste Characterization and Disposal:** Material removed from a Type A structure shall be disposed of as a non-hazardous waste in accordance with the requirements of (d)1 herein.

Material removed from a Type B structure shall be contained, collected, and stored in closed 55-gallon USDOT approved steel drums or portable metal roll-off containment refuse disposal bins. For small quantities of waste, approved 5-gallon containers may be used.

Comment [1336]: Right Way

The Contractor shall, with the oversight of the Engineer; collect and provide to the Department samples for analysis at the following frequency:

Containers	Samples
1	1
2-6	2
Over 6	1 for every 3 containers

Samples shall be randomly collected and shall be representative of the contained waste. Waste shall not accumulate for more than 30 days before samples are collected. A laboratory certified by the American Industrial Hygiene Association to perform lead analysis and approved by the Department shall perform the testing. Testing will be performed in accordance with the requirements of Section 411.04(a). The Department shall pay the cost of all tests performed by the laboratory. Waste generated from abrasive blasting with recycled steel abrasive shall be classified as hazardous if the

Comment [1337]: Right Way

Comment [1338]: Right payment

Trial Use and Comment

total lead level exceeds 0.01 percent. If the material is declared to be a hazardous waste by the Department, the Contractor shall dispose of the material in accordance with the requirements of Section 411.08(d)3. The Contractor is not relieved from performing waste testing in accordance with the aforementioned procedures by using test results from samples of coatings collected while adhered to the structural steel.

Each structure shall have a separate lockable storage area for waste material located immediately adjacent to the structure. The Contractor shall collect the material at the end of each workday and shall transport the waste material to the storage area in a closed container that will not permit leakage. Each container shall be marked indicating the origin of the material; the date the material was placed in the storage area; and a 24-hour telephone number of the Contractor and Department representative. Prominent warning signs shall be displayed around the perimeter of the storage. The signs shall be located at a distance from the storage area that will allow personnel to read the sign and take the necessary protective actions required before entering the storage area. Warning signs and notices shall be posted in accordance with CFR 29 Part 1926, Section 62.

One centralized storage site may be used to store waste materials from structures at adjacent projects provided that transport of waste over roads open to the public is not required and that the materials shall be labeled and stored separately. If a centralized storage location is used, suitable security fencing shall be installed around the perimeter of the centralized storage area to prevent unauthorized access. The Contractor shall establish this site, with Department approval, prior to beginning any coating removal.

The site for the temporary storage of the waste material shall be approved by the Engineer and shall not be located within a flood plain or drainage area or where water will pond. Containers of waste material shall have tops secured and be covered with waterproof coverings, and the site shall be secured. If such a site is not available immediately adjacent to the structure, an alternate location on state property shall be used as approved by the Engineer and shall be submitted as a requested amendment to the Environmental Protection Plan. The Contractor shall be responsible to ensure that any over-the-road transport of hazardous waste complies with all local, state, or federal permitting, licensing, manifesting, and/or fee requirements.

(d) **Disposal:**

1. Solid waste material from a Type A structure or waste from a Type B structure that is determined by the Department not to be a hazardous waste shall be disposed of in a sanitary landfill Resource Conservation and Recovery Act (RCRA) Subtitle D or licensed industrial landfill that has a permit from the Virginia Department of Environmental Quality or an equivalent state or federal agency for out-of-state disposal facilities. The Contractor shall identify the landfill used by name, address, and permit number and shall certify that the waste material was properly disposed.

Comment [1339]: Right Way and Right Location

Comment [1340]: Right Way

Comment [1341]: Right documentation

Comment [1342]: Right Location and Right Way

Comment [1343]: Right Time

Comment [1344]: Right Way and Right Location

Comment [1345]: Right Way

Comment [1346]: Right Location

Comment [1347]: Right documentation

Trial Use and Comment

2. Liquid waste from Type A and Type B structures that is determined by the Department not to be a hazardous waste shall be legally disposed of in a publicly owned treatment works facility (POTW). The Contractor shall identify the POTW used by name, address, and permit number and shall certify that the waste material was properly disposed.

3. If waste material from a Type B structure is classified as hazardous, the Contractor shall obtain a provisional hazardous waste generator number from the Virginia Department of Environmental Quality in accordance with applicable federal and state regulations and shall legally store, pack, label, and ship such material by a transporter with an RCRA Hazardous Waste Transporter permit to a RCRA, Subtitle C, Treatment Storage and Disposal Facility (TSDF) for treatment and disposal. The Contractor shall prepare a hazardous waste shipping manifest(s) and provide it to the Engineer for signature. The Engineer's signature on the waste shipping manifest does not relieve the Contractor of his obligations as co-generator of the waste.

(e) **Certifications**: The Environmental Plan shall be implemented in accordance with the provisions contained therein; any deviations from the plan shall be separately approved by the Engineer. The individual providing the plan certification shall at a minimum be present during startup and removal operations to ensure that the plan is fully implemented. Within 1 week following completion of the lead-based paint activities, the Contractor shall submit for the Engineer's record a written certification by the SSPC QP-2 Supervisor/Competent Person or CIH, including notations of any areas of non-compliance and corrective actions taken, that all work has been completed in full compliance with all applicable regulations and requirements as set forth in these specifications and that the plans on record were fully implemented. The Contractor shall forward for the Engineer's record one copy of the Environmental Plan complete with all revisions and results from the air monitoring activities, including notations of any areas of non-compliance and corrective actions taken.

411.09—Health and Safety

In accordance with the requirements of Section 107, the Contractor shall protect the health and safety of the workers, the public, and the environment from leaded paint or hazardous material resulting from coating preparation (cleaning) removal operations, blast abrasive, rust, and overspray.

(a) **Plan:** The worker health and safety plan shall be in accordance with the requirements of the Virginia Occupational Safety and Health Administration, 29 CFR 1926.62 requirements and the applicable requirements of 29 CFR 1910.1025, and other applicable toxic metal standards, whichever is more restrictive.

Comment [1348]: Right Way

Comment [1349]: Right Way

Comment [1350]: Right documentation

Comment [1351]: Right Time

Comment [1352]: Right Time and Right Way

Comment [1353]: Right Way and right documentation

Comment [1354]: Right documentation

Trial Use and Comment

The worker health and safety plan shall be approved by a CIH currently certified by the American Board of Industrial Hygiene or by an SSPC QP-2 Supervisor/Competent Person.

These plans shall not be submitted to the Engineer for approval but shall be submitted for the Engineer's review and record. After project award but not less than 3 weeks prior to commencing operations, the worker health and safety plan shall be submitted to the Engineer.

Within 2 weeks of receipt, the Engineer will review the submitted plan for completeness. Should deficiencies in the plan exist, the plan will be returned to the Contractor for incorporation of revisions as noted by the Engineer. The Contractor shall make such revisions and submit completed plans for the Engineer's record prior to commencing operations. In no case shall the Contractor begin work prior to the Engineer's receipt and review of a satisfactorily completed plan.

(b) **Monitoring:** The CIH or SSPC QP-2 Supervisor/Competent Person providing plan approval or a qualified designated representative shall be present during startup, during surface preparation periods, and as needed during removal operations throughout the duration of the project to ensure the provisions of the worker safety and health plans are properly implemented.

(c) **Certification:** At completion of the project, the CIH or SSPC QP-2 Supervisor/Competent Person shall submit a written statement of certification for the Engineer's record, complete with all revisions including notations of any areas of non-compliance and corrective actions taken, that the worker health plans fully complied with all regulations and that the plans were fully implemented.

411.10—Measurement and Payment

Coating of new metal on structures will not be measured for separate payment but shall be included in the price for structural steel or metal items. When a pay item, coating of new metal in or on structures will be paid for at the contract lump sum price per structure.

Prepare and spot coat existing structure, when a pay item, will be measured in square feet of surface area and will be paid for at the contract unit price per square foot.

Prepare and overcoat existing structure, when a pay item, will be paid for at the contract lump sum price per structure.

Recoat existing structure, when a pay item, will be paid for at the contract lump sum price per structure.

Comment [1355]: Right Way

Comment [1356]: Right Way

Comment [1357]: Right Time

Comment [1358]: Right Time

Comment [1359]: Right Way

Comment [1360]: Right Way and Right Time

Comment [1361]: Right Way

Comment [1362]: Right Time

Comment [1363]: Right Time and right documentation

Comment [1364]: Right payment

Trial Use and Comment

Zone coating of existing structure, when a pay item, will be paid for at the contract lump sum price per structure.

These prices shall include washing, surface preparation, and applying protective coating.

Environmental protection and health and safety will be paid for at the contract lump sum price per structure. This price shall include containment operation, regulation compliance, environmental protection plan preparation and approval, worker health and safety plan preparation and approval, providing CIH and SSPC QP-2 Supervisor/Competent Person monitoring services, worker protection, and all other related costs.

Disposal of material will be paid for at the contract lump sum price per structure. This price shall include transporting, storing, and disposal. No payment will be made for this item until the Contractor provides the signed return manifests from the disposal facility(s).

Payment will be made under:

Pay Item	Pay Unit
Coating of new metal on structures (B or Str. No.)	Lump sum
Prepare and spot coat existing structure (B or Str. No. and type)	Square foot
Zone coating of existing structure (B or Str. No. and type)	Lump sum
Prepare and overcoat existing structure (B or Str. No. and type)	Lump sum
Recoat existing structure (B or Str. No. and type)	Lump sum
Environmental protection and health and safety (B or Str. No.)	Lump sum
Disposal of material (B or Str. No. and type)	Lump sum

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III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:
Review specification requirements, material documentation, construction procedures, measurement and payment.

Start:
Review environmental plan, health and safety plan, and containment certification. Verify daily record and mapping format.

Continuous inspection:
Continuous visual inspections of containment structures, dust collector, and abrasive recycling equipment to detect and control any emissions into the unconfined air space. Monitor waste disposal sites. Monitor removal and surface preparation operations, and monitor and test the application of protective coatings.

Final Inspection:
Final inspection of field coatings, receipt of daily records and mapping, receipt of final environmental plan certification with air monitoring results, receipt of final health and safety certification, and application of the coating system(s) legend on the structure.

Documentation Required: Source of Materials (Form C-25), Invoices, site specific Environmental Plan, Worker Health and Safety Plan, Containment certification, Daily record and mapping, and hazardous waste shipping manifest.

IV. REVIEW QUESTION

Spec. Ref.	
411.03(a)	Has the contractor submitted proof of certification in accordance with this section prior to commencing coating application, as needed?
411.03(b)	Has the contractor provided evidence of certification to perform coating removal from Type B structures in accordance with this section?
411.03(C)	Has the contractor provided certification by a Professional Engineer, if required, in accordance with this section?
411.04(a)1	Were all surfaces prepared in accordance with this section prior to coating application?
411.04(a)2	Has the contractor collected and contained all solid and liquid waste during surface preparation in accordance with this section?
411.04(b)02	Was the coating application not done when weather conditions are as noted in this section unless recommended by the manufacturer

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	and approved by the Engineer?
411.04(b)03	Does the application of the coating result in a tight film of specified thickness that is well bonded to metal or underlying coatings, including crevices and corners?
411.04(b)04	Is the application free from laps, streaks, sags, runs, overspray, dry spray, shadow through, skips, excessive film build-up, mud cracking, misses, and other defects?
411.04(b)05	Were all deficient, impaired, or damaged areas of each coat repaired using material from the Department's approved systems list?
411.04(b)06	Were preceding coats dried or cured and approved by the Engineer prior to application of subsequent coats?
411.04(b)07	Were coatings applied in accordance with the requirements of Table IV-6?
411.04(b)08	Were the coatings mixed in accordance with the manufacturer's recommendations?
411.04(b)09	Were zinc-rich coatings applied from containers equipped with a mechanical agitator kept in motion throughout the application period unless otherwise specified by the manufacturer?
411.04(b)10	Was thinning of the coatings performed in accordance with this section?
411.04(c1)	Did the Inspector determine the dry film thickness of paint coats through the use of a Tooke gage or magnetic gage?
411.04(d)1	Has the contractor maintained a daily record of coating removal or application as required in this section?
411.04(d)2	Has the Engineer approved the contractor's daily record and mapping format prior to commencement of work as required in this section?
411.04(d)3	Has the contractor stenciled a legend as required at a location approved by the Engineer?
411.05(a)	When located within 5 feet of a deck joint on existing structures, were all uncoated weathering steel items including the entire outside surface of fascia girders and beams, thoroughly cleaned no less than 6 inches outside the area to be coated, and coated with System B?
411.05(b)	Were all remaining coatings in existing structures prepared and coated in accordance with the requirements of this section?
411.06(a)	When located within 5` of a deck joint on new structures, were all uncoated weathering steel items including the entire outside surface of fascia girders and beams, thoroughly cleaned no less than 6 inches outside the coated area and and painted with System B?
411.06(b)1	Was the field application of coatings performed only after concrete work was completed and forms removed?
411.06(b)2[25001302]	Were surfaces to be field coated cleaned according to Method 7 as specified?

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411.06(b)3	Were all uncoated surfaces and deficient or damaged areas cleaned in accordance with requirements of the coating manufacturer and primed with a touch up primer from System B?
411.06(b)4	After installation and approval by the Engineer, were galvanized bolts or bolts protected with approved coatings cleaned and coated in accordance with this section?
411.06(b)5	Were surfaces that will be inaccessible after assembly and erection coated prior to assembly?
411.07(a)	Were existing uncoated galvanized surfaces cleaned in accordance with the requirements of this section the coated with a coating system from the Department's approved list?
411.07(b)	Were new galvanized surfaces cleaned in accordance with recommendations of the coating manufacturer and coated with a coating system from the Department's approved list?
411.08(a)1	Prior to beginning painting operations, did the Contractor submit to the Engineer and have reviewed for completeness a detailed site specific environmental plan conforming to the requirements of this section?
411.08(a)2	Has the Engineer notified the contractor that the site-specific environmental plan contains all the necessary elements stated in this section?
411.08(b)	Has the contractor performed air monitoring and submitted analysis to the Engineer as specified in this section?
411.08(c)1	Was material from Type A & B structures stored and disposed of according to the requirements of this section?
411.08(c)2	Has the Engineer approved the site for temporary storage of waste material in accordance with provisions of this section?
411.08(d1,2)	Has the contractor certified that all non-hazardous solid and liquid waste materials from Type A and B structures have been disposed of in accordance with this section?
411.08(d3)	Has the contractor disposed of material from a Type B structure classified as hazardous and executed proper documents as required by the section?
411.08(e)1	During the startup and removal portions of paint removal operations, is the Contractor's Certified Industrial Hygienist (CIH), SSPC Supervisor (as identified in the Environmental Plan) present on site?
411.08(e)2	Has the contractor provided certification as specified in this section within one week of completing lead based paint activities?
411.09(a)1	Did the Contractor submit to the Engineer a detailed site-specific worker health and safety plan approved by a CIH or SSPC QP-2 Supervisor/Competent Person conforming to the requirements of this section at least 3 weeks prior to commencing operations?
411.09(b)	Has the monitoring of the contractor's operations been performed for worker health and safety and environmental plans in

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	accordance with this section?
411.09(C)	Has the CIH or SSPC QP-2 Supervisor/Competent Person provided written certification at the completion of the project as required in this section?
411.09(a)2	Has the contractor's worker health and safety plan been reviewed for completeness prior to beginning of work within 2 weeks of receipt?
411.03(b)2	Has the Contractor implemented required environmental protections when project work involves the removal of greater than 100 square feet of coating from a Type B structure?
	Did the Contractor submit proof of the required certification prior to beginning work? If a containment structure was erected, was the structure certified by a Professional Engineer licensed in the Commonwealth of Virginia? Are all surfaces prepared as specified? Did the Contractor contain all solid and liquid waste during surface preparation? Is the coating operation done in accordance with Section 411? Are all surfaces dry prior to coating operations? Has the coating material been tested and approved? Is the coating applied at the specified thickness? Are preceding coats dried or cured and approved by the Engineer prior to subsequent coats being applied? Does the Contractor maintain daily records as specified? Is waste material stored and disposed of as specified? Did the Contractor submit the required worker health and safety plan? Did the Contractor submit the required compliance certification at the end of the operation?

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V. CRITICAL INSPECTION POINTS

• Environmental and Health and Safety Plan reviews complete, daily record and mapping format, and disposal site approvals.
• Surface preparation inspection and disposal of waste.
• Coatings inspection.
• Final record keeping submittals.

Trial Use and Comment

SECTION 412 – WIDENING, REPAIRING, AND RECONSTRUCTING EXISTING STRUCTURES

I. INTRODUCTION:

On a regular basis, bridges are repaired and reconstructed to prolong the life of the structure and widened to meet current needs and requirements. There are various types of repairs that can be made to the substructure and superstructure

PROCEDURES

General

Concrete structures are repaired by removing and replacing deteriorated concrete, thoroughly cleaning concrete and reinforcing steel to remain, and replacing reinforcing steel if necessary. Specific details associated with each activity associated with the widening and repair of existing structures is included in Section 412 of the specifications with modifications, adjustments or changes as noted in the special provisions of the specific contract.

a) Forms:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

412.01—Description

The Department will specify whether latex hydraulic cement concrete or silica fume hydraulic cement concrete will be used on bridge deck in the widening, repairing, or reconstruction of existing structures. The specific overlay deck material and the depth of the overlay will be shown in the contract documents.

412.02—Materials

(a) **Epoxy and mineral fillers** shall conform to the requirements of Section 243. Epoxy for epoxy mortar shall be Type EP-5. Epoxy used for crack repair shall be Type EP-4 or EP-5, low viscosity.

(b) **Hydraulic cement concrete and latex hydraulic cement concrete** shall conform to the requirements of Section 217, except that the coarse aggregate

Trial Use and Comment

shall be size No. 7, No. 8, or No. 78 for depths and steel clearances less than 2 inches and shall be size No. 57, No. 7, No. 8, or No. 78 for depths more than 2 inches. The inclusion of fly ash or slag will not be permitted in concrete mixes used in bridge deck overlays or deck patching operations. An approved accelerator may be permitted when justified by traffic conditions.

(c) **Reinforcing steel** shall conform to the requirements of Section 406.

(d) **Accelerators** shall be noncorrosive and shall be approved by the Engineer.

(e) **Materials for shotcrete** shall be as follows:

1. Portland and blended cements shall conform to the requirements of Section 214.

2. Fly ash, slag, and silica fume shall conform to the requirements of Section 215.

3. Water shall conform to the requirements of Section 216.

4. Air-entraining admixtures shall conform to the requirements of Section 215.

5. High-range and regular water reducers shall conform to the requirements of Section 215.

6. Accelerators shall conform to the requirements of Section 215 but may be used only if approved by the Engineer. If used, they shall be added at the nozzle.

7. Fine aggregates shall conform to the requirements of Section 202 for Grading A. Coarse aggregates shall conform to the requirements of Section 203 for size No. 8.

8. Steel fibers shall have a minimum length of ¾ inch and a diameter between 0.015 and 0.025 inch. They shall have bent or deformed ends or be continuously deformed throughout.

9. Synthetic fibers shall have a minimum length of ¾ inch and shall have demonstrated long-term resistance to deterioration in concrete.

(f) **Welded wire fabric** shall conform to the requirements of Section 223 and shall be galvanized or epoxy coated.

(g) Expansion bolts shall conform to the requirements of **Section 226.02(d).**

412.03—Procedures

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Repairing concrete structures shall consist of removing and replacing deteriorated material, thoroughly cleaning exposed concrete surfaces and reinforcing steel, and replacing reinforcing steel. Cleaning shall be performed by sandblasting, waterblasting, or other approved methods to remove concrete, rust, oil, and other foreign materials detrimental to achieving a bond. The area and depth of repairs shall be as directed by the Engineer.

Comment [1365]: Right Way

Dimensions of existing structures shown on the plans are approximate, and those that are pertinent to the construction of the new portion shall be verified in the field by the Contractor. Where details of new portions of the structure shown on the plans are not adaptable to the shape of the existing structure, practical modifications may be made during construction with the approval of the Engineer provided neither the existing nor the new portions are impaired in structural strength.

Areas to be repaired shall be outlined with saw cuts to a depth of at least 1 inch or to a depth that will clear the top of the reinforcing steel.

Comment [1366]: Right Way

Loose and unsound materials shall be removed by the use of hand tools or pneumatic hammers weighing 30 pounds or less. Pneumatic hammers shall be worked at an angle of 45 to 60 degrees to the plane of the concrete surface being removed. The surface shall be sounded with a masonry hammer to determine the relative concrete strength.

Comment [1367]: Right Way

When reinforcing bars are exposed, the exposed length shall be cleaned. Epoxy-coated steel shall not be cleaned by sandblasting. Damaged epoxy coating shall be repaired in accordance with the requirements of Section 243. Care shall be taken to prevent striking reinforcing bars with hammer points. Reinforcing steel that has lost 1/4 or more of its original cross-sectional area shall be lapped with new bars of the same size and shape. New bars shall lap existing bars a length of 30 diameters on each side of the damaged portion if a sufficient length of the existing bar is exposed. Otherwise, new bars shall be welded with a 6-inch arc-welded lap on each side of the damaged portion with a double-flare V-groove weld in accordance with the requirements of Section 407 or mechanically connected in accordance with the requirements of Section 406.

Comment [1368]: Right Way

Dust and debris shall be removed by blowing with compressed air or hosing with water. A fine spray of moisture shall be applied to the surface to outline, as it evaporates, loose fragments that are locked in place. Just prior to placement of repair material, the surface shall be cleaned.

Comment [1369]: Right Time

Unsupported areas shall be supported with forms.

Excess material and debris resulting from repairs shall be removed and disposed of in an approved disposal area in accordance with the requirements of Section 106.04.

Wherever concrete is placed against existing concrete, dowels at least 3/4 inch in diameter shall be placed at no more than 2 feet 6 inches center to center over the entire jointing surface and 6 to 12 inches from the edge. Dowels shall be placed perpendicular to the

Trial Use and Comment

surface of existing concrete by drilling and grouting and shall project into both new concrete and existing concrete to a depth as great as the thickness of the concrete will allow but need not project more than 9 inches.

For footings and neat work of substructures where joining planes are vertical, 3/4-inch headed expansion bolts shall be used instead of dowels. Bolts shall project at least 9 inches into new concrete and shall extend sufficiently far into existing concrete to develop their rated pullout strength but not less than 6 inches. When drilling holes for expansion bolts, care shall be taken so that existing reinforcing steel is not damaged.

Where necessary to prevent featheredges, existing concrete shall be removed to ensure a thickness for new concrete of at least 6 inches.

Concrete shall be constructed in accordance with the requirements of Section 404 except that surfaces shall be finished to match the existing adjacent surfaces. Superstructure concrete shall be Class A4, and substructure concrete shall be Class A3.

(a) **Bridge Superstructure Repairs:**

1. **Type A milling** shall consist of milling the surface of the bridge deck and concrete approaches to a depth of 1/2 inch.

   Equipment shall be capable of removing material to the required depth while maintaining a reasonably uniform surface without damaging adjacent areas or the remaining material. Milling equipment shall be capable of removing at least 1/2 inch of existing material per pass. Power-driven hand tools for removing unsound concrete around reinforcing steel and in confined areas shall be required.

2. **Type A patching** shall consist of repairing the deck from the existing deck surface or milled surface to a depth that will not expose reinforcing steel.

3. **Type B patching** shall consist of repairing the deck from the existing deck surface or milled surface to a depth at least 1 inch below the top mat of reinforcing steel.

4. **Type C patching** shall consist of repairing the deck from the existing deck surface or milled surface to its full depth. Forms may be suspended from reinforcing steel by wire ties for areas of less than 3 square feet. In the case of larger area openings, forms shall be supported by blocking. Sound concrete shall be removed to obtain a somewhat vertically shaped surface at the edges of the patch.

5. **Epoxy-mortar patching** shall be performed in accordance with the requirements for Type A patching and to a depth up to and including 3/4 inch. Proportions of sand and epoxy shall be approved by the Engineer. Surface areas to be patched shall be

Comment [1370]: Right Location

Comment [1371]: Right Way

Comment [1372]: Right documentation

Comment [1373]: Right Time

Trial Use and Comment

dry and primed with neat epoxy just prior to mortar placement. Mortar may be troweled in place to featheredges. The patched surface shall be sprinkled with sand before the epoxy sets or sandblasted just prior to placement of the seal to ensure bonding. When epoxy mortar is to be the finished riding surface, patches exceeding 8 feet in a longitudinal direction shall be tested in that direction in accordance with the requirements of Section 404.04.

6. **Crack repairs** shall be performed as follows: Structural cracks and dormant cracks shall be V-grooved to a depth of approximately 1/2 inch and blown clean. The groove shall be filled with neat epoxy. At the Contractor's option, latex concrete may be brushed into the groove in lieu of epoxy when latex concrete is monolithically placed for Type A, B, or C patching or joint repairs.

7. **Concrete superstructure surface repair** shall include repairing raised medians, median barriers, beams, diaphragms, parapets, posts, rails, curbs, and sidewalks. Superstructure surface repair shall be performed in accordance with the requirements for Type B patching.

   When the thickness of the surface repair is 2 inches or more, 2 x 2-W1.4 x W1.4 welded wire fabric shall be used. The fabric shall be tied to reinforcing steel where possible. If reinforcing steel is not exposed or if the steel has a spacing greater than 1 foot 6 inches, expansion bolts 3/8 inch in diameter shall be placed and the fabric tied to the bolts. The expansion bolts shall be spaced not more than 1 foot 6 inches apart and shall be embedded at least 2 inches into the concrete. The minimum thickness of Class A and Class B shotcrete over reinforcing steel, including expansion bolts and welded wire fabrics, shall be 2 inches except in transition areas where shotcrete is feathered to existing concrete with less than 2 inches of cover or where patches are made on existing concrete with less than 2 inches of cover. Where shotcrete containing silica fume is used, the minimum cover over reinforcing steel shall be 1 1/2 inches.

8. **Joint opening repairs** shall be performed as follows: Expansion joint removal shall consist of removing and disposing of concrete, repairing and replacing reinforcing steel, and cleaning exposed surfaces.

   Expansion joint reconstruction shall consist of removing and disposing of concrete, repairing and replacing reinforcing steel, cleaning exposed surfaces, and recasting the joint to the limits detailed with hydraulic cement concrete.

   When not included in other joint repairs, saw cutting of the joint shall consist of saw cutting concrete to the limits detailed.

9. **Joint resealing of existing joints** shall be performed in accordance with the requirements of Section 316 unless otherwise specified on the plans.

Trial Use and Comment

(b) **Bridge Deck Overlay Repairs:** Overlays shall not be placed until deck repair concrete has attained 93 percent of the minimum design compressive strength. Vehicular traffic will not be permitted on the bridge until the overlay has attained a compressive strength of 3,500 pounds per square inch.

Expansion joints and dams shall be maintained through the overlay. A bulkhead equal in thickness to the width of the joint shall be installed to the required grade and profile prior to concrete placement.

A construction dam or bulkhead shall be installed in the case of a major delay in placement operations. During minor delays of 1 hour or less, the end of the placement shall be protected from drying.

1. **Latex or Silica Fume:** Within 24 hours immediately preceding the beginning of the overlay operations, the entire surface to be overlaid and the edge of previously placed overlay shall be thoroughly cleaned. This shall include the widened portion of bridge decks that are specified to be overlaid with latex or silica fume concrete.

For at least 1 hour prior to placement of overlay concrete, the surface shall be continuously and thoroughly water soaked. Puddles of standing water shall be removed before the overlay is placed.

The overlay shall be placed only when the ambient air temperature is 50 degrees F and rising. At temperatures above 85 degrees F, the Engineer may require placement to be made at night or during early morning hours if a satisfactory surface finish is not achieved.

Mixers for latex hydraulic cement concrete shall be batch mixers or automatic mobile continuous mixers conforming to the requirements of Section 217. The mixing capacity shall be such that placing and finishing operations can proceed at a uniform rate, with final finishing completed before formation of the plastic surface film. A yield test shall be performed by the Contractor prior to deck placement for each mixing unit, when each unit is moved from the job site for recharging, when the source of stockpiled materials is changed and when there is reason to believe that the calibration may be erroneous. Mixers for silica fume concrete shall be truck mixers conforming to the requirements of Section 217. The amount mixed shall be such that the placing and finishing operations can proceed at a uniform rate. The latex concrete shall be uniform in composition and consistency when discharged from the mixer.

The overlay shall have a thickness of at least 1¼ inches of latex or silica fume hydraulic cement concrete. At the Contractor's option, latex or silica fume concrete may be used in lieu of hydraulic cement concrete as required for Type A, B, or C patching or joint and crack repairs, and such material shall be placed monolithically with the overlay.

Prior to placement of the overlay, a portion of the latex or silica fume concrete shall be brushed onto the prepared surface. Care shall be taken to ensure that both vertical and horizontal surfaces receive a thorough even coating and that the rate of progress is limited

Comment [1374]: Right Time

Comment [1375]: Right Time

Comment [1376]: Right quantity

Comment [1377]: Right Time

Comment [1378]: Right Time

Trial Use and Comment

so that the brushed material does not become dry before it is covered with additional material and brought to final grade. Excess coarse aggregate remaining after brushing shall be removed.

If the rate of evaporation of surface moisture from the latex-modified or the silica fume concrete exceeds 0.05 pound per square foot per hour during placement, measures shall be taken to reduce the rate of evaporation. One effective method is to increase the relative humidity near the surface by fogging.

The surface shall be protected from drying or cracking by prompt application of wet burlap. Care shall be taken to ensure that the burlap is well drained and that it is placed as soon as the surface will support it without deformation. The burlap and surface of the concrete shall be maintained in a continuously moist condition during the initial curing period. For the latex concrete, the initial moist curing period shall be 48 hours, unless otherwise specified, followed by an additional 48 hours of air curing before opening to traffic. For the silica fume concrete, the initial moist curing period shall be 72 hours, unless otherwise specified, followed by the immediate application of a liquid membrane-forming curing compound conforming to the requirements of Section 220. The curing compound shall be completely dry before opening the overlay to traffic.

2. **Polymer:** Polymer overlays shall be placed in accordance with the applicable special provisions.

(c) **Removing Asphalt Concrete Overlay:** Removal of the asphalt wearing surface from bridge decks and approach slabs shall be performed in a manner such that underlying sound concrete can be prepared to receive necessary treatment. The asphalt material shall be disposed of in an approved manner. Sound concrete damaged as a result of the Contractor's operations shall be repaired in accordance with the requirements of (a) herein at the Contractor's expense. Fuel oils or other materials that will prevent subsequent treatments from bonding to remaining concrete shall not be used.

(d) **Bridge Substructure Repairs:** Concrete substructure surface repair shall include repairing piers, wing blocks, and abutments. Substructure surface repair shall be performed in accordance with the requirements for Type B patching. Removal of concrete shall be to a depth as specified on the plans or as directed by the Engineer. Welded wire fabric shall be installed in accordance with the requirements of (a)7. herein.

(e) **Blocking and Jacking Beams:** The Contractor shall submit to the Engineer for approval his method of jacking and blocking beams to repair beam seats. Unless approved by the Engineer in writing, structures supported on jacks shall not be subjected to traffic loadings.

Comment [1379]: Right Time, Right Way

Comment [1380]: Right Way

Comment [1381]: Right documentation

Trial Use and Comment

(f) **Shotcrete:** When specified for repairs or approved in lieu of hydraulic cement concrete, shotcrete repairs shall be performed in accordance with the requirements of (a)7 and (d) herein.

1. **Classes of Shotcrete and Mixture Proportions:** Two classes of shotcrete are established. The minimum amount of cementitious material shall be 658 pounds per cubic yard for Class A and 635 pounds per cubic yard for Class B. The classes are as follows:

   a. **Class A:** Class A shotcrete shall be reinforced by either steel or synthetic fibers as specified on the plans and shall have a minimum compressive strength at 28 days of 5,000 pounds per square inch. When steel fibers are used, the minimum fiber content shall be 60 pounds per cubic yard. When synthetic fibers are used, the minimum fiber content shall be 6¾ pounds per cubic yard. Shotcrete shall also contain silica fume at a minimum of 7 percent by mass of the cementitious material. Use of fly ash (maximum 20 percent by mass of the cementitious material) or slag (maximum 50 percent by mass of the cementitious material) will be permitted. The minimum thickness of Class A shotcrete cover over reinforcing steel shall be 2 inches except in transition areas where shotcrete is feathered to existing concrete with less than 2 inches of cover or where patches are made on existing concrete with less than 2 inches of cover over reinforcing steel.

   b. **Class B:** Class B shotcrete shall have a minimum 28-day compressive strength of 4,000 pounds per square inch. The cementitious material shall be either all portland cement; portland cement and fly ash (maximum 20 percent by mass of the cementitious material); portland cement and slag (maximum 50 percent by mass of the cementitious material); or portland cement and silica fume (minimum 7 percent t materialby mass of the cementitious material). The minimum thickness of Class B shotcrete cover over reinforcing steel shall be 2 inches except in transition areas where shotcrete is feathered to existing concrete with less than 2 inches of cover or where patches are made on existing concrete with less than 2 inches of cover over reinforcing steel. Where shotcrete containing silica fume is used, the minimum cover over reinforcing steel shall be 1½ inches.

   The Contractor shall submit for the Engineer's approval shotcrete mixture proportions and performance test data for each class of shotcrete based on the materials to be used in the project. If appropriate recent test data do not exist, the Contractor shall prepare trial mixtures and submit the test results as obtained from tests specified in Section 412.03(f)7.
   Wet Process: Shotcrete subject to freezing and thawing shall have an air content of 7.0 percent ± 1.5 percent as delivered to the job site. The materials for wet process shotcrete shall be mixed in accordance with the requirements of Section 217 and applied within 90 minutes after batching.

Comment [1382]: Right material

Comment [1383]: Right material

Comment [1384]: Right documentation

Trial Use and Comment

Dry Process: Solid ingredients for dry-mix shotcrete shall be predampened as needed and mixed in a batch type or continuous mixer. Most of the mixing water shall be added at the nozzle. Dry-mix shotcrete material shall be applied within 45 minutes after batching or predampening.

2. **Equipment and Personnel:**

   a. **Equipment:** Shotcrete delivery equipment shall be approved by the Engineer before the commencement of the work. It shall be capable of discharging the shotcrete mixture in a continuously smooth stream of uniformly mixed ingredients. Air added at the nozzle shall be free from oil or other contaminants, and the air pressure shall be capable of maintaining sufficient nozzle velocity to all parts of the work.

   b. **Personnel:** Nozzlemen with at least 100 hours of recent similar shotcrete application experience and supervisors with at least 3 years of recent similar shotcreting experience who can provide references showing satisfactory performance on at least three similar jobs may be approved as being qualified without gunning prequalifying panels.

   When proposed nozzlemen do not have the required experience or when the Engineer deems the work to be done of a sufficiently critical nature to require prequalifying tests for nozzlemen, approval will be based on test panels as described herein prior to the commencement of the work. The Engineer will observe the gunning of such test panels and judge the qualifications of the nozzleman on the basis of the texture, uniformity of work, and adequacy of the encasement of shotcrete around the reinforcement.

3. **Surface Preparation:**

   a. The perimeter of all areas where concrete is removed shall be tapered at approximately a 45-degree angle except that the outer edges of all areas removed by chipping shall be saw cut perpendicular to the surface to a minimum depth of 1/2 inch to prevent featheredging unless otherwise approved by the Engineer.

   b. Earth surfaces shall be trimmed to line and grade and shall have adequate support to prevent displacement during shotcrete placement. Shotcrete shall not be placed on an earth surface that is frozen, spongy, or subject to free running water at the time of the application of shotcrete. Active seeps, drips, and flowing water shall be controlled by installation of suitable drain systems such that water pressure does not build behind shotcrete linings. The Contractor shall prevent excessive loss of mixing water from the shotcrete. This shall be accomplished by one of the following procedures:

      (1) Wet the soil prior to the time of gunning to the extent that it is damp but with no visible free water on the surface. Puddling, ponding, or freestanding water shall be eliminated from areas to be shotcreted.

Comment [1385]: Right documentation

Comment [1386]: Right Way

Trial Use and Comment

(2) As an alternative or when specified, install a moisture barrier system to inhibit the movement of moisture from the newly placed shotcrete into the earth. Wrinkling and folding of moisture barrier shall not be permitted.

c. Rock surfaces shall be free of loose material, debris, chips, mud, dirt, and other foreign matter. Surfaces shall be damp at the time of gunning, but puddling, ponding, or freestanding water shall not be permitted.

d. Wood forms that are to be removed after use shall have a form release agent applied to prevent the absorption of moisture and inhibit the bond between shotcrete and the form.

4. **Application:**

a. When applied, shotcrete shall have a temperature of at least 50 degrees F but not more than 85 degrees F. The ambient and surface temperature shall be 50 degrees F and rising. At ambient air temperatures above 85 degrees F, the Engineer may require placement to be made at night or during early morning hours.

Comment [1387]: Right Time

b. Shotcrete to be applied to uneven and previously repaired surfaces shall first be applied to any deep hole, deeply excavated sections, corners, or areas where rebound cannot escape or be blown free. The thickness of the shotcrete layer shall be such that no sloughing, sagging, tearing, or debonding will occur. Existing concrete shall be sandblasted within 24 hours of application, and the surface shall be damp just prior to application.

c. Where a layer of shotcrete is to be covered by a succeeding layer, it shall be first allowed to develop its initial set. Then, loose, uneven, or excess material, glaze and rebound shall be removed by brooming, scraping, or other means. Any surface deposits that take a final set shall be removed by sandblasting, and the surface cleaned with an air-water blast from the nozzle. Curing compounds shall not be applied to surfaces that will be covered by an additional layer of shotcrete.

Comment [1388]: Right Way

d. Shooting wires, ground wires, or other devices acceptable to the Engineer shall be used to control the line, grade, and thickness of the shotcrete.

e. During the shotcrete application, the nozzle shall be held perpendicular to and, when possible, 3 to 5 feet away from the receiving surface and rotated steadily in series of small oval or circular patterns. Whenever possible, sections shall be gunned in one layer to the full design thickness. However, for multiple layers of reinforcement, gunning of one layer of shotcrete may be required for each layer of reinforcement.

f. When encasing reinforcement, the nozzle shall be held closer than normal and at a slight upward angle. The mixture may be wetter than normal but not so wet that sloughing behind the reinforcement will occur.

Trial Use and Comment

g. Vertical surfaces shall be gunned starting at the bottom. Rebound or previously expended material shall not be incorporated in the applied layer, and all such material shall be removed from the surface and work area prior to final set and before placement of shotcrete on adjacent surfaces. Shotcrete shall not be placed if drying or stiffening of the mixture is occurring.

5. **Finishing:** Prior to the initial set, the shotcrete surface shall be scraped or cut with a trowel or metal template to obtain an even and aesthetically acceptable appearance. The final finishing shall be with a wet sponge unless otherwise specified. Trowel or float smoothing will not be allowed.

Comment [1389]: Right Time

6. **Curing:** After gunning, the surfaces of shotcrete shall be protected from drying or cracking. When necessary, fogging shall be used prior to the application of moist curing or a curing compound. Shotcrete shall be moist cured for a period of at least 7 days or cured using a curing compound conforming to the requirements of Section 220. The rate of application shall be not less than 1 gallon of curing compound per 100 square feet of surface. The color of the curing compound shall be approximately that of the existing concrete.

7. **Quality Assurance and Testing:**

a. Preconstruction testing may be waived by the Engineer if it can be shown that the crew to be used is qualified and that the mixture has been successfully used in similar work.

Comment [1390]: Right Way

Test panels 24 inches by 24 inches by 4 inches deep containing steel reinforcement representative of that to be used on the project shall be prepared. Each crew shall gun two test panels with the mix design to be used on the project and for each gunning orientation to be encountered on the job. Panels shall be cured in the field in the same manner as the structure for 1 day and transported to the laboratory, where curing shall be continued until the time of testing. For shotcrete jobs of less than 200 square feet, the Contractor shall cut one of the test panels with a trowel or a metal template before the initial set in the presence of the Engineer to check visually for possible voids under the reinforcement. For larger jobs where specific evidence of good encasement of reinforcing bars is needed, the Contractor shall cut cores from the test panels after the concrete has hardened for at least 3 days. Cores shall be cut through the steel.

The second panels for all jobs shall be used to determine the compressive strength of the applied shotcrete. Cores shall be 2 inches to 4 inches in diameter and shall be taken between the reinforcement. The cores will be tested by the Department at the specified age in accordance with the requirements of ASTM C42.

b. In-place shotcrete shall be of uniform quality and free from segregation, honeycombing, sand pockets, sand lenses, sagging, dry patches, overspray, rebound, or incomplete encasement of reinforcement. It shall also be free from delamination, cracking, or single voids with dimensions in excess of ¼ inch.

Trial Use and Comment

The Department reserves the right to test any section and reject shotcrete that does not conform to the specification requirements in terms of test values, soundings, and visual examination. The cost of any additional testing of disputed shotcrete that results in rejection shall be borne by the Contractor.

The Contractor shall remove and replace or correct defective shotcrete to the satisfaction of the Engineer.

c. For compressive strength tests, one test panel shall be prepared for each day's production or for each 200 square feet of shotcreting by each crew using the same ingredients and gunning orientation as the shotcrete applied to the job. These panels shall be cured and delivered to the designated testing laboratory as specified earlier in this section.

Test values on such panels shall equal or exceed the required 28-day strength requirements. Should failures occur, acceptance of the material will be determined by tests on cores from the applied work. A minimum of three cores shall be taken from the area in question. The average compressive strength of the cores taken from the work shall equal or exceed the specified strength for the class of shotcrete applied, and no single core shall have a strength less than 85 percent of the specified value. If deemed necessary by the Engineer, the adequacy of the bond between the existing concrete and the shotcrete shall be determined by pull-off tests in accordance with the requirements of ACI 503. A minimum bond strength of 250 pounds per square inch will be accepted as satisfactory. Bond failure at less than 250 pounds per square inch attributable to the failure of existing concrete will not be cause for rejection. The cost of up to three pull-off tests shall be the responsibility of the Contractor; additional pull-off tests will be the responsibility of the Department.

Comment [1391]: Right documentation

412.04—Measurement and Payment

Volumes outlined by the completed excavation, formwork, and surfaces of the existing concrete will be measured prior to concrete placement so that quantities can be accurately computed.

Comment [1392]: Right payment

Comment [1393]: Right Way

Hydraulic cement concrete for the class specified will be measured and paid for in accordance with the requirements of Section 404.

Type A milling will be measured and paid for in square yards for the depth specified.

Types A, B, and C patching and concrete substructure or superstructure surface repair will be measured in square yards of surface area and will be paid for at the contract unit price per square yard. This price shall include furnishing and placing concrete to fill the prepared areas.

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Epoxy-mortar patching will be measured in gallons of epoxy-mixed system used as a binder for mortar in place and for priming prior to application of epoxy mortar and will be paid for at the contract unit price per gallon.

Expansion joint removal, expansion joint reconstruction, and backwall reconstruction will be measured in linear feet and will be paid for at the contract unit price per linear foot. This price shall include furnishing and placing concrete to fill the prepared areas for expansion joint reconstruction and backwall reconstruction.

Saw cutting, when a pay item, will be measured in linear feet of concrete sawed and will be paid for at the contract unit price per linear foot.

Jacking and blocking of beams as required to complete beam seat repair, when a pay item, will be paid for on an each basis per beam end.

Latex hydraulic cement concrete will be measured and paid for at the contract unit price per square yard on a plan quantity basis. The price bid will be full compensation for producing the latex hydraulic cement concrete mix, delivering it to the job site, and placing it at the job site. This price shall also include handling, finishing, and curing the latex hydraulic cement concrete and all material, labor, tools, equipment, and incidentals necessary to complete the work. Latex hydraulic cement concrete shall be placed within the range of depth specified and verified by the Engineer prior to and during placement operations. The Engineer may direct additional depth of latex hydraulic cement concrete to address cross slope and other surface irregularities and rideability issues. Additional latex hydraulic cement concrete beyond the depth range of the pay item that is requested to address such issues at the direction of the Engineer will be compensated for in accordance with the provisions of Sections 104.02 and 109.05. Only those volumes of additional latex hydraulic cement concrete that are approved by the Engineer prior to or during the placement of the overlay will be considered for payment. Payment will be made for the actual cost only for furnishing the mixture to the job site.

Silica fume hydraulic cement concrete will be measured and paid for at the contract unit price per square yard on a plan quantity basis. The price bid will be full compensation for furnishing silica fume hydraulic cement concrete; placing, handling, finishing, and curing the silica fume hydraulic cement concrete; and for all material, labor, tools, equipment, and incidentals necessary to complete the work. Silica fume hydraulic cement concrete shall be placed within the range of depth specified and verified by the Engineer prior to and during placement operations. The Engineer may direct additional depth of silica fume hydraulic cement concrete to address cross slope and other surface irregularities and rideability issues. Additional silica fume hydraulic cement concrete beyond the depth range of the pay item that is requested to address such issues at the direction of the Engineer will be compensated for in accordance with the provisions of Sections 104.02 and 109.05. Only those volumes of additional silica fume hydraulic cement concrete that are approved by the Engineer prior to or during the

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placement of the overlay will be considered for payment. Payment will be made for the actual cost only for furnishing the mixture to the job site.

Crack repair will be measured in linear feet and will be paid for at the contract unit price per linear foot.

Removal of asphalt concrete overlay will be measured in square yards of surface area and will be paid for at the contract unit price per square yard.

Shotcrete, when specified as a pay item, will be measured in square feet of surface to which it is applied and will be paid for at the contract unit price per square foot or per cubic foot for the type specified.

These prices shall include cutting, drilling, hammering, and all other work involved in the complete removal and disposal of concrete and other materials necessary to provide for joining the new and old portions of the structure in accordance with the plans or as directed by the Engineer. The contract unit price shall also include dowels or other approved anchoring devices, disposing of surplus material, cleaning and repairing reinforcing steel, and welded wire fabric if necessary. If Class A shotcrete is used, the price shall also include steel or synthetic fibers.

Payment will be made under:

Pay Item	**Pay Unit**
Type A milling (Depth)	Square yard
Type A patching	Square yard
Type B patching	Square yard
Type C patching	Square yard
Epoxy-mortar patching	Gallon
Concrete substructure surface repair	Square yard
Concrete superstructure surface repair	Square yard
Expansion joint removal	Linear foot
Expansion joint reconstruction	Linear foot
Back wall reconstruction	Linear foot
Saw cutting	Linear foot
Jacking and blocking	Each
Latex hydraulic cement concrete (1 ¼ inches to 1 ¾ inches)	Square yard
Silica fume hydraulic cement concrete (1 ¼ inches to 1 ¾ inches)	Square yard
Crack repair	Linear foot
Removal of asphalt concrete overlay	Square yard
Pneumatically applied mortar	Square foot
Shotcrete (Class __)	Square foot or cubic foot

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- If necessary by use of new structural components, have shop drawings been submitted and approved?
- Have clear instruction been provided as to what party will be responsible for the sounding or checking the limits of the concrete to be removed?
- Has a plan for jacking and blocking of existing structures been prepared, submitted and approved?
- If traffic is be detoured during construction has proper notification been made to the affected users?
- Have provisions been made for the proper disposal of any debris created during removal?

Start:

- Are proper traffic control items in place and functioning as desired?
- Are the correct removal methods being utilized?
- Are the removed materials being handled and disposed of in accordance with approved methods?
- Is the existing reinforcing steel to remaining place being protected?

Continuous inspection:

- Are traffic control items functional and maintained?
- Are the patches and repairs areas being cleaned properly before placement of fresh concrete or shotcrete?
- Is the appropriate cure being applied correctly and timely?
- Are an adequate number of control sampoles being taken and properly handled?
- If additional reinforcing steel is required, is it being secured properly and placed in the correct location?
- Are the joints being formed at the width specified based on ambient temperature?

Final Inspection:

- Ensure all surfaces of new concrete are clean and smooth,
- A straight edge check of the riding surface has been completed on the new deck overlay.

Documentation Required:

- Concrete tickets and materials documentation
- Calculations for areas of each pay quantity utilized for the contract.

Trial Use and Comment

IV. REVIEW QUESTIONS

Spec. Ref.	
412.03(01)	Was cleaning performed by sandblasting, waterblasting, or other approved methods in order to remove concrete or other materials detrimental to achieving a bond?
412.03(02)	Were dimensions of existing structures pertinent to construction field-checked by the Contractor?
412.03(03)	Were plan details not adaptable to existing structures modified with approval of the Engineer?
412.03(04)	Were areas to be repaired outlined with saw cuts to a depth of at least 1 inch or that which will clear the top of reinforcing steel?
412.03(05)	Has all the loose and unsound material been removed using hand tools or pneumatic hammers weighing 30 pounds or less and worked at an angle of 45 to 60 degrees to the plane of the concrete surface being removed?
412.03(06)	Was the surface sounded with a masonry hammer to determine relative concrete strength?
412.03(07)	Have exposed reinforcing bars been cleaned, with sandblasting not done on epoxy coated steel?
412.03(08)	Have reinforcing bars that have lost 1/4 or more of their original cross-sectional area been repaired in accordance with this section?
412.03(09)	Was dust and debris removed by blowing with compressed air or by hosing with water?
412.03(10)	Were dowels or expansion bolts provided when joining new and existing concrete?
412.03(11)	Was concrete work done in accordance with the section 404 on Hydraulic Cement Concrete Operations except that surfaces were finished to match the existing adjacent surfaces?
412.03(a5)	Were epoxy mortar patches exceeding 8 feet in a longitudinal direction and intended for use as a finished riding surface tested according to the section 404.04 Bridge Deck Construction?
412.03(a6)	Have structural or dormant cracks been V-grooved to a depth of approximately 1/2 inch, blown clean, and filled with neat epoxy?
412.03(a7)1	Was superstructure surface repair performed in accordance with Type B patching?
412.03(a7)2	When concrete surface repairs are made, was a cover of at least 2 inches maintained over all reinforcing steel, expansion bolts, and welded wire fabric, except in transition areas, at patches less than 2" in depth over existing concrete?
412.03(b)1	Has the deck repair concrete attained 93% of the minimum design compressive strength before overlays are placed?
412.03(b)2	Was vehicular traffic not allowed on the bridge until the overlay obtained a compressive strength of 3,500 psi?
412.03(b)3	Have expansion joints and dams been maintained through the overlay by use of bulkheads equal in thickness to the width of the joint and installed to the required grade and profile?

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412.03(b)4	Was the end of the overlay placement protected from drying during delays of 1 hour or less?
412.03(b1)1	Within 24 hours immediately preceding the beginning of latex or silica fume concrete overlay, was the entire surface to be overlaid thoroughly cleaned?
412.03(b1)2	Was the surface to be overlaid continuously and thoroughly water soaked for at least 1 hour prior to overlay placement?
412.03(b1)3	Is overlay placed only when the ambient air temperature is 50 degrees F and rising?
412.03(b1)4	Prior to deck placement, did the Contractor perform a yield test for each mixing unit according to the requirements of this section?
412.03(b1)5	Was a thorough, even coating of latex concrete or silica fume brushed onto the prepared surface prior to overlay placement?
412.03(b1)6	Were measures taken to reduce the rate of evaporation if the rate exceeds 0.05 lb/sq ft/hr during placement?
412.03(b1)7	Was the latex concrete surface cured through prompt application of wet burlap, covered with polyethylene, and kept continuously moist for the initial 48 hour curing period, followed by 48 hours of air curing?
412.03(b1)8	Were silica fume concrete surfaces cured through prompt application of wet burlap kept continuously moist for the initial 72 hour curing period, followed immediately by the application of curing compound?
412.03(C)	Were the methods used to remove asphalt wearing surfaces from bridge decks and approach slabs of such nature as to promote bonding with subsequent treatments?
412.03(d)1	Was substructure surface repair performed in accordance with Type B patching?
412.03(d)2	Was concrete removed to a depth as specified on the plans or as directed by the Engineer?
412.03(e)1	Did the Contractor submit a method of jacking and blocking beams for seat repair for the Engineer's approval?
412.03(e)2	Was written approval obtained from the Engineer prior to subjecting structures supported on jacks to traffic loadings?
412.03(f1)1	Was the minimum thickness of Class A, Class B, or shotcrete containing silica fume as specified for cover over reinforcing steel?
412.03(f1)2	Did the Contractor submit for the Engineer's approval shotcrete mixture proportions and performance test data for each class of shotcrete based on the materials to be used in the project?
412.03(f2)1	Was shotcrete delivery equipment approved by the Engineer prior to commencement of the work?
412.03(f2)2	Was gunning of test panels required for approval of inexperienced nozzlemen or supervisors?
412.03(f3)	Were existing concrete, earth, rock, or wooden surfaces prepared as specified?
412.03(f4)	Did temperature requirements and application methods conform to the requirements of this section?
412.03(f5)	Was initial and final finishing performed as specified?

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412.03(f6)	Was the shotcrete fogged, if necessary, and moist cured for at least 7 days or cured using a curing compound?
412.03(f7)	Were test panels for compressive strength and for preconstruction testing, if required, prepared as specified?

• Is the latex concrete surface cured through prompt application of wet burlap, covered with polyethylene, and kept continuously moist for the initial 48 hour curing period, followed by 48 hours of air curing?
• Is concrete removed to a depth as specified on the plans or as directed by the Engineer?
• Did the Contractor submit a method of jacking and blocking beams for seat repair for the Engineer's approval?
• Was written approval obtained from the Engineer prior to subjecting structures supported on jacks to traffic loadings?
• Is the minimum thickness of Class A, Class B, or shotcrete containing silica fume as specified for cover over reinforcing steel?
• Is shotcrete delivery equipment approved by the Engineer prior to commencement of the work?
• Have sufficient measurements been taken and recorded to facilitate payment for the repair performed?

V. CRITICAL INSPECTION POINTS

• Check that removal of existing concrete is completed to sound concrete.
• Check cleanliness of areas where patch material are to be placed.
• Approved material is placed depending on type of repair
• New surfaces protected and cured timely with proper methods and type of cure.

Trial Use and Comment

SECTION 413 – DISMANTLING AND REMOVING EXISTING STRUCTURES OR REMOVING PORTIONS OF EXISTING STRUCTURES

I. INTRODUCTION:

The purpose of this section is to detail specific instructions to be taken into account during removal of existing portions or portions of existing structures.

a) Forms:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

413.01—Description

This work shall consist of dismantling and removing all or portions of existing structures in accordance with these specifications and in conformity with the lines, grades, and details shown on the plans or as established by the Engineer. The Contractor shall make all necessary notifications, including, but not limited to, the National Emission Standards for Hazardous Air Pollutants (NESHAPs) demolition/renovation notification to the Virginia Department of Labor and Industry, amended notifications, and obtain any necessary permits in accordance with all applicable local, state, and federal laws and regulations. The Contractor shall protect the public and the environment from leaded paint or other hazardous material encountered in the work.

Comment [1394]: Right Time

413.02—Procedures

(a) **Dismantling and Removing Existing Structure:** Dismantling and removing existing structures shall include removing the entire superstructure, substructure, and slope protection. The substructure shall be removed down to the streambed or to an elevation of at least 2 feet below the natural ground or finished grade of embankment that is to remain in place. Removal shall include any part of the substructure or foundation piling that will interfere with the new construction. For bridges crossing streams under the jurisdiction of the U.S. Coast Guard, the substructure shall be removed to or below the bed of the stream as required by the U.S. Coast Guard.

Comment [1395]: Right Way

1. **Dismantling structures for retention by the Contractor:** Removed materials shall become the property of the Contractor and shall be removed from the project. The Contractor shall assume all personal and property liability associated with such materials and shall protect and save harmless the Department from any and all

Trial Use and Comment

damages and claims associated with the handling, transportation, storage, or use of such materials. The Department does not warrant the condition or the physical or chemical characteristics of the materials.

2. **Dismantling structures for retention by the Department:** Dismantling shall be in accordance with a method approved by the Engineer and shall be such as to preserve the existing condition of materials.

Units shall be match marked for re-erection according to an approved diagram provided by the Department.

Material shall be stored as directed within ½ mile of the site of the existing structure.

(b) **Removing Portion of Existing Structure:** The portions to be removed shall be the areas designated on the plans. No portion of the structure shall be removed by blasting or other methods that may damage any portion of the structure that will remain in place. When pneumatic hammers are used to remove concrete, their weight shall be not more than 90 pounds for widening work or 30 pounds for deck repair work. The use of tractor-mounted demolition hammers with a maximum manufacturer's rated striking energy of 1,000 foot-pounds will be permitted for the removal of concrete parapets down to the top of deck and for that portion of the deck where the reinforcing steel will be removed. The use of tractor-mounted demolition hammers or pneumatic hammers weighing more than 30 pounds shall not be allowed for the removal of that portion of the deck that is within 6 inches of the top flange of the beams/girders to remain in the structure. With the written approval of the Engineer, hydraulically actuated, jaw type, concrete crushers may be used for the removal of concrete parapets down to the top of the deck. The approval of hydraulically actuated, jaw type, concrete crushers shall be contingent upon continuous satisfactory results with no damage to any portion of the structure that is to remain in place. The removal of concrete parapet on prestressed concrete slab spans or prestressed concrete box beam spans shall be limited to 30-pound pneumatic hammers within 2 inches of the deck and not more than 90-pound pneumatic hammers for the remainder of the parapet unless otherwise approved by the Engineer.
Disturbed areas shall be uniformly graded to natural ground contours in a manner that will facilitate drainage and prevent impoundment of water.

Materials or portions of existing structures removed shall be handled in accordance with the requirements of (a)1. herein.

(c) **Environmental and Worker Protection:** Heating, welding, flame cutting, grinding, chipping, needle gun cleaning, manual scraping, heat gun cleaning, drilling, straightening, and other construction operations, or demolition of Type B structures, as defined in Section 411.01(b), that disturbs areas coated with a hazardous material shall require environmental and worker protection.

1. **Environmental protection** shall be in accordance with the requirements of Section 411.08 except that work involving the removal of 100 square feet or less of protective

Comment [1396]: Right Way

Comment [1397]: Right Way

Comment [1398]: Right Way

Comment [1399]: Right Way

Trial Use and Comment

coating from a Type B structure will not require the Contractor to submit and implement an environmental plan as specified in Sections 411.08(a) and 411.08(b). However, the Contractor shall comply with appropriate local, state, and federal codes and regulations and shall employ appropriate measures to prevent the release of hazardous materials in the environment. Determination of the total square footage of removal area shall not include the cumulative area of coating disturbance from removal of bolts. Hazardous materials generated from the Contractor's operation shall be disposed of in accordance with the requirements of Sections 411.08(c) and 411.08(d).

2. **Worker health and safety protection** shall be in accordance with the requirements of Section 411.09 except that work involving the removal of 100 square feet or less of protective coating from a Type B structure will not require the Contractor to submit and implement a worker health and safety plan as specified in Sections 411.09(a) and 411.09(b). However, the Contractor shall comply with applicable codes and regulations regarding public and worker health and safety.

Upon completion of the project, the Contractor shall submit a written statement of certification for the Engineer's record, complete with all revisions including notations of any areas of non-compliance and corrective actions taken, that certifies both the Environmental Protection Plan and the Worker Health and Safety Plan were fully implemented during the performance of the work covered by this specification.

Comment [1400]: Right Way

Comment [1401]: Right documentation

413.03—Measurement and Payment

Dismantling and removing an existing structure will be paid for at the contract lump sum price.

Removing a portion of an existing structure will be paid for at the contract lump sum price.

Environmental and worker protection, when a pay item, will be paid for at the contract lump sum price per structure. This price shall include containment operations, regulation compliance, plan approval services, worker protection, and other related costs.

Material disposal, when a pay item, will be paid for at the contract lump sum price per structure. This price shall include transporting, storing, and legal disposal of material.

If not shown as a pay item, the cost for worker and environmental protection and material disposal shall be included in other appropriate bid items.

Payment will be made under:

Pay Item	Pay Unit

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Dismantle and remove existing structure (B or Str. No.)	Lump sum
Remove portion of existing structure (B or Str. No.)	Lump sum
Environmental and worker protection (B or Str. No.)	Lump sum
Material Disposal (B or Str. No. and type)	Lump sum

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- If necessary, has shoring plan been submitted and reviewed. This is critical if shoring is required for adjacent roadway or structure.
- Has use of method other than jackhammers been requested and reviewed or approved?
- Have all plans for environmental and employee safety and health requirements been submitted and acted upon?
- Are provisions in place to protect adjoining property and /or streams from construction debris created by removal of structure?
- All permit and other environmental concerns in place?
- Are there portions that are to be retained by the Agency and is there in place instructions for handling and storage?

Start:

- Are the demolition tools being used in accordance with specification 413.02(b)?
- Are the protection devices in place functioning as designed?

Continuous inspection:

- Not required, but site should be monitored to insure safety and environmental protections continue to function as designed.
- Periodic checks for worker safety requirements should be made.
- Are materials described as hazardous being properly removed and stored?

Final Inspection:

- Has proper portion of structure been removed as detailed on the plans?
- Is the removal taken to the correct elevation as detailed in Section 413.02(a)?
- Was any material deemed as hazardous properly disposed of as witnessed by manifests?

Documentation Required:

Hazardous material manifest and documentation of disposal at approved site.

Trial Use and Comment

IV. REVIEW QUESTIONS

Spec. Ref.	
413.02(a)	Is the substructure removed down to stream bed elevation or at least 2' below natural ground or finished grade of an embankment which is to remain in place, including any part or piling that will interfere with new construction?
413.02(a2)1	Has the Contractor submitted for the Engineer's approval a method for dismantling structures to be retained by the Department that will preserve the existing condition of materials?
413.02(a2)2	Have units been match marked for re-erection according to an approved diagram provided by the Department?
413.02(b)1	Is concrete not removed by blasting or other methods which could damage any portion of the structure that will remain in place?
413.02(b)2	Do pneumatic hammers weigh no more than 90 pounds for widening work or 30 pounds for deck repair work?
413.02(b)3	Where permitted, are tractor-mounted hammers being used in accordance with this section?
413.02(b)4	Have all disturbed areas been uniformly graded to natural ground contours that will facilitate drainage and prevent impoundment of water?
413.02(b)5	Has the contractor received written approval from the Engineer to use hydraulically actuated, jaw type, concrete crushers for parapet removal?
413.02(b)6	Has the removal of concrete parapets on prestressed concrete slab spans or prestressed concrete box beams been performed in accordance with this section?
413.02(c1)	When demolition operations involve a Type B structure (as defined in Section 411), has an environmental plan been submitted in accordance with Section 411.08?
413.02(c1)2	Has contractor complied with this section when contractor is not required to have an environmental plan?
413.02(c2)	Has the contractor submitted for review a worker health and safety plan in accordance with this section?

V. CRITICAL INSPECTION POINTS

- **Before removal begins, all necessary safety and containment items installed as detailed.**
- **Checking to see all protection items functioning as designed.**

Trial Use and Comment

SECTION 414 – RIPRAP

I. INTRODUCTION:

GENERAL

Since channel changes usually alter the hydraulic characteristics of a stream, riprap is frequently specified to protect property and roadways from erosion. When riprap is specified, the type and location will be specified on the plans.

The Project Inspector is to visually examine the slope upon which the plans designate riprap is to be placed. If the slope is comprised of solid rock or closely consolidated boulders whose soundness, size and weight equal or exceed the Specifications for the proposed riprap, then the riprap may be deleted by the Engineer.

The plans show the general location but the definite limits must be determined based on field inspections and within the approved environmental permits.

It is essential for Project Inspectors to ensure that Contractors furnish and place the class of dry riprap specified on the plans. Refer to R&B specifications for classes and descriptions.

STOCKPILED DRY RIPRAP

The Contractor should furnish a sample of the minimum to maximum size riprap at the project work site to be used for visual comparison of riprap delivered to the project and a sample should be maintained at the quarry for the producers benefit. When necessary, the Inspector may request assistance from the District Material Engineer to visit the quarry and establish the size and percentages of dry riprap.

PROCEDURES

Grading: The Inspector should verify that the slope to receive the riprap has been graded to within 6 inches of the lines shown on the plans. Riprap or bedding shall not be placed until the prepared base has been approved by the Inspector.

Bedding: Riprap bedding is placed on the embankment to form a backing for riprap. Bedding shall be spread uniformly on the prepared base. Compaction of the bedding material will not be required, but material shall be finished to a reasonably even surface, free from mounds or depressions. Geo-textile fabric should be placed as shown on the plans.

Placing stones: Riprap shall be placed on the embankment as soon as practicable after bedding has been finished, but no later than 15 days.
Riprap shall be placed to its full course thickness in one operation and in a manner to avoid displacing underlying material. Riprap stone shall not be dropped onto fabric from a height greater than 1 foot. Smaller-sized material shall not be dropped onto fabric from a height greater than 3 feet. Larger stones shall be reasonably well distributed. Hand placing may be required to the extent necessary to secure the results specified and form uniform slopes.

A tolerance of ±1/4 of the thickness of the maximum-size stone from the lines and grades shown on the plans will be allowed in the finished surface.

Placing riprap by dumping into chutes or similar methods likely to cause segregation of the various sizes will not be permitted.

MORTARED RIPRAP

Stone shall be the same size as specified for dry riprap, Class II, and shall be selected to secure fairly large, flat-surfaced stones that will produce a true and even surface with a minimum of voids.

Stones shall be placed first and roughly arranged in close contact, with the larger stones placed near the base of the slope. Spaces between larger stones shall be filled with stones of suitable size, leaving the surface reasonably smooth and tight and conforming to the contour required.

As each larger stone is placed, it shall be surrounded by fresh mortar, and adjacent stones shall be shoved into contact. After larger stones are in place, spaces or openings between them shall be filled with mortar, and smaller stones shall then be placed by shoving them into position, forcing excess mortar to the surface, ensuring that each stone is carefully and firmly bedded laterally.

GROUTED RIPRAP

Grout shall be approved prior to placement. Stones shall be of the same sizes and placed in the same manner as specified for dry riprap, Class I. Care shall be taken during placing to keep earth or sand from filling spaces between stones. After stones are in place, spaces between them shall be filled with grout from bottom to top and the surface swept with a stiff broom. Riprap shall not be grouted in freezing weather. In hot, dry weather, the work shall be protected from sunlight and kept moist for at least 3 days after grouting by the use of saturated burlap.

a) **Forms:**

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

414.01—Description

This work shall consist of placing the specified type of riprap in accordance with the plans, Standard Drawings where applicable, and these specifications.

414.02—Materials

(a) **Riprap** shall conform to the requirements of Section 204.

(b) **Sand** shall conform to the requirements of Section 202. Grading A, B, or C sand may be used in mortared or grouted riprap.

(c) **Mortar and grout** shall conform to the requirements of Section 218.

(d) **Geotextile bedding** shall conform to the requirements of Section 245.

(e) **Welded wire fabric** shall conform to the requirements of Section 223.

414.03—Procedures

(a) **Dry Riprap:** The classes of dry riprap shall be as follows:

Comment [1402]: Right material

1. **Class I:** Stones shall weigh between 50 and 150 pounds each. At least 60 percent shall weigh more than 100 pounds, and approximately 10 percent may weigh 50 pounds or less.

2. **Class II:** Stones shall weigh between 150 pounds to 500 pounds each. At least 50 percent shall weigh more than 300 pounds, and approximately 10 percent may weigh 150 pounds or less.

3. **Class III:** Stones shall weigh from 500 pounds to 1,500 pounds each. At least 50 percent shall weigh more than 900 pounds, and approximately 10 percent may weigh less than 500 pounds.

4. **Class AI:** Stones shall weigh between 25 and 75 pounds each, except that approximately 10 percent may weigh 25 pounds or less and 10 percent may weigh 75 to 100 pounds.

Dry riprap shall be placed as follows:

Grading: Slopes shall be finished to a reasonably smooth and compact surface within a tolerance of 6 inches from the surface lines shown on the plans.

Immediately prior to placement of riprap bedding, the prepared base will be inspected. Riprap or bedding shall not be placed until the prepared base has been approved.

Bedding: Riprap bedding shall be placed on the embankment to form a backing for riprap. Riprap bedding shall be spread uniformly on the prepared base. Compaction of the bedding material will not be required, but material shall be finished to a reasonably even surface, free from mounds or depressions.

When geotextile bedding material is required, the entire perimeter of the material shall be turned down and buried at least 9 inches for anchorage. Adjacent strips of material shall run only up and down the slope and shall overlap at least 18 inches. Geotextile bedding material shall not be used on slopes greater than 1:1. If sewed, strips shall overlap at least 4 inches and shall be double stitched with a prayer seam, Type SSa 1. Damaged material shall be replaced or repaired with a patch of the same material overlapping the damaged area by at least 18 inches on all sides. Displaced material shall be repositioned, including, if necessary, removing and replacing riprap stone, at the Contractor's expense. Material shall be placed loosely so that positioning riprap will not stretch or tear it.

Placing stones: Riprap shall be placed on the embankment as soon as practicable after bedding has been finished but no later than 15 days in a manner that will produce a reasonably well-graded mass of rock with the minimum practicable percentage of voids. Riprap shall be placed to its full course thickness in one operation and in a manner to avoid displacing underlying material. Riprap stone shall not be dropped onto fabric from a height greater than 1 foot. Smaller-sized material shall not be dropped onto fabric from a height greater than 3 feet. Larger stones shall be reasonably well distributed.

Finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. Hand placing may be required to the extent necessary to secure the results specified and form uniform slopes.

A tolerance of ±1/4 of the thickness of the maximum-size stone from the lines and grades shown on the plans will be allowed in the finished surface. However, the extremes of such tolerance shall be not continuous over an area of more than 200 square feet. Riprap shall be keyed into the natural ground in an approved manner and to a depth equal to the bed thickness or to solid rock.

Comment [1403]: Right Location

Comment [1404]: Right Way

Comment [1405]: Right Way

Comment [1406]: Right Way

Comment [1407]: Right Way

Comment [1408]: Right Time

The desired distribution of various sizes of stones throughout the mass may be obtained by selective loading at the source, controlled dumping of successive loads during final placement, or a combination of these methods. Placing riprap by dumping into chutes or similar methods likely to cause segregation of the various sizes will not be permitted.

Riprap protection shall be maintained until the riprap is accepted by the Engineer. Displaced material shall be replaced to the lines and grades shown on the plans at the Contractor's expense.

(b) **Dumped Riprap:** The types of dumped riprap shall be as follows:

1. **Type I:** Core riprap shall be composed of compact angular pieces of derrick stone weighing from 3/4 ton to 2 tons each with an average weight of approximately 1 ton. Approximately 10 percent by weight may weigh less than 3/4 ton.

2. **Type II:** Heavy riprap shall be composed of compact angular pieces of derrick stone weighing from 3 to 10 tons each with an average weight of approximately 4 tons. Approximately 10 percent by weight may weigh less than 3 tons.

   Dumped riprap shall be placed in the same manner described for dry riprap in (a) herein. Dumped riprap shall not be placed in layers.

(c) **Mortared Riprap for Slopes:** Stone shall be the same size as specified for dry riprap, Class II, and shall be selected to secure fairly large, flat-surfaced stones that will produce a true and even surface with a minimum of voids. Stone shall be placed on a slope not steeper than the natural angle of repose of the fill material. Fifty percent of the mass shall be broad flat stones placed with the flat surface uppermost and parallel to the slope. Stones shall be placed first and roughly arranged in close contact, with the larger stones placed near the base of the slope. Spaces between larger stones shall be filled with stones of suitable size, leaving the surface reasonably smooth and tight and conforming to the contour required. Stones shall be placed in a manner so as to ensure for plane surfaces a maximum variation from a true plane of not more than 1¼ inches in 4 feet. Warped and curved surfaces shall have the same accuracy as specified for plane surfaces.

As each larger stone is placed, it shall be surrounded by fresh mortar, and adjacent stones shall be shoved into contact. After larger stones are in place, spaces or openings between them shall be filled with mortar, and smaller stones shall then be placed by shoving them into position, forcing excess mortar to the surface, ensuring that each stone is carefully and firmly bedded laterally.

After the work is complete, excess mortar forced up shall be spread uniformly to fill surface voids completely. Surface joints shall then be pointed roughly with flush or shallow smooth-raked joints.

Comment [1409]: Right material

Comment [1410]: Right material

Comment [1411]: Right Way

Comment [1412]: Right Way

Comment [1413]: Right Time

Comment [1414]: Right Way

(d) **Grouted Riprap for Slopes:** Grout shall consist of 1 part hydraulic cement and 3 parts sand, thoroughly mixed with water to produce grout having a thick, creamy consistency.

Stones shall be of the same sizes and placed in the same manner as specified for dry riprap, Class I. Care shall be taken during placing to keep earth or sand from filling spaces between stones. After stones are in place, spaces between them shall be filled with grout from bottom to top and the surface swept with a stiff broom. Riprap shall not be grouted in freezing weather. In hot, dry weather, the work shall be protected from sunlight and kept moist for at least 3 days after grouting by the use of saturated burlap.

(e) **Erosion Control Stone for Culvert Outlet Protection:** Erosion Control Stone for Class AI, I, & II culvert outlet protection shall conform to the requirements for Dry Rip Rap Class AI, I, & II respectively of (a) herein for weight and shall be placed in a manner to present an irregular or rough surface.

(f) **Erosion Control Riprap:** Riprap shall consist of sound, nonerodible shot rock or rock excavation, which may be obtained from within the excavation for the typical sections on the project. Erosion control riprap rock shall be not more than 15 inches in its greatest dimension and shall contain a sufficient percentage of smaller rocks to provide a reasonably dense mass with a thickness of at least 8 inches. Riprap shall be placed where shown on the plans or as directed by the Engineer in accordance with the requirements of Section 303.04(h).

(g) **Concrete Riprap in Bags:**

1. **Wet mixture:** Riprap shall consist of Class C1 concrete in suitable burlap bags except in brackish or tidal water, where concrete shall be Class A3. Bags shall weigh approximately 100 pounds when 2/3 filled with concrete. Each bag shall be securely tied and immediately placed in the work. When used for foundation protection, bags shall be placed in accordance with the provisions governing placement of stone riprap for foundation protection as specified. When used for slope protection, riprap shall be placed in conformance with the provisions governing placement of dry riprap.

2. **Dry mixture:** Riprap shall conform generally to the requirements for wet mixtures except that the mixture shall consist of the dry ingredients and the requirements for water, consistency, and air will be waived.

   Burlap or paper bags will be permitted. Riprap shall be a rectangular solid approximately 3 inches in thickness and shall weigh approximately 80 pounds per bag. Paper bags shall be perforated throughout on approximate 1-inch centers and shall be of adequate seal, thickness, and strength to maintain the integrity of the riprap until setting of the concrete mixture. Bag compositions shall be such that bags will disintegrate without presenting environmental problems.

(h) **Stone Riprap for Foundation Protection:** Riprap for pier, abutment, and bridge spill slope protection shall conform to the requirements of the applicable specifications.

Comment [1415]: Right material

Comment [1416]: Right Way

Comment [1417]: Right material

Comment [1418]: Right Way

Comment [1419]: Right material

Comment [1420]: Right Way

Comment [1421]: Right material

Comment [1422]: Right Way

Comment [1423]: Right material

Comment [1424]: Right Way

(i) **Concrete Slab Riprap for Stream Crossings:**

1. **Materials:** Riprap shall consist of Class A3 concrete, cast-in-place, 6 inches in thickness. Concrete shall have a consistency that will permit placement without the use of top forms.

   Welded wire fabric shall be No. 6 gage wire, spaced 6 inches center to center.

2. **Excavation and fine grading:** The finished embankment slope shall be reasonably smooth and dense. A trench shall be dug at the toe of the slope to accommodate the toe of the slab. Slab riprap shall not be placed until the slope has been approved by the Engineer.

3. **Construction methods:** Riprap shall be constructed in accordance with the applicable requirements of Section 404 except as modified herein and shall be cured in accordance with the requirements of Section 316.04(j). Welded wire fabric shall be positioned at the center of the slab, shall run continuously throughout the slab, and shall lap approximately 6 inches at the edges of each sheet of fabric.

   The berm portion of the slab shall be placed on a slope of approximately 12:1, draining away from the abutment. Where the edge of the slab is placed against the abutment, the joint shall be sealed to a depth of at least ½ inch with hot-poured joint sealer conforming to the requirements of Section 212.

   The toe of the slab shall extend to an elevation at least 3 feet below the elevation of the toe of fill, and the lower edge of the slab shall be increased approximately 6 inches in thickness, tapering to its nominal thickness 3 feet up the slope from the lower edge of the slab. The tapering shall be on the underside of the slab. The slab shall be placed using one of the following methods:

   a. **Block method:** The slab shall be placed in alternate blocks approximately 4 feet by 4 feet.

   b. **Strip method:** The slab may be placed in alternate, continuous strips having scored or formed joints perpendicular to construction joints. Strips shall be placed in alternating widths of 4 feet and 5 feet, or 4 feet 6 inches each. Joints shall be at least 1 inch in depth and spaced approximately 4 feet 6 inches apart. The width of the joint shall be as small as possible.

      Successive courses or strips shall not have joints that line up with the joints in the preceding courses or strips. Horizontal joints shall be normal to the slope. Joints shall be closed without filler.

Comment [1425]: Right material

Comment [1426]: Right material

Comment [1427]: Right Way

Comment [1428]: Right Way

After concrete is placed, it shall be consolidated and the surface struck off by means of a strike board. Concrete shall be float finished with a wooden or cork float. The surface shall not vary more than ½ inch under a 10-foot straightedge.

414.04—Measurement and Payment

Comment [1429]: Right Payment

Dry riprap will be measured in square yards of surface area or tons as specified.

Mortared riprap will be measured in square yards of surface area.

Grouted riprap will be measured in square yards of surface area or tons as specified.

Stone riprap for foundation protection will be measured in square yards of surface area or tons as specified.

Dumped riprap will be measured in square yards of surface area or tons as specified.

Concrete riprap in bags will be measured in cubic yards.

Concrete slab riprap will be measured in square yards. When an optional riprap is used in lieu of concrete slab riprap, bedding material will not be measured for payment and the riprap will be paid for at the contract unit price for concrete slab riprap.

Erosion control riprap will be measured in square yards of surface area or tons as specified.

Riprap will be paid for at the contract unit price. This price shall include furnishing and placing riprap, including welded wire fabric, mortar, or grout; excavation; and riprap bedding.

These prices shall include geotextile bedding material when required and when not a separate pay item for these purposes. The price bid shall include preparing the surface, furnishing and installing geotextile bedding material, overlaps, repair work, and excavating and backfilling toe-ins.

Erosion Control Stone used for Culvert Outlet Protection will be measured in square yards of surface area or tons for the class specified and will be paid for at the contract unit price per square yard or ton. This price shall include excavating, backfilling, preparing the surface, furnishing and installing geotextile bedding material including overlaps, repair work, excavating and backfilling toe-ins, and placing the required materials.

<u>Payment will be made under</u>:

Pay Item	Pay Unit

Dry riprap (Class and depth)	Square yard or ton
Mortared riprap (Depth)	Square yard
Grouted riprap (Depth)	Square yard or ton
Stone riprap (Depth)	Square yard or ton
Dumped riprap (Type and depth)	Square yard or ton
Concrete riprap in bags	Cubic yard
Concrete slab riprap	Square yard
Erosion control riprap (Depth)	Square yard or ton
Erosion control stone (Class, st'd)	Square yard or ton

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Is there approval of source of material (commercial or local source), correct type of material (size/weight)?
- Are the areas for material placement staked?
- Is the proper geo-textile material available and approved?
- Is required permit approved and in-stream plan of operations received and approved if required?

Start:

- Geotextile fabric (if required) is in place and properly secured
- For concrete rip rap, forms must be secure and installed at proper elevation and geometry

Continuous inspection:

- Is appropriate placement of rock occurring to prevent damage to underlying strata?
- If control cylinders are necessary for concrete, are they being prepared?
- Is concrete placement and consolidation occurring as described by specification?
- Is the curing performed timely and properly?

Final Inspection:

- Is the material placed at the appropriate depth and at the correct elevation?
- Does the surface appearance met the requirements of the specification?

Documentation Required:

- Measurements and computations are in diary of items that are paid by area
- Tickets for manufactured stone if measured and paid by weight.
- All tickets and weighsheets for records are to be saved and turned in.
- Concrete tickets are to be saved.

IV. REVIEW QUESTIONS

414.03(a)	Does dry riprap conform to the weight and grading requirements of this section for Class I, II, III, or AI?
414.03(a)02	Was dry riprap placed on slopes finished to a reasonably smooth and compact surface within a tolerance of 6 inches of the surface lines shown

	on the plans?
414.03(a)03	Was riprap bedding uniformly spread to produce a reasonably even surface free of mounds and depressions?
414.03(a)04	Has the entire perimeter of geotextile bedding material been turned down and buried at least 9 inches for anchorage?
414.03(a)05	Do adjacent strips of material overlap at least 18 inches and run up and down the slope?
414.03(a)06	Is damaged material repaired or replaced with a patch of the same material overlapping the damaged area by at least 18 inches?
414.03(a)07	Was displaced material repositioned at the Contractor's expense?
414.03(a)08	Was riprap placed on the embankment no later than 15 days after completion of bedding?
414.03(a)09	Has riprap been placed in one operation in a manner that will produce a reasonably well graded mass of rock with a minimum practicable percentage of voids?
414.03(a)10	Was the prohibition on dropping riprap onto fabric adhered to?
414.03(a)11	Does the finished riprap conform to the tolerance of +/-1/4 of the thickness of the maximum size stone, with the extremes of this tolerance not continuous over an area of more than 200 square feet?
414.03(a)12	Has the riprap been keyed into natural ground in an approved manner to a depth equal to the bed thickness or to solid rock?
414.03(a)13	Does the Contractor maintain riprap until accepted and repair displaced areas at his expense?
414.03(b)1	Does dumped riprap conform to the weight and grading requirements of this section, for Type I or II?
414.03(b)2	Was dumped riprap placed in the same manner described in this section for dry riprap?
414.03(c)1	Is Class II dry riprap used for mortared riprap?
414.03(c)2	Is 50% of the mass composed of broad, flat stones laid with the flat surface uppermost and parallel to the slope?
414.03(c)3	Are larger stones placed near the base of the slope?
414.03(c)4	Are spaces between larger stones filled with stones of suitable size, leaving the surface reasonably smooth and tight?
414.03(c)5	Is the stone laid so that the maximum variation from a true plane is not more than 1-1/4 inch in 4 feet?
414.03(c)6	Is fresh mortar added to the voids between previously positioned larger stones and smaller stones then shoved into position, forcing excess mortar to the surface?
414.03(c)7	Is excess mortar uniformly spread to fill surface voids completely?
414.03(d)1	Does grout consists of 1 part hydraulic cement and 3 parts sand thoroughly mixed with water to produce a thick, creamy consistency?
414.03(d)2	Are stones of the same sizes and placed in the same manner as specified for dry riprap, Class I?
414.03(d)3	Was care taken to prevent earth or sand from filling spaces between stones?
414.03(d)4	Have all spaces between stones been filled with grout and the surface

	swept with a stiff broom?
414.03(d)5	Is the prohibition on grouting during freezing weather adhered to?
414.03(d)6	In hot, dry weather, is the work protected from sunlight and kept moist for 3 days by the use of saturated burlap?
414.03(e)	Does erosion control stone for culvert outlet protection conform to the weight requirements of this section?
414.03(e1)	Was Class I dry riprap placed in a manner to present an irregular or rough surface with a depth no less than two feet?
414.03(e2)	Was Class II dry riprap placed in a manner to present an irregular or rough surface with a total depth not less than three feet?
414.03(f)	Does erosion control riprap rock not exceed 15 inches in its greatest dimension and contain a sufficient percentage of smaller rocks to provide a reasonably dense mass with a thickness of at least 8 inches?
414.03(g1)	Has Concrete Riprap in Bags (wet mixture) been performed in accordance with this section?
414.03(g2)	Has Concrete Riprap in Bags (dry mixture) been performed in accordance with this section?
414.03(i1)1	Does the riprap consist of Class A3 concrete that is cast in place, 6 inches in thickness, and of a consistency that permits placement without using top forms?
414.03(i1)2	Is the welded wire fabric No. 6 gage wire, spaced 6 inches center to center?
414.03(i2)1	Was the slope approved by the Engineer prior to placement of slab riprap?
414.03(i2)2	Is the embankment slope reasonably smooth and dense with a trench dug at the toe of the slope to accommodate the toe of the slab?
414.03(i3)1	Has the concrete been cured in accordance with curing concrete in section [316.04(j)] on hydraulic cement concrete pavement?
414.03(i3)2	Is welded wire fabric positioned at the center of the slab, run continuously throughout the slab, and lapped approximately 6 inches at the edges of each sheet of fabric?
414.03(i3)3	Is the berm portion sloped approximately 12:1 to drain away from the abutment?
414.03(i3)4	Has the joint between the slab and abutment been sealed to a depth of at least 1/2 inch with hot-poured joint sealer?
414.03(i3)5	Does the toe of the slab extend to an elevation of at least 3 feet below the toe of the fill?
414.03(i3)6	Was the lower edge of the slab increased approximately 6 inches in thickness by tapering on the underside to its nominal thickness 3 feet up the slope from the lower edge of the slab?
414.03(i3a)	Is the slab placed in alternate blocks approximately 4 feet square when using the block method?
414.03(i3b)1	Is the slab placed in alternate, continuous strips with joints and dimensions conforming to the requirements of this section, when using the strip method?
414.03(i3b)2	Does the surface not vary more than 1/2 inch under a 10 foot straightedge?

•	Is all vegetation removed from the slope prior to placement of the riprap?
•	Is the slope graded as required?
•	Is geotextile fabric installed properly if required?
•	Is riprap of the gradation specified?
•	Is riprap keyed into existing toe of fill or stream bed as shown on plans or as directed by the Engineer?

V. CRITICAL INSPECTION POINTS

• **Foundation area proper line and grade, prepared with geo-textile or aggregate as required by plan or standard**
• **Forms secure and correct (concrete)**
• **Material delivery is approved source and visually inspected for conformance with appropriate class of material.**
• **Concrete is approved source and tested. Finish and cure in accordance with 316.04**

SECTION 415 – CONCRETE SLOPE PROTECTION

I. INTRODUCTION:

The plans may require concrete slope protection to be constructed with pre-cast blocks or "cast-in-place" concrete slabs. When blocks are required, the joints between the blocks are filled with mortar. In the case of cast-in-place slabs, all joints are ordinary construction butt joints. Horizontal joints to be continuous on the face of the slope with vertical joints being staggered perpendicular to the horizontal joint.

Slope protection requires the firm support of bedding material, although it has the structural strength to "bridge over" small local voids. Adequate drains must be provided to prevent an uplift force from frost action and from the pressure of water trapped behind the slope.

Cast-in-place slope protection is used more often than the block type. All slabs are reinforced and tied together with woven wire fabric. If the slabs are to have the necessary rigidity and durability, the wire fabric must be positioned at mid depth of the slab. Frequently, the weight of the fresh concrete pushes the wire below mid depth and the workers neglect to reposition it accurately. Considerable attention must be given to this very important detail.

The Contractor may elect to place slope protection in alternate horizontal or vertical strips and score the perpendicular joints with a jointing tool in lieu of placing the concrete in alternate blocks.

If the slope protection is for a roadway grade separation rather than a bridge over a stream, examine the grading plans for ditch line elevations. The ditch line elevations on the roadway plans should agree with those of the slope protection on the bridge plans. Any differences are to be brought to the attention of the Construction Manager.

Finally, check the layout of slope protection in the field. All slope protection is to extend along the slope for a sufficient distance to catch storm water dripping from the outer edges of the deck. A slight amount of additional concrete here will eliminate a serious erosion (maintenance) problem.

a) <u>Forms:</u>

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Trial Use and Comment

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

415.01—Description

This work shall consist of furnishing and installing precast concrete blocks in a bed of coarse sand or installing a concrete slab on embankments at or near bridge abutments as shown on the plans or as specified by the Engineer.

415.02—Materials

(a) **Precast concrete blocks** shall conform to the requirements of Section 222.

(b) **Mortar** shall be nonshrinking and shall conform to the applicable requirements of Section 218.

(c) **Foundation course** shall be Grading B sand conforming to the requirements of Section 202 or approved local material similar in nature.

(d) **Concrete** shall be Class A3 conforming to the requirements of Section 217.

(e) **Welded wire fabric** shall be No. 6 gage, 6 inches center to center each way, conforming to the requirements of Section 223.

(f) **Herbicide** shall conform to the requirements of Section 244.

415.03—Procedures

(a) **Precast Concrete Block Slope Protection:** The subgrade shall be constructed at the required distance below the finished surface of the slope. Soft sections and unsuitable material shall be removed and replaced. The subgrade shall be compacted and shaped to a smooth, uniform surface.

The foundation course shall be spread on the subgrade to a depth of 2 inches and treated with an approved highly insoluble soil sterilent. Material shall be in a dry form and have a maximum solubility rate of 250 parts per million. Material shall be uniformly applied at the maximum rate recommended by the manufacturer.

Blocks shall be bedded in the foundation course perpendicular to the finished surface in straight rows, with the longest dimension horizontal.

Comment [1430]: 415.02: Right Material

Comment [1431]: Right Location/ Right material/ Right documentation

Comment [1432]: Right documentation

Comment [1433]: Right Location/ Right Way

Trial Use and Comment

Blocks shall be placed with continuous joints extending horizontally on the face of the slope and with broken (staggered) joints extending perpendicular thereto, up or down the slope. Blocks shall be rammed until the surface is firm and conforms to the finished slope. Joints shall be filled with mortar.

Cast-in-place edging for block slope protection shall be placed as specified in (b) herein.

(b) **Concrete Slab Slope Protection:** The subgrade shall be prepared as for block slope protection. The cast-in-place concrete slab shall be 4 inches in thickness and shall be placed in accordance with the requirements of Section 414.03(i).

Except at railroad grade separations, the Contractor may provide a combination concrete slab and stone slope protection in lieu of the specified concrete slab slope protection. Protection shall be in accordance with the following:

1. Concrete portions, consisting of a paved ditch and a strip of concrete approximately 3 feet in width placed on the berm along the face of the abutment, shall be furnished as required for concrete slab slope protection. Stone shall be placed at a depth of 7 to 9 inches over the remaining area to be covered with slope protection.

2. The subgrade for concrete and stone shall be prepared in accordance with the requirements of Section 414.03(i). The portion of the slope to be protected with stone shall be treated with a herbicide in accordance with the requirements of (a) herein. Care shall be taken to confine application to areas designated for sterilization.

3. Stone shall be crushed gravel or stone conforming to the requirements of Section 205.02. Sizes furnished shall be not smaller than the sizes specified in Table II-5 for aggregate size No. 1, and the pieces shall be not larger than 8 inches in their greatest dimension. Stone shall be in a sufficient range of sizes to create a stable and reasonably uniform slope.

The condition of the subgrade and method of placing stone shall be such that pieces of stone in contact with the subgrade shall be partially embedded where practicable. Stone immediately adjacent to concrete shall not project more than 3 inches above the concrete.

Approved splash blocks connecting with the paved ditch shall be provided under downspouts draining onto the slope protection.

415.04—Measurement and Payment

Concrete slope protection will be measured in square yards of surface area and will be paid for at the contract unit price per square yard. If limits are not shown on

Comment [1434]: Right Location/ Right material/ Right Way

Comment [1435]: Right Location/ Right quantity/ Right material

Comment [1436]: Right Payment

Trial Use and Comment

the plans, measurements will be from the outside edge to outside edge, including curb, and from the edge of slope protection at abutment to the bottom of the curtain wall or outside edge of the paved ditch as appropriate. This price shall include the foundation course and treatment.

Payment will be made under:

Pay Item	Pay Unit
Concrete block slope protection	Square yard
Concrete slab slope protection (Depth)	Square yard

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review plans, specification & approved material.

Start:

- Verify location of herbicide application is confined to riprap placement area.
- Review MOT setup, review E&S control installation, verify proper concrete testing & sample storage & track washout areas.
- Verify the subgrade is prepared according to section 415.03(a).

Continuous inspection:

- Visually verify location of welded wire fabric in accordance with section 223, joints orientation, stone projection & embedment, mortar application, quality of concrete.

- **Final Inspection:**
- Make sure excess concrete, stone, block or course is disposed properly and the site is cleaned.
- Verify slope, grade and location as per plan or as directed.
- Make sure the finished in place concrete is cured & protected as per section 316.04(j).
- Verify the toe is aligned with the ditch.

Documentation Required:

- Source of materials (C-25).
- Measurements of quantity.
- Concrete test report.
- Weight tickets, invoices, TI-28A.
- Manufacturer's recommendation for foundation course.

Trial Use and Comment

IV. REVIEW QUESTIONS

415.03(a)1	Was subgrade for concrete block or slab slope protection constructed at required distance below slope surface with soft sections and unsuitable material replaced,and compacted to smooth, uniform surface?
415.03(a)2	Was the foundation course spread to a depth of 2 inches and treated at the recommended rate with an approved highly insoluble soil sterilent?
415.03(a)3	Are blocks laid with continuous joints extending horizontally and staggered joints extending up or down the slope?
415.03(a)4	Have joints between blocks been filled with mortar?
415.03(a)5	Has cast in place edging been placed as specified in this section?
415.03(b)1	Was the cast in place slab at least 4 inches in thickness and placed in accordance with this section?
415.03(b)2	Were approved splash blocks connecting with the paved ditch provided under downspouts draining onto the slope protection?
415.03(b1)	Have concrete portions, consisting of a concrete paved ditch and concrete strip approximately 3 feet in width along with stone placed to a depth of 7 to 9 inches, been furnished for combination concrete slab and stone slope protection?
415.03(b2)	Was the subgrade prepared in accordance with the section on Concrete Slab Riprap for Stream Crossings and treated with an approved herbicide?
415.03(b3)	Does stone used for combination concrete slab and stone slope protection conform to the requirements of the materials section on Crusher Run Aggregate and project no more than 3 inches above the concrete?

• Is the subgrade constructed properly?
• Is the 2 inch bedding material placed properly?
• Are blocks laid with continuous horizontal joints and staggered joints extending up and down the slope?
• Are all joints filled with mortar?
• Is cast in place edging placed as specified?
• Is the toe of slope protection in alignment with proposed and/or existing ditch?

V. CRITICAL INSPECTION POINTS

• **Herbicide application area**
• **Foundation inspection**
• **Subgrade preparation**

Trial Use and Comment

SECTION 416—WATERPROOFING

I. INTRODUCTION:

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

416.01—Description

This work shall consist of furnishing and applying waterproofing material on concrete bridge decks or other surfaces as shown on the plans.

416.02—Materials

(a) **Epoxy-resin compounds and aggregates for surface application** shall conform to the requirements of Section 243. Epoxy resin shall be Type EP-5, low viscosity.

(b) **Membrane and primer** shall conform to the requirements of Section 213.

416.03—Procedures

(a) **Epoxy-resin:** Containers, tools, and mechanical equipment shall be free from solvents, loose material, and deposits of hardened material.

Epoxy resin shall not be applied when the concrete surface or the ambient air temperature is below 50 degrees F unless otherwise permitted by the manufacturer's instructions.

1. **Surface preparation:** Surfaces on which epoxy compounds are to be applied shall be free from grease, dirt, dust, paint, mill scale, curing compound, laitance, and other foreign material.

   Concrete surfaces on which epoxy compounds are to be used shall be ground or sandblasted sufficiently to expose the sound concrete. Surfaces that are not to receive epoxy compounds shall be protected from sandblasting. Immediately following sandblasting, the surface shall be thoroughly cleaned.

Comment [1437]: 416.02: Right material

Comment [1438]: Right Way/ Right Time

Comment [1439]: Right Way/ Right Location

Trial Use and Comment

Before epoxy compounds are applied to metal surfaces, surfaces shall be sandblasted to a bright metallic luster.

Wood surfaces shall be sanded to the texture of new wood.

2. **Mixing:** Epoxy mortar shall be made by blending sand, epoxy resin, and hardener in accordance with the manufacturer's instructions.

Batch sizes shall be limited to the maximum batch size recommended by the manufacturer. Mixed epoxy compounds shall be used within the manufacturer's specified pot life. Solvents or other materials shall not be added to the mixture.

3. **Application:** Masking shall be used to form straight edges. Epoxy resin shall not be allowed to flow into or over expansion joints. The first coat of epoxy resin shall be applied at the rate of 1 gallon per 75 square feet. Sand shall be broadcast into the wet epoxy in sufficient quantity, approximately 11 pounds per square yard, to cover the epoxy completely. Sand shall be firmly embedded so that at least 95 percent of the deck area displays a sand surface after brooming. Brooming shall not be performed until the epoxy resin has cured sufficiently to prevent tearing. After curing, unbonded sand shall be broomed from the surface and may be reused if uncontaminated. The second coat of epoxy resin shall be applied at the rate of 1 gallon of epoxy per 50 square feet. Requirements pertaining to masking, epoxy, flow, sand broadcasting, percentage of embedment, curing, and brooming shall also apply to the second coat of epoxy resin.

At edges of the waterproofing system and at any point where it is punctured by appurtenances such as drains or pipes, suitable provisions shall be made to prevent water from getting between the waterproofing and the waterproofed surface.

The waterproofing system shall be extended as follows: 1 inch up faces of curbs; continuously across abutment backwalls and at least 6 inches down the back of backwalls; at least 12 inches onto approach slabs; and continuously across joints except expansion joints.

When applied to prestressed concrete slab and box beam units for new construction, application shall be made at the prestressing plant. Joints and damaged areas shall be waterproofed after erection.

4. **Curing:** Curing time shall conform to the manufacturer's recommendations. During this time, both pedestrian and vehicular traffic shall be barred from freshly placed surfaces.

(b) **Membrane:**

Comment [1440]: 40-41: Right Documentation

Comment [1441]: Right Way/ Right quantity

Comment [1442]: Right Way/ Right Location/ Right Time/ Right docmentation

Trial Use and Comment

1. **Waterproofing membrane sealant**: The sealant shall consist of a prefabricated membrane or liquid membrane conforming to one of the following systems:

System A: A primer and prefabricated membrane consisting of a laminate formed with suitably plasticized coal tar and reinforced with nonwoven synthetic fibers or glass fibers.

System B: A primer, mastic, and prefabricated membrane consisting of a laminate formed and rubberized asphalt and reinforced with synthetic fibers or mesh.

System C: A primer and prefabricated membrane consisting of a laminate formed with suitably plasticized asphalt, reinforced with open weave fiber glass mesh, and having a thin polyester top surface film.

System D: A hot-poured liquid elastomeric membrane with protective covering.

System E: A surface conditioner and a hot-applied rubberized asphalt membrane with protective covering.

2. **Construction:** On new decks, the waterproofing membrane system shall not be placed until at least 28 days after deck concrete placement unless otherwise directed by the Engineer.

Each phase of the bridge deck construction shall be completed, including the placing of the surface course overlay, before roadway traffic may be placed on that portion of the bridge structure. In order to minimize possible damage to the membrane, placing of the membrane sealant system will not be permitted until the adjacent roadway binder course has been completed and is ready for traffic. Only vehicles necessary for construction, including the paver, will be permitted on the structure during and after the placing of the membrane system, and such vehicles shall be rubber tired or have rubber-covered treads. The Contractor shall be responsible for maintaining the condition of the membrane system until covered with the bituminous concrete surface course overlay.

All methods employed in performing the work and equipment, tools, and machinery used for handling materials and executing any part of the work shall be subject to the approval of the Engineer before the work is started, and whenever found unsatisfactory, they shall be changed and improved as required. Equipment, tools, machinery, and containers used shall be kept clean and maintained in satisfactory working condition.

Work shall not be performed during wet weather conditions. In addition, work shall not be performed when the deck and ambient air temperatures are below 50 degrees F except for application of System E, for which the minimum temperature shall be 20 degrees F. The deck surface shall be thoroughly dry at the time of the application of the primer or liquid membrane.

Comment [1443]: 22-39: Right Material

Comment [1444]: Right Time

Comment [1445]: Right Time / Right Way

Comment [1446]: Right documentation/ Right Way/ Right Time

Trial Use and Comment

Concrete parapet surfaces and railing, including armor plates for the elastomeric joint seals, shall be protected to prevent their being defaced by primer or membrane material. Should defacement occur, the Contractor shall clean surfaces on the structure to the satisfaction of the Engineer.

Between the time the bridge deck is cleaned and prepared for primer and the time the membrane system is placed, no vehicles, including mechanical spreaders, shall be operated on the area being treated. Only the necessary personnel and equipment to perform the required work will be allowed on the treated surface, and only at such time and in such manner as approved by the Engineer. Care shall be taken to prevent sudden starts, stops, or turns by equipment. All other traffic shall be maintained on portions of the structure that are not being given the membrane protection.

3. **Preparation of concrete deck:** Surfaces that are to be covered shall be thoroughly cleaned by the use of sandblasting, air jets, mechanical sweepers, hand brooms, or other approved methods, or as required by the Engineer, until the surface is free of sand, clay, dust, and loose or foreign matter. Water shall not be used to clean the deck unless authorized by the Engineer.

Any accumulations of oil or grease shall be scraped off the roadway surface and cleaned with a strong caustic solution. The resulting residue shall be thoroughly flushed away with clean water. Cleaned areas shall be primed without delay as soon as they are dry. Dust and dirt shall be blown off with air jets immediately preceding application of primer or liquid membrane.

Any sharp concrete protrusions on the deck surface that would puncture the membrane shall be removed prior to application of the membrane.

4. **Construction procedures:**

a. **Application of primer:** The primer shall be applied to the cleaned concrete surfaces at the rate and in accordance with the procedure recommended by the membrane manufacturer. Surfaces to be covered by prefabricated membrane shall be uniformly coated with primer. Drying time prior to applying the membrane shall be as recommended by the manufacturer.

b. **Application of membrane:** Before applying the membrane, the direction of operation of the paving equipment shall be ascertained. Unless otherwise approved, each phase of preformed waterproofing membrane construction shall begin at the low point of the surface to be waterproofed and shingled so that water will run over and not against any laps. At deck joints, the membrane shall extend to the edge of the joint opening as shown on the plans.

Comment [1447]: Right Time/ Right Way

Comment [1448]: Right Way/ Right Location/ Right documentation

Trial Use and Comment

(1) Prefabricated membrane shall be applied to the primed curb and bridge deck surfaces by either hand methods or mechanical applicators. Prefabricated membranes shall be placed in such a manner that a shingling effect will be achieved, and any water that accumulates will drain toward the curb and the drainpipes. Each strip shall be overlapped a minimum of 4 inches. The membrane sections shall be placed so that end laps will be in the direction of the paving operation.

An adhesive or a wide tipped torch shall be used, if necessary, to ensure a good seal of the prefabricated membrane joints. Hand rollers or other satisfactory pressure apparatus shall be used on the applied membrane to ensure firm and uniform contact with the primed concrete surfaces. Special care shall be used at the curb face to ensure that the membrane is uniformly and positively adhering to the concrete.

Prefabricated membranes shall be free of wrinkles, air bubbles, and other placement defects. Any torn or cut areas or narrow overlaps shall be patched using a satisfactory adhesive and by placing sections of the membrane over the defective area in such a manner that the patch extends at least 6 inches beyond the defect. The patch shall be rolled or firmly pressed onto the surface.

(2) Liquid elastomeric membrane shall be heated in a manner as recommended by the membrane manufacturer to 375 degrees F. Then, it shall be applied to the cleaned concrete surface by spraying with a special type nozzle as recommended by the membrane manufacturer or poured onto the concrete surface and worked into the surface with a silicone rubber squeegee to a uniform 90-mil thickness for System D and 125-mil thickness for System E.

c. **Application of protective covering:** For Systems A, B, and C, protective covering shall be used when or as recommended by the membrane manufacturer. For Systems D and E, the protective covering shall be applied immediately following application of the liquid elastomeric membrane and prior to cooling before loss of adhesion between materials. Protective covering shall be placed parallel to the centerline of the bridge, unless otherwise approved by the Engineer, and with the talc-coated side up.

In the event protective covering is recommended by the prefabricated membrane manufacturer, a suitable compatible mastic or adhesive cement, as recommended by the membrane manufacturer, shall be used to adhere any protective covering material securely to membrane surfaces. Protective covering strips shall be butted tightly together at both longitudinal and transverse joints. Protective covering material shall be securely bonded to the membrane material and shall be essentially free of wrinkles, bubbles, and other placement defects. Wrinkles and "fish mouths" rising more than ½ inch above the bridge deck shall be split and either removed or lapped and securely bonded together.

Comment [1449]: Right Way/ Right quantity

Comment [1450]: Right material/ Right quantity/ Right documentation

Comment [1451]: Right Time/ Right Location/ Right material

Comment [1452]: Right Location/ Right Way/ Right material

Trial Use and Comment

d. **Application of surface course overlay:** Unless otherwise approved by the Engineer; an asphalt concrete surface course mixture shall be placed within 24 hours after the placement of the waterproofing membrane system in accordance with the requirements of Section 315 except as modified herein.

The asphalt concrete surface course shall be of the type and amount specified on the plans with a minimum compacted depth of 1½ inches. The paving operation shall be in the same direction as the end laps of the membrane. When a protective covering is used, a tack coat shall be applied prior to the paving operation.

The mixing discharge temperature of the mixture shall not exceed 310 degrees F. The temperature of the mixture at the time of placement shall be not less than 275 degrees F. The mixture shall be dumped directly into the paver hopper. After filling the hopper, the truck shall pull forward and shall not be in contact with the paver while it is moving. Dumping the mixture onto the deck ahead of the paver will not be permitted. The mixture shall be spread and rolled in such a manner that the protective coating, when used, will not be damaged. The temperature of the mixture at the time of rolling and compacting shall be not less than 235 degrees F. When using vibratory roller equipment, the vibrator shall not be activated.

e. **Performance:** After completion of the surface course, the waterproofing effectiveness of the membrane pavement system will be determined. The minimum electrical resistance shall be 500,000 ohms when tested in accordance with VTM-39. Areas designated by the Engineer as having a lower resistance reading than 500,000 ohms will be evaluated by the Department, and those areas determined by the Engineer to be detrimental to the effectiveness of the system shall be repaired at the Contractor's expense by removing the pavement and then replacing or repairing the defective membrane. Asphalt pavement shall then be placed in a manner that will yield a neat-appearing, smooth-riding pavement. In the event more than 30 percent of the bridge deck area is shown defective by tests and is determined by the Engineer to be detrimental to the effectiveness of the system, the entire asphalt pavement and membrane system shall be removed and the deck cleaned in a satisfactory manner. The entire membrane-pavement system shall then be replaced in accordance with the requirements herein at the Contractor's expense.

416.04—Measurement and Payment

Waterproofing will be measured and paid for in square yards of completed deck surface covered between the beginning and end stations of the bridge. For applications other than bridge decks, waterproofing will be measured and paid for in square yards of completed surface as shown on the plans.

Comment [1453]: Right Time

Comment [1454]: Right Way

Comment [1455]: Right Way

Comment [1456]: Right Way

Comment [1457]: 414.04: Right Payment

Trial Use and Comment

The cost of waterproofing applied to prestressed concrete members before erection and the cost of waterproofing joints and damaged areas shall be included in the price bid per member.

Payment will be made under:

Pay Item	Pay Unit
Waterproofing	Square yard

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Verify the new deck surface is cured 28 days or as directed by the Engineer, review approved material, construction procedure, plans, specification, and manufacturer recommendations, weather condition.

Start:

- Verify placement surface temperature & cleaning
- Material temperature
- Cleanliness of tools and equipment
- Area is protected from traffic as needed

Continuous inspection:

- Monitor application rate
- Surface & Material temperature
- Lap length, priming & Tacking
- Application direction
- Adhesion
- Surface and tools condition

Final Inspection:

- Verify water proofing was applied to the entire area as per plans, verify adequate provision was made for joints, holes & curbs, end sections are properly secured.
- Measure completed area for payment.
- Conduct performance tests by electrical resistance method and make necessary adjustments.

Documentation Required:

- Manufacturer's recommendation
- Approved material (C-25)
- Measurement for payment
- Invoices

Trial Use and Comment

IV. REVIEW QUESTIONS

N/A

V. CRITICAL INSPECTION POINTS

• **Surface preparation inspection**
• **Application surface & Material temperature**
• **Priming & Tack application**
• **Performance testing**

Trial Use and Comment

SECTION 417—DAMP-PROOFING

I. INTRODUCTION:

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

417.01—Description

This work shall consist of furnishing and applying damp-proofing material to concrete surfaces in accordance with the plans and these specifications.

417.02—Materials

Materials shall conform to the applicable requirements of Section 213.

417.03—Procedures

(a) **Surface Preparation:** Surfaces shall be cleaned of loose, foreign material and shall be dry. The Engineer may require the surface to be scrubbed with water and a stiff brush, after which it shall be allowed to dry before application of primer.

(b) **Application:** The clean surface shall be brush painted or spray painted with at least two coats of primer, using at least 1/8 gallon per square yard of surface per coat. On the primed surface, one application of an asphalt seal coat shall be applied by brush, using at least 1/10 gallon per square yard.

Asphalt shall be confined to areas to be damp-proofed and shall not be dripped or spread on any other parts of the structure.

417.04—Measurement and Payment

Damp-proofing, when a pay item, will be paid for at the contract unit price per square yard. When not a pay item, the cost thereof shall be included in the price for other appropriate pay items.

Comment [1458]: 12: Right Material

Comment [1459]: Right Location/ Right quantity

Comment [1460]: Right Way

Comment [1461]: 417.04: Right Payment

Trial Use and Comment

Payment will be made under:

Pay Item	Pay Unit
Damp-proofing	Square yard

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

Review approved material, plans, specification, and procedures

Start:

Verify the area to be damp- proofed is cleaned.

Continuous inspection:

- Monitor either the cleaned area is either brushed or spray painted.
- Monitor application rate.
- Monitor applications confined to the area shown on the planes.

Final Inspection:

- Measure completed area for payment.

Documentation Required:

- Measurement for payment.
- Material invoice.

IV. REVIEW QUESTIONS

417.01	Is the work being performed in accordance with the plans and specifications?
417.02	Do materials used for damp-proofing conform to the requirements of the materials section on damp-proofing and waterproofing?
417.03(a)	Is the surface being damp-proofed cleaned of all loose foreign material and dry?
417.03(b)1	Has the cleaned surface been brush or spray painted with at least 2 coats of primer using at least 1/8 gallon per square yard of surface per coat?
417.03(b)2	Has an application of at least 1/10 gallon per square yard of asphalt seal coat been applied to the primed surface by brush?
417.03(b)3	Was care taken to confine the asphalt to be damp-proofed and not dripped or spread on any other parts of the structure?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Surface preparation**
• **Application rate**

Trial Use and Comment

SECTION 418- TIMBER STRUCTURES

I. INTRODUCTION:

Timber structures are used throughout the State for small bridges on the secondary system. Timber structures are a specialty and questions regarding the work or material should be directed to the District Bridge and Materials Sections.

For measurement purposes, foot-board-measure (FBM) is calculated as follows:

- 1 FBM (foot board measure) is equal to a board 12" wide x 12" long x 1" thick
- FBM is calculated as thickness (inches) x width (inches) x length (feet) / 12
- Thickness and width used in the FBM calculation are nominal (2x4, 2x6) although the finished size is 1.500 x 3.500, 1.500 x 5.500, etc.
- A 2x4x8' would equal 5.33 FBM

MFBM or 1000 FBM is simply 1000 times the calculated FBM

Pay for 5,350 FBM will be 5.35 MFBM (5,350 FBM/1000 =5.35 MFBM)

Always review the contract and plans for amendments to the specifications through special provisions, copied notes or general notes.

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a) <u>Forms:</u>

- **Intentionally Left Blank**

II. <u>2007 ROAD & BRIDGE SPECIFICATION and the 7R's</u>

418.01—Description

This work shall consist of furnishing and erecting timber materials required to complete a structure in accordance with these specifications and in conformity with the lines and grades shown on the plans or as established by the Engineer.

418.02—Materials

(a) **Lumber and Timber:** Lumber and timber shall conform to the requirements of Section 236.

Comment [1462]: Right material

Trial Use and Comment

(b) **Structural Shapes:** Rods, plates, shapes, and eyebars shall conform to the requirements of Section 226.

(c) **Castings:** Castings shall be cast steel or gray iron, as shown on the plans, conforming to the applicable requirements of Section 224.

(d) **Hardware:** Machine bolts, drift bolts, and dowels shall conform to the requirements of Section 226. Washers may be ogee gray iron or malleable castings or may be cut from mild steel plate as shown on the plans.

Machine bolts shall have square heads and nuts. Nails shall be cut or round wire of standard form. Spikes shall be cut, wire, or boat spikes as shown on the plans.

Nails, spikes, bolts, dowels, washers, and lag screws shall be black or galvanized, as specified on the plans.

Other hardware, except malleable iron connectors, shall be galvanized in accordance with the requirements of Section 233 or cadmium plated in accordance with the requirements of ASTM A165, Type OS.

(e) **Paint:** Paint shall conform to the requirements of Section 231.

418.03—Procedures

Comment [1463]: Right Way

(a) **Storing Material:** Lumber and timber on the work site shall be stored in stacks or ricks.

Material shall be stacked at least 12 inches above the ground surface and sloped. It shall be protected from weather by a suitable covering. The ground underneath and in the vicinity of material shall be cleared of weeds and rubbish.

Untreated material shall be open stacked, and treated material shall be close stacked.

(b) **Treated Timber:** Treated timber shall be handled with rope slings without sudden dropping, breaking of outer fibers, or bruising or penetrating of the surface with tools such as cant hooks, peaveys, pikes, or hooks.

Cutting, framing, and boring of treated timbers shall be performed before treatment insofar as is practicable. When treated timbers are to be placed in water infested by marine borers, as determined by the Engineer, untreated cuts, borings, or other joint framings below the high water elevation shall be avoided.

Trial Use and Comment

Cuts in treated piles or timbers and abrasions, after having been carefully trimmed smooth, shall be brush coated with at least two applications of the preservative used in the treatment of the pile.

Bolt holes bored after treatment shall be treated with a preservative. After being treated, unfilled holes shall be plugged,

Whenever forms or temporary braces are attached to treated timber with nails or spikes, holes shall be filled by driving galvanized nails or spikes flush with the surface or by plugging as required for bolt holes.

(c) **Untreated Timber:** Ends, tops, and contact surfaces of sills, caps, floor beams, stringers, and bracing and truss units shall be thoroughly coated with two coats of preservative before assembly. The back faces of bulkheads and other timber that will be in contact with earth, metal, or other timber shall be similarly treated.

(d) **Treatment of Pile Heads:** After required cutting to receive caps and prior to placement of caps, pile heads shall be treated to prevent decay. Heads of timber piles shall be protected by one of the following methods, as indicated on the plans. If not otherwise indicated, Method A shall be used.

1. **Method A—zinc covering:** The sawed surface shall be brush coated with three applications of a preservative. Before the cap is placed, a sheet of 12 gage (0.028 inch) zinc shall be placed on each pile head. The sheet shall be of sufficient size to project at least 4 inches outside the pile and shall be bent down, neatly trimmed, and securely fastened to the face of the pile with large-headed galvanized roofing nails.

2. **Method B—fabric covering:** Heads of piles shall be covered with alternate layers of hot pitch and cotton fabric for waterproofing, using four applications of pitch and three layers of fabric. The cover shall measure at least 6 inches more in dimension than the diameter of the pile and be neatly folded down over the pile and secured by large-headed galvanized nails or by binding with at least seven complete turns of galvanized wire securely held in place by large-headed galvanized nails and staples. Edges of fabric projecting below the wire wrapping shall be trimmed to present a neat appearance.

(e) **Holes for Bolts, Dowels, Rods, and Lag Screws:** Holes for round drift bolts and dowels shall be bored with a bit 1/16 inch less in diameter than the bolt or dowel to be used. The diameter of holes for square drift holes or dowels shall be equal to the least dimension of the bolt or dowel.

Holes for machine bolts shall be bored with a bit the same diameter as the bolt.

Holes for rods shall be bored with a bit 1/16 inch greater in diameter than the rod.

Trial Use and Comment

Holes for lag screws shall be bored with a bit not larger than the body of the screw at the base of the thread.

(f) **Bolts and Washers:** A washer shall be used under bolt heads and nuts that would otherwise come in contact with wood. Bolts shall be checked after nuts have been finally tightened.

(g) **Countersinking:** Countersinking shall be performed wherever smooth faces are required. Recesses in horizontal surfaces shall be painted with a preservative and filled with hot pitch after the bolt or screw is in place.

(h) **Framing:** Lumber and timber shall be cut and framed to a close fit so that the joints will have an even bearing over the contact surfaces. Mortises shall be true to size for their full depth, and tenons shall fit snugly. Shimming will not be permitted in making joints, and open joints will not be accepted.

(i) **Pile Bents:** Preparing and driving piles shall be in accordance with the requirements of Section 403.

Piles for any one bent shall be carefully selected as to size to avoid undue bending or distortion of the sway bracing. Care shall be taken in distributing piles of varying sizes to secure uniform strength and rigidity in bents of any given structure.

Cutoffs shall be accurately made to ensure a uniform bearing between the cap and piles of a bent.

(j) **Framed Bents:**

1. **Mud sills:** Untreated timber used for mud sills shall be of heart cedar, heart cypress, redwood, or other durable timber. Mud sills shall be firmly and evenly bedded to solid bearing and tamped in place.

2. **Concrete pedestals:** Concrete pedestals for the support of framed bents shall be finished so that sills or posts will take an even bearing. Dowels or anchor bolts at least ¾ inch in diameter shall be set in pedestals when they are cast for anchoring sills or posts.

3. **Sills:** Sills shall have a true and even bearing on mud sills, piles, or pedestals. They shall be drift bolted to mud sills or piles with bolts at least ¾ inch in diameter and extending into the mud sills or piles at least 6 inches. When possible, earth shall be removed from contact with sills so that there will be free air circulation.

4. **Posts:** Posts shall be fastened to pedestals with dowels at least ¾ inch in diameter, extending at least 6 inches into the posts.

Trial Use and Comment

Posts shall be fastened to sills by one of the following methods, as indicated on the plans: by dowels at least ¾ inch in diameter extending at least 6 inches into posts and sills or by drift bolts at least ¾ inch in diameter driven diagonally through the base of the post and extending at least 9 inches into the sill.

(k) **Caps:** Timber caps shall be placed with ends aligned in a manner to secure an even and uniform bearing over the tops of supporting posts or piles. Caps shall be secured by drift bolts at least ¾ inch in diameter extending at least 9 inches into the posts or piles. Drift bolts shall be in the approximate center of the post or pile.

(l) **Bracing:** Ends of bracing shall be bolted through the pile, post, or cap with a bolt at least 5/8 inch in diameter. Intermediate intersections shall be bolted or spiked with wire or boat spikes, as indicated on the plans. In all cases, spikes shall be used in addition to bolts.

(m) **Stringers:** Stringers shall be sized at bearings and placed in position so that knots near edges will be in the top portions of stringers.

Outside stringers may have butt joints with ends cut on a taper, but interior stringers shall be lapped to take bearing over the full width of the floor beam or cap at each end. Lapped ends of untreated stringers shall be separated at least ½ inch for the circulation of air and securely fastened by drift bolting where specified. Where stringers are two panels in length, joints shall be staggered.

Cross bridging between stringers shall be neatly and accurately framed and securely toenailed with at least two nails in each end. Cross-bridging units shall have full bearing at each end against the side of stringers. Cross bridging shall be placed at the center of each span.

(n) **Plank Floors:** Planks shall be surfaced on four sides (S4S).

Single-plank floors shall consist of a single thickness of plank supported by stringers or joists. Planks shall be carefully graded as to thickness and placed so that no two adjacent planks shall vary in thickness by more than 1/8 inch. Each plank shall be placed heart side down, firmly jacked together, and securely fastened to each joist.

(o) **Wheel Guards and Railings:** Wheel guards and railings shall be erected true to line and grade. Wheel guards, rails, and rail posts shall be surfaced on four sides (S4S). Wheel guards shall be laid in sections at least 12 feet in length.

(p) **Painting:** Rails and rail posts, untreated timber, or timber treated with a preservative shall be painted with three coats of paint.

Metal parts, except hardware, shall be given one coat of shop paint and, after erection, three coats of field paint.

Trial Use and Comment

Timber shall be painted with No. 11 paint.

418.04—Measurement and Payment

Lumber and timber will be measured in units of 1,000 foot-board-measure (MFBM) for materials placed in the finished structure and will be paid for at the contract unit price per

MFBM. Computations for lumber quantities will be based on nominal sizes, complete-in-place. No other allowance for waste will be made.

Structural steel will be paid for in accordance with the requirements of **Section 407**.

Painting timber structures, when a pay item, will be paid for at the contract lump sum price. When not a pay item, the cost thereof shall be included in the price for other appropriate pay items.

These prices shall include preparing surfaces and preservative treatment.

Payment will be made under:

Pay Item	**Pay Unit**
Lumber (Treated or untreated)	MFBM
Painting timber structures	Lump sum

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review plans and specifications.
- Discuss materials, certifications and storage.
- Consult with District Bridge and Materials Sections for any clarifications or instructions.

Start:

- Ensure all material is approved.

Inspection:

Comment [1464]: Right quantity/payment

Comment [1465]: Right quantity

Trial Use and Comment

- Inspect lumber, hardware, and paint for materials compliance.
- Check installation process for proper treatments, lines and grades.

Final Inspection: All work is in accordance with plans and specifications.

Documentation Required:

- Materials approvals, measurement and calculations of Lumber and Timber, Document Lump Sum payment of Painting Timber Structures if included as a pay item.

- Document inspections, adjustments, measurement and payment information in Site Manager.

IV. REVIEW QUESTIONS

• Are all materials in compliance with the specifications?
• Is material stored properly?
• Are the ends, tops, and contact surfaces of untreated timber coated with two coats of preservative before assembly?
• Are pile heads protected?
• Are holes for bolts, dowels, rods and lag screws bored at the proper diameter?
• Are bolts checked for tightness and proper use of a washer?
• Have structure members been checked for uniform bearing, air circulation, cuts, surfacing, joints, and anchoring in accordance with the specifications?
• Have three coats of approved paint been applied?

V. CRITICAL INSPECTION POINTS

• Are all materials approved, tested and in compliance with plans and specifications?
• Have all components been assembled, tightened, painted, and protected in accordance with the plans and specifications?

Trial Use and Comment

SECTION 419 - BRIDGE CONDUIT SYSTEMS AND LIGHTING SYSTEMS

I. INTRODUCTION:

As soon as practicable, the Inspector should carefully study the plans, Specifications and Special Provisions and become familiar with the requirements therein. Layouts should be checked to determine any omissions or necessary changes.

MATERIALS

Occasionally, plans will specify a manufacturer's brand name, model number and state "or equal". If the Contractor elects to order an "equal", he is to submit pertinent details (drawings and manufacturer's specifications) to the Area Construction Engineer for review and approval prior to ordering such materials.

INSTALLATION

Installation is to be performed in accordance with Section 700. Conduit is generally installed in conjunction with the reinforcing steel and is to be placed so as not to interfere with the proper location of the steel. Conduit should be secured in place to avoid dislocation or damage which would affect installation of wiring.

Conduit that has been crushed, kinked, or in any way deformed is not to be used in the work. During installation, conduit is to be kept free of dirt or other objectionable material. After installation, there should be no obstructions in the conduit that will hinder the "pulling" of electrical conductors.

The location of the conduit "runs" shown on the plans is for the purpose of circuitry and bidding only. During construction it may be advantageous to alter or change the runs somewhat to avoid obstacles unforeseen during design stages.

Conduit field cuts are to be made with a pipe cutter with the ends square. When metal conduit is properly joined, the ends are butted tightly together. Periodically, the Inspector should test the couplings with a wrench to see that the joints are made up tight.

Field cuts in non-metallic conduit are also to be made square. Couplings should be checked to ensure that the proper gaskets are installed correctly and that the joint is tight.

Conduit is to be equipped with expansion and deflection fittings which coincide with bridge joints. Sufficient slack is to be left in conductors to allow for movement of bridge sections. When a bonded system is required, care should be exercised to

Trial Use and Comment

ensure continuity of the system by flexible bond across moveable fittings. Where non-metallic conduit is used, the system is bonded internally with a bare copper wire no smaller than No. 6.

Always review the contract and plans for amendments to the specifications through special provisions, copied notes or general notes.

a) Forms:

See Construction Division Memorandum:

CD-2007-01	1/18/07	Materials on Hand: Guidelines for Inventory of Items Paid for as Material on Hand

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

419.01—Description

This work shall consist of furnishing and installing a bridge conduit system and a bridge lighting system in accordance with these specifications and in conformity with the lines and details shown on the plans or as established by the Engineer.

419.02—Materials

Conduit, boxes, and fittings shall be as specified in **Section 238**.

419.03—Procedures

The Contractor shall verify or locate the origin of power sources when modifying or relocating existing electrical systems and shall advise the Engineer at least 48 hours prior to the anticipated time of de-energizing the electrical system. Workmanship shall conform to the standards of **NEC** and the requirements of the local power company.

Conduit, fittings, and electrical items shall be installed in accordance with the requirements of **Section 700.**

419.04—Measurement and Payment

Comment [1466]: Right material

Comment [1467]: Right Way

Comment [1468]: Right Location/time

Comment [1469]: Right quantity/payment

Trial Use and Comment

Bridge conduit systems, when a pay item, will be paid for at the contract lump sum price per structure. When not a pay item, the cost thereof shall be included in the price for other appropriate pay items.

Bridge lighting systems will be paid for at the contract lump sum price per structure.

Payment will be made under:

Pay Item	Pay Unit
Bridge conduit system (B or Str. No.)	Lump sum
Bridge lighting system (B or Str. No.)	Lump sum

Trial Use and Comment

III. REVIEW QUESTIONS

419.01	Is the appearance and operation of the bridge conduit and lighting system as required by the plans and specifications?
419.02	Have the materials for this work been tested or certified as specified in the materials section for electrical and signal components?
419.03(1)	Did the Contractor advise the Engineer at least 48 hours prior to any anticipated de-energizing of the electrical systems?
419.03(2)	Were conduits, fittings, and electrical items installed in accordance with the general section on Traffic Control Devices?
	Are all joints tight and expansion provided at appropriate locations?
	Are all conduit runs clear of obstructions after installation?

IV. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

Review plans and specifications. Discuss schedule and sequence of work with the contractor. Anticipate any conflicts or design issues related to locating conduit system. Plan for de-energizing and energizing system. Review manufacturer's material and installation instructions for conduit and lighting system.

Start:

Make sure all materials and "or equal" products are approved for use.

Inspection:

Ensure system is installed in accordance with plans and specifications. Check joints to make sure the cuts are square and fittings are tight. Conduit shall be free from kinks, crushed sections, deformity, or other obstructions.

Final Inspection:

System is properly installed and functional for end use.

Trial Use and Comment

Documentation Required: Manufacturer's material and installations instructions, materials certifications and approvals. Document inspections, adjustments, measurement and payment information in Site Manager.

V. CRITICAL INSPECTION POINTS

• Material and "or equal" products have proper certification and approvals before installation.
• System is installed so that conduit is free from obstructions and will not be in conflict with other structural components.

Trial Use and Comment

SECTION 420 - PREFORMED ELASTOMERIC JOINT SEALER

I. INTRODUCTION:

Open and Filled Joints

All joints should be made by the insertion and subsequent removal of a wood strip or other material. A common tendency of concrete finishers is to plaster over the wooden strip when finishing the joint. Proper attention should be directed to this very important detail. The edges of all joints should be tooled to a radius of 1/4" unless otherwise specified.

Joints are often damaged by construction traffic. Steel wheeled rollers and other construction equipment can cause spalls at the edges of unprotected joints. Once broken, these edges can never be satisfactorily repaired. Joints should be kept clean and free of dirt, pebbles and other incompressible materials in order that the openings may partially close during expansion of adjoining units of concrete.

All joints are to be completely cleaned immediately prior to filling and sealing. Remove water and other material that may have collected in the joint. The Specifications outline the proper procedure to follow when sealing a joint. Poured or extruded joint sealers are to be installed slightly lower than the deck surface (1/4" to 3/8") so that traffic does not damage the joint material. Only tested and approved joint materials are to be used.

a) Forms:

- Intentionally Left Blank

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

420.01—Description

This work shall consist of furnishing and installing preformed elastomeric joint sealer in accordance with these specifications and in conformity with the lines shown on the plans or as established by the Engineer.

420.02—Materials

Comment [1470]: Right Way

Comment [1471]: Right Material

Trial Use and Comment

Material for preformed elastomeric joint sealer and lubricant adhesive shall conform to the requirements of Section 212.02(i). The joint sealer shall be furnished in the form of an extruded compartmented tube.

420.03—Procedures

(a) **Preparation of Joint:** The joint shall be formed to provide the nominal opening at the specified temperature as shown on the plans. Sides of the joint shall be parallel to each other. Edges of concrete or epoxy mortar adjacent to the joint shall be rounded to a radius of not more than ¼ inch. A joint having an insufficient opening may be required to be sawed or ground to the proper size. If a joint opening is larger than specified, the Contractor may furnish a larger-size sealer up to 4 inches in its uncompressed width as determined by the Engineer. If the joint opening is larger than that which will accommodate the larger sealer, the end of the slab shall be cut back at least 6 inches and rebuilt with Class A4 concrete to obtain the required joint opening. The cost of such additional work or material shall be borne by the Contractor unless designated in the Contract as a pay item.

Before placement of sealer, the joint shall be thoroughly cleaned by brushing, compressed air, or other means so that it is free from dust, oil, grease, or other foreign materials.

(b) **Installation:** Sealer shall be installed using methods and procedures recommended by the manufacturer of the sealer. A lubricant adhesive shall be used. During installation, the sealer shall not be subjected to lengthwise stretching. The length to be installed shall be measured prior to installation and cut or marked to indicate the installed length.

No splices will be permitted in joint sealers for lengths less than 50 feet. For lengths greater than 50 feet, one splice will be permitted for each additional 50 feet. Splices shall be made by the manufacturer at the manufacturing plant. Longitudinal joint sealers may be field spliced where intersected by transverse joints. Field splices shall be sealed with a sealant recommended by the manufacturer.

The top surface of the sealer after installation shall be 3/8 ± 1/16 inch below the surface of the adjacent roadway.

420.04—Measurement and Payment

Preformed elastomeric joint sealer, when a pay item, will be measured in linear feet along the pavement surface from out to out of the deck slab, complete-in-place, and will be paid for at the contract unit price per linear foot. When not a pay item, the cost thereof shall be included in the price for other appropriate pay items.

Payment will be made under:

Comment [1472]: Right Way / Right Material

Comment [1473]: Right payment

Comment [1474]: Right Way

Comment [1475]: Right Way

Comment [1476]: Measure and payment

Trial Use and Comment

Pay Item	Pay Unit
Preformed elastomeric joint sealer (Width)	Linear foot

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review contract, plans, specifications, and field conditions.
- Receive invoices and test reports (if required/possibly approved list) for joint material and lubricant adhesive.
- Verify appropriate width joint material has been procured by the contractor and that a bid item exists for all required joint widths.

Start:

- Verify that the joint has been properly constructed and that the correct width joint material will be utilized.
- Verify that concrete is the appropriate type and acceptance testing is performed.

Continuous inspection:

- Verify that the joint material is installed and sealed in accordance with section 420.

Final Inspection:

- Ensure that the joint material is installed at the correct height with all areas properly sealed.

Documentation Required:

- Invoices for materials.
- Diary entries reflecting the width of joint, any temperature corrections, measurements for length of joint.

IV. REVIEW QUESTIONS

420.02	Have all materials been tested for conformity with Section 212, Joint Materials?
420.01(1)	Has the joint sealer been installed in reasonably close conformity with the specifications?
420.03(a)1	Is the joint formed to provide the nominal opening at the specified

Trial Use and Comment

	temperature as shown on the plans?
420.03(a)2	Are the sides of the joint parallel to each other?
420.03(a)3	Are edges of concrete adjacent to the joint rounded to a radius of not more than 1/4 inch?
420.03(a)4	Was the joint thoroughly cleaned to remove all foreign material prior to sealer placement?
420.03(b)1	Has the sealer been installed by tools that will not damage the material during installation?
420.03(b)2	Was the prohibition on stretching the sealer during installation adhered to?
420.03(b)3	Was the prohibition on splices in joint sealers less than 50 feet in length adhered to?
420.03(b)4	Were splices for lengths greater than 50 feet limited to 1 splice for each additional 50 feet?
420.03(b)5	Are field splices in longitudinal joint sealers sealed with a sealant recommended by the manufacturer?
420.03(b)6	Are joint sealers installed so that the top surface of the sealer is 3/8 (+/- 1/16) inch below the surface of the adjacent roadway?

V. CRITICAL INSPECTION POINTS

• **Forming of Joint:** Inspection of joint when formed to ensure appropriate width and length.
• **Placement of concrete:** Ensure concrete is correct type, consolidated, and finished with a ¼" radius at the top edges adjacent to the joint.
• **Form Removal:** Ensure joint is correct after form removal and advise contractor of required corrective action (if needed).
• **Joint Installation:** Ensure the joint has not been damaged by traffic or construction activity prior to allowed placement of joint material. If no corrections are needed verify that joint installation is performed in accordance with section 420 and the manufacturer recommendations.

Trial Use and Comment

SECTION 421 - ELASTOMERIC EXPANSION DAM

I. INTRODUCTION:

An elastomeric expansion dam will consist of elastomeric material and metal components arranged to provide for expansion and contraction movement of the bridge deck.

a) Forms:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

421.01—Description

This work shall consist of furnishing and installing elastomeric expansion dams in accordance with these specifications and in conformity with the lines, elevations, and locations shown on the plans or as established by the Engineer.

421.02—Materials

Materials shall conform to the requirements of Section 212.02(j).

421.03—Procedures

Working drawings showing the complete details and dimensions of the dam and other pertinent information, such as required special shop fabrication necessary for installation of practical leakproof joints, shall be submitted to the Engineer for review in accordance with the requirements of Section 105.10. The Contractor shall provide a factory-trained representative on the job site prior to and during the initial installation of the expansion dam.

Dams shall consist of elastomeric material and metal components arranged to provide for expansion and contraction movement of the bridge deck.

Expansion and contraction movements between adjacent spans of the bridge deck shall be compensated for entirely by deformation of the elastomeric component, without detriment to it, and shall cause no appreciable change in the elevation of the deck surface. The opening between the rigid portions of dams at the roadway level shall be not more than 3 1/2 inches at maximum opening.

Comment [1477]: Right material

Comment [1478]: Right documentation / Right Time / Right Way

Comment [1479]: Right material

Comment [1480]: Right Way / Right material

Trial Use and Comment

Dams shall seal the deck surface, gutters, curbs, and parapets to prevent water and other contaminants from seeping onto the substructure.

Dams shall have a continuous elastomeric membrane. Field-vulcanized joints for each dam may be permitted in accordance with plan details.

Dams shall be cast in place, with top surfaces parallel to the bridge deck. Concrete shall be placed beneath the dam in a manner to prevent the formation of air pockets in the concrete.

Final sealing of the finished dam shall be completed as soon as possible after installation. Bolt cavities shall be wire brushed and filled with sealant. Edges of the dam, exposed ends, and other areas of possible leakage shall be filled with sealant. Sealant shall be smoothed, and any excess scraped off before the initial set.

421.04—Measurement and Payment

Elastomeric expansion dams will be measured in linear feet of dam, complete-in-place, for the movement range specified and will be paid for at the contract unit price per linear foot. The movement range will be 0 to 2, 2 to 3, and 3 to 4 inches. When not a pay item, the cost thereof shall be included in the price for other appropriate pay items. This price shall include furnishing, installing, components, and anchoring devices.

Payment will be made under:

Pay Item	Pay Unit
ɜric expansion dam (Movement range)	Linear foot

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review contract, plans, specifications, and field conditions.
- Receive invoices and test reports (if required/possibly approved list) for joint material and lubricant adhesive.
- Verify appropriate width joint material has been procured by the contractor and that a bid item exists for all required joint widths.
- The Contractor shall provide a factory-trained representative on the job site prior to and during the initial installation of the expansion dam.

Start:

- Verify that the shop drawings and expansion dam material agree.
- Verify that concrete is the appropriate type and acceptance testing is performed.

Comment [1481]: Right Way

Comment [1482]: Right material / Right Way

Comment [1483]: Right Way

Comment [1484]: Right Way

Comment [1485]: Measurement and Payment

Trial Use and Comment

- Ensure that the expansion dam is constructed to fit correctly.
- The Contractor shall provide a factory-trained representative on the job site prior to and during the initial installation of the expansion dam.

Continuous inspection:

- Verify that the expansion dam is installed and concrete placed in accordance with the requirements of section 421 of the specifications.

Final Inspection:

- Ensure that the expansion dam is installed at the correct height with all areas properly sealed as detailed in section 421 of the specifications.

Documentation Required:

- Approved shop drawings for expansion dam, Invoices for materials. Diary entries reflecting the width of joint, any temperature corrections, measurements for length of joint.

IV. REVIEW QUESTIONS

Spec. Ref.	
421.01	Have the expansion dams been installed in conformity with the specifications and with the lines, elevations and locations shown on the plans or as established by the Engineer?
421.02	Have all materials been tested for conformity with Section 212, Joint Materials?
421.03(1)	Has the Contractor submitted working drawings for review by the Engineer?
421.03(2)	Does the Contractor provide a factory-trained representative on the job site prior to and during the initial installation of the expansion dam?
421.03(3)	Is the opening between the rigid portions of the expansion dam at roadway level no more than 3-1/2 inches at maximum opening?
421.03(4)	Does the dam seal the structure to prevent water and other contaminants from seeping onto the substructure?
421.03(5)	Does the dam have a continuous elastomeric membrane?
421.03(6)	Do field-vulcanized joints conform to plan details?
421.03(7)	Are the dams cast in place with top surfaces parallel to the bridge deck?
421.03(8)	Was concrete placed in such manner as to prevent formation of air pockets in the concrete?
421.03(9)	Was final sealing accomplished as soon as possible after installation?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Forming of Joint**: Inspection of joint when formed to ensure appropriate width and length.
• **Placement of concrete**: Ensure concrete is correct type, consolidated, and expansion dam is secured to prevent movement during concrete placement.
• **Form Removal**: Ensure joint is correct after form removal and advise contractor of required corrective action (if needed).
• **Joint Installation**: Ensure the joint has not been damaged by traffic or construction activity prior to acceptance. If no corrections are needed verify that joint installation is performed in accordance with section 421(including the sealer) and the manufacturer recommendations.
• **Joint Sealing**: Final joint sealing shall be completed as soon as possible after installation and in accordance with section 421 of the specifications.

Trial Use and Comment

SECTION 422 – NAVIGATION LIGHTS

I. INTRODUCTION:

This work shall include furnishing, installing, and wiring navigation lights complete and ready for service on structures shown on the plans or as directed by the Engineer.

a) Forms:

- Intentionally Left Blank

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

422.01—Description

This work shall include furnishing, installing, and wiring navigation lights complete and ready for service on structures shown on the plans or as directed by the Engineer.

422.02—Materials

(a) **Conduit, boxes, and fittings** shall conform to the requirements of **Section 238**.

(b) **Conductors and electrical components** shall conform to the requirements of **Section 238**. No. 8 single-conductor wire shall be used from the connection at the service pole to the first junction box on the structure, and No. 10 single-conductor wire shall be used for other wiring.

422.03—Procedures

(a) **Electrical Service:** Power will be furnished within 100 feet of the end of the bridge by 120/240-volt single-phase, 60-hertz, three-wire service. The Contractor shall furnish and install a wood pole on which the power company will terminate its service lines. The Contractor shall install service entrance equipment on the wood pole in accordance with the requirements of Standard SE-8. The safety switch shall be rated at 30 amp, 240 volts, two pole, solid neutral 120 volt AC, and fused for 15 amps.

Comment [1486]: Right Material

Comment [1487]: Right Material

Comment [1488]: Right Location

Comment [1489]: Right Material

Comment [1490]: Right Way/Right Material

Trial Use and Comment

(b) **Conduit, Boxes, and Fittings:** These shall be installed in accordance with the requirements of **Section 700**.

(c) **Lights:** Lights shall be furnished and installed in accordance with the latest rules and regulations for lighting bridges furnished by the **U.S. Coast Guard** and shall be subject to their approval. Materials and workmanship shall conform to the standards of **NEC** and the requirements of the local power company. Lights shall be equipped with an automatic lamp changer with a capacity of four lamps and a step-down transformer to operate standard low-voltage prefocused lamps. Lights shall be arranged to be turned on and off automatically so that they will burn continuously from sunset to sunrise.

Lights shall be controlled by a photoelectric control. The control shall operate a two-pole, 30-amp, normally open, magnetic relay mounted in a NEMA 3R control center cabinet. The control for the lights shall be mounted on the service pole.

422.04—Measurement and Payment

Navigation lights will be paid for at the contract lump sum price, wherein no measurement will be made. This price shall include furnishing and installing conduit, conductor cable, service entrance equipment, junction boxes, navigation lights, lamp changer, photoelectric control and step-down transformer, control center cabinet, and safety switch.

Payment will be made under:

Pay Item	Pay Unit
Navigation lights	Lump sum

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Discuss the contractors plan for Navigational Lighting. The contractor needs to submit all materials invoices for the materials used prior to starting the work.
- Contractor also needs to provide documentation that tells the Department that the lights that they are planning on using meet the US Coast Guard Regulations.
- Review Sections 238 and 700 in the Specifications for materials and installation requirements.

Start:

Comment [1491]: Right Way

Comment [1492]: Right Way

Comment [1493]: Right Material

Comment [1494]: Right Time

Comment [1495]: Right Way

Trial Use and Comment

- Get a contact name and number for someone who can come to the project in the case of an emergency.

- Check locations. Verify pole placement for Service hookup.

Continuous inspection:

- Inspect operation procedures to ensure they lights burn and turn on and off accordingly.

- Inspect the installation of the junction boxes as needed.

Final Inspection:

- Ensure that the lights are operating properly.

- Once the need for the lights are over ensure that they have been completely removed

Documentation Required:

- Need to document the work in detail in the DWR for payment.

- Need invoices for materials used to verify.

- Need letter stating who the emergency contact is and their information.

IV. REVIEW QUESTIONS:

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V. CRITICAL INSPECTION POINTS

• **Ensure that the contractors plan meets any and all of the U.S. Coast Guard's requirements prior to installation.**
• **Ensure that all materials are approved and types are correct.**
• **Ensure that contact information is obtained for someone who can respond in an emergency.**

Trial Use and Comment

SECTION 501 – UNDERDRAINS

I. INTRODUCTION:

The purpose of Underdrains is to lower the water table and dispose of water seeping into the roadway from backslopes or other sources outside the roadbed

Changes in design location, elimination of underdrains, or the selection of additional locations should be made by the Construction Manager or District Materials representative and documented in the project diary.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7Rs

501.01—Description

This work shall consist of constructing underdrains, using pipe, aggregate, and geosynthetics, in accordance with these specifications and in conformity to the lines and grades shown on the plans or as designated by the Engineer.

501.02—Materials

(a) **Pipe** shall conform to the requirements of **Section 232**.

(b) **Aggregate** shall conform to the requirements of **Section 202 or 203**.

(c) **Geosynthetics, to include geotextile fabric and prefabricated geocomposite pavement edgedrains**, shall conform to the requirements of **Section 245**.

501.03—Procedures

(a) **Excavation:** The trench shall be excavated so that the walls and bottom are free of loose and jagged material. Large depressions shall be filled with sandy material, and sharp contours and rises shall be leveled. Excavated material shall be handled in a way that prevents contamination with the aggregate used to backfill the trench for the underdrain.

Comment [1496]: Right Documentation

Comment [1497]: Right Materials

Comment [1498]: Right Way

Trial Use and Comment

(b) **Placing Geosynthetics:** When geotextile fabric or prefabricated geocomposite pavement edgedrain (PGPE) is required, it shall be placed as shown on the plans. Torn or punctured fabric shall be replaced at the Contractor's expense. Splices, when required for PGPE, shall be made using splice kits furnished by the manufacturer and in accordance with the manufacturer's written instructions. Spliced joints shall not damage the panel, shall not impede the open flow area of the panel, and shall maintain the vertical and horizontal alignment of the drain within 5 percent. Splices shall be made in such a manner as to prevent infiltration of the backfill or any fine material into the water flow channel.

Comment [1499]: Right Way/Right Material

(c) **Installing Pipe:** Perforated pipe shall be placed with the perforations facing downward on a bed of aggregate material. Pipe sections shall be joined with appropriate couplings. Semi-round underdrain pipe shall be placed with the rounded section down.

Comment [1500]: Right Matrial/Right Material/Right Location/Right Location

Wherever the depth of the trench is modified to a lesser depth than shown on the standard drawings, concrete or corrugated pipe shall be used.

Pipe shall be placed with the bell end upgrade. Open joints shall be wrapped with the same geotextile used for lining the excavation.

Upgrade ends of pipe, except for combination underdrains, shall be closed with suitable plugs. Where an underdrain connects with a manhole or catch basin, a suitable connection shall be made through the wall of the manhole or catch basin.

After the Engineer has approved the pipe installation, aggregate backfill material shall be placed and compacted. Pipe and covering at open joints shall not be displaced during subsequent operations.

Outlet pipes shall be installed at the low points of a sag.

Endwalls for outlet pipes shall be placed on a prepared surface that has been compacted to comply with the requirements of Section 303.04. If settlement of the endwall occurs, the Contractor shall make necessary repairs at his expense.

Prior to final acceptance of the underdrain system, the Contractor shall conduct a video inspection of the installed system in accordance with the requirements of VTM-108.

(d) **Combination Underdrain Outlets:** Pipe shall be placed in the trench with sections securely joined. After the Engineer has approved pipe installation,

Comment [1501]: Right Material/Right Way

Trial Use and Comment

the trench shall be backfilled with aggregate material in layers not more than 6 inches in depth and thoroughly compacted.

(e) **Inspection Ports:** Inspection ports shall be installed on the PGPE at a rate of two per mile of installed PGPE or a minimum of four per project. Inspection ports shall meet and be installed in accordance with the manufacturer's specification. The Department will use these ports in conjunction with a borscope camera as part of the basis for acceptance of the PGPE. The Department will perform inspection after PGPE installation but prior to paving of the shoulder. Bends, water flow restrictions, J-shaped panels, tears in the geotextile, debris in pipes, and sags are unacceptable and shall be removed and replaced at no cost to the Department.

Comment [1502]: Right Quantity/Right Quantity

501.04—Measurement and Payment

Comment [1503]: Right Payment

Underdrains and combination underdrains will be measured in linear feet, complete-in-place, and will be paid for at the contract unit price per linear foot. The contract unit price for underdrains installed at depths greater than those shown in the standard drawings will be increased 20 percent for each 1-foot increment of increased depth. No adjustment in the contract unit price will be made for an increment of depth of less than 6 inches. When drains are to be placed under pavement that is not constructed under the Contract, the contract unit price shall include removing and replacing pavement.

Geotextile drainage fabric, when a pay item, will be measured and paid for in accordance with the requirements of Section 504.04.

Outlet pipe for underdrains will be measured in linear feet, complete-in-place, and will be paid for at the contract unit price per linear foot.

Method of measurement

Underdrains of all types are to be measured to the nearest linear foot for each line.

These prices shall include geotextile drainage fabric when not a pay item, excavating, aggregate, backfilling, compaction, splicing, inspection ports, if any, disposing of surplus and unsuitable materials, and installing outlet markers.

Payment will be made under:

Pay Item	Pay Unit

Trial Use and Comment

Underdrain (Standard)	Linear foot
Combination underdrain (Standard)	Linear foot
Outlet pipe	Linear foot

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Verify approved source of materials
- Review specification requirements
- Review construction procedures
- Review measurement and payment.

Start:,

- Verify plans and cross sections for approved location

Intermittent inspection:

- Monitor excavation
- Monitor placement of underdrain
- Monitor backfill of trench and verify that the correct type of aggregate is placed as shown in Section 108),
- Verify that inspection ports are inspected per Section 501.03(e)
- Verify placement of endwall per section 303.04(c) or that underdrain is tied in to drainage structure

Final Inspection:

- Prior to final acceptance verify that Contractor has conducted a video inspection of the installed system in accordance with the requirements of VTM-108.
- Verify installation of EW-12 Endwalls and outlet markers are be in accordance with Section 101 of the Road and Bridge Standards

Documentation Required:

- Contractor's approved material, section 232, 202,203,245
- Manufacturer's installation recommendations
- Copy of video from VTM-108 for Materials Section
- Contractor Furnished Sources, 106.03
- Payment computations

Engineers Approval/Authorization

IV. REVIEW QUESTIONS

501.01	Are underdrain trenches excavated to the dimensions and

Trial Use and Comment

	grade required by the standard drawings, plans, or the Engineer?
501.02(a)	When polyethylene (PE) corrugated pipe is used for underdrains or outlet pipe, was the pipe smooth wall, non-perforated at the outlet? [Ref.Section 232.02(j)]
501.03(b)	Has Geotextile drainage fabric been installed as designated and has torn or puncutured material been replaced with sametype of fabric?
501.03(c)1 [38000200]	Are the perforations on perforated pipe placed facing downward on a bed of aggregate material and pipe sections joined with appropriate couplings?
501.03(c)2	If semiround pipe is used, is the rounded side placed down?
501.03(c)3	Are the upgrade ends of pipe, except for combination underdrains, closed with suitable plugs?
501.03(c)4	Where an underdrain connects with a manhole or catch basin, was a suitable connection made through the wall of the manhole or catch basin?
501.03(c)5	After the pipe installation has been approved by the Engineer, was aggregate backfill placed and compacted?
501.03(c)6	Was care taken not to displace pipe or the covering at open joints during backfill?
501.03(d)	Was the backfill material for combination underdrains placed in 6" lifts and thoroughly compacted?
501.03(e)	Are Inspection ports installed on the (Prefabricated Geocompsite Pavement Edgedrain) PGPE at a rate of two per mile of installed PGPE or a minimum of four per project?
• Are all cuts checked for springs and seepage after heavy rains?	
• Are trenches excavated to the proper depth and width?	
• Is non-perforated pipe used for outlets?	
• Are the upgrade ends of pipes adequately capped or plugged?	
• Are pipe joints checked to ensure tight connections?	
• Is the pipe placed and bedded in accordance with applicable Specifications and Standards?	
• Are all special problems pertaining to drainage brought to the attention of the Construction Manager?	

Trial Use and Comment

• Is an adequate number of outlets provided for all underdrains? Are outlets so located that there is no chance of water backing into underdrains during heavy storms?
• Are all pipe outlets checked to ensure they had not been crushed or displaced during construction?
• Are all outlets checked after periods of heavy rainfall to ensure that they were flowing freely?
• Did the Contractor place markers at outlet end of all underdrain installations?
• Is extra depth installation over 4 feet adjusted for pay in accordance with Section 501?
• Are all cuts checked for springs and seepage after heavy rains? • Are trenches excavated to the proper depth and width?
• Is non-perforated pipe used for outlets?
• Are the upgrade ends of pipes adequately capped or plugged?
• Are pipe joints checked to ensure tight connections?
• Is the pipe placed and bedded in accordance with applicable Specifications and Standards?
• Are all special problems pertaining to drainage brought to the attention of the Construction Manager?
• Did the Contractor place markers at outlet end of all underdrain installations?
• Is extra depth installation over 4 feet adjusted for pay in accordance with Section 501?

V. CRITICAL INSPECTION POINTS

• **Verify plans for location and quantity**
• **Verify source of materials**

Trial Use and Comment

• **Verify depth and size of trench**
• **Verify placement of pipe and proper backfill**

Trial Use and Comment

SECTION 502 – INCIDENTAL CONCRETE ITEMS

I. INTRODUCTION:

Incidental concrete items include paved ditches, paved flumes, curbs, gutters, combination curbs and gutters, bridge drainage aprons, concrete median barriers, median strips, sign islands and directional island curbs.

These items are shown on the plans by the designer in locations and in quantities based on the field data that is available. Additions or deletions may be necessary to suit conditions on the project. As soon as practical, the Project Inspector should review the project with the Construction Manager for any necessary changes.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7Rs

502.01—Description

This work shall consist of constructing curbs, gutters, combination curbs and gutters, paved ditches, paved flumes, bridge drainage aprons and chutes, concrete median barriers, median strips, sign islands, and directional island curbs in accordance with these specifications and in conformity to the lines and grades shown on the plans or as established by the Engineer.

502.02—Materials

(a) **Hydraulic cement concrete** shall conform to the requirements of Section 217. With the approval of the Engineer, the design of the mixture may be modified to accommodate the placement equipment to be used.

(b) **Asphalt concrete** shall conform to the requirements of Section 211.

(c) **Preformed joint filler** shall conform to the requirements of Section 212. Material shall be approximately 1/2 inch in thickness and shall have a width and depth equal to those of the incidental structure.

(d) **Curing materials** shall conform to the requirements of Section 220.

Comment [1504]: Add Product is to meet all Contract requirements and produce an aesthetically pleasing appearance.

Comment [1505]: Right materials

Trial Use and Comment

(e) **Reinforcing steel** shall conform to the requirements of Section 223, Grade 40 or 60.

(f) **Rubble stone** shall conform to the requirements of Section 205.

(g) **Grout** shall conform to the requirements of Section 218.

(h) **Foundation course** shall be aggregate No. 68 conforming to the requirements of Section 203.

(i) **Dry filler** shall consist of aggregate conforming to the requirements of Section 202 or 203, as applicable.

(j) **Seed** shall conform to the requirements of Section 244.

(k) **Topsoil** shall conform to the requirements of Section 244.

502.03—Procedures

The foundation shall be constructed to the required elevation. Unsuitable material shall be removed and replaced as directed by the Engineer. The subgrade shall be thoroughly compacted and shaped to provide a uniform, smooth surface. The foundation for hydraulic cement concrete items shall conform to the specified density of the course and shall be moist when concrete is placed.

Comment [1506]: Right Way, Right Documentation

Immediately following finishing operations, hydraulic cement concrete shall be cured and protected in accordance with the requirements of Section 316.04.

Comment [1507]: Right Way, right material

(a) **Fixed Forms Requirements:** Fixed forms shall be straight, free from warp, and of such construction that there will be no interference with the inspection of grade and alignment. Forms shall extend the entire depth of the item and shall be braced and secured so that no deflection from alignment or grade will occur during concrete placement. Radial forms shall be sufficiently flexible or otherwise designed to provide a smooth, uniform, curved surface of the required radius. Face forms shall be removed as soon as concrete has attained sufficient set for the curb to stand without slumping. The exposed surface shall then be smoothed by the use of a suitable finishing tool.

Transverse joints for crack control for fixed forms shall be provided at the following locations:

Comment [1508]: Right Location, Right Way

1. at approximately 20-foot intervals

2. at the gutter where the curb and gutter tie to the gutter apron of drop inlets

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3. when the time elapsing between consecutive concrete placements exceeds 45 minutes

4. where no section shall be less than 6 feet in length.

Crack control joints may be formed by using one of the following methods:

a. removable 1/8-inch-thick templates

b. scoring or sawing for a depth of not less than 3/4 inch when using curb machine

c. approved "leave-in" type insert or may be formed or created using other approved methods which will successfully induce and control the location and shape of the transverse cracks.

The joint at the gutter where the curb and gutter ties to the apron gutter of the drop inlet shall be formed by scoring or sawing.

Expansion joints shall be formed at intervals of approximately 100 feet, at all radii points at concrete entrances and curb returns, and at locations no less than 6 feet and no more than 10 feet from drop inlets.

Hydraulic cement concrete shall be sufficiently consolidated to produce a uniform, closed surface. Edges shall be rounded to a 1/4-inch radius.

Exposed surfaces except concrete median barrier immediately adjacent to the roadway shall be given a light broom finish. Concrete median barrier shall be given a Class 1 finish in accordance with the requirements of Section 404.07(a). Paved ditches and paved flumes shall be given a coarse or roughened texture. Other exposed surfaces shall be given a rough wood float finish. Mortar used in the removal of surface irregularities shall conform to the requirements of Section 218.

(b) **Slipform Requirements:** The Contractor will be permitted to slipform incidental concrete items provided the following conditions contained herein are met. Approval by the Engineer to allow the Contractor the option of slipforming concrete items is permissive only and in no way relieves the Contractor from his responsibility to comply with the contract requirements and conditions.

Slipform equipment shall produce a product equal to or better than that produced by fixed form construction. Equipment for slipforming operations shall be designed or engineered to form the type of construction design for which its use is intended. Where equipment has been modified to such an extent that its use is questionable, the Contractor may be required at his expense to demonstrate to the Engineer's satisfaction that the equipment can consistently produce the desired type of construction. The slipform equipment shall be self-propelled and shall be equipped to consolidate, form, extrude, and finish the freshly placed concrete in such a

Comment [1509]: Right material, Right Way

Trial Use and Comment

manner that a minimum of hand finishing is required to produce a dense, consolidated, homogenous product. Slipform equipment shall be controlled to line and grade by automatic sensing, guidance, and control devices such that the machine automatically senses and follows taut guidelines or other stable reference, performing any necessary corrective action to ensure the correct grade and alignment are achieved. The Contractor shall ensure the slipform operation is planned to result in the full cross section and grade of the desired design at the beginning and end of the placement. Slipform equipment shall operate with a continuous forward movement. The Contractor shall plan and stage the work to eliminate the need for the slipform machine to be stopped during placement operations. If for any reason it is absolutely necessary to stop the forward progress of the machine, operation of the vibrating and tamping elements shall be stopped immediately. Equipment used for slipforming shall conform to the general requirements of Section 108.07. If the results of the slipform operation are not satisfactory to the Engineer in accordance with the requirements stated herein, the continued use of the equipment will not be permitted.

Concrete for use in slipform operations may be manufactured with a slump as low as zero. The top of the slump range shall conform to the requirements for the class of concrete specified on the plans or special provisions in accordance with Section 217. The concrete shall have properties that consistently maintain workability and the cross section, line, and grade of the proposed product. Concrete shall be finished to a light broom finish. If water is held back to maintain the desired slump, it may be added in increments provided the maximum water per cubic yard has not been exceeded and a minimum of 30 revolutions at mixing speed is used for complete mixing.

Where reinforcing steel is incorporated into the proposed design, it shall be uncoated steel conforming to the requirements of Section 223. Reinforcing steel shall be tied at 100 percent of the bar intersections and shall be sufficiently strengthened with braces, additional reinforcement, or chairs to make the reinforcement cage rigid so as to prevent any movement during concrete placement. If the reinforcing steel exhibits any movement during concrete placement using slipforming methods, the work shall be suspended until the reinforcing steel has been sufficiently tied and stabilized to the satisfaction of the Engineer. The reinforcing steel shall be continuous from fixed object to fixed object. All reinforcing steel shall have the appropriate amount of concrete cover for the particular design with a tolerance of – 0 or +½ inch**.** In no case shall the amount of cover be less than 1½ inches. Reinforcing steel inserted in the freshly placed concrete shall be inserted with the use of vibration to achieve adequate bond of the reinforcing steel. Where bonding is suspect, the Engineer may require pull out tests be performed by the Contractor at his expense. If such tests confirm the presence of adequate bond, the Department will reimburse the Contractor the cost of such testing.

Comment [1510]: Right material

Comment [1511]: Right Way

Trial Use and Comment

The maximum height of any extrusion shall be limited such that the alignment and cross-sectional shape of the design is maintained within the construction tolerances. If the Contractor elects to use or is required to use multiple placements to achieve a particular design, the Contractor shall submit a plan outlining the details of each placement for approval by the Engineer prior to beginning placement operations. Where multiple placements are permitted for installation of a particular design, the separate placements shall be staged so that any horizontal joints incorporated in the phased construction shall be arranged in such a manner as to prevent water infiltration in the final design and water flowing through any longitudinal joint.

Where weep holes are part of the proposed median barrier design, the Contractor shall use 6-inch-diameter underdrain pipe in lieu of weep holes. Underdrain pipe conforming to the requirements of Section 232 shall be installed at the grade at the bottom of the footing and shall terminate in catch basins or drop inlets.

Where naturally occurring vertical contraction cracking occurs and where there exists a grade separation on each side of the barrier, the Contractor shall install a waterproofing membrane conforming to the requirements of Section 213, spanning 1½ feet on each side of the contraction crack at the back surface of the higher grade side of the barrier to prevent water from passing through the barrier.

Expansion joint material 1½-inch thick shall be installed adjacent to each fixed object. Expansion material shall be placed against each fixed object prior to placement of the slipformed concrete. Contraction joints will not be required with slipformed operations provided the reinforcing steel is continuous from fixed object to fixed object.

(c) **Individual Item Requirements:**

Comment [1512]: Right Way, Right Location, Right material, Right Time

1. **Hydraulic Cement Concrete Curbs, Gutters, Combination Curbs and Gutters, Paved Ditches, and Paved Flumes:** Where standard mountable curb or combination curb and gutter with mountable curb is specified, adjacent curbs of standard entrance gutter and standard connection for streets shall be modified to provide a mountable shape corresponding to the standard mountable shape.

Where integral curb is specified, the curb shall be placed simultaneously with or immediately after placement of the slab. The time period between slab and curb placement shall be not more than 45 minutes except as hereinafter specified. The surface of the slab on which the curb is to be placed shall be roughened, and the concrete shall be placed so as to secure a bond between the slab and curb.

When authorized by the Engineer, the Contractor may construct the integral curb by providing steel dowels $^{5}/_{8}$ inch in diameter, 7 inches in length, to be embedded in the slab at 1-foot intervals. Dowels shall be placed so as to extend at least 2

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inches into the curb. While the slab is still plastic, it shall be roughened to a depth of approximately ½ inch below the screeded surface for the full width of the curb.

Local irregularities in the face and top of curbs shall be not more than $^{3}/_{8}$ inch in 10 feet. Vertical alignment shall be sufficiently uniform and regular to ensure complete drainage.

Any curb, gutter, or combination curb and gutter, except those on structures, may be placed by the slipform method provided the finished product is true to line, cross section, and grade and the concrete is dense and has the required surface texture. The concrete shall be of such consistency that it will maintain the desired shape or cross section of the design without support.

Where concrete curb or curb and gutter is placed over existing pavement, it shall be anchored to the existing pavement either by placing steel dowels and reinforcing steel or by using an approved adhesive. Steel dowels shall be firmly mortared with 1:1 portland cement and sand mortar in holes drilled in the pavement. If an adhesive is used, the surface of the pavement shall be thoroughly cleaned before the adhesive is applied. Adhesive shall be EP-4 epoxy resin, a two-component system conforming to the requirements of Section 243. The pavement shall be cleaned by either blast cleaning or wire brushing so that the prepared surface is free of dust, loose material, oil, or any other material that may prove deleterious to bonding.

The grade for the top of the extruded curb shall be indicated by an offset guideline set by the Contractor from survey information supplied by the Department. The forming tube portion of the extrusion machine shall be readily adjustable vertically to accommodate, when necessary, a variable height of curb conforming to the predetermined curb grade line. A grade line gage or pointer shall be attached to the machine to monitor the elevation of the curb being placed against the established grade line so as to make corrective adjustments as necessary. In lieu of a grade line gage or pointer, the extrusion machine may be operated on rails or forms set to produce the predetermined finished grade line for the curbing.

Concrete shall be continuously fed to the slipforming machine at a uniform rate. The machine shall be operated under sufficient uniform restraint of forward motion so as to produce a well-compacted homogenous mass of concrete free from surface pits larger than ¼ inch in diameter and requiring no further finishing other than light brushing with a broom. Finishing with a brush application of grout will not be permitted.

Expansion joints shall be constructed as specified for fixed formed curbing or shall be constructed by sawing through the curb section to its full depth. The width of the cut shall be such to allow the insertion of the joint filler with a snug fit. If sawing is performed before the concrete has hardened, the adjacent portions of the curb shall

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be supported firmly with close fitting shields. The operations of sawing and inserting the joint filler shall be completed before curing the concrete.

If sawing is performed after the concrete has hardened, the joint filler shall be mortared in place with heavy trowel pressure. After sawing is performed, all exposed portions of the curb in the vicinity of the joint shall be covered with another application of curing compound. At the conclusion of the curing period, the filler in each sawn joint shall be checked for tightness of fit. Any loose filler shall be mortared in place again and cured.

Within 3 to 7 days, the Contractor shall backfill curb, gutter, and combination curb and gutter to the required elevation with approved material. Backfill material shall be compacted with curbs and gutters remaining plumb.

2. **Asphalt Concrete Curbs and Paved Ditches:** The curb shall be placed on a clean dry surface. Immediately prior to placement of the asphalt mixture, a tack coat of asphalt shall be applied to the surface at a rate between 0.05 and 0.15 gallon per square yard of surface. Asphalt shall be prevented from spreading outside the area to be occupied by the curb.

Asphalt concrete curb shall be placed by a self-propelled automatic curb machine or a paver having curbing attachments to form a satisfactorily compacted curb of a uniform texture, shape, and density. The Engineer may permit construction of curbs by other means when short sections or sections with short radii are required. The resulting curbs shall conform in all respects to curbs produced by a curb machine.

Sealing or painting shall be performed only on curbs that are clean, dry, and cooled to ambient temperature.

Asphalt concrete paved ditches shall be placed and compacted so as to provide a smooth, uniform, and dense texture.

3. **Grouted Rubble Gutter:** Aggregate for the foundation course shall be spread on the subgrade to a depth of at least 4 inches.

Gutter stones shall be bedded in the foundation course perpendicular to the finished surface, flat side up, in straight rows, with the longest dimension perpendicular to the centerline of the gutter. Joints shall be broken in a satisfactory manner, and the width of interstices in the dry gutter shall be not more than 1 inch.

Stones shall be rammed until the surface is firm and conforms to the finished grade and cross section. Joints shall then be filled with dry filler to within 4 inches of the top of stones, and the surface shall be rammed to ensure proper compaction of filler. After irregularities have been corrected, cement grout shall be poured and broomed into joints and over stones. Additional grout shall be applied and brooming shall be continued until grout remains flush with the top of stones.

Comment [1513]: Right Way, Right material, Right Location, Right Quantity

Comment [1514]: Right Way, Right material, Right Location, Right Quantity

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4. **Concrete Median Barriers:** Concrete median barriers shall be constructed in accordance with the requirements specified herein and in Sections 512, 404, and 410.

Concrete median barriers shall be constructed within an allowable tolerance of ½ inch for overall depth and overall width, ¼ inch for the width of the upper portion of the barrier, and ¼ inch per 10 feet for horizontal alignment.
After the specified curing time has elapsed, concrete median barriers for roadways shall be backfilled to the required elevation with approved material. Where crushed glass is used as porous backfill an 18-inch by 18-inch swatch of drainage fabric meeting the requirements of Section 245.03(c) of the Specifications shall be used to cover the #4 mesh at each weep hole opening exposed directly to crushed glass, or as approved by the Engineer. Crushed glass shall be capped with concrete in accordance with the details shown on the standard drawing, or a minimum of 6 inches of other approved soil or aggregate material. Crushed glass shall not be used as porous backfill directly beneath paved surfaces for barrier applications. Material shall be thoroughly tamped in layers not more than 6 inches in depth before compaction. Delineators shall be installed on median barriers in accordance with the requirements of Section 702.03.

(d) **Saw Cut Hydraulic Cement Concrete Items:** This work shall consist of the Contractor saw cutting to the full depth hydraulic cement concrete curb, sidewalk, and entrances as shown on the plans and as directed by the Engineer.

502.04—Measurement and Payment

Standard concrete curbs, radial curbs, standard combination curb and gutter, radial combination curb and gutter, and asphalt concrete curbs will be measured in linear feet along the face of the curb, complete-in-place, and will be paid for at the contract unit price per linear foot. The price shall include modifying curbs for standard entrance gutters, standard street connection pavement, and standard median strips. Where the curb or curb and gutter is adjacent to drop inlets, the contract unit price for the drop inlets shall include that part of the curb or curb and gutter within the limits of the structure.

Where there is no excavation within the limits of the curb, gutter, combination curb and gutter, or median barrier other than that necessary for its construction, the contract unit price shall include excavating, backfilling, compacting, and disposing of surplus and unsuitable material. Where excavation is necessary for the roadway, the part within the limits of the curb, gutter, combination curb and gutter, or median barrier section will be paid for as regular excavation in accordance with the requirements of Section 303.06.

Comment [1515]: Right Way, Right material, Right Location, Right Quantity

Comment [1516]: Right Location, Right quantity

Comment [1517]: Right payment and Right Quantity

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Standard, radial, entrance, and grouted rubble gutters; paved ditches; paved flumes; street connection pavement; and bridge drainage aprons and chutes will be measured in square yards of surface area, complete-in-place, and will be paid for at the contract unit price per square yard. The price for grouted rubble gutter shall include rubble stone, grout, foundation course, and filler. When pipe drain ditch liner is substituted for standard paved ditch at the Contractor's option, payment will be made at the contract unit price for the standard paved ditch specified. When pipe drain ditch liner is specified on the plans, payment will be made at the contract unit price per linear foot, complete-in-place.

The cost of excavation below the finished grade or below the slope surface of cut or fill sections that is necessary for installing and backfilling paved ditches and flumes shall be included in the contract unit price for the paved ditch or flume. Undercut excavation below the neat lines of paved ditches in cut sections, including replacement backfill for undercut excavation and excavation above the upper lateral limits of paved ditches and paved flumes that are outside the normal plan earthwork limits, will be measured and paid for in accordance with the requirements of Section 303.06.

Cattle guards will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each.

Energy dissipators will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each.

Median barriers will be measured in linear feet along the centerline of barriers complete in place and will be paid for at the contract unit price per linear foot. Unless otherwise specified, this price shall include furnishing and placing delineators, aggregate, excavation, backfill, weep hole covering, concrete cap, dowels, and joint sealer.

Curb-cut ramps will not be measured for separate payment but will be measured in the units specified for their components.

Median strips will be measured in square yards or linear feet as specified and will be paid for at the contract unit price per square yard or linear foot.

Sign islands will be measured in units of each or square yards, complete-in-place, exclusive of posts and signs and will be paid for at the contract unit price per each or per square yard.

Directional island curbs will be measured in linear feet along the face of the curb and will be paid for at the contract unit price per linear foot.

Embankment material between curb lines will be measured and paid for in accordance with the requirements of Section 303.06 except as follows.

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When there is no excavation or construction other than that necessary for constructing median strips, sign islands, or directional island curbs, the contract unit price shall include excavating, removing existing pavement, disposing of surplus and unsuitable material, backfilling, and compacting. When excavation or demolition of pavement is necessary for the adjoining roadway, that portion within the limits of the median strip, sign island, or directional island curb will be paid for as regular excavation or demolition of pavement in accordance with the requirements of Sections 303.06 and 508.03, respectively.

These prices shall include applying topsoil and seed.

Ditch flume connector will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each. This price shall include excavation when required, dowels, welded wire fabric, reinforcing steel, anchor lugs, curtain walls, and concrete.

Saw cut hydraulic cement concrete items will be measured in linear feet and paid for at the contract unit price per linear foot. This price will be considered full compensation for saw cutting the hydraulic cement concrete items to the depth specified.

Payment will be made under:

Pay Item	**Pay Unit**
Curb (Type and standard)	Linear foot
Combination curb and gutter (Type and standard)	Linear foot
(Type and standard)	Square yard
Paved ditch (Standard)	Square yard
Pipe drain ditch liner (Standard)	Linear foot
Paved flume (Standard)	Square yard
Energy dissipator (Standard)	Each
ce gutter (Standard)	Square yard
Street connection pavement (Standard)	Square yard
Median barrier (Standard)	Linear foot
Bridge drainage apron and chute (Standard)	Square yard
Median strip (Standard width)	Square yard or Linear foot
Sign island (Standard)	Each or Square yard
Directional island curb (Standard)	Linear foot
Cattle guard (Standard)	Each
Ditch flume connector (Standard)	Each
Saw cut hydraulic cement concrete items (Depth)	Linear foot

Comment [1518]: Right payment, Right pay quantity

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III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review plans and specification requirements
- Review procedures
- Review same with Contractor

Start:

- Make sure Approved material is being used for incidental concrete item and items associated with the pay item.
- Observe contractor's layout to ensure proper dimensions will be obtained upon completion of incidental Concrete item.
- Ensure Contractor has a Certified concrete technician on site during pour.

Continuous / Intermittent Inspection:

- Continuous inspection is necessary during any traffic control set ups and during concrete placement, consolidating, finishing and curing.

- Intermittent: Ensure that the contractor is correctly grading and compacting base material prior to placement of material. Continue to spot check contractors' form dimensions, joint spacing, condition of forms and bracing procedures.

Final Inspection:

- Verify that concrete has received its' proper finish and is cured properly.

Documentation Required:

- Delivery tickets covering amount of material used: Including all incidental items to pay item.
- Document location of work performed and all computations needed to verify pay quantities.

IV. REVIEW QUESTIONS

Spec Ref.	
502.01	Are all dimensions and reinforcing steel in accordance with the applicable standards for various incidental concrete items?
502.03(01)	Does the foundation for incidental concrete items conform to density requirements with all unsuitable material removed and replaced prior to

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	placement of hydraulic cement concrete items?
502.03(02)	Is the subgrade moist when concrete is placed?
502.03(03)	Has the concrete been cured and protected in accordance with Section 316.04(j) of Hydraulic Cement Concrete Pavement?
502.03(a)01	Are forms free of warp and braced to prevent deflection during concrete placement?
502.03(a)02	Are radial forms sufficiently flexible or otherwise designed to provide a smooth, uniform, curved surface of the required radius?
502.03(a)03	Are face forms removed as soon as concrete has attained sufficient set and exposed surfaces then smoothed with a suitable finishing tool?
502.03(a)04	Are transverse joints for crack control in hydraulic cement concrete items provided at the specified locations and times?
502.03(a)05	Are sections of concrete items the minimum length required?
502.03(a)06	Are crack control joints formed by the methods indicated?
502.03(a)07	Are expansion joints placed at 100'± intervals, all radii points on concrete entrances and curb returns, and 6 to 10 feet from drop inlets?
502.03(a)08	Is concrete sufficiently consolidated to produce a closed surface and edges rounded to a 1/4-inch radius?
502.03(a)09	Are exposed surfaces immediately adjacent to the roadway, except concrete median barrier, given a light broom finish?
502.03(a)10	Are concrete median barriers given a Class 1 finish in accordance with Section 404.07(a) of Hydraulic Cement Concrete Operations?
502.03(a)11	Are paved ditches and flumes given a coarse or roughened texture?
502.03(b)1	Does slipforming equipment produce equal or better than that of fixed form construction?
502.03(b)2	Is concrete mixed at least 30 revolutions when water is added during slipforming?
502.03(b)3	Has contractor placed 1 1/2" thick expansion joint material against each fixed object prior to placement of slipforming concrete on median barriers?
502.03(b)4	During slipforming is reinforcing steel tied 100% at all intersections to prevent movement of cage during operations?
502.03(c1)1	When mountable curb or combination mountable curb and gutter is placed, are adjacent curbs modified to provide a mountable shape?
502.03(c1)2	Is integral curb placed within 45 minutes of slab placement?
502.03(c1)3	Is the surface of the slab on which integral curb is to be placed roughened or doweled to improve bonding?
502.03(c1)4	Are irregularities in the face & tops of curbs no more than 3/8" per 10' with vertical alignment smooth enough to ensure complete drainage?
502.03(c1)5	Has the contractor anchored curb & gutter to existing pavement by means of smooth dowels or approved adhesive?
502.03(c1)6	Has the curb, gutter, and combination curb and gutter been backfilled and the material compacted within 3 to 7 days?
502.03(c2)1	Are asphalt concrete curbs placed on a clean dry surface which has been tacked at a rate between 0.05 and 0.15 gallons/square yard prior to asphalt placement?

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502.03(c2)2	Does the contractor prevent the spread of bituminous material outside the curb area?
502.03(c2)3	Is asphalt concrete curb placed by machine except when short sections are required?
502.03(c2)4	Is bituminous concrete paved ditch placed in a manner which seals the surface sufficiently to provide a smooth, uniform, and dense texture?
502.03(c4)1	Are concrete median barriers constructed to within a +/- 1/2 inch tolerance for overall depth and width, +/- 1/4 inch for width of the upper portion, and +/- 1/4 inch per 10 feet for horizontal alignment?
502.03(c4)2	Are concrete median barriers backfilled in accordance with this section?
502.03(c4)3	Are delineators installed on median barriers in accordance with Section 702.04(b) of Delineators?

V. CRITICAL INSPECTION POINTS

• **Verify whether product is in the proper location**
• **Review grade to verify it is an adequate foundation to place concrete**
• **Verify dimensions of forms to assure they meet requirements**
• **Verify class of concrete is correct for item being placed**
• **Verify concrete is being placed, vibrated, finished and cured properly**
• **Verify pay quantity unit and document it. Ensure that all computations needed for quantity verification are in project documentation.**

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SECTION 504 – SIDEWALKS, STEPS AND HANDRAILS

I. INTRODUCTION:

Sidewalks can be constructed with either hydraulic cement concrete or asphalt concrete. The location of sidewalks should be verified by the Inspector prior to excavation. After excavation, unsuitable material should be removed and the foundation graded to the proper elevation and thoroughly compacted.

Prior to placement of concrete the forms should be free of warp, free of foreign material, and sufficiently braced to prevent deflection. .

The foundation shall be thoroughly moistened and the forms oiled prior to placement of concrete.

Class A3 concrete should be used for the construction of sidewalks. The outside edges and joints should have a radius of ¼-inch, the surface finished using a hand float and trowel, and the marks removed with brooming.

Transverse expansion joints are to be constructed at approximately 100 - foot intervals. Slabs should be at least 3 feet in length and be separated by preformed joint filler extending from the bottom of the slab to ¼ inch below the top of the slab.

Construction joints shall be formed around appurtenances extending into and through the sidewalk. These joints shall be constructed using ¼ inch performed joint material, but not adjacent to drop inlets. An expansion joint shall be filled with ¼ inch performed joint filler no less than 6 feet and no more than 10 feet from drop inlets. Performed joint filler shall be installed between the concrete sidewalk and any adjacent fixed structure.

Where sidewalks are adjacent to curb, the expansion joints in the sidewalk and curb should coincide.

Sidewalks should not be open to pedestrian traffic for 5 days and not open to vehicular traffic for 14 days or until the minimum design strength had been achieved.

When liquid membrane curing compound is used a uniform coating shall be applied and heavy concentrations should not be allowed.

When asphalt concrete is used, a 4 inch layer of No. 8 aggregate bedding shall be placed and thoroughly compacted. Asphalt concrete may be placed in one or more layers, dependant on the depth required. Asphalt concrete should be accomplished

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using a hand operated or power roller of sufficient weight to achieve the necessary density. Hand tamping is only permitted in areas inaccessible to the roller.

STEPS

Hydraulic cement concrete steps are to be constructed in accordance with the plans or **Sections 404** and **406**.
A light broom finish should be given to the tread portion of the steps.

Finished concrete shall be cured and protected in accordance with **Section 316.04**.

HANDRAILS

Handrails are constructed using galvanized metal rails, posts, and fittings in accordance with **Section 233**. If joints are welded, all exposed joints shall be finished smooth by grinding or filing to give a neat appearance.

Handrails shall be grounded in accordance with **Section 410.03(b).**

a) Forms:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

504.01—Description

This work shall consist of constructing sidewalks, steps, and handrails on steps or walls in accordance with these specifications and in conformity to the lines and grades shown on the plans or as established by the Engineer.

Comment [1519]: Right Way

504.02—Materials

Comment [1520]: Right Material

(a) **Concrete** shall be Class A3 conforming to the requirements of Section 217.

(b) **Reinforcing steel** shall conform to the requirements of Section 223.

(c) **Curing materials** shall conform to the requirements of Section 220.

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(d) **Preformed joint filler** shall conform to the applicable requirements of Section 212. Material shall be approximately 1/2 inch in thickness and shall have a width and depth equal to those of the structure.

(e) **Asphalt concrete** shall conform to the requirements of Section 211.

(f) **Rails and posts** shall conform to the requirements of Section 232.02(c)4.b. Rails shall be of standard weight, and posts shall be extra strong pipe.

(g) **Geotextile drainage fabric** shall conform to the requirements of Section 245.

(h) **Grounding materials** shall conform to the requirements of Section 238.

504.03—Procedures

(a) **Sidewalks:** The foundation shall be shaped and compacted to a firm, even surface.

Unsuitable material shall be removed and replaced with approved material as directed by the Engineer.

When geotextile drainage fabric is required, the designated area shall be cleared of debris prior to fabric installation. Large holes shall be filled with sandy, coarse material, and sharp contours and rises shall be leveled. Adjacent strips of geotextile drainage fabric shall be overlapped at least 12 inches. If fabric is torn or punctured, it shall be repaired with the same type of fabric. A patch shall be placed over the damaged area with an overlap of at least 12 inches in all dimensions at the Contractor's expense.

Forms shall be straight, free from warp, and of sufficient strength to resist the pressure of concrete without springing and shall extend for the full depth of concrete. Forms shall be braced and stacked so that they will remain in horizontal and vertical alignment until their removal. Where practicable, forms shall be placed at least 100 feet in advance of concrete placement. Forms shall be cleaned of foreign matter and oiled before concrete is placed.

1. **Hydraulic cement concrete sidewalk:** The foundation shall be thoroughly moistened immediately prior to concrete placement. Concrete shall be placed in forms by methods that will prevent segregation. Concrete shall be spread to the full depth and brought to grade by screeding and straightedging. Concrete shall be spaded adjacent to forms to prevent a honeycomb appearance, and the surface shall be floated with a wooden float to produce a surface free from irregularities. The final finish shall be obtained with an approved hand float that will produce a uniform surface texture. Light metal marking rollers or light brooming may be used to hide trowel marks. Outside edges of the sidewalk slab and joints shall be edged with an edging tool having a radius of 1/4 inch.

Comment [1521]: Right Way

Comment [1522]: Right Material

Comment [1523]: Right Payment

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Transverse expansion joints shall be constructed at intervals of approximately 100 feet, except for closures. Slabs shall be at least 3 feet in length. Slabs shall be separated by transverse preformed joint filler, 1/2 inch in thickness that extends from the bottom of the slab to approximately 1/4 inch below the top surface.

Comment [1524]: Right Material

The slab between expansion joints shall be divided into sections approximately 5 feet in length by transverse control joints formed by a jointing tool, trowel, or another approved means. Transverse control joints shall also be provided when the time period between consecutive concrete placements is more than 45 minutes. Control joints shall extend into concrete for at least 1/4 of the depth and shall be approximately 1/8 inch in width. Where slabs are more than 7 feet in width, control joints shall be formed longitudinally to obtain secure uniform blocks that are approximately square. Transverse control joints shall also be installed where the corners of the drop inlets project into the sidewalk.

Comment [1525]: Right Time

Construction joints shall be formed around appurtenances extending into and through the sidewalk. Preformed joint filler 1/4 inch thick shall be installed in these joints except that joint filler shall not be used adjacent to drop inlets. An expansion joint shall be formed and filled with 1/4-inch preformed joint filler no less than 6 feet and no more than 10 feet from drop inlets. Preformed joint filler shall also be installed between concrete sidewalk and any adjacent fixed structure that is not tied to the sidewalk with steel dowels.

Comment [1526]: Right Material

Where the sidewalk is constructed in conjunction with adjacent curb, expansion joints in the curb and sidewalk shall coincide. Where such construction is adjacent to existing curb, the expansion joint shall coincide, where practicable.

Where existing or proposed structures are within the limits of the sidewalk area, concrete around them shall be scored in a block approximately 8 inches wider than the maximum dimension of the structure at the sidewalk elevation.

Preformed joint filler shall be securely fastened.

The Engineer may drill cores from the completed slab to make depth measurements. Sections showing a deficiency of more than 3/8 inch shall be removed and replaced to the specified depth at the Contractor's expense.

Immediately following finishing operations, concrete shall be cured and protected in accordance with the requirements of Section 316.04. Sidewalks shall not be opened to pedestrian traffic for the first 5 days. Vehicular traffic shall be excluded for the first 14 days or until the minimum design compressive strength is attained, whichever is the lesser time.

Comment [1527]: Right Time

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When liquid membrane-forming compound is used, heavy concentrations of compound that will not properly set and that may be tracked into homes or businesses shall not be used.

2. **Asphalt concrete sidewalk:** When specified on the plans, a layer of bedding material consisting of approved aggregate conforming to the grading requirements of No. 8 aggregate shall be placed in layers not more than 4 inches in depth, loose measurement, and thoroughly compacted.

   Asphalt concrete shall be placed in forms in one or more courses to provide the specified depth when compacted. Compaction shall be accomplished by means of a hand-operated or power roller of a type and weight acceptable to the Engineer. Tamping by hand will be permitted in areas inaccessible to a roller. The method of compaction shall produce a smooth, dense, uniformly compacted sidewalk.

(b) **Hydraulic Cement Concrete Steps:** Hydraulic cement concrete steps shall be constructed in accordance with the requirements of Sections 404 and 406. The tread portion of steps shall be given a light broom texture. Finished concrete shall be cured and protected in accordance with the requirements of Section 316.04.

(c) **Handrails:** Standard or special fittings shall be used, or joints may be welded. If joints are welded, exposed joints shall be finished by grinding or filing to give a neat appearance. Handrails shall be bonded internally to maintain continuity. Electrical grounding shall conform to the requirements of Section 410.03(b).

   Metal items, including rails, posts, and fittings, shall be galvanized in accordance with the requirements of Section 233 except for metal posts and rails fabricated from pregalvanized material whose ends and other exposed areas are satisfactorily repaired with a material conforming to the requirements of Section 233.

   When rails are placed on a mortar rubble wall, the wall shall be capped with 14 inches of Class A3 concrete.

504.04—Measurement and Payment

Comment [1528]: Right Payment

Hydraulic cement concrete sidewalks will be measured in square yards of finished surface, complete-in-place, and will be paid for at the contract unit price per square yard. Each structure located within the limits of the sidewalk having an area greater than 1 square yard will be excluded in computing the square yards of sidewalk.

Asphalt concrete sidewalks will be measured in tons of asphalt mixture placed and will be paid for at the contract unit price per ton.

If regular excavation is not shown in the sidewalk area, the contract unit price for sidewalks shall include excavating, removing existing sidewalk, and disposing of

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surplus and unsuitable material. When the sidewalk area is located in the cross-sectional area for roadway excavation, excavation within the sidewalk area will be paid for at the contract unit price for regular excavation.

Bedding material will be measured in tons or cubic yards in accordance with the requirements of Section 109 and will be paid for at the contract unit price per ton or cubic yard.

Concrete steps will be measured in cubic yards of concrete and pounds of reinforcing steel, complete-in-place, and will be paid for at the contract unit price per cubic yard of concrete and per pound of reinforcing steel.

Handrails will be measured in linear feet along the top rail, complete-in-place, and will be paid for at the contract unit price per linear foot. This price shall include concrete placed on mortar rubble walls when the wall is not included in the Contract. This price shall include grounding.

Geotextile drainage fabric will be measured in square yards to the limits shown on the plans or as directed by the Engineer, complete-in-place, and will be paid for at the contract unit price per square yard. Overlaps, overwidths, and waste fabric will not be measured. This price shall include preparing the surface; furnishing and installing fabric, overlaps, and repair work; and excavating and backfilling toe-ins.

Payment will be made under:

Pay Item	Pay Unit
Hydraulic cement concrete sidewalk (Depth)	Square yard
Asphalt concrete sidewalk	Ton
Bedding material	Ton or Cubic yard
Concrete, Class A3, Miscellaneous	Cubic yard
Reinforcing steel	Pound
Handrail (Standard)	Linear foot
Geotextile drainage fabric (Type)	Square yard

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III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- **Have an approved concrete mix design.**

Start:

- **Review location to ensure subgrade is properly prepared.**
- **Forms are clean, placed straight and secured to avoid displacement of the concrete.**
- **Subgrade is moistened prior to concrete placement.**
- **Testing concrete to meet specification requirement.**

Continuous inspection:

- **Check formwork**
- **Concrete placement**
- **Joints properly placed**
- **Sections of the sidewalk are at least 3 feet in length.**
- **Handrail placed in accordance with the plans/specifications.**

Final Inspection:

- **Sidewalk finished**
- **Curing compound applied**
- **Handrail grounded**

Documentation Required:

- **TL-13**
- **TL-28A**
- **Concrete Tickets.**
- **Invoice for Handrail.**
- **Completed Daily Work Report (DWR).**
- **Sketches and Calculations.**

IV. REVIEW QUESTIONS

Spec. #	
504.02(d)	Does preformed joint filler conform to the materials section on Joint Materials and is it approximately ½ inch thick?
504.03(a)1	Is the foundation for sidewalk shaped and compacted to a firm, even surface with unsuitable material and debris removed?
504.03(a)2	Are adjacent strips of geotextile fabric installed as required?
504.03(a)3	Are forms straight, free from warp, and strong enough to withstand concrete pressures?
504.03(a)4	Are forms cleaned and oiled prior to concrete placement?
504.03(a1)0	Is concrete screeded and spaded to prevent honeycombing and the

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1	surface floated free of irregularities?
504.03(a1)02	Are outside edges of the slab and joints edged with a ¼ inch radius edging tool?
504.03(a1)03	Are transverse joints constructed at intervals of ˜ 100 feet, except for closures, and filled with ½" joint filler extending to ¼" below the top surface?
504.03(a1)04	Are crack control joints placed as required in this section?
504.03(a1)05	Are slabs at least 3 feet in length?
504.03(a1)06	Are construction joints formed around all appurtenances, except drop inlets where expansion joints are formed between 6 and 10 feet away, and ¼ inch preformed joint filler placed as required?
504.03(a1)07	When sidewalk is constructed in conjunction with an adjacent curb, or to an existing curb, do expansion joints coincide?
504.03(a1)08	Is the sidewalk scored in a block approximately eight inches wider than the maximum dimension of light poles, poles, or fire hydrants?
504.03(a1)09	Is preformed joint filler securely fastened to prevent displacement?
504.03(a1)10	Is the fresh concrete sidewalk cured and protected in accordance with Section 316.04(j) of Hydraulic Cement Concrete Pavement?
504.03(a1)11	Is the sidewalk protected from traffic until the time or strength requirements are met?
504.03(a1)12	Was the foundation thoroughly moistened immediately prior to concrete placement?
504.03(a2)1	When specified, are layers of No. 8 aggregate, not exceeding four inches of depth, placed and compacted as base for asphalt concrete sidewalk or bike path?
504.03(a2)2	Is asphalt concrete placed in forms in one or more courses to provide the specified depth and yield a smooth dense, uniformly compacted sidewalk?
504.03(b)	Is the tread of steps given a light broom texture?
504.03(c)1	Are all exposed welded joints on handrail finished by grinding or filing to give a neat appearance?
504.03(c)2	Are all handrail items galvanized in accordance with Section 233, Galvanizing?
504.03(c)3	Are all exposed areas of pregalvanized rail repaired with a material conforming to Section 233, Galvanizing?
504.03(c)4	Are handrails installed in accordance with the applicable standards and specifications?
504.03(C)5	Are handrails grounded in accordance with 410.03(b)?
SPCN504	Has the contractor submitted a sample of exposed aggregate sidewalk at least 12"x12"x2" depth?

- Are handrails installed in accordance with Sections 404 and 406 of the Road and Bridge Standards?

Trial Use and Comment

• Are the forms placed at least 100 feet in advance of concrete placement?
• Is a transverse joint placed when the time between consecutive concrete pours exceed 45 minutes?
• Is a transverse joint installed when the corner of a drop inlet projects into the sidewalk?

V. CRITICAL INSPECTION POINTS

• **Test the concrete.**
• **Check the formwork.**
• **Check the concrete placement for the sidewalk.**
• **Check all joints.**
• **Check the handrail is grounded.**

Trial Use and Comment

SECTION 505 – GUARDRAIL AND MEDIAN BARRIER

I. INTRODUCTION:

This work shall consist of furnishing and constructing guardrail and steel median barriers and installing reuse galvanized guardrail in accordance with the plans and these specifications and with the lines, grades, and tolerances shown on the plans or as designated by the Engineer.

The edge of pavement should be established in order to align the guardrail posts. Generally, the holes for concrete or wood posts are auger dug, while steel posts are driven, however, all post may be driven providing the equipment used is capable of installing the post without damaging them. After the posts have been placed in auger dug holes, the space around the post shall be backfilled and well compacted. Posts shall be set plumb (check this with a carpenter's level), spaced in accordance with the standards and the top of the posts set to the design elevations. The rails should lap in the direction of vehicular travel.

The Inspector should verify that the Contractor has contacted Miss Utility to investigate for the presence of underground utility conduits, pipelines, or other covered items before any posts are driven. Also, in areas of Department owned equipment, signals, lighting, changeable message signs, cameras, or roadway antennas, the Contractor shall not drive any post without first contacting the District Traffic Engineering Section and allowing them to locate their equipment. The appropriate utility company or the Engineer is to be immediately notified by the Contractor if their underground utilities are damaged due to construction.

For additional information and guidance the Inspector should use the following web site:

http://www.extranet.vdot.state.va.us/locdes/GRIT/main.htm

A) Forms:

See Construction Division Memorandum:

CD-2009-02	5/15/09	Field Change Documentation: Documentation of Field Changes

Trial Use and Comment

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

505.01—Description

This work shall consist of furnishing and constructing guardrail and steel median barriers and installing reuse galvanized guardrail in accordance with the plans and these specifications and with the lines, grades, and tolerances shown on the plans or as designated by the Engineer.

505.02—Materials

(a) **Guardrail components** shall conform to the requirements of **Section 221**.

(b) **Median barriers and posts** shall conform to the contract requirements for the materials specified on the plans. Posts may be furnished with as many as six holes so that posts for installation of standard guardrail and steel median barrier may be used interchangeably.

(c) **Concrete** shall be Class A3 conforming to the requirements of **Section 217** except that mixing by hand for guardrail terminal posts will be permitted.

(d) **Reinforcing steel** shall conform to the requirements of **Section 223**.

(e) **Delineators** shall conform to the requirements of **Section 235.02(d).**

505.03—Procedures

The use of more than one type of post on a continuous line of guardrail will not be permitted.

Rail and elements shall be erected and aligned in a manner that will result in a smooth, continuous, taut installation. Installation shall not result in the cross section of the rail or other elements being kinked or crimped. Damaged rail or other elements will be rejected and replaced by the Contractor at no additional cost to the Department.

Guardrail delineators shall be installed in accordance with the requirements of **Section 702.03**. Spring cable end assemblies (compensating device) shall be provided with a permanent match mark (hacksaw cut or file mark) on the bolt shaft or spring stop and shall be referenced to the outer assembly to denote the neutral position. Cable slack shall be eliminated by tightening the steel turnbuckle cable

Comment [1529]: Right material

Comment [1530]: Right Way

Comment [1531]: Right Location

Comment [1532]: Right payment

Trial Use and Comment

assembly at the end opposite the compensating device until the device is compressed 3½ inches. Cables with a compensating device at each end shall be tightened such that neither end indicates less than the required tension. The assembly shall remain compressed for at least 2 weeks and then loosened, and each cable shall be readjusted to the same required tension. The required tension shall be determined by tightening the turnbuckle at the end opposite the compensating device and displacing the match mark in accordance with the following:

Comment [1533]: Right Time

Ambient Air Temperature (degrees F)	Match Mark Displacement (in)	Required Tension (lb)
0-19	3 1/2	1,575
20-39	3	1,350
40-59	2 1/2	1,125
60-79	2	900
80-99	1	675
100-120	1	450

Anchor assemblies shall be installed on firm earthen foundations, backfilled with suitable material in 4- to 6-inch layers, and thoroughly compacted by tamping or rodding. Stress loads shall not be placed on anchor assemblies until concrete has cured at least 28 days or has attained a compressive strength of at least 3,000 pounds per square inch as determined by field control cylinders in accordance with the requirements of **Section 404.03**.

Comment [1534]: Right Time

On beam guardrail anchors, nuts on anchor bolts shall be tightened to a snug tight fit as defined in **Section 407.06** to ensure flush contact between the beam and concrete base throughout the length of the anchor assembly.

Postholes shall be backfilled to the ground line with approved material placed in layers not more than 4 inches in height. Each layer shall be compacted by tamping.

Steel posts may be driven provided the method used will not damage the posts.

Concrete posts that are chipped or cracked will be rejected.

Wood posts shall be sawed to the dimensions shown on the plans within a tolerance of 2 percent for length and 1/4 inch scant. Wood posts may be driven, but posts that are damaged during installation shall be replaced at the Contractor's expense. If it is necessary to saw off the tops of wood posts to achieve a uniform and neat appearance, the amount sawed off shall be not more than 3 inches. Tops of sawed posts shall be brush coated with three heavy applications of the preservative used in treating the posts. Each application shall be given sufficient time to penetrate the wood. Painting wood posts will not be required. Dirt and other foreign matter shall be removed after installation.

Comment [1535]: Right Time

Trial Use and Comment

Galvanized items shall be handled and stored in accordance with the requirements of **Section 233**. After erection, the threaded portion of fittings with fasteners and cut ends of bolts and galvanized surfaces that have been abraded or damaged shall be repaired in accordance with the requirements of **Section 233.03**.

Reuse guardrail that has maintained its original shape and is suitable for reuse may be used. When necessary, reuse guardrail shall be rebored to the dimensions shown on the standard drawings. Reuse guardrail that is damaged or lost because of the Contractor's negligence shall be replaced at the Contractor's expense.

Comment [1536]: Right payment

Reuse guardrail posts and blockouts may be used provided they conform to the requirements of the standard drawings and these specifications.

The Contractor shall ensure that guardrail and barriers are kept clean during application of fertilizer, lime, tack coats, primer, or other material that cannot be readily cleaned from the guardrail or barrier.

The Contractor shall have a trained guardrail installer on the project during guardrail installation. For the purpose of this specification, a trained guardrail installer is a person who has a current certificate of training from a Department-approved guardrail installing training course.

Comment [1537]: Right documentation

Posts may be driven provided the equipment used is capable of installing the post without damaging it. Damaged posts will be rejected and shall be replaced by the Contractor at no additional cost to the Department. Posts shall be set plumb. Posts shall not be set with a variation of more than 1/8 inch per foot from vertical.

Posts shall be spaced in accordance with the standard drawings. A longitudinal deviation of 3/4 inch will be allowed providing the bolt holes in the guardrail, blockouts, and posts can be properly aligned without alteration or force. The height of the guardrail shall be as shown in the standard drawings.

On guardrail, nuts on bolts shall be tightened to a snug tight fit as defined in Section 407.06 to ensure full contact between the beam, blockout, and post.

The Contractor shall submit two copies of the manufacturers' recommended installation instructions for guardrail end treatments to the Engineer on the project site 2 weeks prior to the start of work.

Comment [1538]: Right documentation/time

505.04—Measurement and Payment

Comment [1539]: Right payment

Guardrail will be measured in linear feet and will be paid for at the contract unit price per linear foot including hardware. Cable guardrail will be measured in linear feet from the point where cable guardrail attaches to the run-on terminal treatment to the point where cable guardrail attaches to the run-off terminal treatment,

Trial Use and Comment

complete-in-place. Shop-curved or field-curved guardrail installed on a radius of 150 feet or less will be measured in linear feet of radial steel beam guardrail or radial steel median barrier.

The price for reuse guardrail shall include transporting and storing; repairing and installing salvaged guardrail beam; and furnishing and placing guardrail posts, blockouts, and hardware.

Steel median barriers will be measured in linear feet from center to center of end posts and will be paid for at the contract unit price per linear foot.

Intermediate anchorage assemblies will be measured in units of each and will be paid for at the contract unit price per each.

Terminal treatment for beam guardrail that terminates in back of the ditch line will be measured in linear feet along the regular guardrail section from center of end post (center of bolt group when guardrail is mounted flush to a structure) to the ditch line. The terminal section in back of the ditch line will be measured from the ditch line to center of end post.

Terminal treatment for beam guardrail, cable guardrail, and steel median barriers terminating on the roadway side of the ditch line will be measured in units of each and will be paid for at the contract unit price per each.

Reuse guardrail terminal will be measured in units of each or linear foot for the standard and type specified and will be paid for at the contract unit price per each or linear foot for the standard and type specified. This price shall include transporting and storing; repairing and installing salvaged beam; and furnishing and placing guardrail post, blockouts, concrete, and hardware.

Fixed object attachments for guardrail will be measured in units of each and will be paid for at the contract unit price per each. This price shall include furnishing and installing guardrail connectors, rubrail**,** and additional posts with blockouts and providing holes to facilitate attachment.

Special design guardrail bridge attachments will not be measured for payment but will be paid for at the contract lump sum price per structure. This price shall include furnishing and installing terminal connectors and additional posts with blockouts.

Cable barricades will be measured in units of each and will be paid for at the contract unit price per each. This price shall include furnishing and installing posts, cable, signs, and padlocks.

When specified as a separate bid item, guardrail terminal site preparation will be measured in units of each per site and will be paid for at the contract unit price per each site.

Trial Use and Comment

The price for guardrail terminal site preparation shall include clearing and grubbing; providing, hauling, and placing fill material; benching existing slopes; and restoration of site including seeding.

These prices shall include excavating; backfilling holes; installing delineators; repairing damaged surfaces; furnishing, galvanizing, and erecting units; furnishing concrete anchor assemblies; and preboring.

Bull nose barrier will be measured and paid for in units of each, complete-in-place, which price shall include furnishing and placing foundation soil tubes, concrete, polystyrene sheeting, welded wire fabric, posts, radial guardrail, blockouts, hardware, and delineators. This price shall be full compensation for all labor, materials, tools, and equipment necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Guardrail (Standard)	Linear foot
Reuse guardrail (Standard)	Linear foot
Radial guardrail (Standard)	Linear foot
Guardrail terminal (Standard and type)	Linear foot or Each
Intermediate anchorage assembly	Each
Median barrier (Standard)	Linear foot
Radial median barrier (Standard)	Linear foot
Median barrier terminal (Standard and type)	Each
Cable barricade (Standard)	Each
Fixed object attachment (Standard)	Each
Special design guardrail bridge attachment (B or Str. No.)	Lump sum
Reuse guardrail terminal (Standard and type)	Linear foot or Each
Guardrail terminal site preparation (Standard)	Each
Bull nose barrier	Each

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- As soon as practical after grading operations have been completed, the Inspector, Construction Manager, District Traffic Engineer, and the Federal Highway Administration's Area Engineer (Federal oversight only) should review the designed location of guardrail and end sections to determine if any changes to the designed location are required prior to installation. The Inspector should also try to have the guardrail installation foreman attend. Field changes must be approved by

Trial Use and Comment

the Responsible Charge Engineer or Design Engineer of Record. Review and have on site the manufacturer's installation instructions.

Start:

- The Inspector should verify that the Contractor has a trained installer on the project that has successfully completed the Guard Rail Installation, Inspection and Repair Training (GRIT) and has a current Verification of Qualification card. Verify that guardrail materials have been approved.

Inspection:

- Verify alignment, proper grade and heights, proper laps, post spacing, fasteners, and galvanization.

Final Inspection:

- Verify that all installations have been accomplished in accordance with the plans and specifications.

Documentation Required:

- The Inspector is to measure and record in the project diary the length of each line of guardrail and median barrier measured to the nearest linear foot. Counting the number of rails and multiplying by the length of rail is a good double check. Make sure that the rail included in the fixed object attachments or end treatments as shown in the standards are paid for appropriately. A copy of all required Certificates of Compliance as outlined in the ***Manual of Instruction - Materials Division*** is to be placed in the project records upon receipt. Retain a copy of the manufacturer's recommended installations instructions.

Trial Use and Comment

IV. REVIEW QUESTIONS

Spec. #	
505(Stds.)1	Are guardrail and median barriers placed at distances and heights as specified in the standard drawings for that type?
505(Stds.)2	Has the required type of barrier been placed in front of fixed objects as specified in the standards?
505.01(2)	Are guardrail and steel median barriers installed in accordance with plans, specifications, and in conformity to the lines and grades and tolerances shown on the plans or as designated by the Engineer?
505.03(001)	Has the Contractor submitted two copies of the manufacturers' recommended installation instructions for guardrail end treatments to the Engineer on the project site 2 weeks prior to the start of work?
505.03(002)	Are guardrail posts placed on a continuous line of guardrail all of one type?
505.03(01)	Are rails and elements erected and aligned in a manner that will result in a smooth, continuous, taut installation?
505.03(02)	Are guardrail delineators installed in accordance with section 702.03 on Delineators?
505.03(03)	Are anchor assemblies installed in accordance with this section?
505.03(04)	Are post holes backfilled to proper grade?
505.03(05)	Are steel posts driven by a method that will not damage them?
505.03(06)	Have concrete posts that are chipped or cracked been replaced?
505.03(07)	Have wood posts been sawed to the dimensions shown on plans and in accordance with this section?
505.03(08)	Have split, splintered, or broken posts been replaced?
505.03(09)	Have the threaded portions of all fittings and the cut ends of bolts and other damaged galvanized surfaces been repaired in accordance with Section 233, Galvanizing?
505.03(10)	Has material for reuse guardrail maintained its original shape and is it suitable for reuse?
505.03(11)	Did the Contractor have a trained guardrail installer on the project during guardrail installation?
505.03(12)	Are guardrail posts set with a variation of not more than 1/8 inch per foot from vertical?

- Does the Inspector verify that all bolts are installed and adequately tightened?
- Does the Inspector verify that guardrail sections are lapped in the correct direction?
- Does the Inspector check for damage to adjacent pavement structures caused by Guardrail installation?
- Is guardrail kept clean during application of fertilizer, lime, tack coats, primer, or other materials?
- Are shoulder widths and slopes adequate for guardrail installations?
- Are deflection areas clear of fixed objects?

Trial Use and Comment

• Is the correct fixed object attachments used at bridge/box culvert locations?
• Does the Inspector verify that all materials delivered were as specified on the Source of Material?
• Does the Inspector review the plans to verify the location of the guardrail was as designed?
• Does the Inspector verify the Contractor's staked location of the guardrail by Station and distance from Edge of Pavement to be in conformance with the plans or as agreed to at a guardrail field review meeting?
• Are there any obvious physical reasons that the guardrail should not be installed as designed? If so, are the Construction Manager, Project Manager, District Traffic Engineer, Project Designer and FHWA Area Engineer (Federal oversight only) requested to review the site?
• Did the Inspector check VDOT's Approved NCHRP 350 Products List for verification of manufactured products being installed?
• Does the Inspector verify that proprietary terminals are installed in accordance with the manufacturer's specifications?

V. CRITICAL INSPECTION POINTS

• Has the Contractor submitted two copies of the manufacturers' recommended installation instructions for guardrail end treatments to the Engineer on the project site 2 weeks prior to the start of work?
• Did the Inspector check VDOT's Approved NCHRP 350 Products List for verification of manufactured products being installed?
• Does the Contractor have a trained guardrail installer on the project during guardrail installation?
• Are guardrail and median barriers placed at distances and heights as specified in the standard drawings for that type?
• Have changes to the plan layouts been reviewed and approved by the Engineer?

Trial Use and Comment

SECTION 506- RETAINING WALLS

I. INTRODUCTION:

This section covers the construction of retaining walls with dry or mortar rubble stone, hydraulic cement, or with the reinforced concrete crib wall method. The foundation exploration, excavation, and backfill of all retaining walls shall be done in accordance with **Section 401**.

a) Forms:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7Rs

506.01—Description

This work shall consist of constructing rubble and hydraulic cement concrete retaining walls in accordance with the plans and these specifications and in conformity to the lines and grades shown on the plans or as established by the Engineer.

Comment [1540]: Right Way

506.02—Materials

Comment [1541]: Right Material

(a) **Dry rubble and mortar rubble retaining walls** shall be constructed of stone conforming to the requirements of Section 204 and mortar conforming to the requirements of Section 218.

(b) **Hydraulic cement concrete retaining walls** shall be constructed of concrete conforming to the requirements of Section 217.

(c) **Reinforced concrete crib walls** shall be constructed of precast concrete units. Concrete shall conform to the requirements of Section 217 except that No. 7 aggregate may be used in lieu of No. 57 aggregate. Crib units shall be free from cracks, depressions, spalls, patched or plastered surfaces or edges, and any other defects that might impair their strength or durability.

(d) **Drain pipe** shall conform to the requirements of **Section 232.02**.

(e) **Reinforcing steel** shall conform to the requirements of **Section 223**, Grade 40 or 60.

(f) **Porous backfill** shall conform to the requirements of **Section 204.02(c).**

Trial Use and Comment

(g) **Granular backfill within crib walls** shall be any material available within the project limits consisting of sand, sandy loam, gravel, rock, or a combination thereof. Materials containing a high percentage of fines, such as clay and silt soils, shall not be used.

(h) **Piles** shall conform to the requirements of **Section 403**.

506.03—Procedures

Excavation, backfill, and foundation exploration shall conform to the requirements of **Section 401.**

Concrete construction shall be performed in accordance with the requirements of **Section 404**. Immediately following finishing operations, concrete shall be cured and protected in accordance with the requirements of **Section 404.03**.

(a) **Dry Rubble and Mortar Rubble Retaining Walls:** Stones shall not be placed in freezing weather or when stone contains frost.

Each stone shall have a thickness of at least 8 inches; a width of at least 1 1/2 times the thickness; and, except for headers, a length at least equal to 1 1/2 times the width. The thickness of courses if varied shall diminish from the bottom to the top of the wall.

Header stones in the heart of the wall shall be the same size as in the face and shall extend at least 12 inches into the core or backing. They shall occupy at least 1/5 of the face area of the wall and shall be evenly distributed. Header stones in walls 2 feet or less in thickness shall extend entirely through the wall

Stones shall be roughly squared on joints, beds, and faces. Selected stone, roughly squared and pitched to line, shall be used at angles and ends of walls.

Stones shall be placed to line and in courses roughly leveled. Bottom or foundation courses shall be composed of large, selected stones. Courses shall be placed with bearing beds parallel to the natural bed of the material.

Shaping or dressing of stone shall be performed before stone is placed in the wall. Dressing or hammering that will loosen the stone will not be permitted after placement.

1. **Dry rubble retaining walls:** Face joints shall be not more than 1 inch in width.

Each stone shall have a firm bearing on the underlying course at no fewer than three points. Open joints, both front and rear, shall be chinked with spalls fitted to take firm

Comment [1542]: Right Way

Comment [1543]: Right Time

Comment [1544]: Right Way

Comment [1545]: Right Material

Comment [1546]: Right Time

Trial Use and Comment

bearing on their top and bottom surfaces and shall have a firm bearing throughout the length of the stone.

2. **Mortar rubble retaining walls:** Each stone shall be cleaned and thoroughly wetted with water before it is placed, and the bed that is to receive it shall be cleaned and moistened. Stones shall be bedded in freshly prepared mortar. Mortar joints shall be full, and stones shall be carefully settled in place before mortar has set. Spalls will not be permitted in beds. Joints and beds shall not have an average thickness of more than 1 inch.

   Whenever possible, face joints shall be properly pointed before mortar has set. Joints that cannot be pointed shall be prepared for pointing by raking them out to a depth of 2 inches before mortar has set. Face surfaces of stones shall not be smeared with mortar forced out of joints.

   Vertical joints in each course shall offset joints with those in adjoining courses by at least 6 inches. A vertical joint shall not be located directly above or below a header.

   If a stone is moved or a joint is broken, the stone shall be taken up, mortar shall be thoroughly cleaned from the bed and joints, and stone shall be placed in fresh mortar.

   Joints that are not pointed at the time stone is placed shall be thoroughly wetted with clean water and filled with mortar. Mortar shall be driven into joints and finished with an approved pointing tool. The wall shall be kept wet while pointing is being done. In hot or dry weather, pointed masonry shall be protected from the sun and kept wet by saturated burlap for at least 3 days after completion.

   After pointing is completed and mortar has set, the wall shall be thoroughly cleaned and left in a neat, orderly condition.

(b) **Concrete Retaining Walls:** Concrete retaining walls shall be constructed in accordance with the requirements of **Sections 403, 404,** and **406.**

(c) **Reinforced Concrete Crib Walls:** Crib units that are damaged during erection shall be removed and replaced at the Contractor's expense.

   Granular backfill shall be used inside and approximately 2 feet in back of and beyond each end of a crib. Backfilling for the crib wall shall follow closely the erection of successive tiers of units. The wall shall not be placed higher than 3 feet above the backfilled portion. Backfill shall be placed carefully to avoid distorting the crib wall.

506.04—Measurement and Payment

Standard retaining walls will be measured in cubic yards, complete-in-place, within the limiting dimensions shown on the plans, and will be paid for at the contract unit

Comment [1547]: Right Material

Comment [1548]: Right Time

Comment [1549]: Right Way

Comment [1550]: Right Way/Right Payment

Comment [1551]: Right Time

Comment [1552]: Right Payment

Trial Use and Comment

price per cubic yard. This price shall include rubble stone, concrete, joint material, and weep holes.

Concrete and reinforcing steel for special design retaining walls will be measured and paid for in accordance with the requirements of **Sections 404.08** and **406.04**, respectively.

Reinforced concrete crib walls will be measured in cubic feet of the net volume of concrete in crib units, complete-in-place, and will be paid for at the contract unit price per cubic foot. This price shall include concrete and reinforcing steel.

Granular backfill will be measured and paid for as regular excavation in accordance with the requirements of **Section 303.06.**

Porous backfill for retaining walls will be measured and paid for in accordance with the requirements of **Section 401.04.**

Piles for retaining walls will be measured and paid for in accordance with the requirements of **Section 403.08.**

Excavation for retaining walls will be measured in accordance with the requirements of **Section 401.04** and will be paid for at the contract unit price per cubic yard. This price shall include excavation, foundation exploration, sheeting and shoring, placing and compacting backfill and disposal of surplus material, and porous backfill when not specified as a separate pay item.

Payment will be made under:

Pay Item	Pay Unit
Retaining wall (Standard)	Cubic yard
Concrete crib (Standard)	Cubic foot
Retaining wall excavation	Cubic yard

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Verify the plans detail the construction of the Retaining Wall**.**

Start:

- Foundation is explored and found acceptable.
- Backfill material is acceptable.
- Environmental devices are installed (if applicable).
- Protecting existing structures and utilities (if applicable).

Continuous inspection:

- Excavation for retaining wall.
- Backfill of retaining wall.
- Construction of retaining wall.
- The wall is wet while pointing is done and during hot or dry weather the wall is protected from the sun with wet burlap.

Final Inspection:

- Stones are placed in line and roughly level.
- The wall is thoroughly cleaned and neat in appearance.
- Damages noted shall be corrected at the Contractor's expense.

Documentation Required:

- Environmental Permits (if applicable).
- Piles (if applicable) – Information on Piling Driving Hammer and Test Pile Information (Section 403.06(d)).
- Invoices for Piles.
- Porous Backfill Invoices (if a pay separate pay item).
- Completed Daily Work Report (DWR).
- Sketches and Calculations.

IV. REVIEW QUESTIONS

• Has the foundation been explored?
• Is the backfill been properly placed?
• Is the concrete cured in accordance with **Section 404.03**?
• Are the stones being placed during freezing temperatures or frost present on the stones?
• Is the stone meeting the size requirements?
• Are the stones properly placed for dry rubble and mortar rubble retaining walls?

Trial Use and Comment

- Is the mortar rubble retaining wall pointed masonry protected from the sun during hot or dry weather?

- Are the joints for mortar rubble retaining walls properly installed?

- Are concrete crib units that are damaged replaced at the Contractor's expense?

V. CRITICAL INSPECTION POINTS

• Ensure the foundation has been explored.
• Ensure proper backfilling of the retaining walls.
• Ensure protection of the wall from hot or dry weather.
• Check for damaged areas.

Trial Use and Comment

SECTION 507 – FENCES

I. INTRODUCTION:

This work shall consist of constructing and grounding new fence in accordance with these specifications and in conformity to the lines and grades shown on the plans or as established by the Engineer.

a) Forms:

- Intentionally Left Blank

III. 2007 ROAD & BRIDGE SPECIFICATION and the 7Rs

507.01—Description

This work shall consist of constructing and grounding new fence in accordance with these specifications and in conformity to the lines and grades shown on the plans or as established by the Engineer.

507.02—Materials

(a) **Materials for fences** shall conform to the requirements of **Section 242**.

(b) **Staples** shall be 9-gage galvanized strand wire and shall be at least 1 1/2 inches in length for soft wood posts and at least 1 inch in length for hardwood posts.

(c) **Grounding materials** shall conform to the requirements of **Section 238**.

507.03—Procedures

Old fences that are not to be salvaged, trees, stumps, logs, and other debris that will interfere with new fence construction shall be removed and disposed of as directed by the Engineer.

If rock is encountered before the specified post depth is reached, posts shall be placed approximately 3 feet in depth or 18 inches into rock, whichever is less. The diameter of holes prepared for setting posts in rock shall be at least 3 inches greater than the larger cross-sectional dimension of the post. If rock is encountered during installation of gates, corners, or brace posts, posts shall be placed in concrete.

Comment [1553]: Right Material

Comment [1554]: Right Material

Comment [1555]: Right Material

Comment [1556]: Right Way

Comment [1557]: Right Way

Trial Use and Comment

Except where rock is encountered, post and braced post anchor devices may be used in lieu of placing post and braces in concrete. Anchor devices shall be fabricated of steel having a yield strength of at least 30,000 pounds per square inch or of other metal approved by the Engineer; shall have a thickness of not less than that specified for the post or 1/8 inch, whichever is greater; and shall be galvanized in accordance with the requirements of **Section 233.**

Post and braced post anchor devices, together with the post, shall develop at least 80 percent of the resistance to horizontal and rotational displacement of individual post and braced post assemblies set in concrete when the load is gradually applied to the fence fabric at midheight. The Contractor shall demonstrate that the performance of post and braced post anchor devices will be comparable to that of concrete when such devices are proposed for use in lieu of concrete. The use of post and braced post anchor devices in lieu of concrete and the demonstration of comparable performance shall be at the Contractor's expense.

(a) **Standard Chain Link Fences:** Metal posts for chain link fences shall be set in Class A3 concrete footings. Posts set in concrete footings shall not be disturbed for at least 7 days following the initial set of concrete and for at least 14 days when the average air temperature for the week following placement is below 50 degrees F.

Each span shall be attached independently at pull and corner posts. Ends of fabric rolls and other sections to be spliced shall be joined by weaving a single strand of the fabric wire into ends of the fabric to create a continuous pattern of mesh. Fabric shall be stretched taut and securely fastened to each post and rail. Fastenings at ends, gates, corners, and pull posts shall be with stretcher bars and metal bands.

(b) **Standard Fences:** Wood posts shall be set with the larger end down. Backfill around wood posts shall be thoroughly compacted in layers approximately 6 inches in thickness. Wood posts may be driven provided they are not damaged.

Metal posts shall be driven.

Wire shall be stretched taut and securely fastened to each post. Unless a splice can be provided that will develop a strength comparable to the strength of the wire, splicing will be permitted only at posts. Each horizontal strand of wire shall be wrapped around the end of the gatepost and securely fastened by winding it about the wire leading to the post.

A new fence shall be joined to an existing fence at the beginning and end of the new fence and at points where cross fences intersect the new fence.

Wood fence posts shall be installed so that the tops form a regular grade line. Tops or bottoms of posts that are sawed in the field shall be brush coated with three heavy applications of 2 percent copper naphthenate from the Department's

Comment [1558]: Right Way

Comment [1559]: Right Material

Comment [1560]: Right Material

Comment [1561]: Right Payment

Comment [1562]: Right Way/Right Time

Comment [1563]: Right Way

Comment [1564]: Right Way

Comment [1565]: Right Way

Comment [1566]: Right Way

Comment [1567]: Right Way/Right Location

Comment [1568]: Right Way/Right Material

Trial Use and Comment

approved product list**.** Each application shall be given sufficient time to penetrate the wood.

Gates shall be erected at locations shown on the plans or where designated by the Engineer. If preferred by the property owner and approved by the Engineer, gates and fences similar in type to those that exist may be substituted for the gate shown on the standard drawings.

Surplus excavated material and other debris resulting from erecting fences shall be removed, and the site shall be left in a neat, orderly condition.

The Contractor shall be responsible for damage caused to or by livestock straying through areas where an old fence has been removed and is to be replaced with a new fence.

(c) **Pedestrian Fences for Bridges:** The frame for pedestrian fences for bridges shall be bonded internally to maintain continuity. Electrical grounding shall conform to the requirements of **Section 410.03(b)**.

(d) **Temporary Safety Fences:** The Contractor shall furnish and install a safety fence at required locations or as directed by the Engineer. The fence shall be no less than 4 feet high and colored bright orange polyethylene web and shall comply with the requirements of Section **242.02(a)12**.

The safety fence shall be installed on metal "T" or "U" post spaced on 6-foot centers driven to a minimum depth of 18 inches.

The Contractor shall maintain the safety fence and remove it when no longer required.

507.04—Measurement and Payment

Fences will be measured in linear feet of fence fabric, complete-in-place, along the top of the fence from outside to outside of end posts for each continuous run of fence, exclusive of gates, and will be paid for at the contract unit price per linear foot of fence fabric. This price shall include clearing, leveling, and preparing terrain at the fence level; line posts; attaching to posts; grounding; and disposing of surplus and unsuitable material.

Line and corner braces will be measured in units of each and will be paid for at the contract unit price per each. This price shall include posts, braces, concrete, and dowels.

Water gates, Types I and II, will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each. This price shall include fittings.

Comment [1569]: Right Location

Comment [1570]: Right Way

Comment [1571]: Right Way

Comment [1572]: Right Way/Right Material

Comment [1573]: Right Way

Comment [1574]: Right Way

Trial Use and Comment

Water gate, Type III, will be measured in linear feet of gate between inside edges of end posts, complete-in-place, and will be paid for at the contract unit price per linear foot. This price shall include end posts and anchor block assemblies.

Pedestrian fences will be measured along the top of the wall, complete-in-place, and will be paid for at the contract unit price per linear foot. This price shall include posts, fabric, braces, ties, and grounding.

Temporary safety fence will be measured and paid for in units of linear foot. This price shall include furnishing and installing the fence, metal post, maintenance, and removal when no longer required.

Payment will be made under:

Pay Item	**Pay Unit**
Fence (Standard)	Linear foot
Corner brace unit (Standard)	Each
Line brace unit (Standard)	Each
Pedestrian fence (Height)	Linear foot
Gate (Standard and length)	Each
Water gate (Standard)	Each or Linear foot
Temporary safety fence, 4 feet	Linear foot

Trial Use and Comment

II. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Get Source of Materials for approved materials.
- If any materials are not on approved lists. Then obtain a proper sample of the material that the contractor wants to use.
- Discuss the contractors plan.
- Go over Specifications. Visit the site and walk location to see if there are any issues that may arise such as large trees in line or under growth that may need removal.
- Check to ensure that all Right of Way is Cleared if it applies. Also check to ensure that contractor has Right of entry agreements to access the area the fence is to be placed if it applies

Start:

- Ensure that the contractor begins at the proper location.

Continuous inspection:

- Check alignment of the fence. Ensure that the fence is being installed on the correct side of the post.
- Measure and check for accurate placement of Line Bracings, post spacing, and corner braces.
- Pay close attention to fence splicing. Ensure they meet Specifications and Standards as to location and overlap.
- Ensure that Concrete is being used to set post in areas where it is required.
- Check fence tautness.
- Ensure that proper measures are being taken in areas where trees fall in line or where under growth needs attention to place fence.

Final Inspection:

- Make a final punch list of the items that are deficient and need attention.

Documentation Required:

- Summarize work and work force in DWR.

Trial Use and Comment

- Keep track of daily totals and document measurement taken.
- Document types of materials installed and quantities for payment.
- Maintain approved materials documentation in project files.
- Obtain Materials invoices and delivery tickets for materials.

IV. REVIEW QUESTIONS

Spec. #	
507.02	Do materials for fences conform to the requirements of Section 242, Fences?
507.03(1)	Are posts placed approximately 3 feet in-depth or 18 inches into rock, whichever is less, when rock is encountered before the specified post depth is reached?
507.03(2)	Are posts placed in concrete if rock is encountered during installation of gates, corner, or brace posts?
507.03(3)	Are post and braced post anchor devices used in lieu of placing posts and braces in concrete except where rock is encountered?
507.03(4)	Did the Contractor demonstrate that the performance of post and braced post anchor devices will be comparable to that of concrete when used in lieu of concrete?
507.03(5)	Is the diameter of holes prepared for setting post in rock at least 3" greater than the cross section dimension of the post?
507.03(a)	Are standard chain link fences installed in accordance with this section?
507.03(b)	Are standard fences installed in accordance with this section?
507.03(c)1	Has the frame for pedestrian fences for bridges been bonded internally wherever possible to maintain continuity?
507.03(c)2	Are pedestrian fences for bridges electrically grounded in accordance with the section on Metal Railings 410.03(b)?
507.03(d)	Are temporary safety fences installed in accordance with this section?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Must have approved source of materials in hand prior to installing any fence.**
• **Must obtain samples of material not on VDOT approved list.**
• **Ensure the contractor has approved access.**

Trial Use and Comment

SECTION 508 – DEMOLITION OF PAVEMENT AND OBSCURING ROADWAY

I. INTRODUCTION:

Demolition of pavement pertains to the breaking-up and removal of the hydraulic cement concrete or asphalt concrete pavement structures including the surface, base, and cement stabilized courses. This item is used in areas inside the limits of new construction. Obscuring of old roadway is the scarifying, plowing, harrowing and shaping of the old roadway outside of the limits of new construction. The restored area is then prepared to receive vegetation.

a) Forms:

- Intentionally Left Blank

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7Rs

508.01—Description

This work shall consist of demolition of pavement and obscuring roadway to restore areas that are no longer needed for highway use in accordance with these specifications and in conformity to the lines and contours shown on the plans or as established by the Engineer.

508.02—Procedures

(a) **Demolition of Pavement Structures:**

1. **Hydraulic cement concrete pavement** shall be demolished as follows:

   a. Pavement shall be broken into pieces and either used in fill areas as rock embankment in accordance with the requirements of **Section 303** or disposed of at locations selected by the Contractor and approved by the Engineer; *or*

   b. Material within the proposed roadway prism and more than 3 feet below the subgrade may be broken into pieces not more than 18 inches in any dimension, sufficiently displaced to allow for adequate drainage, and left in the roadway prism.

Comment [1575]: Right Way

Comment [1576]: Right Way

Trial Use and Comment

2. **Asphalt concrete pavement** that does not overlay or underlie hydraulic cement concrete pavement shall be removed as follows:

   a. Pavement shall be removed and used in the work as designated on the plans or as directed by the Engineer; *or*

   b. When approved by the Engineer, pavement shall be removed and disposed of at locations selected by the Contractor.

3. **Cement-stabilized courses underlying pavement designated for demolition** shall be disposed of in accordance with (a)1.a. or (a)1.b. herein.

4. **Aggregate underlying pavement designated for demolition** except hydraulic cement concrete pavement disposed of in accordance with (a)1.b. herein shall be salvaged and used for maintenance of traffic or, when approved by the Engineer, disposed of in accordance with (a)2.a. herein.

(b) **Obscuring Roadway:**

1. **Areas outside construction limits consisting of asphalt concrete or hydraulic cement concrete pavement demolished in accordance with (a) herein** shall be conditioned in accordance with the following:

   a. Tops of slopes that do not contain rock shall be rounded for a distance of not more than 10 but not less than 5 feet (where sufficient right of way exists) beyond the point of intersection of the existing slope and the natural ground surface. The depth of the rounding shall be not more than 2 feet below the original surface of slopes.

   b. Disturbed areas that are to receive vegetation shall be scarified or plowed, harrowed, and shaped.

   c. Clearing and grubbing shall be performed in accordance with the requirements of Section 301.

2. **Areas outside construction limits consisting of pavement structures, other than asphalt concrete or hydraulic cement concrete, that are designated for obscuring roadway** shall be conditioned in accordance with (b)1. herein. Prior to the obscuring, pavement structures shall be removed in accordance with the applicable requirements of (a) herein.

508.03—Measurement and Payment

Comment [1577]: Right Way

Comment [1578]: Right Way

Comment [1579]: Right Way

Comment [1580]: Right Way

Comment [1581]: Right Way

Trial Use and Comment

Demolition of hydraulic cement concrete pavement and shoulder structure courses or a combination thereof will be measured as demolition of pavement (rigid) and will be paid for in square yards based on the width of the widest course. Such price shall include all demolition, removal and disposal costs of pavement, base, subbase and stabilized subgrade materials.

Demolition of asphalt concrete pavement and shoulder structure courses or a combination thereof will be measured as demolition of pavement (flexible) and paid for in square yards based on the width of the widest course. Such price shall include all demolition, removal and disposal costs of pavement, base, subbase and stabilized subgrade materials.

Demolition of a combination of hydraulic cement concrete pavement and asphalt concrete pavement and shoulder structure courses or a combination thereof will be measured as demolition of pavement (combination) and paid for in square yards based on the width of the widest course. Such price shall include all demolition, removal and disposal costs of pavement, base, subbase and stabilized subgrade materials.

Obscuring roadway will be measured in units of 1,000 square feet computed to the nearest 1/10 unit and will be paid for at the contract unit price per unit. The area measured will be entirely outside the construction limits of the new roadway, as evidenced by slope stakes. Areas disturbed by the operations, including tops of slopes to be rounded, will be included in the measurement. Removing pavement structures other than hydraulic cement–stabilized, hydraulic cement concrete, and asphalt concrete pavement structures in accordance with (b) 2. herein will be measured as regular excavation in accordance with the requirements of **Section 303** or as lump sum grading on minimum plan and no plan projects. Clearing and grubbing will be paid for in accordance with the requirements of **Section 301**.

Payment will be made under:

Pay Item	Pay Unit
Demolition of pavement	Square yard
Obscuring roadway	Unit
Demolition of pavement (Type)	Square yard

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Discuss the areas that are planned to be removed.

Trial Use and Comment

- Discuss what is to be done with the material that is removed.

- If the material is to be wasted, check to see that all necessary steps have been taken and an approved waste area obtained.

- Review the E & S plan to ensure that proper controls are planned to be used as necessary.

Start:

- Measure and mark the area to be removed prior to removal for accurate payment.

- Ensure that all required E & S Controls are in place prior to beginning.

- Ensure that proper disposal area is ready for material to be placed.

Continuous inspection:

- Keep an eye on the removal and disposal areas for changes that may need to be made to E & S measures.

- If material is planned to be reused. Ensure that the size of the material is per Specifications.

- If the contractor wants to stockpile the removed material to be used at a later date, ensure that proper E&S controls are in place and maintained until material is used. The stockpile my require seeding.

- Ensure that once removal is complete that grading takes place soon after.

- Once final grade has been achieved, seeding is done if area is outside of the new roadway.

Final Inspection:

- Ensure that all final grading and seeding is done when Obscuring Roadway.

Documentation Required:

- DWR created reflecting work, equipment, personnel, etc.

- Sketch showing location, dimensions and calculations for method of payment to be included in diary.

Trial Use and Comment

IV. REVIEW QUESTIONS

N/A

V. CRITICAL INSPECTION POINTS

• **Located areas to be removed on plans or in contracts and mark off these areas if possible in the field prior.**
• **Ensure that the contractor has a plan for what is to be done with the material.**
• **If material is to be used in fills on the project ensure that removed material is suitable and the proper size to be used. Also pay close attention as to where the material is being placed in the fill.**
• **IF material is to be disposed of. Ensure that the contractor has an approved waste area prior to beginning work. Also ensure that all E&S measures are in place.**
• **If contractor is planning on wasting the material but does not have an approved waste area. The contractor can stockpile the material in a suitable location as long as E&S measures are in place prior to beginning.**
• **Measure the area again once it has been removed. Ensure that the proper depth has been obtained. If contractor has increased the depth it may cause payment issues of the material that is placed back.**

Trial Use and Comment

SECTION 509- PATCHING HYDRAULIC CEMENT CONCRETE PAVEMENT

I. INTRODUCTION:

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7Rs

509.01—Description

This work shall consist of removing designated areas of defective hydraulic cement concrete pavement and unstable subbase material, replacing subbase material where required, and replacing pavement with high-early-strength hydraulic cement concrete in accordance with these specifications and in conformity to the original lines and grades or those established by the Engineer.

509.02—Materials

(a) **Hydraulic cement concrete** shall conform to the requirements of Section 217 for Class A3 paving concrete except that the compressive strength shall be at least 3,000 pounds per square inch within 24 hours. The accelerated strength gain shall be achieved by the use of 800 ± 50 pounds per cubic yard of Type III cement conforming to the requirements of AASHTO M-85 and approved air-entraining, accelerating, and water-reducing admixtures conforming to the requirements of Section 215. If calcium chloride is permitted as an accelerating admixture, it shall be limited to 2 percent by weight. The air content shall be 6 ± 2 percent. The water/cement ratio shall be not more than 0.42 by weight.

The Contractor shall prepare a sufficient number of trial batches in the presence of the Engineer to verify the strength and workability of the mixture design when required. The continued adequacy of the mixture design and minimum compressive strength will be verified monthly by the Engineer.

(b) **Asphalt concrete** shall conform to the requirements of Section 211 except that material may be accepted by certification and visually inspected at the job site.

(c) **Subbase material** shall conform to the requirements of Section 208.

Comment [1582]: Right Location

Comment [1583]: Right Time/Right Way/Right Materials

Comment [1584]: Right Quantity

Comment [1585]: Right Materials

Trial Use and Comment

(d) **Preformed asphalt joint filler and joint sealer** shall conform to the requirements of Section 212.

(e) **Curing material** shall conform to the requirements of Section 220.

(f) **Reinforcing steel** shall conform to the requirements of Section 223.

509.03—Procedures

Comment [1586]: Right Way

Where the existing joint dowel assembly is to be removed, existing concrete shall be saw cut and removed at least 1 foot on each side of transverse joints. Undisturbed portions of pavement adjacent to the area to be patched shall be left with straight, vertical sides. In areas from which concrete has been removed, the subbase shall be dressed, brought to grade, and mechanically compacted. Dowels and assemblies shall be removed and disposed of off the project.

Saw cuts shall not extend into adjacent concrete pavement except when repairs are to be extended at that location. Saw cuts shall be straight, neat, vertical, and parallel or perpendicular to the centerline as required.

Unsuitable subbase shall be removed, disposed(Section 106.04) of, and replaced in accordance with the requirements of Section 307 or 308, whichever is applicable. Where soil cement subbase is present and sound, excavation below the top of the soil cement line and under adjacent slabs will not be required.

Preformed asphalt joint filler shall be installed in accordance with the requirements of Section 316.04(g)2.

Joint material and reinforcing steel shall be placed in accordance with the following:

1. **Patches less than 10 feet in length:** Preformed asphalt joint filler shall be placed flush against the run-off side of the adjacent pavement.

2. **Patches greater than 10 feet in length:** Preformed asphalt joint filler shall be placed flush against sides of the adjacent pavement.

3. **Patches 20 feet in length or greater:** Patches shall conform to the requirements of the applicable reinforced concrete pavement standards.

4. **Load transfer devices used in initial construction:** Load transfer devices shall be left intact, straightened, and used for tying in the replaced slab or shall be replaced with an approved load transfer device.

Trial Use and Comment

5. **Joints:** Rounded or beveled transverse joints shall be provided adjacent to the undisturbed pavement to allow installation of sealant at a depth of at least 1/4 but not more than 1/2 inch.

The excavated area shall be thoroughly cleaned and moistened before concrete is placed.

Full-depth forms shall be of sufficient strength to support plastic concrete without deformation.

Existing pavement shall not be removed if removal will result in concrete being placed when the air temperature is below 55 degrees F. The concrete temperature at the time of placement shall be at least 70 degrees F but not more than 95 degrees F.

Concrete shall be placed on the subgrade and consolidated so that it fills the area of the patch. Concrete shall be finished in accordance with the requirements of Section 316.04(h) except that the final surface shall have a texture similar to that of the adjoining pavement.

As soon as concrete is finished and prior to its initial set, the patch and existing pavement for a distance of 8 feet shall be tested by means of a 10-foot straightedge placed parallel to the centerline of the road surface. Irregularities in the patch in excess of 1/4 inch shall be corrected.

Immediately after it has been textured, concrete shall be covered with wet burlap and PE film. An insulating blanket shall be placed over the PE film whenever the air temperature is below 65 degrees F during the curing period. Curing shall continue until immediately before opening to traffic but will not be required beyond 24 hours.

Transverse joints at pavement repair locations shall be cleaned and resealed in accordance with the requirements of Section 316.04(m).

Asphalt concrete shoulders that are damaged during repair operations shall be reconstructed within 24 hours after completion of a patch in accordance with the requirements of Section 315 with full-depth SM-12.5A asphalt concrete to match the finished grade. If traffic is to be permitted on the patch prior to reconstruction of the shoulder, the shoulder shall be temporarily repaired to prevent any hazardous condition.

Traffic shall be maintained in accordance with the requirements of Section 512 or as directed by the Engineer.

Comment [1587]: Right Way

Comment [1588]: Right Time

Comment [1589]: Right Time

Comment [1590]: Right Way

Comment [1591]: Right Way/Right Time

Comment [1592]: Right Way

Trial Use and Comment

509.04—Measurement and Payment

Comment [1593]: Right Payment

Patching hydraulic cement concrete pavement will be measured in square yards of pavement surface area, complete-in-place, and will be paid for at the contract unit price per square yard. This price shall include saw cutting pavement full depth; removing and disposing of existing concrete; preparing subgrade; furnishing and installing preformed asphalt joint filler; placing, finishing, and curing special design concrete; trial batches; cleaning and resealing joints; repairing shoulders; sealing joints; and reinforcing steel.

Payment will be made under:

Pay Item	Pay Unit
Patching hydraulic cement concrete pavement	Square yard

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review designated locations shown on plans of defective pavement structure to be removed
- Review approved source of materials
- Review approved Disposal Site
- Review contractor's plan of operation and make recommendations
- Review contractor's MOT Plan/Section 512

Start:

- Perform field review of the Hydraulic Cement Concrete Pavement and determine if additional sounding of the pavement structure is required.
- Mark any areas which may require additional sections are to be removed

Continuous inspection:

- Monitor MOT and complete TE-97001 as required and have contractor sign/Section 512
- Monitor disposal of any unsuitable material
- Monitor placement of any subbase materials for proper compaction Section 308
- Monitor placement of dowels Section 223
- Monitor placement of asphalt concrete Section 211
- Monitor placement of hydraulic cement concrete Section 215/316.04(h)

Trial Use and Comment

- Monitor placement of preformed asphalt joint filler and sealer Section 212/Section 316.04(g)2
- Monitor placement of curing material Section 220

Final Inspection:

- Verify concrete has cured prior to opening of traffic

Documentation Required:

- C-25 source of materials
- TE-97001
- Approved disposal site
- SWPP documentation

IV. REVIEW QUESTIONS

Spec. #	
509.01	Has all defective pavement and unstable subbase material been removed prior to placement of new pavement?
509.02	Are materials used for patching pavement as specified in Section, 217 Hydraulic Cement Concrete?
509.03(1)	Where the existing joint dowel assembly is to be removed, has the existing concrete been saw cut and removed at least one foot on each side of transverse joints?
509.03(2)	Have all undisturbed portions of pavement adjacent to patched areas been left with straight, vertical sides that are parallel or perpendicular to the centerline?
509.03(3)	In areas from which concrete has been removed, has the subbase been dressed, brought to grade and mechanically compacted?
509.03(4)	Is the prohibition on saw cuts extending into adjacent concrete pavement adhered to?
509.03(5)	Has preformed asphalt joint filler been installed in accordance with the section 316.04(g)2 on Hydraulic Cement Concrete Pavement for Transverse Expansion Joints?
509.03(6)	Are the temperature requirements for the removal and placement of concrete in accordance with this section?
509.03(7)	Has all joint material and reinforcing steel been placed in accordance with this section?
509.03(8)	Does the existing pavement and patches conform to the 1/4" in 10' tolerance?
	Did the Contractor remove all defective pavement prior to placing new pavement?
	Where existing joint dowel assemblies are to be replaced, is the existing concrete saw cut and removed for one foot on each side of the transverse

Trial Use and Comment

	joint?
	Is subgrade under removed concrete dressed and compacted?
	Do saw cuts extend into adjacent sections of pavement to remain?
	Are temperature requirements adhered to?
	Is joint material and reinforcing steel properly placed?

V. CRITICAL INSPECTION POINTS

• **C-25 Source of materials**
• **Approved Disposal Site (SWPP Book)**
• **MOT Plan**
• **Check subgrade and remove unsuitable material if necessary**
• **Prior to placement of concrete**
• **Verify curing prior to opening to traffic**

Trial Use and Comment

SECTION 510 - RELOCATING OR MODIFYING EXISTING MISCELLANEOUS ITEMS

I. INTRODUCTION:

The purpose of this section is to detail actions taken by the Inspector when relocating or modifying an existing miscellaneous item is included in a contract. A thorough examination of the plans and contract should be completed for any specific instructions pertaining to the item to be relocated or modified.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7Rs

510.01—Description

This work shall consist of removing, resetting, relaying, adjusting, installing, modifying, reconstructing, or relocating existing items or items furnished by the Department or others, including, but not limited to, right-of-way monuments, guardrail, riprap, drainage structures, traffic control devices, water or sanitary sewer facilities, and other items designated on the plans.

510.02—Materials

The principal materials to be used in this work shall be those salvaged.

Comment [1594]: Right material

Items shall be constructed, adjusted, modified, or reconstructed with the same type of material as used in the original construction.

The suitability of existing material for salvage, modification, or reuse will be determined by the Engineer.

New, salvaged, or refurbished materials necessary for resetting, relaying, adjusting, modifying, or relocating the item specified shall conform to the requirements of the applicable specifications for items of the same character and type. Salvaged or refurbished materials shall be in good working condition, which shall include cleaning, repainting, and refinishing to the approximate original condition.

Trial Use and Comment

510.03—Procedures

Materials designated for salvage shall be carefully removed, dismantled, cleaned, and stockpiled in areas where they will not be damaged or shall be delivered to the storage area. Material that is not designated for salvage shall be disposed of in an approved disposal area. Items designated for relocation, relaying, adjustment, modification, or installation shall be installed in accordance with the applicable specifications or as directed by the Engineer.

Comment [1595]: Right Way

510.04—Measurement and Payment

Removing, resetting, relaying, adjusting, installing, modifying, reconstructing, or relocating designated items will be measured by the unit specified in the Contract in accordance with the plans and the applicable sections of these specifications and will be paid for at the contract unit price for the specified item. This price shall include loading, unloading, and transporting furnished materials; cleaning, repainting, and refinishing salvaged items; removing, resetting, relaying, adjusting, installing, modifying, reconstructing, or relocating designated items; salvaging or disposing of surplus and unsuitable material; excavating; trenching; backfilling; preparing foundation; reconnecting components for electrical and electronic items; revising wiring diagrams or schematics; and restoring disturbed areas.

Payment will be made under:

Pay Item	Pay Unit
Remove, reset, relay, adjust, install, modify, reconstruct, relocate existing (Item or standard)	Each, Linear foot, Square yard, Cubic yard, or Lump sum

Comment [1596]: Right payment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Identify proper unit for removal and re-use or modification.
- Preparations have been made for proper storage if required to re-use.

Start:

- Before removal begins, make sure item designated for removal is as detailed on plans and at located on project as described.

Inspection:

- Proper erosion practices in place
- Existing unit to be modified or re-used not damaged during removal/modification.

Trial Use and Comment

Final Inspection:

- Finished product is in accordance with plan location and description.
- Insure correct method of measurement was used as designated in contract.

Documentation Required:

- Diary should contain all relevant information.
- Material documentation if portion of modification required new material.

IV. REVIEW QUESTIONS

N/A

V. CRITICAL INSPECTION POINTS

• **Pre-placement of any erosion control items.**
• **Modified structure treated as detailed on plan if special instructions are included.**
• **Completed product provides appropriate functionality.**

Trial Use and Comment

SECTION 511 – ALLAYING DUST

I. INTRODUCTION:

Allaying of dust is to be performed as a pay item when the control of dust is necessary for the protection and comfort of motorists or area residents regardless of whether the dust is created on the project or on a haul road leading to the project.

Large "overruns" in the number of truck hours of allaying dust can be avoided by giving more attention to the completion of certain areas of the project before other areas are disturbed. Your attention is directed to the provisions of **Section 108.05** entitled Limitation of Operations.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7Rs

511.01—Description

This work shall consist of applying either moisture, calcium chloride, or both on areas designated by the Engineer for the purpose of allaying dust.

511.02—Procedures

The Contractor shall furnish a truck(s) equipped with a water tank having a capacity of at least 1,000 gallons and pumps for furnishing, loading, and applying water to the roadway.

Equipment and operators shall be available at all times.

Calcium chloride conforming to the requirements of **Section 239** shall be applied at the rate specified on the plans or by the Engineer.

The Contractor shall plan and prosecute the work so as to expedite completion of the pavement structure as soon as is practicable.

511.03—Measurement and Payment

Comment [1597]: Right Material

Comment [1598]: Right Material

Comment [1599]: Right Way

Trial Use and Comment

Allaying dust will be measured and paid for on the basis of the time the truck is in service on this work or per ton of calcium chloride. Loading time allowed for payment shall be not more than 30 minutes per 1,000 gallons of water. Truck hours shall be evidenced by daily time reports submitted by the Contractor and approved by the Engineer. This price shall include water and calcium chloride.

When in-place base material is used as a riding surface to maintain traffic or as a haul route, truck hours or tons of calcium chloride used for allaying dust will be paid for in accordance with the provisions herein.

Payment will be made under:

Pay Item	**Pay Unit**
Allaying dust	Hour or Ton

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Get equipment list from contractor which should include the water truck or the equipment used to place calcium chloride.
- If contractor elects to use calcium chloride, the material must conform to Section 239 in the Specifications.
- If Contractor elects to use Calcium Chloride check and make sure that the storage of this material is covered either by letter stated that none will be stored on the project or that the storage facility is included in the SWPPP.
- Go over the contractor's plan and check to see that efforts are being made to prosecute work in a timely manner to eliminate the need for allaying dust or to keep it to a minimum.

Start:

- Check truck to ensure that the tank is 1000 gallons or greater.
- Check to ensure that the loading pump is capable of loading the truck in 30 minutes or less.

Continuous inspection:

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- Continue to monitor the area where dust is being allayed. Make sure dust is allayed when needed.

- Also make sure it is only being allayed when needed.

- Continue to check on the loading of the truck to ensure proper time frames are being met. Often times the contractor may have capable equipment on the project, and it may just not be operated to its correct capacity.

- Remind the contractor to finish an area so that allaying dust is not needed. Strive to get base courses and paving courses installed as soon as possible. This will help eliminate the need for allaying dust.

- This pay item is to be only used for allaying dust. Often times the water truck is used for other activities (water line filling, asphalt washing, etc.) Be sure to keep good and accurate records of actual allaying dust time only for payment.

Final Inspection:

- Check to see if desired outcome is achieved.

Documentation Required:

- The contractor must provide the number of hours the water truck was used on the project each day to the Inspector. In the form of a daily time report showing hours used.

- If using chemical, the contractor must provide the amount of tons used on the project each day.

IV. REVIEW QUESTIONS

• Does the Inspector check on dusty areas, especially in populated areas and be alert to dust which may create a hazard for motorists on nearby roadways?
• Does the Contractor have a 1000 gallon minimum capacity water truck on the project at all times?
• Does the Contractor exceed the 30 minute maximum loading time for payment per 1000 gallons of water?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Contractor must have 1000 gallon tank or bigger. Contractor must have pumps capable of loading the 1000 gallons in under 30 minutes.** • **Be sure to keep a check on loading time. The contractor may have equipment capable of loading in the allotted time but just not running the pump accordingly.**
• **Contractor must provide all necessary documentation if going to use calcium chloride on the project. Be sure that if the contractor is using calcium chloride on the project that the storage of this chemical must be included in your SWPPP documentation**
• **Contractor and Inspector need to be paying close attention to how often areas are watered. Not enough watering causes to much dust and too much watering can cause an unsafe roadway.**
• **Ensure the contractor is using the pay item as intended. Water truck hours are not paid when the truck is being used to fill up rollers, used in waterline laying operations to fill lines, etc**

Trial Use and Comment

SECTION 512 – MAINTAINING TRAFFIC

I. INTRODUCTION:

This work shall consist of maintaining and protecting traffic through areas of construction, maintaining public and private entrances and mailbox turnouts, constructing and obliterating detours, and protecting the traveling public within the limits of the project and over detours that are not a part of the state highway system in accordance with the contract documents.

The maintenance of traffic through construction projects is very important. Construction operations may inconvenience people who live along the right-of-way as well as those who must travel through a project built under traffic. Anything the Inspector can do to minimize this annoyance will improve public relations. Important resources include the ***Virginia Work Area Protection Manual*** and the ***Manual on Uniform Traffic Control Devices***.

The Engineer should require the Contractor to erect the necessary guardrail or barriers at hazardous locations as soon as practicable rather than waiting until the final stages of the project; or he should require the Contractor to erect a suitable temporary barrier service at such locations.

The Specifications require the Contractor to maintain traffic in such a manner as to provide safe, unobstructed and convenient passage of the public through the construction project at all times. See **section 105.14** Maintenance During Construction.

Inspectors should ensure that the Contractor adheres to the Sequence of Construction and requirements of the Maintenance of Traffic plan that is part of every contract.

Improper signing can create dangerous conditions, thereby causing accidents. Construction Managers and Project Inspectors have the authority to determine the signing of construction projects. However, they should rely heavily on the advice of the District Traffic Engineer and the Work Zone Safety Coordinator.

Comment [S1600]: The improper installation/location of (transitory) construction roadway signage may create dangerous conditions; thereby causing accidents. ……the authority to determine the proper installation/location of (transitory) construction projects' roadway signage.

Inspectors should perform a review of projects which affect traffic using the Work Zone Safety Checklist (**Form # TE-97001**) at least once a week. At a minimum every second weekly review should be performed at night. Additional reviews are necessary after a change in the traffic pattern or severe weather conditions.

The Inspector should frequently evaluate the signing of the project in light of the Contractor's operation. Modifications may be needed to insure safety. Knowing when signs are no longer required is just as important as knowing when they are required. The effectiveness of all signs is reduced if one sign is left up after the

Trial Use and Comment

need for it passes. This leads drivers to believe they can ignore construction signs. When signs are not needed the Contractor should be required to remove them from the roadway.

The Inspector should ensure the Contractor maintains all signs in a satisfactory condition. Cleaning will be needed periodically to improve their visibility. Regulatory signs, such as black-on-white speed limit signs, are enforceable when authorized and placed on construction projects. To be correct and enforceable, these signs must conform to the standards for regulatory signs and be erected in accordance with State laws. The Area Traffic Engineer has the authority to determine the speed limit within the project limits. Police may be asked to enforce these signs.

The Project Inspector should review the condition of the project at least twice daily, once in the morning and again before leaving the project in the evening. The Inspector should be certain such items as barrier services, warning lights, signs, channelization devices, and other traffic devices are clean and visible in the proper location and are effective. Any unusual situations which may require signs should be brought to the attention of the Construction Manager. Any irregularities or defects in the operation of detour items or the detour surface should be brought to the Contractor's attention for prompt correction.

The public's impression of a project is greatly influenced by its flaggers. When flaggers are neat, courteous and efficient, the public will accept inconvenience of construction with little question. A rude, discourteous, or lazy flagger will create a potentially dangerous condition, especially if the public thinks he can be ignored. Flaggers are required to speak English when performing flagger duties. Flaggers are required to be properly attired when directing traffic (see ***Work Area Protection Manual***). This includes the Contractor's forces as well as the Department's. Above all, flaggers must be familiar with the proper procedures of directing traffic, as shown in the ***Work Area Protection Manual.***

The Contractor shall keep all parked equipment, stored materials, employee vehicles, etc, either behind guardrail and median barrier or outside the clear zone area throughout the project limits. The clear zone will vary with field conditions and is defined in ***Location and Design Instructional and Information Memorandum***. Any equipment parked behind the guardrail must be beyond the deflection zone of the guardrail.

CONSTRUCTION PAVEMENT MARKINGS

Caution should be used in the application of construction pavement markings. Improper markings lead to confusion and create a serious safety hazard.

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CONSTRUCTION PAVEMENT MARKERS

Raised temporary pavement markers are typically used in work zones and are used in conjunction with construction pavement markings to further delineate traffic flow. Raised temporary pavement markers are glued to the roadway with either bitumen or epoxy adhesive and shall be installed in accordance with the manufacturer's instructions.

IMPACT ATTENUATORS

Temporary Impact Attenuator Units (regardless of condition) shall not be allowed as a substitute for a permanent installation. Doing so would expose the Department to increased liability. It is very important to ensure the certified equipment is installed in accordance with the contract documents.

TEMPORARY SIGNALIZATION

Prior to installing temporary signalization, the Contractor must submit a plan for installing and maintaining signals that depicts the Contractor's intent for maintaining traffic flows. This shall included timing and sequencing of the signals. The Inspector should not allow the Contractor to proceed with the installation until the plan is approved by the Area Traffic Engineer.

TRAFFIC BARRIER SERVICE

When used, traffic barrier service must be of sufficient length to protect the work zone and traffic. Any adjustments to the Maintenance of Traffic plan should be coordinated with the Area Traffic Engineer.

Always review the contract and plans for amendments to the specifications through special provisions, copied notes or general notes.

a. Forms:

- See Construction Division Memorandum:

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CD-2009-01	5/27/09	Maintenance of Traffic on Construction Projects: Work Zone Traffic Control (WZTC) Coordinator
CD-2009-02	5/15/09	Field Change Documentation: Documentation of Field Changes
CD-2008-05	3/13/08	Maintenance of Traffic: Construction Pavement Markings
CD-2008-08	3/13/08	Maintenance of Traffic: Reusing Pavement Marking Tape

TE-97001
http://vdotforms.vdot.virginia.gov/SearchResults.aspx?filename=TE-97001.pdf

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7Rs

512.01—Description

This work shall consist of maintaining and protecting traffic through areas of construction, maintaining public and private entrances and mailbox turnouts, constructing and obliterating detours, and protecting the traveling public within the limits of the project and over detours that are not a part of the state highway system in accordance with the contract documents.

512.02—Materials

Comment [1601]: Right material

(a) **Materials** salvaged from the roadway shall be used in the maintenance of traffic insofar as possible. Material shall conform to the requirements of the applicable specifications.

(b) **Signalization, barricades, channelizing devices, safety devices, and pavement markings** shall conform to the requirements specified in Division VII, Traffic Control Devices, and the ***Virginia Work Area Protection Manual*** except where otherwise indicated. Retroreflective surfaces shall conform to the requirements of **Sections 235**, **247**, and **702**, as applicable.

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(c) **Temporary pavement markers** shall conform to the requirements of **Section 235**.

(d) **Construction pavement markings** shall conform to the requirements of **Section 246**.

(e) **Construction signs** shall conform to the requirements of **Section 247**. Sign substrates for rigid construction signs mounted on posts shall conform to the requirements of **Section 701** or be a 0.079-inch-thick aluminum/plastic laminate.

Sign substrates for signs mounted on drums, Type III barricades, and portable sign stands shall be of the materials as specified in the charts that follow and shall be the same material that was used when the device was tested and found to be in compliance with the requirements of *National Cooperative Highway Research Program (NCHRP) Report 350,* Test Level 3, or of other materials allowed in the FHWA acceptance letter.

Sign Substrates for Type III Barricades and Portable Sign Stands

Rollup sign 0.4-inch-thick corrugated polypropylene or polyethylene plastic 0.079-inch-thick aluminum/plastic laminate

Sign Substrates for Drums

0.4-inch-thick corrugated polypropylene or polyethylene plastic

512.03—Procedures

Comment [1602]: Right Way

Traffic shall be maintained and protected in accordance with the requirements of Section 105.14. Work shall be scheduled and performed so as to provide minimum interference with and maximum protection for traffic. The Contractor's personnel, equipment, machinery, tools, and supplies shall be kept outside the clear zone and clear of active traffic lanes except as necessary for prosecuting active work. Stabilized construction entrances shall be used in construction areas where there is a potential for construction vehicles to track material from the construction site onto a paved surface. Material that is spilled or tracked onto the traveled pavement during prosecution of the work shall be promptly removed.

The Contractor shall maintain the traffic control devices, which shall include, but not be limited to, repositioning of displaced devices including traffic barrier service, replacement due to inadequate structural integrity including traffic barrier service, replacement due to loss of reflectivity, repair of defaced sheeting and legend, replacement of broken supports, repositioning of leaning signs so they are plumb and the sign face is perpendicular to the pavement edge, cleaning of dirty devices, and replacement of stolen or vandalized devices. Barricades, barriers, and other

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safety devices shall be inspected at least daily, and deficiencies shall be immediately corrected. Safety and protective devices furnished by the Contractor will remain the property of the Contractor and shall be removed from the project site upon completion of the work or as directed by the Engineer.

(a) **Signs:** When construction signs are included in the Contract as a pay item, the Contractor shall furnish and install temporary sign panels necessary for the project, which shall include, but not be limited to, maintenance of traffic, beginning and end of construction, and off-project detour signing. When construction signs are not included in the contract as a pay item, the Department will furnish temporary sign panels necessary for maintenance of traffic, including those designating the beginning and end of construction, to the Contractor for installation. When the Department furnishes the temporary sign panels and off-project detour signing is required and the signing requirements are shown in the plans, the Contractor shall also install the detour signing. When the Department furnishes the construction signing and the detour signing requirements are not shown in the plans, the Department will furnish, install, and maintain the detour signing except when the municipality is responsible for such work in accordance with Section 105.14(a).

Signs and their placement shall conform to the requirements of the ***Virginia Work Area Protection Manual***, the ***MUTCD***, and the plans and as directed by the Engineer. The Contractor shall submit to the Engineer a sketch of his proposed construction sign layout for approval prior to installation. The Contractor shall furnish supports, i.e., wood posts and barrier and wall attachments, and hardware for use with the temporary sign panels. In lieu of using wood posts, the Contractor may request permission from the Engineer to use alternate products on the Special Products Evaluation List. The request shall contain all information related to the manufacturer's installation requirements, including but not limited to, post spacing and the square footage of sign panel the product can support based on AASHTO's requirements for a wind speed of 60 miles per hour. The Contractor shall be responsible for covering, uncovering, or removing and reinstalling existing signs that conflict with the signs needed for maintenance of traffic. Covering of existing signs shall be accomplished in accordance with the requirements of **Section 701.03(d)**. The Contractor shall furnish and install flags for the temporary sign panels as directed by the Engineer except flags will not be required for use on portable sign supports. Signs shall be installed and attached to wooden supports in accordance with **Standard WSP-1** of the Department's *Road and Bridge Standards.* The size and number of wooden supports shall be in accordance with the standard drawings. When alternate products for supports are approved for use by the Engineer, the supports, including size and number, and signs shall be installed in accordance with the manufacturer's recommendation.

Retroreflective flexible sign base materials conforming to the requirements of **Section 247** for material that is not Type VI material may be used both day and night up to a maximum of three continuous days.

Comment [1603]: Right documentation

Comment [1604]: Right Way

Comment [1605]: Right Time

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The Contractor may furnish portable sign stands for mounting temporary sign panels in accordance with the following:

1. Sign installations shall be used for no longer than 3 consecutive days.

2. Portable sign stands shall be used with signs having a substrate material of the type required in **Section 512.02(e)** and only those that were tested and found to be in compliance with the requirements of *NCHRP Report 350,* Test Level 3, or otherwise accepted in an FHWA acceptance letter for the specific sign stand.

   Portable sign stands shall conform to the requirements of *NCHRP Report 350,* Test Level 3, and shall be selected from those shown on the Department's Approved List or the Contractor shall submit a certification letter submitted prior to their use stating the brands and models of portable sign stands to be used along with a copy of the FHWA acceptance letter indicating compliance with *NCHRP Report 350,* Test Level 3,.Portable sign stands shall be self-erecting and shall accommodate signs of the shape being used. Portable sign stands shall support a 16-square-foot sign panel in sustained winds of 50 miles per hour without tipping over, walking, or rotating more than ±5 degrees about its vertical axis. Additional weight consisting of no more than one 25-pound sandbag placed on each leg or no more than two cone weights positioned on the center of the sign stand and around the mast may be used to comply with this requirement. When used on uneven surfaces, the portable sign stand shall be capable of adjusting to those surfaces to allow the signs to be installed in their normal upright position ±15 degrees. Portable sign stands shall include decals, stenciling, or other durable marking system that indicates the manufacturer and model number of the stands. Such marking shall be of sufficient size so it is legible to a person in a standing position.

The Contractor shall erect, maintain, move, and be responsible for the security of sign panels and shall ensure an unrestricted view of sign messages for the safety of traffic. The Contractor shall maintain and store signs furnished by the Department in a manner approved by the Engineer until they are returned to the Department.

When construction signs are covered to prevent the display of the message, the entire sign shall be covered with silt fence or other materials approved by the Engineer such that no portion of the message side of the sign shall be visible. Plywood shall be used on ground-mounted construction signs only. Attachment methods used to attach the covering material to .the signs shall be of a durable construction that will prevent the unintentional detachment of the material from the sign. At no times shall a construction sign and/or post be rotated to prevent the display of the message. In addition, the posts where the signs are being covered shall have two ED-3 Type II delineators mounting vertically on the post below the signs at a height of 4 feet to the top of the topmost delineator. The bottom delineator shall be mounted 6 inches below the top delineator.

Comment [1606]: Right Time

Comment [1607]: Right documentation

Comment [1608]: Right Location

Comment [1609]: Right Location/material

Trial Use and Comment

(b) **Flagger Service and Pilot Vehicles:** The Contractor shall provide flagger service in accordance with the requirements of **Section 105.14(c)**.

When one-way traffic is approved, the Contractor shall provide flagger service and, where necessary, pilot vehicles to maintain traffic. Each vehicle shall be equipped with at least one roof-mounted rotating amber flashing light and shall display required signs while in service.

Portable traffic control signals conforming to the requirements of **Section 512.03(h)2** may be used in lieu of flagger service when specified or approved by the District Traffic Engineer. When portable traffic control signals are used in lieu of flagger service, the portable traffic control signals will be measured and paid for separately.

(c) **Electronic Arrows:** Electronic arrows shall be electronic flashing or sequential amber arrows having dimmer controls and shall be mounted on suitable trucks or trailers. The Contractor shall maintain and move electronic arrows as needed for traffic control.

Trailers supporting arrow boards and the boards themselves shall be either Virginia highway orange (DuPont Color No. LF74279 AT or color equivalent) or federal yellow in color. The trailer's back frame shall have 2-inch-high retroreflective sheeting conforming to the requirements of **Section 247.02(c)** installed on the area facing traffic. The sheeting shall have alternating 11-inch-wide vertical red stripes and 7-inch-wide vertical white stripes.

(d) **Warning Lights:**

1. **Type A flashing lights** shall be used for advance warning signs and hazardous locations and shall be in operation during hours of darkness and low visibility. A Type A flashing light shall be installed on concrete traffic barrier service at the break point between the transition and tangent sections.

2. **Type B flashing lights** shall be used when specified on the plans for advanced warning signs and extremely hazardous locations and shall be in operation at all times.

3. **Type C steady burn lights** shall be used when specified on the plans for channeling traffic and may be placed on Group 2 channelizing devices. When used on Group 2 channelizing devices, the channelizing devices shall have been tested with the light and an FHWA acceptance letter issued indicating compliance with *NCHRP Report 350,* Test Level 3, as required in (e) herein. Lights shall be placed at intervals of 80 feet along tangent sections and 40 feet along bridges, transitions, and curves greater than 6 degrees. Lights shall be in operation from 30 minutes before sunset until 30 minutes after sunrise, on heavy overcast days, in fog, and during periods of darkness or low visibility as directed by the Engineer.

Comment [1610]: Right documentation

Comment [1611]: Right documentation

Comment [1612]: Now **Area** Traffic Engineer

Comment [1613]: Right Time

Comment [1614]: Right material

Comment [1615]: Right Location

Comment [1616]: Right documentation

Comment [1617]: Right Location/time

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(e) **Channelizing Devices:** Channelizing devices shall conform to the requirements of *NCHRP Report 350,* Test Level 3, Channelizing devices shall be selected from those shown on the Department's Approved List beginning with the applicable purchasing dates. The Contractor shall provide a certification letter stating the brands and models of channelizing devices contained on the listing that will be used. In lieu of using channelizing devices on that listing, the Contractor may use other brands and/or models conforming to the specification requirements provided he submits catalog cuts/brochures of each brand and model prior to their use and complies with the following requirements:

1. **Channelizing devices except drums/cones with an auxiliary device attached and portable vertical panel assemblies:** A copy of a letter from the manufacturer certifying that the specific channelizing device is crashworthy, i.e., that it will comply with the evaluation criteria specified in *NCHRP Report 350.* This certification may be a one-page affidavit signed by the manufacturer.

2. **Drums/cones with an auxiliary device attached, and portable vertical panel assemblies with or without an auxiliary device attached:** A copy of the FHWA acceptance letter indicating compliance with *NCHRP Report 350,* Test Level 3 shall be submitted.

The Contractor shall provide, when applicable, a certification letter indicating that the channelizing devices being used that are not on the Department's Approved List and for which no catalog cuts/brochures and self-certification are being supplied were purchased prior to October 2, 1998, or October 2, 2000, as applicable.

Spacing of channelizing devices shall be in accordance with the *Virginia Work Area Protection Manual.*

a. **Group 1 devices** shall consist of tubular delineators or cones approximately 36 inches in height for interstate and other limited access roadways and approximately 28 inches in height for other roadways. They shall be used as temporary channelizing devices. When used during hours of darkness, they shall be provided with reflectorized collars or sleeves.

b. **Group 2 devices** shall be drums or vertical panels. Drums shall be round, or partially round with no more than one flat side; made from plastic; have a minimum height of 36 inches, have a cross-sectional width no less than 18 inches in any direction; and conform to the requirements of the *Virginia Work Area Protection Manual*. Drums shall be designed to allow for separation of ballast and drum upon vehicular impact but not from wind and vacuum created by passing vehicles. Drums of two-piece design, i.e., drum and associated base, shall utilize**)**sufficient amounts of enclosed sand at the base in accordance with the manufacturer's recommendations to provide stable drum support. The base

Comment [1618]: Right documentation

Comment [1619]: Right documentation

Comment [1620]: Right documentation

Comment [1621]: Right documentation

Comment [1622]: Right Location

Comment [1623]: Right Way/ Right Material

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shall be not greater than 5 inches in height. Two-piece drums may also utilize a flared drum foundation and collar of not more than 5 inches in height and of suitable shape and weight to provide stable support. One-piece drums may be used provided they comply with these above requirements.

Vertical panels shall be mounted on posts conforming to the requirements of AASHTO's *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.*

Vertical panels will be allowed only for use in locations indicated in the contract documents. Non-portable vertical panels shall be mounted on posts conforming to the requirements of AASHTO's *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.*

Open-top drums will not be allowed. Markings on drums shall be horizontally circumferential, alternating from the top of the drum, with orange and white 6-inch-wide retroreflective stripes. Each drum shall have a minimum of two orange and two white stripes, and the top stripe shall be orange. Any non-retroreflective areas on the drum except the base shall be orange, and spaces between retroreflective stripes shall not exceed 2 inches in width.

The Contractor shall furnish and install signs (Stop, chevron, Keep Right, etc.) for the drums as directed by the Engineer. Sign panels used on drums tested for conformance with NCHRP 350, Test Level 3 requirements shall be of the same material as that used for the test except that materials as allowed by the FHWA acceptance letter may be used when approved by the Engineer.

Comment [1624]: Right documentation

(f) **Traffic Barrier Service:** Barrier service shall be of sufficient length to protect traffic and personnel in construction areas.

Comment [1625]: Right Location

The Contractor shall continuously prosecute the work until completion once a barrier is in place. If the Contractor does not, the Engineer may cause him to discontinue operations in other areas on the project and concentrate efforts behind the traffic barrier service. When construction work is completed to the extent that traffic barrier service is no longer required as determined by the Engineer, devices shall be removed.

Neither workers nor equipment shall traverse areas confined by traffic barrier service and travel lanes except as approved by the Engineer and then only with adequate flagger service to safeguard workers and traffic in advance of and at the point the traffic barrier service is opened. Barrier openings for construction access may be provided only along tangent sections or along the inside of curved sections and shall be limited to the minimum length required for equipment access. The normal pavement alignment at the barrier opening shall be maintained with removable pavement marking. At ingress openings, the exposed end of the barrier service shall be provided with a temporary impact attenuator as approved by the Engineer. At

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egress openings, the exposed end shall be transitioned as dependent on the posted speed for traffic. The transition flare rate shall comply with the requirements of the ***Virginia Work Area Protection Manual***. For speeds below 30 miles per hour, the transition flare rate shall be the same as that indicated for 30 miles per hour. An impact attenuator will not be required at the exposed end of egress openings in barrier service provided the deflection angle between the pavement edge and ends of the barrier service openings is 20 degrees or more.

Delineators shall be installed on traffic barrier service in accordance with the requirements of **Section 702**. Barrier vertical panels shall be installed on top of the concrete barrier service. Reflectorized sheeting shall comply with the requirements of **Section 247**. Design and installation of barrier vertical panels shall comply with the requirements of the ***Virginia Work Area Protection Manual.***

The Contractor shall maintain the structural integrity of the barrier and its alignment while it is in use and shall maintain warning lights, delineators, and other devices in a clean and visible condition at all times.

Comment [1626]: Right Time

1. **Guardrail barrier service and terminal treatments** shall be installed in accordance with the requirements of **Section 505** except that the offset distance shall be as specified by the Engineer. The Contractor may reuse guardrail used for traffic barrier service guardrail for permanent installation provided the guardrail material conforms to the requirements of **Section 505** and the standard drawings and is acceptable to the Engineer. Marred galvanized surfaces shall be repaired in accordance with the requirements of **Section 233**.

2. **Concrete barrier service** shall be installed in accordance with the plans and standard drawings or as directed by the Engineer. When barrier terminates at a guardrail, fixed object attachments connecting the barrier to the guardrail shall be installed in accordance with the applicable standard for fixed object attachment. Installation shall include additional guardrail posts and attachments as required. Concrete barrier connections shall be snug to prevent motion between sections.

Precast concrete parapet for precast concrete parapet traffic barrier service shall be anchored as shown on the plans. Anchor holes in bridge decks shall be drilled with a rotary impact drill or other approved equipment that will prevent damage to the deck. Anchor holes shall be located so as to avoid cutting reinforcing steel. Upon removal of the parapet, anchor holes shall be cleaned and filled with Type EP-4 or EP-5 epoxy mortar conforming to the requirements of **Section 243**.

Parapet used for concrete parapet traffic barrier service will not be permitted for permanent installations on bridge structures.

The Contractor shall visually inspect all traffic barrier service shipped to a project prior to placing it in use. Concrete barrier sections shall be structurally sound with no concrete missing along the top, bottom, sides, or end sections of the barrier; no

Comment [1627]: Right Time

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through cracks; and no exposed rebar. Any traffic barrier service found by the Contractor or Engineer to be unacceptable due to inadequate structural integrity or functionality shall be promptly removed from the project site and replaced at no cost to the Department. Traffic barrier service shall be selected from those shown on the Department's Approved List, except that the Contractor may use other traffic barrier service provided he submits a copy of the FHWA acceptance letter indicating compliance with *NCHRP Report 350* prior to it being used.

The Contractor shall maintain the structural integrity of the barrier and its alignment while it is in use and shall maintain warning lights, barrier vertical panels, delineators, and other devices in a clean and visible condition at all times. Concrete barrier service shall be cleaned or coated sufficiently to afford good visibility and uniformity of appearance.

(g) **Impact Attenuator Service:** Impact attenuator service shall be installed at locations shown on the plans or designated by the Engineer. A modified Type III object marker shall be installed on impact attenuators.

(h) **Temporary Signalization:** When specified on the plans, the Contractor shall install and maintain temporary or portable traffic control signal equipment. The Contractor shall submit to the Engineer a plan for locating, installing, and maintaining signals that shall depict the Contractor's intent for maintaining traffic flows during construction operations, including type of vehicle detection, phase sequencing, and timings. The Contractor shall receive acceptance of the plan from the Engineer prior to beginning work that would necessitate installing the proposed temporary or portable traffic control signals. The Contractor's design shall conform to the requirements of the applicable sections of *AASHTO's 1994 Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*; ***MUTCD***; and the ***Virginia Work Area Protection Manual***. Existing traffic control signal equipment materials on the project may be used. New, salvaged, or refurbished traffic control signal equipment materials brought to the project shall conform to the contract specifications and standards.

1. **Temporary traffic control signals** shall conform to the following: the controller, accessory, auxiliary, and conflict monitoring equipment shall conform to the requirements of **NEMA TS-1**, **NEMA TS-2**, or as approved by the Engineer.

2. **Portable traffic control signals** shall conform to the following:

   a. phase sequencing, timings, and conflict monitoring complying with **NEMA TS-1** (Functional Standards).

   b. 5 programmable day programs within a 24-hour period.

   c. 12-inch traffic signal head sections with backplates mounted in the vertical display arrangement.

Comment [1628]: Right documentation

Comment [1629]: Right Time

Comment [1630]: Right Time/documentation

Comment [1631]: Right material

Comment [1632]: Right material

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d. vehicular detection that will detect all licensed vehicles unless otherwise indicated in the contract documents.

e. adequate safeguards to prevent unauthorized entry to the control equipment.

f. trailer-mounted type with at least one of the two traffic signal heads positioned over the travelway with a minimum 16 feet of clearance from the pavement to the lowest point of the signal head assembly.

g. operate from its own self-contained power supply with the capability of connecting to an external 110-VAC electrical power supply. When operating from a self-contained solar power supply, the battery backup shall be capable of operating for 18 continuous days at 77 degrees F without solar array assist.

h. back frame of trailer with 2-inch-high reflective sheeting conforming to the requirements of **Section 247.02(c)** installed on the area facing traffic; sheeting shall have alternating 11-inch-wide vertical red stripes and 7-inch-wide vertical white stripes.

i. designed to comply in the operating mode with loading conditions associated with wind gusts of 80 miles per hour as specified in *AASHTO's 1994 Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*.

Temporary and portable traffic control signals that are not specified on the plans but are installed by the Contractor for his convenience shall be installed at the Contractor's expense and shall be approved through the process specified herein.

Maintenance and operation of temporary and portable traffic control signals shall be the responsibility of the Contractor and shall be in accordance with the requirements of **Section 703.03(a).**

When required, the Contractor shall make arrangements with the local utility company for electrical service for new temporary and portable traffic control signals, which shall include the costs of connection, disconnection, and energy. If electrical service is not available, the Contractor shall provide a generator capable of continuously operating the temporary and portable traffic control signals for at least 24 hours unassisted. The Contractor shall demonstrate the signal's operational procedures and reliability to the Engineer for approval prior to beginning work necessitating use of the signal equipment.

(i) **Construction Pavement Markings:** Construction pavement markings shall be installed at locations shown on the plans and in the ***Virginia Work Area Protection Manual*** and at other locations as directed by the Engineer. Construction pavement markings shall be selected from the Department's Approved List of Construction

Comment [1633]: Right payment

Comment [1634]: Right Time/documentation

Comment [1635]: Right Location/material

Trial Use and Comment

Pavement Marking Materials. Construction pavement markings are classified as Type D, Classes I and II (removable tape); Type E (non-reflective black removable tape); and Type F, Classes I and II (temporary markings). Construction pavement markings shall be used as follows:

1. **Type D construction pavement markings** shall be used on final roadway surfaces or in areas where traffic patterns are subject to change before pavement is resurfaced unless the surface temperature of the pavement is below the pavement marking minimum application temperature recommended by the manufacturer. When the surface temperature of the pavement is below the manufacturer's minimum application temperature, a Type F construction pavement marking on the approved list under the same class as the specified Type D construction pavement marking may be used except on final surfaces. The Contractor shall select a Type F product known to perform the best under those temperature conditions. When a Type F construction pavement marking is used in lieu of a Type D construction pavement marking due to the surface temperature being below the manufacturer's minimum application temperature, the Contractor will be paid the price bid for Type D, which will include the Type F markings and any necessary eradication of existing pavement markings.

2. **Type E construction pavement markings** shall be used to cover existing markings in accordance with (j) herein.

3. **Type F construction pavement markings** shall be used where the roadway is to be resurfaced prior to changes in the traffic pattern or where pavement is to be demolished and traffic patterns will not change before demolition.

Construction pavement markings shall be installed in accordance with the manufacturer's recommendations. Application thickness and bead application shall comply with the manufacturer's recommendations except as follows. In the event the manufacturer's recommendation for material thickness and quantity of beads is less than that used when the material was tested by the National Transportation Product Evaluation Program (NTPEP), the minimum values used during product installation shall conform to the NTPEP test values that are indicated on the approved list for the specific marking. The Contractor shall furnish a copy of the manufacturer's installation recommendations including the thickness, bead embedment, and dispersement to the Engineer.

The Contractor shall maintain the construction pavement markings and shall correct any deficient markings by reapplying markings. Deficient construction pavement markings are considered to be any markings that do not provide adequate guidance to motorists due to inadequate retroreflectivity or color qualities or due to problems with adherence to the pavement. The Engineer will make a visual nighttime inspection of all construction pavement markings to identify areas of markings that have inadequate retroreflectivity qualities.

Comment [1636]: Right documentation

Comment [1637]: Right documentation

Comment [1638]: Right Time/documetation

Trial Use and Comment

Those markings that have inadequate retroreflectivity qualities as determined by the Engineer shall be replaced by the Contractor with the following exceptions:

a. Reapplication of skip line construction pavement markings is not required unless the inadequate retroreflectivity qualities are for at least two consecutive skip lines.

b. Reapplication of center; line, except skip lines; or edge line construction pavement markings is not required unless the inadequate retroreflectivity qualities are for at least a continuous section of 70 feet.

c. Reapplication of transverse markings is not required unless the inadequate retroreflectivity qualities are for at least a continuous section exceeding 3 feet.

In lieu of replacement of construction pavement markings based on visual observations by the Engineer, the Contractor may have retroreflectivity readings made. These measurements shall be taken within 48 hours after the Contractor has been notified of the deficient markings except additional time will be granted due to inclement weather that prevents the adequate measurement of the markings. The Contractor shall brush any form of debris from the line before performing the measurements. Measurements shall be taken in the presence of the Engineer using Contractor-furnished equipment conforming to the requirements of **ASTM E 1710**. The Contractor shall operate the equipment in accordance with the manufacturer's instructions, and a copy of such instructions shall be provided to the Engineer. The photometric quantity to be measured is the coefficient of retroreflected luminance (R_L), which shall be expressed as millicandelas per square foot per footcandle. Measurements shall be taken at three random locations within each area of markings that have inadequate retroreflectivity qualities. When the length of the visually inadequate area is greater than 1 mile, measurements shall be taken at three locations per mile segment or portion thereof. Measurements for all lines shall be taken in the middle of the line horizontally. Measurements for skip lines shall be taken in the middle of their length. Measurements for transverse lines shall be taken outside of the wheel path locations. The Engineer will designate the locations along the line segments where the measurements shall be taken. The Contractor shall make a log of the measurements and their locations and provide a copy to the Engineer. When the average of the three readings for an area is below 100 millicandelas per square foot per footcandle, the Contractor shall reapply the markings as indicated.

Construction pavement markings that no longer adhere to the pavement shall be reapplied by the Contractor with the following exceptions:

1. Reapplication of skip line construction pavement markings is not required unless the markings do not adhere for at least two consecutive skip lines.

Comment [1639]: Right Time

Comment [1640]: Right Location/documentation

Trial Use and Comment

2. Reapplication of center; lane, except skip lines; or edge line construction pavement markings is not required unless the markings do not adhere for at least a continuous section of 70 feet.

3. Reapplication of transverse markings is not required unless the markings do not adhere for at least a continuous section exceeding 3 feet.

However, all construction pavement markings that no longer adhere to the roadway that may cause guidance problems for motorists shall be removed by the Contractor.

Removable construction pavement markings shall be replaced on time frames as recommended by the manufacturer of the marking to prevent the need for eradication. The Contractor shall furnish a copy of the manufacturer's recommendations to the Engineer.

Those construction pavement markings found in need of reapplication in accordance with these requirements shall be reapplied by the Contractor at no additional cost to the Department with the following exceptions:

a) Markings that have been under traffic for more than 90 days will be paid for at the contract unit price when needing reapplication unless the manufacturer's warranty coverage is still in effect.

b) Markings damaged by the Department's snow removal or other maintenance and construction operations will be paid for at the contract unit price.

Construction pavement markings shall be replaced in accordance with the time requirements of **Section 704.**

Eradication for reapplication of Type F construction pavement markings is not required if allowed by the marking manufacturer provided the existing marking is well adhered and the total thickness of the existing and reapplied marking combined will not exceed 40 mils. If not well adhered, 90 percent of the existing markings shall be removed prior to reinstallation of the markings.

Temporary pavement markers shall be installed with construction pavement markings in accordance with (k) herein.

(j) **Eradicating Pavement Markings:** Markings that may conflict with desired traffic movement, as determined by the Engineer, shall be eradicated as soon as is practicable: either immediately prior to the shifting of traffic or immediately thereafter and prior to the conclusion of the workday during which the shift is made.

Eradication shall be performed by grinding, blasting, or a combination thereof. Grinding shall be limited to removal of material above the pavement surface except

Comment [1641]: Right payment

Comment [1642]: Right Time

Comment [1643]: Right Time

Comment [1644]: Right Way

Trial Use and Comment

when removing thermoplastic and preformed tape markings, which may be removed by grinding alone. Blasting shall be used on both asphalt concrete and hydraulic cement concrete pavements to remove all other types of markings. Other methods may be submitted for approval by the Engineer. The Contractor shall ensure that the roadway surface is damaged as little as possible when performing the eradication.

When eradicating pavement markings, the Contractor shall ensure workers are protected in conformance to the requirements of *Occupational Safety and Health Administration's (OSHA)* standards as detailed in 29 CFR 1910 or 1926, whichever is the most stringent at the time. The Contractor shall collect the eradication residue during or immediately after the eradication operation, except dust shall be collected during the entire operation. Eradication residue from the removal of any pavement markings is considered to be a non-hazardous waste material and shall be disposed of in a properly permitted waste disposal facility in accordance with state and federal laws and regulations. Testing of the eradication residue for the eight Resource Conservation Recovery Act metals will not be required.

When markings are removed for lane shifts or transitions, 100 percent of the marking shall be removed.

Comment [1645]: Right quantity

Non-reflective removable black construction pavement marking may be used to cover existing markings in lieu of eradication on asphalt concrete surfaces when its use will not be required for more than 120 days and when specified as a pay item. The Contractor shall use this material to cover markings as indicated in the plans or as directed by the Engineer. Non-reflective removable black construction pavement marking shall be applied in accordance with the manufacturer's recommendations.

(k) **Temporary Pavement Markers:** Temporary pavement markers shall be installed with construction pavement markings, except non-reflective removable markings, in transition (lane drop) or lane shift areas of work zones that will encroach upon the traveled roadway for a period of more than 3 days and in other areas as required by the Engineer.

Temporary pavement markers shall be installed on 20-foot centers in lane shift and transition areas. When temporary pavement markers are required in other areas, they shall be installed on 40-foot centers unless otherwise required by the Engineer. Temporary pavement markers shall be located between and in alignment with broken lines and beside solid line pavement markings. Where double-line pavement markings separating traffic are installed, two-way markers shall be installed beside each line. The Contractor may install two one-way markers in lieu of each two-way marker at no additional cost to the Department.

Comment [1646]: Right Location

Temporary pavement markers shall be installed with a hot-applied bitumen adhesive except epoxy may be used on hydraulic cement concrete roadways and non-final surfaces of asphalt concrete roadways. Damage to the pavement by removal of

Comment [1647]: Right Way

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markers shall be repaired in kind by the Contractor at no additional cost to the Department.

Temporary pavement markers found in need of replacement shall be replaced by the Contractor at no additional cost to the Department except those markers damaged by the Department's snow removal operations or other maintenance and construction operations will be paid for at the contract unit price.

(l) **Detours:** Where temporary structures are necessary, they shall be designed and provided by the Contractor and of sufficient strength, width, and design to accommodate the volume and character of traffic using the highway. Temporary structures crossing waterways shall provide necessary hydraulic openings to accommodate the flow of the waterway. Temporary structure designs shall be submitted to the Engineer for review.

When a detour is no longer required, as determined by the Engineer, it shall be promptly removed, and the materials shall be disposed of as approved or directed by the Engineer. The Contractor shall design and provide temporary drainage facilities of adequate size to carry the normal flow of the existing drainage or waterway.

(m) **Aggregate Material:** Aggregate material shall be placed at crossovers, private entrances, and mailbox turnouts and where specified by the Engineer.

(n) **Construction Pavement Message Markings:** Markings shall be installed at locations designated on the plans and as determined by the Engineer and shall consist of messages that comply with the requirements of **Section 704**. Construction pavement message marking material including maintenance of the markings shall comply with the requirements for construction pavement markings. Retroreflective measurements shall be taken out of the wheel path locations, and each separate entity of a pavement message marking shall be replaced when the average of the three readings for the entity is below 100 millicandelas per square foot per footcandle.

(o) **Type III Barricades:** Type III barricades shall conform to the requirements of *NCHRP Report* 350, Test Level 3, be at least 4 feet in width, and be selected from those shown on the Department's Approved List. The Contractor shall provide a certification letter stating the brands and models of Type III barricades on the listing that will be used. In lieu of using Type III barricades on that listing, the Contractor may use other brands and/or models provided that prior to their use he submits a copy of the FHWA acceptance letter indicating their compliance with *NCHRP Report* 350, Test Level 3.

(p) **Truck-mounted Attenuators:** Truck-mounted attenuators shall conform to the requirements of *NCHRP Report 350,Test* Level 3.

Comment [1648]: Right payment

Comment [1649]: Right documentation

Comment [1650]: Right material/documentaion

Comment [1651]: Right documentation

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Prior to their use, the Contractor shall submit catalog cuts/brochures of the truck-mounted attenuator and a copy of the FHWA's acceptance letter documenting acceptance of the specific truck-mounted attenuator

The truck-mounted attenuator shall be no less than 72 inches wide and no more than 96 inches wide. The color of the truck-mounted attenuators shall be yellow or orange.

The rear panel shall have alternate 6-inch-wide orange and black chevron (inverted V) stripes. Stripes shall be sloped at a 45-degree angle downward in both directions from the upper center of the rear panel. Stripes shall be fabricated from fluorescent orange prismatic lens reflective sheeting conforming to the requirements of **Section 247.02(e)**.

The weight of the support truck shall be as recommended by the manufacturer of the truck-mounted attenuator. The Contractor shall provide a copy of the manufacturer's recommendation to the Engineer and a copy of a weigh ticket for the truck. The weigh ticket shall contain adequate information to associate the ticket with the applicable truck. Additional weight may be added to the support vehicle to achieve the range recommended by the manufacturer of the truck-mounted attenuator provided the total weight is within the Gross Vehicle Weight Recommendation of the support vehicle and is installed such that no movement will occur during impacts.

The support vehicle shall have at least one rotating amber light or high-intensity amber strobe light functioning while in operation in accordance with the ***Virginia Work Area Protection Manual*** *(visible for 360 degrees)*. When allowed by the ***Virginia Work Area Protection Manual***, an electronic arrow operated in the caution mode may be used in lieu of the rotating or high-intensity amber strobe light.

The transmission of the support vehicle with the truck-mounted attenuator in use shall be in second gear, except for those with an automatic transmission, which shall be in park. The parking brake shall be applied and the front wheels aligned straight ahead when operating in the stationary mode.

Limitations: Support vehicles shall not be used for other purposes while the truck-mounted attenuator is being used. There shall be no additional devices in the bed of the support vehicle except the additional weight as allowed in this Section and traffic control devices such as truck-mounted electronic arrows. There shall be no additional devices, including, but not limited to, signs, lights, and flag holders attached to the truck-mounted attenuator except those that were tested on the truck-mounted attenuator and provided by the manufacturer of the truck-mounted attenuator.

Comment [1652]: Right Time/documentation

Comment [1653]: Right documentation

Comment [1654]: Right Way

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In the event the truck-mounted attenuator is impacted, resulting in damage that would cause the unit to be ineffective, all work requiring the use of the truck-mounted attenuator shall cease until such time that the Contractor can provide an acceptable unit by means of repair or replacement.

Work performed in conjunction with (i), (j), (k), and (n) herein shall be performed in accordance with the requirements of **Section 704** except as noted herein.

Replacement and correction of ineffective work zone traffic control devices: These shall be accomplished in accordance with the *American Traffic Safety Service Association's (ATSSA) Quality Standards for Work Zone Traffic Control Devices* with the following additions and exceptions:

Comment [1655]: Right Way

1. Requirements herein for replacement and correction of construction pavement markings shall be used in lieu of the requirements in the section entitled "Evaluation Guide Pavement Tape & Raised Pavement Markers."

2. The categories for "Arrow Panel (Flashing Arrow and Double Arrow Mode)" shall be replaced by the following:

   Acceptable: No lamps out in stem and arrow head(s), and dimming properly.

   Marginal: No more than 1 lamp out in the stem and no lamps out in the head(s), and dimming properly.

   Unacceptable: Any lamp out in the head(s) or more than 1 lamp out in the stem, or arrow panel not dimming properly.

3. "Arrow Panel (Caution Mode - Bar or Corners)" shall be replaced by the following:

   EVALUATION GUIDE - ARROW PANEL (CAUTION MODE - CORNERS)

   Acceptable: No lamps out and dimming properly.

   Unacceptable: Any lamp out or arrow panel not dimming properly.

   Any operating lamp that is out of alignment will be considered not functioning.

4. The "unacceptable" category for arrow panels shall necessitate immediate corrective action if the device is found in operation on the jobsite.

(q) **Portable Changeable Message Sign** (PCMS):

Units shall be self-contained, including message board, power supply, and trailer. The controller head shall have a back-up system to prevent loss of memory. The

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trailer and sign frame shall be painted federal yellow or Virginia Highway Orange (DuPont Color #LF74279 AT or color equivalent). The sign panel support shall provide for an acceptable roadway viewing height that shall be not less than 7 feet from bottom of sign to crown of road.

The message board shall provide for 3 lines of legend and shall be formed of characters no less than 18 inches high. Each line shall be composed of at least eight characters and each character module shall at a minimum use a five-wide by seven high pixel matrix. The message shall be composed from keyboard entries. The message shall be legible in any lighting condition. Motorists should be able to read the entire PCMS message twice while traveling at the posted speed.

The sign shall be capable of sequentially displaying at least 3 messages of 3 lines each with appropriate controls for selection of messages and variable off-on time.

The Contractor shall determine from its plan of operations or working schedule the most efficient and effective use of the PCMS units based on its construction sequencing or traffic control operations. PCMS signs shall be periodically checked by the Contractor for compliance with manufacturer's requirements for operation and functions, and shall be ready for immediate use once employed on the project.

During emergency situations the Contractor shall make every effort to deploy units it has assigned to the project. However, if the number of units shown on the plans are already in operation and cannot be reassigned to handle the emergency situation, then the Contractor shall immediately contact the Engineer. The Engineer will then make a determination as to the most expeditious manner in which to deploy units for emergency use, whether by using Department supplied units, directing the Contractor to reassign those units he has committed to the project, or having the Contractor supply additional units as may be necessary. In these circumstances, the cost for such additional units that are authorized by the Engineer shall be in accordance with the requirements of **Section 109.05**.

If the use of additional units beyond the number of those identified in the plans is required due to reasons attributable to the Contractor or his manner of operations as determined by the Engineer, and no units are available, the Contractor shall furnish such additional unit(s) to the project within two hours of the Engineer's request or the Department will move to provide such units as necessary and deduct the cost from any monies due the Contractor. This action shall in no way relieve the Contractor of the responsibility for controlling, maintaining, and completing the work.

The number of units estimated by the Department to be used for the project will be as shown on the plans. The number of units and hours of use estimated by the Department was based on the suggested Sequencing of Construction shown in the plans and may be different from the Contractor's own construction plan.

Comment [1656]: Right Location

Comment [1657]: Right payment

Comment [1658]: Right Time/quantity/payment

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512.04—Measurement and Payment

Comment [1659]: Right quantity/payment

Flagger service will be measured in hours as authorized or approved by the Engineer except when used for the Contractor's convenience, such as for ingress and egress for moving construction equipment or materials. In such cases, payment will not be made for flagger service. Flagger service will be paid for at the contract unit price per hour. This price shall include paddles, safety equipment, and portable traffic control signals.

Pilot vehicles will be measured in hours of actual use, as required by the Engineer, and will be paid for at the contract unit price per hour. This price shall include vehicles, necessary warning devices, drivers, fuel, and maintenance.

Electronic arrows will be measured in hours of actual use, as required by the Engineer, except when used as an option to the use of a rotating amber light or alternating high-intensity amber strobe light. In such cases, payment will not be made for electronic arrows. Electronic arrows will be paid for at the contract unit price per hour. This price shall include arrow panels, fuel, maintenance, and a truck or trailer having flashing amber warning lights.

Warning lights for use on sign panels will be measured in days of actual use for the type specified and will be paid for at the contract unit price per day. This price shall include maintaining, relocating, and removing warning lights. Warning lights installed on traffic barrier service will not be measured for separate payment, but the cost thereof shall be included in the linear foot price bid for traffic barrier service.

Group 1 channelizing devices will not be measured for separate payment. The cost thereof shall be included in the price for other appropriate pay items.

Group 2 channelizing devices, as required by the Engineer, will be measured in days and will be paid for at the contract unit price per day. This price shall include maintaining devices, removing devices when no longer required, and signs. When Group 2 channelizing devices are moved to a new location or are removed and re-installed at the same location, they will be measured for separate payment. However, when the Group 2 channelizing devices are moved from one lane to another by simply moving the devices across the lane edge line without removal from the roadway, no additional payment will be made.

Traffic barrier service will be measured and paid for at the contract unit price per foot per location. This price shall include warning lights, delineators, barrier vertical panels, fixed object attachments, patching restraint holes, maintaining, and removing when no longer required. When fixed object attachments are used on traffic barrier service in locations where existing guardrail is in place, this price shall include restoring existing guardrail to its original condition. When traffic barrier service is moved to a new location as directed or approved by the Engineer, the relocation will

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be measured for separate payment. Payment for traffic barrier service will not be made until the work behind the barrier is actively pursued.

Traffic barrier service guardrail terminal will be measured and paid for in units of each or linear feet, as applicable, which price shall include furnishing, installing, and removing when no longer needed. When traffic barrier service guardrail terminal is moved to a new location, as directed or approved by the Engineer, the relocation will be measured for separate payment.

Impact attenuator service will be measured in units of each and will be paid for at the contract price per each. Impact attenuators used with barrier openings for equipment access will not be measured for separate payment.

Temporary traffic control signal will be paid for on a lump sum basis. This price shall include, but not be limited to, poles; span wire; conduit; conductor cable; traffic signal heads; backplates; hanger assemblies; necessary control items; vehicle detection; and, when approved, portable traffic control signal equipment. The price shall also include maintaining, adjusting, and aligning equipment; providing electrical service; utility company costs; and removing equipment when no longer required.

Construction pavement markings will be measured in linear feet and will be paid for at the contract unit price per linear foot. This price shall include marking materials, preparing the surface, adhesive, maintaining, removing removable markings when no longer required, inspections, and testing.

Construction pavement message markings will be measured in units of each and will be paid for at the contract unit price per each. This price shall include marking materials, preparing the surface, adhesive, and maintaining and removing removable markings when no longer required.

Temporary pavement markers will be measured in units of each and will be paid for at the contract unit price per each. This price shall include furnishing and installing pavement markers, surface preparation, adhesive, maintaining and replacing lost or damaged markers, and removing the pavement markers and adhesive when no longer required.

Eradication of existing pavement markings will be measured in linear feet of a 6-inch width or portion thereof. Widths that exceed a 6-inch increment by more than 1/2 inch will be measured as the next 6-inch increment. Eradication of existing pavement markings will be paid for at the contract unit price per linear foot. This price shall include removing pavement line markings and messages and disposal of residue.

Temporary detours will be measured in linear feet along the centerline of the detour or by individual components with the quantities shown on the plans as maintenance of traffic items, in which the components will be measured in accordance with the applicable specifications. This price shall include removing and restoring. When a

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pay item, temporary detour will be paid for at the contract unit price per linear foot. This price shall include excavating, aggregate materials, drainage items, grading, asphalt, maintaining and removing detour, disposing of surplus and unsuitable material, and restoring property.

Aggregate material will be measured in tons and will be paid for at the contract unit price per ton for the type specified. This price shall include preparing the grade and furnishing, placing, maintaining, and removing material as required.

Type III barricades will be measured in units of each and will be paid for at the contract bid price per each for the width specified. Multiple 4-foot-wide Type III barricades may be used together to obtain the width being specified in the pay item. This price shall include the barricades; retroreflective sheeting; and maintaining, relocating to new locations, and removing the barricades when no longer required.

Construction signs will be measured in units of square feet and will be paid for at the contract price per square foot. This price shall include furnishing, installing, maintaining, covering and uncovering, relocating, and removing temporary sign panels, sign supports, hardware, delineators and flags. Payment based on square footage shall be compensation for the sign(s) for the duration of the project; multiple payments for the same sign used more than once will not be allowed.

Truck-mounted attenuator will be measured in hours of actual use and will be paid for at the contract unit price per hour. This price shall include the truck-mounted attenuator; support vehicle; lights; electronic arrows if allowed but not required; and maintenance. When electronic arrows are used at the option of the Contractor in lieu of the rotating or high-intensity amber strobe light, the cost of the electronic arrow shall be included in the price bid for truck-mounted attenuators. When electronic arrows are required and not only allowed on the truck-mounted attenuator support vehicles, they will be paid for separately.

Portable traffic control signal will be paid for on a lump sum basis. This price shall include portable traffic control signal equipment; installation; energy source; and maintaining, adjusting, aligning, removing, and relocating equipment.

Portable changeable message sign will be measured and paid for in hours of use, which price shall be full compensation for furnishing or mobilizing the unit(s) to the project, maintenance, operation, and repositioning the unit(s).

Payment will be made under:

Pay Item	Pay Unit
Flagger service	Hour
Pilot vehicle	Hour
Electronic arrow	Hour

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Warning light (Type)	Day
Group 2 channelizing device	Day
Traffic barrier service (Type and/or Standard)	Linear foot
Traffic barrier service Guardrail terminal (Standard)	Each or Linear foot
Impact attenuator service (Type)	Each
Temporary signalization	Lump sum
Construction pavement marking (Type and width)	Linear foot
Construction pavement message marking (Type and message)	Each
Eradication of existing pavement marking	Linear foot
Temporary pavement marker ([ ]-way)	Each
Temporary detour (Standard and type)	Linear foot
Aggregate material (No.)	Ton
Type III barricade (Width)	Each
Construction signs	Square foot
Truck-mounted attenuator	Hour
Temporary traffic control signal	Lump sum
Portable traffic control signal	Lump sum
Portable Changeable Message Sign	Hour

II. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting: Maintenance of traffic is one of the most important aspects of any project. Daily planning and review is a necessity. The inspector should review the Maintenance of Traffic plans to thoroughly understand the sequence of construction along with all required components. Advise the contractor to make sure that all submittal requirements are completed and approved before work begins. Daily discussions of what is needed and how things will be accomplished should be routine between the inspection staff and the contractor. Questions and concerns should be addressed through the Area Traffic Engineer. Modifications to the Maintenance of Traffic plans shall be reviewed and approved by the Engineer. Review the manufacturer's installation instructions for traffic components as required in the specifications.

Start: Ensure work zones are set up in accordance with the approved plan for each phase of construction. Make sure all traffic control items are in approved, in good conditions and functional before use. Certified Work Zone Traffic Control coordinator for contractor and VDOT must be on site.

Inspection: Multiple daily inspections of work zones are necessary. Ensure traffic items are set up correctly and maintained during use and removed when no longer needed. Fill out form TE-97001 on a weekly basis. At least once every two weeks perform a night inspection and document on this form.

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Final Inspection: Items covered in this section are for temporary traffic control and are removed prior to final acceptance. Make all temporary items including detours and construction limits signs are removed after work is complete.

Documentation Required: Manufacturer's installation instructions, materials and equipment certifications, Work Zone Safety Check List, Daily documentation of inspection, measurement and payment.

III. REVIEW QUESTIONS

Spec. #	
512.03	Are stabilized construction entrances used in construction areas where there is a potential for construction vehicles to track material from the construction site onto a paved surface?
512.01(4)	Are the work area zones in compliance with the guidelines as shown in the Typical Traffic Control figure of the Work Area Protection Manual and contract documents?
512.02(b)1	Do signalization, barricades, channelizing devices, pavement markings and other safety devices conform to the requirements of specifications and MUTCD (materials)?
512.02(b)2	Are reflectorized surfaces made from lens sheeting conforming to the requirements of Section 235, 247.02, and 702?
512.03(1)	Are clearance values being maintained as indicated in the Safety Guidelines for Construction Zones of the Work Area Protection Manual?
512.03(2)	Is traffic maintained and protected in accordance with the general provisions sections on Maintenance During Construction (Section 105.14) and Barricades & Warning Signs? [2002 - Ref 107.10]
512.03(3)	Are barricades, barriers and other safety devices inspected daily by the contractor and deficiencies immediately corrected?
512.03(a)	Does the Contractor furnish and install signs when required, maintain signs and furnish accessory items in accordance with this section?
512.03(b)	Does the Contractor provide certified flagger service and pilot vehicles when required in accordance with this section?
512.03(c)	Are electronic arrows furnished, maintained, and moved in accordance with this section and the VA Work Area Protection Manual or Traffic Control Plan.
512.03(d)	Are the type and spacing of warning lights in accordance with this section?
512.03(e)	Are the type and spacing of channelizing devices in accordance with this section?
512.03(f)1	Does the Contractor continuously prosecute the work until

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	completion once the barrier is in place?
512.03(f)2	Is the barrier service removed as soon as construction work is completed to the extent the barrier service is no longer required?
512.03(f)3	Are barrier openings only in tangent sections or along the inside of curved sections and limited to the minimum length required for access?
512.03(f)4	Is the normal pavement alignment at the barrier opening maintained with removable pavement markings?
512.03(f)5	Are ingress and egress openings in accordance with the requirements of this section?
512.03(f)6	Are delineators installed on barrier service in accordance with Section 702, Delineators?
512.03(f)7	Does the Contractor maintain the alignment and structural integrity of the barrier, and are warning lights, delineators, vertical panels, and other devices on barrier service in a clean and visible condition at all times?
512.03(f)8	If Contractor used Traffic Barrier Service not shown on the Department's Approved List, did the Contractor submit to the Department a copy of the FHWA acceptance letter indicating compliance with NCHRP Report 350 prior to it being used?
512.03(f1)	Is guardrail barrier service in accordance with this section?
512.03(f2)1	Is concrete barrier service installed in accordance with the plans and standard drawings or as directed by the Engineer?
512.03(f2)2	When barrier terminates at a guardrail, are fixed object attachments in accordance with the applicable standards?
512.03(f2)3	Is precast concrete parapet service anchored as shown on the plans?
512.03(f2)4	Upon parapet removal, are anchor holes cleaned and filled with the proper epoxy mortar EP4 or EP5?
512.03(g)	Is impact attenuator service in accordance with this section?
512.03(h)1	When specified on the plans, did the Contractor install and maintain temporary or portable traffic control signalization equipment?
512.03(h)2	Did the Contractor submit and have approved a plan to the Engineer for locating, installing and maintaining signals that depicted the intended traffic flows during construction operations, including type of vehicle detection, phase sequencing and timing?
512.03(h)3	If electrical service is not available, does the contractor provide a generator capable of continuously operating for at least 24 hours unassisted?
512.03(i)1	Are construction pavement markings installed at locations shown on the plans, and the Work Area Protection Manual and at other locations as determined by the Engineer?

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512.03(i)2	Are construction pavement markings Type D, E, & F installed in accordance with the manufacturer's recommendations?
512.03(i)3	Have construction pavement markings been maintained and deficiencies been corrected in accordance with this spec?
512.03(j)1	Are pavement markings that may conflict with desired traffic movement eradicated as soon as is practicable?
512.03(j)2	Is eradication and containment being performed in accordance with this section?
512.03(j)3	Are markings for lane shifts/transitions 100% eradicated?
512.03(j)4	Is Type E Black Construction Pavement Marking applied and/or removed in accordance with this section?
512.03(k)1	Are temporary pavement markers installed with construction pavement markings in work zones that occupy the traveled roadway for a period of more than three days?
512.03(k)2	Are temporary pavement markers installed in transition areas on 20-foot centers and in all other areas on 40-foot centers unless otherwise required by the Engineer?
512.03(k)3	Are temporary pavement markers located in alignment with the pavement markings?
512.03(k)4	When double line pavement markings separating traffic are installed, are two-way markers installed on each line, unless the contractor elects to install two one-way markers?
512.03(k)5	Have temporary pavement markers been installed in accordance with this section?
512.03(l)	Are detours provided in accordance with this section?
512.03(m)	Is aggregate material placed in accordance with this section?
512.03(n)	Are construction pavement message markings installed in accordance with this section?
512.03(p)	Did the Contractor prior to use submit the required documentation and does the Truck Mounted Attenuator meet all the requirements of this section?

	Are posts installed in accordance with the Standards?
•	Are signs placed at the correct height above the edge of pavement?
•	If signs on posts are covered, are delineators installed on the posts?
•	Is the detour properly delineated?
•	Is the Work Zone Safety Checklist (Form # TE-97001) being used at least once a week?
•	Is the Inspector documenting when traffic is disrupted?
•	Do the materials listed on the approved Source of Material Form match the materials used?

Trial Use and Comment

• Does the Contractor have a certified pavement marking technician on site?
• Is the pavement to be striped clean and free of moisture?
• Does the Contractor properly pre-mark the area to be striped?
• Is the correct amount of beads used?
• Are pavement markings applied at the right thickness and width?
• Are pavement markers applied with the correct spacing?
• Is the correct type of adhesive used to apply pavement markers?
• Are pavement markings protected from traffic until dry?
• Does the Contractor give the Inspector a Form C-85, Contractor's Daily Log and Quality Control Report for the work performed each day?

IV. CRITICAL INSPECTION POINTS

• Are all materials/equipment approved and are they certified to meet NCHRP Report 350 standards prior to use.
• Has the contractor submitted to the Engineer a plan for locating, installing, and maintaining signals that shall depict the Contractor's intent for maintaining traffic flows during construction operations, including type of vehicle detection, phase sequencing, and timings? Has the plan been approved by the Area Traffic Engineer?
• Are all components of the Maintenance of Traffic plan in place, maintained and appropriately adjusted as work progresses?
• Are detours in place, functional and clearly signed and marked as required?
• Are flaggers certified, properly dressed, and performing duties as required?
• Are Work Zone Safety Checks being performed by the inspector and contractor and is Form TE-97001 filled out on a weekly basis?
• Is contractor facilitating minimum interference and maximum protection for traffic for each operation as required by the specifications?
• Is certified Work Zone Traffic Control coordinator on site?

Trial Use and Comment

SECTION 513 – MOBILIZATION

I. INTRODUCTION:

Activation of a contractor's physical and manpower resources for transfer to a construction site until the completion of the contract.

This work shall consist of performing preparatory operations, including moving personnel and equipment to the project site; paying bonds and insurance premiums; and establishing the Contractor's offices, buildings, and other facilities necessary to allow work to begin on a substantial phase of the Contract.

a. Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

513.01—Description

This work shall consist of performing preparatory operations, including moving personnel and equipment to the project site; paying bonds and insurance premiums; and establishing the Contractor's offices, buildings, and other facilities necessary to allow work to begin on a substantial phase of the Contract.

513.02—Measurement and Payment

Mobilization will be paid for at the contract lump sum price. This price shall include demobilization.

Payment for mobilization up to the limitations specified hereinafter will be made in two separate installments. The first installment of 50 percent of the contract lump sum price will be made on the first progress estimate following partial mobilization and initiation of construction work. The second installment will be made on the next progress estimate following completion of substantial mobilization, including erection of the Contractor's offices and buildings. Completion of erection of processing plants, if any, will not be required as a condition for the release of the second installment.

If the original contract lump sum price exceeds the limit stated hereinafter, the excess will be included on the semifinal estimate as follows:

More Than	To and Including	Limit
$0	$200,000	10% of total contract amount
200,000	1,000,000	$20,000 plus 7.5% (of total contract amount minus $200,000)

Trial Use and Comment

1,000,000	More	$80,000 plus 5% (of total contract amount minus $1,000,000)

No additional payment will be made for demobilization and remobilization because of shutdowns, suspensions of work, or other mobilization activities.

When not shown as a pay item, the cost of mobilization shall be included in the price bid for other appropriate items.

Payment will be made under:

Pay Item	Pay Unit
Mobilization	Lump sum

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Construction Manager should ask for the equipment list from the contractor prior to this meeting and the contractor should present this at this time.
- Find out the actual start date so that the correct payment can be made when work begins.
- Get employee roster and emergency contact information for the project.
- Remind the contractor that traffic control requirements need to be met if equipment is being loaded or unloaded within the travel portion of the roadway.

Start:

- Ensure that 50% of the lump sum item is paid on the first estimate following partial mobilization. (it is not always on the first estimate for the project. The contractor may not be beginning work for awhile but a estimate may need to be run to pay for stored materials. Be sure that contractor equipment is actually being delivered to the site during the period for payment.)
- All the employees and Equipment needs to entered into the project diary upon delivery to the project.
- Ensure that any and all necessary traffic control is being installed and functioning properly if the situation warrants.

Intermittent inspection:

Trial Use and Comment

- Ensure that the correct amount is paid to the contractor on the second estimate following the completion or substantial mobilization. (pay close attention to the limitations in the specifications for proper payment.)

- A list of employees and equipment shall be kept and maintained in the project diary.

- In the event the contractor brings in new equipment or removes equipment from the project make note.

- Ensure that any and all necessary traffic control is being installed and functioning properly if the situation warrants.

Final Inspection:

- Ensure that contractor has removed all equipment from the project.

Documentation Required:

- Equipment Lists
- Emergency Contact Information

- In the event the contractor brings in new equipment or removes equipment from the project make note.

IV. REVIEW QUESTIONS

N/A

V. CRITICAL INSPECTION POINTS

• **The Contractor has to partially mobilize before the first 50% installment can be paid.**
• **The Contractor must have performed substantial mobilization to the project and office trailers and building must be installed before making second installment.**

Trial Use and Comment

SECTION 514- FIELD OFFICE

I. INTRODUCTION:

The Field Office is an important component for Project Managers and Construction Inspectors to facilitate the many administrative, planning and management aspects of a construction project. Locating and setting up the Field Office takes advanced planning and should be accomplished as earlier as possible after award. Working with the contractor to find an appropriate location and initiating the installation of needed utilities early in the process can help get the Field Office functional during the critical start up timeframe of the project

a) Forms:
See Construction Division Memorandum:

CD-2007-02	Reissued 4/2/07	Section 514 Field Offices: Network Connectivity for Field Offices

Always review the contract and plans for amendments to the specifications through special provisions, copied notes or general notes.

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

514.01 – Description
This work shall consist of furnishing, erecting, equipping, maintaining and removing upon completion a field office of the type specified for the exclusive use of Department Engineers and Inspectors at a location on the project approved by the Engineer.

514.02 - Procedures

The field office and equipment as required herein shall remain the property of the Contractor. The field office shall be separated from buildings and trailers used by the Contractor and shall be erected and made functional as an initial operation. Failure to have the field office functional when work first begins on the project will result in withholding payment of the Contractor's monthly progress estimate, except that the estimate will not be withheld if the Contractor has shown that the failure is not due to negligence on his part or for reasons beyond his control. The field office shall be operational throughout the duration of the project and shall be removed upon completion and final acceptance of the project. Furnishings and

Comment [1660]: Right Location

Comment [1661]: Right Way

Comment [1662]: Right Time

Comment [1663]: Right material

Trial Use and Comment

equipment specified shall be in sound and functional condition throughout the duration of the project.

The field office shall be weatherproof, tightly floored and roofed, constructed with an air space above the ceiling for ventilation, supported above the ground and anchored against movement. The width of the field office shall be at least 8 feet, and the floor-to-floor ceiling height shall be at least 7 feet 6 inches. If a trailer is provided for the field office, its width shall be at least 7 feet 6 inches and the floor-to-ceiling height shall be at least 6 feet 6 inches. The inside walls and ceilings shall be constructed of, Masonite, gypsum board, or other similarly suitable materials as permitted by fire and building codes. The exterior walls, ceiling and floor shall be insulated. Field office shall be provided and outfitted as follows according to the type specified.

Type I Field Offices shall have an enclosed floor space of at least 500 square feet with 100 square feet of counter space and 120 square feet of overhead shelving. The field offices shall be equipped with the following:

Quantity	Item
4	Double–pedestal desk, keyed, (approximately 60 inches by 34 inches) at least 2,000 square inches
1	Plan and drafting table (approximately 30 inches by 96 inches) with an adjustable stool
2	Computer tables - 29 inch height, with surface area approximately 48 inches by 30 inches
3	4-Drawer metal fire protection file cabinets, 15-inch drawer width, minimum UL rating of Class 350
2	2-Drawer fire protection file cabinet, 15 inch drawer width, minimum UL rating of Class 350
2	Rolling Plan rack for 24 by 36 inch drawings with 6 plan clamps
2	Bookcase 36 inches by 42 inches with four shelves
1	Dry erase board – wall mounted, minimum 15 square feet, with eraser and markers
1	Small frost free refrigerator
1	Small microwave
2	Printing calculators
6	Office Chairs, 2 with casters
3	Wastebaskets
3	Folding conference tables – minimum 36 inches by 72 inches
4	Folding chairs
1	Pencil sharpener
1	Answering Machine
1	Facsimile machine with optional memory and service contract for preventative maintenance, including replacement print cartridges
1	Copy machine with the following features: - Capability of copying 8-1/2” x 11”, 8-1/2 x 14” and 11” x 17” sized originals - Bin sorter - Automatic Feed

Trial Use and Comment

- Automatic paper size selection
- Size magnification/reduction from 200% to 50% of original image size
- Service contract with preventive maintenance, including drum replacement and toner supply

1	First Aid kit containing eyes and skin protection for emergencies.
2	Smoke detectors with batteries

Type II Field Offices shall have an enclosed floor space of at least 400 square feet and shall be equipped with the following:

Quantity	Item
1	Double–pedestal desk, keyed (approximately 60 inches by 34 inches) at least 2,000 square inches
1	Plan and drafting table (approximately 30 inches by 96 inches) with an adjustable stool
1	Computer table - 29 inch height, with surface area approximately 48 inches by 30 inches
1	4-Drawer metal fire protection file cabinet, 15 inch drawer width, minimum UL rating of Class 350
2	2-Drawer fire protection file cabinet, 15 inch drawer width, minimum UL rating of Class 350
1	Rolling Plan rack for 24 by 36 inch drawings with 6 plan clamps
1	Bookcase, 36 inches by 42 inches with four shelves
1	Dry erase board – wall mounted, minimum 15 square feet, with eraser and markers
1	Small frost free refrigerator
1	Small microwave
1	Printing calculator
4	Office chairs, 2 with casters
4	Folding chairs
4	Wastebaskets
1	Folding conference table – minimum 36 inches by 72 inches
1	Pencil sharpener
1	Answering Machine
1	Copier machine capable of copying 8 inch by 11 inch and 11 inch by 17 inch sized originals
1	First Aid kit containing eye and skin protection for emergencies.
2	Smoke detectors with batteries

Trial Use and Comment

Type III Field Office shall have an enclosed floor space of at least 200 square feet and shall be equipped with the following:

Quantity	Item
1	Double–pedestal desk, keyed (approximately 42 inches by 30 inches) at least 1,250 square inches
1	Plan and drafting table approximately 30 inches by 72 inches with an adjustable stool
1	Computer table - 29 inch height, with surface area approximately 48 inches by 30 inches
1	4-drawer metal fire protection file cabinet, 15 inch drawer width, minimum UL rating of Class 350
2	2-Drawer fire protection file cabinet, 15 inch drawer width, minimum UL rating of Class 350
1	Rolling Plan rack for 24 by 36 inch drawings with 6 plan clamps
1	Dry erase board – wall mounted, minimum 15 square feet, with eraser and markers
1	Small frost free refrigerator
1	Small microwave
1	Printing calculators
3	Office chairs, 2 with casters
4	Folding chairs
2	Wastebaskets
1	Folding conference table – minimum 36 inches by 72 inches
	Pencil sharpener
1	Answering Machine
1	First Aid kit containing eye and skin protection for emergencies.
1	Smoke detector with batteries

(a) **Windows and Doors:** The field office shall have at least three windows with removable screens and appropriately sized blinds or shades. Each window shall have an area of at least 540 square inches, capable of being easily opened and secured from the inside. All field office types shall have at least two exterior passage doors. Doors shall be at least 30 inches in width and 78 inches in height. Exterior passage doors shall be equipped with locks and at least two keys per door shall be furnished to the Engineer or Project Inspector.

In addition, each exterior door shall be equipped with a steel security bar that is installed horizontally and fabricated to lock with a 3/8" diameter padlock shank. The Department will furnish the padlocks for the security bars.

(b) **Steps:** Steps shall conform to the requirements of the *State Building Code* and shall be maintained free from obstruction.

(c) **Storage Facility for Nuclear Gage(s):** The field office shall be furnished with an outside storage facility for the Department's nuclear gage(s), which shall not be located within 10 feet of any structure. This facility shall be provided with electrical power and shall be equipped for an interior switched light and one single-phase,

Trial Use and Comment

120V, 15 amps, grounded, weatherproof, duplex receptacle for recharging the nuclear gage(s). The storage facility for the nuclear gage(s) shall be weatherproof, tightly floored and roofed, having a tamper resistant key operated lock with two keys furnished to the Engineer or Project Inspector.

(d) **Storage Facility for Test Equipment:** The field office shall be provided with a storage facility, separate from the office for storage of test equipment, other than the nuclear gage. The storage facility shall have a minimum floor space of 64 square feet and include four shelves at least 11 inches deep mounted along the length of one wall. The storage facility for test equipment shall be weatherproof, tightly floored and roofed, having a tamper resistant key operated lock with two keys furnished to the Engineer or Project Inspector.

Comment [1664]: Right Quantity

(e) **Lighting, Heating, and Air Conditioning:** The field office shall have satisfactory functional lighting, electrical outlets, heating equipment, an exhaust fan, and air conditioner connected to an operational power source. At least one of the light fixtures shall be a fluorescent light situated over the plan and drafting table. There shall also be at least one 100 watt exterior light fixture at each exterior doorway. Electrical power and fuel for heating equipment shall be furnished by the Contractor.

(f) **Fire Extinguishers:** The Contractor shall furnish and maintain one fire extinguisher for each required exterior passage door. Fire extinguisher(s) may be chemical or dry powder, UL Classification 10B:C (minimum), suitable for Type A:B:C fires and shall be mounted and maintained in accordance with OSHA Safety and Health Standards.

(g) **Toilets –** Toilets shall conform to the requirements of the state and local boards of health or other bodies or courts having jurisdiction in the area. Toilet facilities may be either inside the Field Office or portable toilet facilities.

If the Contractor provides toilet facilities inside the Field Office, the toilet facilities shall have a continuous supply of water at a flow rate of not less than five gallons per minute. The toilet facilities shall be connected to either a sewer line or a permitted sewage holding tank with sewage pumping at a frequency that prevents overflow and back ups. The toilet facilities shall have a positive functional lock on the inside of the doors.

If the Contractor provides portable toilet facilities, then there shall be separate facilities for both male and female personnel with appropriate signs for “Men’s Rest Room” and “Women’s Rest Room” having lettering at least 2 inches in height. Both men’s and women’s portable toilet facilities shall have an adequate positive locking system provided on the inside of the doors. The facility labeled “Women’s Rest Room” shall also have a positive, uniquely-keyed, exterior locking device; and the Contractor shall provide two keys to the Engineer or Project Inspector.

Trial Use and Comment

The Contractor shall provide washing facilities in accordance with VOSH regulations.

(h) **Drinking Water**: The Contractor may provide either potable water inside the Field Office or bottled drinking water service that includes a dispenser capable of providing both hot and cold water, and disposable cups. The Contractor shall cause the bottled drinking water service to replenish both bottled water and disposable cups no less frequently than twice per month.

(i) **Utilities:** Except for telephone services, the Contractor shall make arrangements for necessary utility connections, maintain utilities, pay utilities service fees and bills, and make arrangements for final disconnection of utilities. The Contractor shall also furnish two touch tone telephones in each field office and permit the work necessary to install them.

(j) **Miscellaneous Items:** The field office shall also include the following:

1. A certification that the office is free of asbestos and other hazardous material.

2. A broom, dust pan, mop, mop bucket, general cleaning supplies, and trash bags.

3. An all weather parking area for either twelve vehicles (for a Type I office) or six vehicles (for either a Type II or a Type III office), and all weather graveled access to the public roadway. The Contractor shall maintain the parking area and graveled access such that it is passable with a compact sedan without causing vehicular damage. The parking lot shall be sufficiently lighted to illuminate all areas of the lot.

4. Security measures for the Field Office during other than normal working hours shall be equivalent to that used by the Contractor for his job site and office facilities.

514.03- Measurement and Payment

Compensation for use of the field office will be based on the time it is used, expressed in calendar months. This price shall include furnishing, erecting, maintaining, and removing the field office when no longer required, and providing the facilities, furnishings, equipment, utilities and services as described herein. Payment for periods less than one month shall be based on the pro-rata days during the month in which the field office is in use by the Engineer, except that payment will not be made for any time in excess of the time limit established in the Contract as extended in accordance with the requirements of **Section 108.04.**

Installation and service fees for the telephone(s) will be paid for by the Department.

Comment [1665]: Right documentation

Comment [1666]: Right Payment

Comment [1667]: Right Time

Trial Use and Comment

Payment will be made under:

Pay Item	Pay Unit
Field Office (Type)	Month

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting: Meet with the contractor as early as possible after contract award to plan for the office location and utility connections. As soon as a location is selected, process the **CONSTRUCTION TELECOMMUNICATIONS REQUEST FORM.**

Start: Ensure that property owner agreements have been signed and approved. Proper documentation may also be necessary as part of the SWPPP.

Inspection: Ensure all required components of the Field Office are provided by the contractor before payment.

Final Inspection: Removal and/or restoration of property and Property Owner Release. Request disconnection of phone and IT utilities.

Documentation Required: Property Owner Agreements/Release, SWPPP approval, Asbestos/Hazardous Material Certification, **CONSTRUCTION TELECOMMUNICATIONS REQUEST FORM**.

IV. REVIEW QUESTIONS

• Is office located on the project or as approved by the Engineer?
• Has contractor provided certification that the office is free from asbestos or other hazardous material?
• Is the office equipped as outlined in the specifications?
• Has contractor provided signed property owner agreement?
• Is location and facilities included on the SWPPP when required?

Trial Use and Comment

• Has contractor restored area and provided property owner release at project completion?

V. CRITICAL INSPECTION POINTS

• Approved Location, Asbestos/Hazardous Materials Certification, Property Owner Agreement, and included as part of the SWPPP (if required)
• All components of Field Office provided by contractor
• Property owner release, restoration of property, disconnection of all utilities

Trial Use and Comment

SECTION 515 – PLANING PAVEMENT

I. INTRODUCTION:

Pavement planing shall be accomplished with equipment capable of milling and removing the millings from the surface in a continuous operation. Equipment must be capable of milling a minimum depth of 2 inches on flexible pavements and ½ inch on rigid pavements.

Milling and planing equipment must have a self-contained watering system to control dust and fine particles.

All equipment and vehicles under traffic shall have flashing or rotating amber lights.

All high spots and irregularities must be removed and pavement resurfaced will have a one inch shoulder cut along the gutter line.

Pavement millings shall be disposed of by the Contractor.

METHOD OF MEASUREMENT

Planing will be measured and paid by the square yard per inch of depth.

a) <u>Forms:</u>

- **Intentionally Left Blank**

II. <u>2007 ROAD & BRIDGE SPECIFICATION and the 7Rs</u>

515.01—Description

This work shall consist of planing rigid or flexible pavement to the designated depth in preparation for pavement repair or pavement overlay.

Comment [1668]: Right Way

515.02—Procedures

Planing shall be performed with a pavement-planing machine of a type that has operated successfully on work comparable to that specified in the Contract.

Comment [1669]: Right Way

Trial Use and Comment

Equipment and vehicles in use under traffic shall operate flashing or rotating amber lights. In addition, trail vehicles shall be equipped with electronic flashing or sequential amber arrows.

Irregularities and high spots shall be eliminated. The pavement surface shall be planed to the designated grade or gradient of approximately 1/4 inch per foot or as directed by the Engineer. Superelevated curves shall be planed as directed by the Engineer. Where the pavement is to be resurfaced, a 1-inch shoulder shall be cut along the gutter line to eliminate the necessity of feathering the edge of the new surface. Payment for providing the 1-inch shoulder shall be based on the total square yards of removed material regardless of the variable depth of the pass. Pavement cuttings shall be disposed of in accordance with the requirements of Section 106.04.

The planed surface shall be free from gouges, grooves, ridges, soot, oil film, and other imperfections and shall have a mosaic appearance suitable as a riding surface.

(a) **Hot Planing Methods:** Hot planing equipment shall be a self-propelled machine capable of heating, planing, and removing flexible pavement to the required depth, profile, and cross section. The machine shall be capable of cutting to a depth of at least 1/2 inch per pass and shall have an integral loader to pick up cuttings from the roadway and discharge them into a truck in a single operation. Planing machine burners shall use a heating fuel that will not cause aggregates or asphalt to be coated with soot or oil.

(b) **Milling and Cold Planing Methods:** Milling and cold planing equipment shall be capable of cutting to a depth of 2 inches in flexible pavement and 1/2 inch in rigid pavement while leaving a uniformly cut roadway surface capable of handling traffic prior to overlay placement. The ground speeds of the machine and the cutting equipment shall be independent. The machine shall have a self-contained water system for the control of dust and fine particles. The width of the machine shall allow controlled traffic.

515.03—Measurement and Payment

Where pavement is to be planed to a uniform depth, planning will be measured in square yards of removed pavement surface area per inch of depth and will be paid for at the contract unit price per square yard per inch. Where planning will be variable depth, planning will be measured in square yards of removed pavement surface area per pass per inch of depth measured at the maximum depth of removed pavement. This price shall include vehicles, safety equipment, warning devices, and removing and disposing of existing pavement.

Payment will be made under:

Pay Item	Pay Unit

Comment [1670]: Right Payment

Comment [1671]: Right Documentation

Comment [1672]: Right Way

Comment [1673]: Right Way

Comment [1674]: Right Payment

Trial Use and Comment

Flexible pavement planning	Square yard
Rigid pavement planning	Square yard

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- **Check the plans to ensure area to be planed represents the work in the field.**

Start:

- **Maintenance is correctly set up.**
- **Proper planing machine**
- **Equipment and vehicles are equipped with the proper lighting.**
- **Knowledge of where the millings are being disposed.**

Continuous inspection:

- **Depth of planing is as shown**
- **Irregularities and high spots are addressed.**

Final Inspection:

- **Planed surface is clean of debris and imperfections.**
- **Planed surface is suitable as riding surface.**
- **Maintenance of Traffic (MOT) remains in place with appropriate signage as shown in the Special Provisions or MOT is removed.**

Documentation Required:

- **Letter from Contractor where millings are disposed. (Section 106.04).**
- **Completed Daily Work Report (DWR).**
- **Sketches and Calculations.**

IV. REVIEW QUESTIONS

Spec. #	
515.01	Has the pavement been planed to the designated depth?
515.02(1)	Is planing performed with a pavement planing machine of a type that has operated successfully on work comparable to that specified in the Contract?
515.02(2)	Are all vehicles in use under traffic using the proper lights and arrows?
515.02(3)	Have all irregularities and high spots in the pavement been eliminated?
515.02(4)	Where the pavement is to be resurfaced, has a one-inch shoulder been cut along the gutter line to eliminate feathering the edge of the new surface?

Trial Use and Comment

515.02(5)	Have pavement cuttings been disposed of in accordance with the general provisions section on Disposal Areas?
515.02(6)	Is the planed surface free from gouges, grooves, ridges, soot, oil film, and other imperfections and have a mosaic appearance suitable as a riding surface?
515.02(a)	Are hot planing methods in accordance with this section?
515.02(b)	Are milling and cold planing methods in accordance with this section?

V. CRITICAL INSPECTION POINTS

• **Check the depth of planing.**
• **Maintenance of Traffic is set up properly.**
• **Ensure the millings are disposed at an approved site.**
• **Check the vehicles and equipment that they are properly equipped with required lights.**
• **Ensure riding surface is clean and suitable for traffic.**
• **Maintenance of Traffic to remain in place or removed.**

Trial Use and Comment

SECTION 516 – DEMOLITION OF BUILDINGS AND CLEARING PARCELS

I. INTRODUCTION:

The District Right-of-Way Manager will advise, in writing, the Residency of the buildings to be released to the Contractor for demolition. The Inspector is to make a visual survey of the project to see if the released buildings are still in place and keep records on items removed by the Contractor.

Some structures may be designated as containing hazardous materials, such as asbestos, which will have to be removed before demolishing the structure. Inspectors should obtain copies of the Asbestos Inspection Reports and consult with the District Environmental Manager.

The Inspector shall review the plans and special provisions for structures having hazardous materials and proceed in accordance with special provisions.

All utilities are to be disconnected before demolishing the structure. It is important that these services be disconnected at the "street", not at the end of the service line. The Contractor is to make the necessary arrangements with the utility companies.
The Contractor may be permitted to occupy a building, scheduled for demolition, for project use with written permission from the Engineer.

Parcels to be cleared will be identified on the plans and may include items off the right-of-way but within easement limits. All items to be cleared from parcels may not be shown; however, such items as those listed in Section 516 of the Specifications are to be cleared as indicated therein.

Section 516.02(d) of the Specifications states that the Contractor will be notified in writing when buildings are ready for demolition. The Project Inspector is to have a copy of the written notification releasing the buildings to the Contractor prior to such buildings being demolished and shown on the monthly voucher for payment. During preparation of the final voucher, a final check is to be made to determine that all buildings being paid for as demolition items were released to the contractor in writing.

Comment [1675]: Replace “b” with “d”

Wells shall be closed in accordance with State Department of Health Private Well Regulations, Department of Environmental Quality, and all local jurisdictions.

MEASUREMENT AND PAYMENT

Trial Use and Comment

Demolition of buildings and Clearing of Parcels are to be paid as lump sum. Closing of Wells is to be paid for in units of each.

a) Forms:
Intentionally Left Blank

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7Rs

516.01—Description

This work shall include disconnecting utilities, closing wells, demolishing building(s), removing materials from the right of way, and removing improvements and material unsuitable for use in roadway embankments from vacant parcels and other areas within the right of way.

516.02—Procedures

(a) **Utilities:** The Contractor shall make necessary arrangements and perform necessary work, in accordance with local ordinances, involved with disconnecting or interrupting public utilities or services. These shall include, but not be limited to, gas, water, sewer, electricity, and telephone.

(b) **Closing Wells:** The Contractor shall close all wells prior to any demolition and clearing parcels in accordance with State Board of Health Private Well Regulations, State Water Control Board, and local jurisdictions.

(c) **Refrigerant-Containing Appliances:** The Contractor shall disconnect all chemical refrigerant-containing equipment including air conditioners and heat pumps in accordance with state and federal laws and regulations; any disconnections shall be made by certified individuals.

(d) **Demolition:** The Contractor will be notified in writing when buildings are ready for demolition. Demolition shall include removing and disposing of materials from buildings and appurtenances down to the ground lines or below the ground lines in the case of basements or similar existing below-ground structure. Any structures that contain non-regulated asbestos-containing materials shall be demolished in accordance with the Special Provision for Demolition of Structures Containing Non-Friable Asbestos-Containing Materials.

The Contractor may use buildings designated for demolition for project-related office space or storage or as a field office for Department personnel only after

Comment [1676]: Right Way

Comment [1677]: Right Way

Comment [1678]: Right Way

Comment [1679]: Right Way

Comment [1680]: Right Way

Comment [1681]: Right Documentation

Comment [1682]: Right Documentation

Comment [1683]: Right Time/Right Documentation

Trial Use and Comment

approval is obtained from the Engineer in writing prior to occupancy. The Contractor shall remove all regulated asbestos-containing materials (RACM) in accordance with the Special Provision for Asbestos Removal for Road Construction Demolition Projects prior to occupancy.

The Contractor shall assume all personal and property liability associated with the use of or salvaging of materials from such buildings and shall protect and save the state harmless from any and all damages and claims associated with such buildings. Salvage operations shall not be performed in advance of the Department's asbestos inspection, and if asbestos-containing materials are identified, prior to asbestos abatement activities. The Contractor is advised that the Department's asbestos inspection procedures are intended to support whole structure demolition and, as such, may not be sufficient to support worker protection for salvage operations. Any additional testing, abatement, notification, and/or worker protection activities required to salvage materials shall be the sole obligation of the Contractor at his expense.

Buildings, materials resulting from their removal, and improvements on the property shall become the property of the Contractor at the time of their removal and shall be disposed of outside and away from the parcel site. Nothing herein shall be construed as giving the Contractor any rights in and to the buildings in the Contract except for their demolition or for the purposes permitted herein. The Contractor shall have no right to sell or lease the buildings. The Department does not warrant or guarantee the existence or continued existence of any materials that are a part of the demolition item(s), and the Department will not be responsible in any way thereof to the Contractor.

(e) **Clearing Parcels:** Parcels shall not be cleared until buildings have been demolished or removed.

Clearing parcels shall include disposing of materials from noncombustible foundations down to and including floor slabs, basement slabs, and any improvement designated for removal but not listed as a pay item. Combustible debris and rubble, including fences, posts, or pillars, shall also be removed from the right of way or from within the limits of easements obtained for removing buildings that may be partially outside the right of way.

The Contractor shall limit the cutting or removing of trees and shrubs to those necessary for completion of the work as approved by the Engineer. Trees or shrubs that are cut shall be removed from the right of way. The Contractor shall not enter or encroach on any parcel that is not included in the Contract.

Materials contained in cisterns, septic tanks, and other openings, including basements, shall be removed and properly disposed of in accordance with the requirements of Section 107.01. Underground tanks shall be closed and removed; cisterns, septic tanks, and other openings, including basements, shall be

Comment [1684]: Right Documentation

Comment [1685]: Right Payment

Comment [1686]: Right Time

Comment [1687]: Right Way

Comment [1688]: Right Documentation

Comment [1689]: Right Location

Comment [1690]: Right Material

Trial Use and Comment

demolished; and the area shall be backfilled with materials suitable for use in roadway embankment in accordance with the requirements of Section 303.

516.03—Measurement and Payment

Comment [1691]: Right Payment

Demolition of buildings will be paid for at the contract lump sum price for the parcel and structure specified. This price shall include coordinating and performing utility work, disposing of materials, and cleaning up. The Contractor shall also take into consideration the salvage value of any material removed and shall include the same in the lump sum price.

Clearing parcels will be paid for at the contract lump sum price for the specified parcel. This price shall include disposing of materials, backfilling, and cleaning up. The limits of payment shall be from the construction limits to the right-of-way or easement line.

Closing wells will be measured and paid for on an each basis, which price shall include chlorination, cement grout or bentonite grout, or other material as applicable; backfilling; and filing of abandonment documents with the Virginia Department of Health**.** The Contractor shall execute and file abandonment documents in accordance with the requirements of Section 107.01.

Payment will be made under:

Pay Item	**Pay Unit**
Demolition of building (Parcel no.) (D no.)	Lump sum
Clearing parcel (Parcel no.)	Lump sum
Closing well	Each

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- **The Contractor has obtained and on the project site EPA, VOSHA, OSHA applicable State and local government regulations regarding the handling of Asbestos Containing Materials (ACM) (Special Provision Asbestos Removal for Road Construction Demolition Projects 3/18/2009).**
- **The Contractor, Supervisor(s), and Employee(s) are licensed for asbestos abatement activities in accordance with the Virginia Department of Professional and Occupational Regulation (DPOR) requirements. A copy of their license(s) shall be included with the Submittals. (Special Provision Asbestos Removal for Road Construction Demolition Projects 3/18/2009).**
- **The Contractor provides a "competent person" that holds a valid Asbestos Supervisor license issued by DPOR. (Special Provision Asbestos Removal for Road Construction Demolition Projects 3/18/2009).**
- **The Contractor shall make all the required notifications at least twenty (20) days prior to beginning the removal of Asbestos Containing Materials (ACM).**
  (Special Provision Asbestos Removal for Road Construction Demolition Projects 3/18/2009).
- **The Contractor shall give both a twenty (20) day and a 72-hour notification to the Asbestos Project Monitor, the VDOT Area Construction Engineer, and the VDOT District Engineer and VDOT Project Manager prior to work being performed.**
  (Special Provision Asbestos Removal for Road Construction Demolition Projects 3/18/2009)
- **Prior to commencing work, two copies each of the following items shall be submitted to the Department for review and approval:**
  (Special Provision Asbestos Removal for Road Construction Demolition Projects 3/18/2009)

- **Notifications**
- **Testing Laboratory**
- **Certificate of Compliance**
- **Qualification of the Contractor's Personnel and Personnel Training**
- **Medical Requirements**
- **Respirator Program**
- **Material Safety Data Sheets (MSDS)**

Start:

- **Submittal approved.**
- **Employees have all personnel protection equipment.**
- **All air handling equipment shall arrive at the job site in a clean (uncontaminated) condition and will be compliant with ANSI 29.2 specifications.**
- **Caution signs and labels placed and visible.**

Trial Use and Comment

- **Decontamination area set up. Preparation of work area(s).**
- **VDOT provides a licensed asbestos project monitor.**

Continuous inspection:

- **Monitor that the removal of contaminated soils does not fall onto unprotected soil.**

- **The Project Monitor shall collect pre-abatement air samples and must inspect and approve the work area preparations before authorizing the Contractor to begin removal.**

- **The Project Monitor will monitor the Contractor's daily personal air monitoring for asbestos exposure and all testing and sampling activities.**

- **Ensure that all laboratory analytical air monitoring results shall be posted at the work site entrance no later than 24 hours after sampling; and copies of the analytical results and signed "Certificates of Analysis" shall be transmitted to the Engineer.**

- **Obtain copies of waste shipment records from the Contractor.**

Final Inspection:

- **Clean up of the construction site in accordance with the (Special Provision Asbestos Removal for Road Construction Demolition Projects 3/18/2009).**
- **Site Inspection in accordance with the (Special Provision Asbestos Removal for Road Construction Demolition Projects 3/18/2009).**

- **Final Clearance when the concentration of fibers for each of the samples shown to be less than or equal to 0.01 fiber per cubic centimeter of air. (Special Provision Asbestos Removal for Road Construction Demolition Projects 3/18/2009)**

Documentation Required:

- **Copies of all exposure records and area monitoring records shall be submitted to the Owner at the conclusion of the project.**
- **All project site regulations.**
- **Waste shipment records.**
- **Copies of asbestos abatement licenses of the Contractor, Supervisor, and Employees.**
- **Submittal for asbestos abatement plan in accordance with Special Provision Asbestos Removal for Road Construction Demolition Projects 3/18/2009.**
- **Laboratory analytical air monitoring results.**

Trial Use and Comment

- **VDOT provided information regarding laboratory analysis method for measuring airborne asbestos fibers (National Institute of Occupational Safety and Health Method 7400).**
- **Completed Daily Work Report (DWR).**

IV. REVIEW QUESTIONS

• Has the Contractor submitted the applicable regulations regarding the handling of Asbestos Containing Materials (ACM)?
• Has the Contractor submitted the Asbestos Plan for review and approval by the Department?
• Does the Department have on site a Project Asbestos Monitor?
• Did the Contractor remove, transport and dispose of the ACM from the job site in accordance with Virginia Department of Environmental Quality (VDEQ) regulations and **Special Provision Asbestos Removal for Road Construction Demolition Projects 3/18/2009**?
• Did the Contractor provide to the Department copies of the waste shipment records?
• Did the Contractor provide to the Department copies of the Supervisor and Employees License for asbestos abatement activities in accordance with Virginia Department of Professional and Occupational Regulation (DPOR) requirements?
• Did the Contractor send the applicable notifications prior to beginning the removal of Asbestos materials?
• Did the Contractor notify the Department and Project Asbestos Monitor a twenty day (20) and 72 hour notice prior to beginning the work?
• Does the Contractor have on the project site a “Competent Person” to monitor and enforce the use of all safety procedures and equipment and shall be knowledgeable of all EPA, OSHA, NIOSH, Virginia DPOR and Virginia Department of Labor and Industry VOSHA requirements and guidelines?
• Are all employees wearing the required personnel protective equipment for asbestos removal?
• Has the Contractor placed in a visible location all the applicable caution signs and labels?
• Has the Contractor shall set up a decontamination area?
• Has the Contractor prepared the work site and approved by the Project Asbestos Monitor before the work begins?
• Is the Contractor performing daily air monitoring for asbestos exposure and providing to the Department copies of the laboratory results?
• Has the Contractor cleaned the project site and the Project Monitor make an initial visual inspection of the work area to ensure that the work area is free of visible asbestos debris?

Trial Use and Comment

• Has the Contractor performed the final clearance Phase Contrast Microscopy (PCM) laboratory analysis method for measuring airborne asbestos fibers (National Institute of Occupational Safety and Health Method 7400) and provided a copy to the Department?
• Did the Contractor submit all the required documentation at the close of the project in accordance with the **Special Provision Asbestos Removal for Road Construction Demolition Projects 3/18/2009**?

V. CRITICAL INSPECTION POINTS

• **Ensure the Contractor obtained and submitted all the required regulations.**
• **Ensure the submittal has been reviewed and approved by VDOT.**
• **Ensure the Contractor, Supervisor, and Employees are licensed for asbestos removal.**
• **Ensure the Contractor has a "competent person" on site.**
• **Ensure the Contractor has provided the appropriate notifications.**
• **Ensure that VDOT has a licensed asbestos monitor on site.**
• **Ensure the Contractor has prepared the site.**
• **Ensure the Contractor has submitted all testing/laboratory results.**
• **Ensure the site has been cleared of all containments.**

Trial Use and Comment

SECTION 517 - CONTRACTOR CONSTRUCTION SURVEYING

I. INTRODUCTION:

Road and Bridge Stakeout

GENERAL

Unless otherwise indicated in the contract, all surveying and stakeouts for the successful prosecution of work on the project shall be accomplished by the Contractor. The Contractor shall provide the Department with a record copy of surveying drawings, field notes, and computations prior to using the stakeouts for construction.

The following survey work shall be performed by or under the direct control of a surveyor licensed in Virginia as a Land Surveyor and is experienced in highway construction:

(1) Right of Way and boundaries affecting property ownership.

(2) Horizontal and vertical control for bridges, box culverts and other culverts having openings greater than 48 inches.

(3) Horizontal and vertical control centerlines or baselines for roadways, ramps, loops and connections.

All other surveying work may be performed by or under direct control of the Contractor if experienced in highway construction stakeout.

SLOPE STAKES

Slope stakes are set at all even and +50 stations except transitioned curves where they are set on the transition stations not to exceed 50' intervals between slope stakes. A careful examination should be made of the typical cross sections shown on the summary sheet for width of surfacing, width of shoulder and width of ditch, together with the cut and fill slopes or CS standards to be used. Also a careful examination should be made of the summary sheets, plan sheets, and special notes pertaining to staking and construction of the project and the plan cross sections to determine the suggested slope to be used in special cases. The Inspector should make certain that the typical section shown on the bridge plans matches the typical section shown on the roadway plans where grade separations are involved.

Trial Use and Comment

FINE GRADE STAKES

Fine grade or other stakes required for the construction of the project are set as the work progresses. Fine grade stakes are required for all projects on which the plans show a definite grade line or as directed by the Engineer. On tangents the fine grade hubs are set on one side of the roadway with distances and grades referenced to the finished grade on centerline. On curves, fine grade hubs are required on both sides with offsets and grades referenced to the edge of pavement. The Contractor shall ensure survey notes are kept on fine grade stakes. Fine grade stakes should not be placed until they are actually needed.

BRIDGE STAKEOUTS

The Contractor sets stakes on the base line of the bridge, where the centerline of all piers and abutments intersect, on either side of the bridge base line, on the centerline of the piers and face of abutments. At least 2 stakes are set on each side of the base line of the bridge on the centerline of the pier or abutment so that if one stake is knocked out, there will still be a stake left in place. The line that is staked for the base line of the bridge is usually the line shown on the bridge plans from which all dimensions are referenced. This may not necessarily be the actual centerline of the bridge, or the centerline of the roadway. The same is true of the piers and abutments. The pier or abutment centerline staked may not be the actual centerline of the piers or abutments, but will be that line shown on the bridge plans from which the dimensions are referenced.

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a) **Forms**:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7Rs

517.01—Description

This work shall consist of the Contractor providing all surveying and stakeout as detailed herein for the successful prosecution of work as indicated on the plans and as directed by the Engineer. Stakeout work shall be in accordance with the Department's Survey Manual and this specification

517.02—General Requirements

The Contractor shall ensure the following surveying work shall be performed by or under the direct responsibility, control and personal supervision of a surveyor who is licensed in Virginia as a Land Surveyor and is experienced in highway construction stakeout work including the following:

Comment [1692]: Right Way

Comment [1693]: Right Way / Right Documentation

Trial Use and Comment

(a) horizontal and vertical control for bridges,

(b) horizontal and vertical control for box culverts and single and multiple line pipe culverts as specified herein,

(c) horizontal and vertical control for additional centerlines or baselines for roadways, ramps, loops and connections and

(d) fine grade or other grade stakes as necessary for construction.

All other surveying work shall be performed by or under the direct supervision and control of the Contractor who is experienced in highway construction stakeout.

The Contractor shall preserve Department furnished centerline or baseline control, references and location benchmarks. The Contractor shall provide all construction benchmarks and reference stakes he develops as detailed herein. All alignment established by the Contractor shall be referenced, with a copy of the references furnished to the Engineer.

The Contractor shall provide the Engineer with a record copy of certified plats, survey drawings, field notes and computations prior to the use of said stakeout information for construction. Survey record drawings shall be prepared and certified in accordance with the requirements of this specification and the sample figure drawings as shown in the Department's Survey Manual. Electronic data files may be submitted along with paper sketches and drawings, subject to the prior approval of the Engineer. All electronic copies submitted shall be in a format fully compatible with the Department's existing computer hardware and software.

517.03—Contractor Responsibility for Examination of Data

It shall be the responsibility of the Contractor to examine all surveying work provided by the Department for accuracy. Should a disagreement involving the accuracy of stakeout or survey work arise during construction, the Contractor shall within 24 hours provide written notice to the Engineer, precisely describing and documenting the discrepancy. The Engineer will determine the validity of the Contractor's assertion in the notice, respond to the Contractor within 3 working days of receipt of the Contractor's notice and provide direction on how to proceed. The Engineer will give consideration to an extension of time in accordance with the requirements of Section 108.04 of the Specifications or provide additional compensation as deemed appropriate after documentation and evidence to the Engineer's satisfaction if the following occurs:

(a) There are delays to the project as a result of inaccurate stakeout information provided by the Department where such delays adversely impact the critical path of the work or,

Comment [1694]: Right Way / Right documentation

Comment [1695]: Right Way / Right documentation

Comment [1696]: Right documentation / Right Time

Comment [1697]: Right Way / Right Time / Right documentation

Trial Use and Comment

(b) Where extra expense is encountered by the Contractor to correct elements of defective survey work by the Department, and

(c) Where written notice is provided by the Contractor within the timeframe specified. Failure to furnish written notice of such a discrepancy within the timeframe specified will invalidate any later claim for time impact or costs by the Contractor unless specifically waived by the Engineer.

517.04—Construction (C) projects

The following specific requirements shall apply:

(a) **Digital Terrain Model (DTM) and Construction Cross-sections:** Original location Digital Terrain Model (DTM) will be provided by the Department and will serve as a basis of payment for earthwork. The Contractor shall be responsible for taking construction DTMs or cross-sections of areas that, in their determination, do not agree with the Department furnished original location DTMs. The Contractor shall submit the disputed DTM information to the Engineer for verification prior to any excavation by the Contractor in these alleged areas of change. The DTM information furnished by the Department and submitted by the Contractor shall be compatible to the Department's current DTM format.

Comment [1698]: Right documentation / Right Time / Right Way

(b) **Borrow Pits:** All borrow pit DTMs or cross-sections, originals and finals, will be secured by the Engineer through the Department Survey party. The Contractor is encouraged to also secure DTMs or cross-sections of borrow areas. A claim of discrepancy in borrow volume will not be considered by the Engineer unless survey data was obtained and submitted by the Contractor to substantiate their claim.

Comment [1699]: Right Way / Right documentation

(c) **Temporary Benchmarks:** The Contractor shall provide and protect temporary construction benchmarks within the construction limits. Temporary construction benchmarks shall be located not farther than 500 feet apart for the total length of the project or as indicated on the plans. Temporary construction benchmarks that are disturbed by the Contractor's activities during construction operations shall be reestablished by the Contractor at no additional cost to the Department.

Comment [1700]: Right Way / Right Location

(d) **Horizontal and vertical control for bridges:** The Contractor shall stake all bridges. These stakeouts shall require certified plats. Certified plats, field notes, coordinates and computations shall be furnished by the Contractor to the Engineer in accordance with the requirements of Sample Figures 2 and 3 as shown in the Department's Survey Manual prior to the Contractor beginning work on these structures.

Comment [1701]: Right Way / Right documentation / Right Time

(e) **Horizontal and vertical control for all box culverts, all pipe culvert installations (including single and multiple line installations) with a total**

Comment [1702]: Right Way / Right documentation / Right Time

Trial Use and Comment

hydraulic opening equivalent to 12.6 square feet and larger, and for all closed systems such as storm sewers, and sanitary sewers regardless of size: These stakeouts are deemed critical and require certified plats. The Contractor's surveyor shall stake all such installations. Certified Plats for these stakeouts shall be furnished in accordance with the requirements of Sample Figure 1 as shown in the Department's Survey Manual and shall be submitted to the Engineer prior to the Contractor beginning installation work on these culvert structures. The notes, coordinates, or computations used to support the platted information shall be provided to the Engineer with the certified plat. For the purposes of identifying those pipe culvert installations please refer to the areas (hydraulic openings) shown in the PB-1 Standards for the respective sizes of pipes specified on the plans. Where multiple lines of pipes are shown, the areas of the pipe sizes shall apply to the total areas of the number of lines specified in the plans. For box culverts refer to the sizes shown in the BC-1 Standards to determine areas of total hydraulic opening.

(f) **Horizontal and vertical control for pipe culvert installations (including single and multiple line installations) having a total hydraulic openings equivalent to 3.1 square feet and up to 12.5 square feet:** The Contractor shall be responsible for staking horizontal and vertical controls for pipe culvert installations having a total hydraulic opening equivalent to 3.1 square feet and up to 12.5 square feet. These stakeouts require sketches, but not certified plats and shall be furnished to the Engineer prior to the Contractor beginning work on these culvert structures. For the purposes of identifying those pipe culvert installations please refer to the areas (hydraulic openings) shown in the PB-1 Standards for the respective sizes of pipes specified on the plans. Where multiple lines of pipes are shown, the areas of the pipe sizes shall apply to the total areas of the number of lines specified in the plans. For box culverts refer to the sizes shown in the BC-1 Standards to determine areas of total hydraulic opening.

Comment [1703]: Right Way / Right documentation / Right Time

(g) **Horizontal and vertical control for additional centerlines or baselines for roadways, ramps, loops and connections:** The Contractor shall provide horizontal and vertical controls for additional centerlines or baselines for roadways, ramps, loops and connections.

Comment [1704]: Right Way / Right documentation / Right Time

(h) **Grading and paving construction:** The Contractor shall provide fine grade or other grade stakes required for the construction of the project as the work progresses except as otherwise stated herein.

Comment [1705]: Right Way / Right documentation / Right Time

Fine grade stakes shall be set on all projects on which the plans show a definite grade line. Fine grade hubs shall be set on at least one side with distances and grades referenced to the finished centerline grade. Typically, on curves, the Contractor shall provide the distances and elevations to each edge of pavement and centerline through the transitions and the distances and elevations to the edge of pavement only (straight-line super) through full super portions of the curve.

Trial Use and Comment

On projects where grading and paving is performed under the same contract, only one set of fine grade stakes will be required by the Engineer. Fine grade stakes may be used for fine grade and paving grade.

On Secondary Road projects, fine grade stakes shall be provided by the Contractor only on those projects having curb and gutter or as directed by the Engineer.

Special design ditches shall be staked with an offset and cut to the centerline of the ditch. Radius points for pavement flares at connections shall be staked by the Contractor.

Generally, slope stakes shall be set by the Contractor as an initial part of the construction operations on the project.

(i) **Right of way and boundary stakeout affecting property ownership:** The right of way stakes will be placed at a minimum of 100-foot intervals on each side of the roadway or as directed by the Engineer and the stakes will be marked with both the station and offset back to centerline. All final boundary stakeout will be performed by the Department survey party.

Comment [1706]: Right location / Right Way

(j) **Locating and setting right-of-way monuments:** All location and final right of way monumentation will be performed by the Department in accordance Section 105.13.

Comment [1707]: Right Way

517.05—Minimum Plan (M) projects

The following specific requirements shall apply:

(a) **Digital Terrain Model (DTM) and construction cross-sections:** "M" projects are based on plan quantities; therefore DTM and construction cross-sections are not required.

Comment [1708]: Right Way

Should the Engineer determine at any time that an actual measurement is warranted, the Department will make the necessary measurement in the field.

(b) **Borrow Pits:** All borrow pit DTM's, originals and finals, will be secured by the Department. The Contractor is encouraged to also secure DTMs or cross-sections of borrow areas. A claim of discrepancy in borrow volume will not be considered by the Engineer unless survey data was obtained and submitted by the Contractor to substantiate the claim.

Comment [1709]: Right Way / Right Time / Right documentation

(c) **Horizontal and vertical control for bridges:** These stakeouts require certified plats. Certified plats, field notes, coordinates and computations

Comment [1710]: Right Way / Right Time / Right documentation

Trial Use and Comment

shall be furnished to the Engineer by the Contractor in accordance with the requirements of Sample Figures 2 and 3 as shown in the Department's Survey Manual prior to the Contractor beginning work on these structures.

(d) **Horizontal and vertical controls for all box culverts, all pipe culvert installations (including single and multiple line installations) with a total hydraulic opening equivalent to 12.6 square feet and larger, and for all closed systems such as storm sewers, and sanitary sewers regardless of size:** These stakeouts are deemed critical and require certified plats. Exceptions may be granted by the Engineer for simple closed systems by requiring stake out sketches. The Contractor shall stake all such installations. Certified Plats for these stakeouts shall be in accordance with the requirements of Sample Figure 1 as shown in the Department's Survey Manual and shall be submitted to the Engineer prior to the Contractor beginning work on these culvert structures. The notes, coordinates, or computations used to support the platted information shall be provided by the Contractor to the Engineer with the certified plat.

Comment [1711]: Right Way / Right documentation / Right Time

(e) **Horizontal and vertical control for pipe culvert installations (including single and multiple line installations) having a total hydraulic openings equivalent to 3.1 square feet and up to 12.5 square feet:** The Contractor shall be responsible for staking horizontal and vertical controls for pipe culvert installations having a total hydraulic opening equivalent to 3.1 square feet and up to 12.5 square feet. These stakeouts require sketches, but not certified plats and shall be furnished to the Engineer prior to the Contractor beginning work on these culvert structures. For the purposes of identifying those pipe culvert installations please refer to the areas (hydraulic openings) shown in the PB-1 Standards for the respective sizes of pipes specified on the plans. Where multiple lines of pipes are shown, the areas of the pipe sizes will apply to the total areas of the number of lines specified in the plans. For box culverts refer to the sizes shown in the BC-1 Standards to determine areas of total hydraulic opening.

Comment [1712]: Right Way / Right Time / Right documentation

(f) **Temporary Benchmarks:** The Contractor shall provide and protect temporary construction benchmarks within the construction limits. Temporary construction benchmarks shall be located not farther than 500 feet apart for the total length of the project or as indicated on the plans. Temporary construction benchmarks that are disturbed by the Contractor's activities during construction operations shall be reestablished by the Contractor at no additional cost to the Department.

Comment [1713]: Right Way / Right Location

(g) **Grading and paving construction:** The Contractor shall provide fine grade or other grade stakes required for the construction of all projects except as stated herein as the work progresses. Slope stakes are not required on "M" projects.

Comment [1714]: Right Way / Right Location

Trial Use and Comment

Fine grade stakes shall be set on all projects on which the plans show a definite grade line. Fine grade hubs shall be set on at least one side with distances and grades referenced to the finished centerline grade. Typically, on curves, the Contractor shall provide the distances and elevations to each edge of pavement and centerline through the transitions and the distances and elevations to the edge of pavement only (straight-line super) through full super portions of the curve.

On projects where grading and paving is performed under the same contract, only one set of fine grade stakes will be required by the Engineer. Fine grade stakes may be used for fine grade and paving grade.

On Secondary Road projects, fine grade stakes shall be provided by the Contractor only on those projects having curb and gutter or as directed by the Engineer.

Special design ditches shall be staked with an offset and cut to the centerline of the ditch. Radius points for pavement flares at connections shall be staked by the Contractor.

(h) **Right of way and boundary stakeout affecting property ownership:** The right of way stakes will be placed at a minimum of 100-foot intervals on each side of the roadway or as directed by the Engineer and the stakes will be marked with both the station and offset back to centerline. All final boundary stakeout will be performed by the Department survey party.

(i) **Setting right-of-way monuments:** Final right of way monumentation will be performed by the Department in accordance Section 105.13.

517.06—Measurement and payment

Construction surveying will be paid for at the contract lump sum price for the type of project specified, which price shall be full compensation for performing the work prescribed herein, and for all materials, labor, tools, equipment and incidentals necessary to complete the work.

Payment for construction surveying will be made upon written request by the Contractor. Such request shall be submitted to the Engineer no earlier than five days, and no later than two days prior to the progress estimate date. Payment may be made in increments selected by the Contractor. However, payments will not exceed 60 percent of the contract unit price bid until the Contractor has provided the Engineer with surveying field notes, layouts, computations, certified plats, sketches and drawings in the format approved by the Engineer.

Comment [1715]: Right Way / Right Location

Comment [1716]: Right Way

Comment [1717]: Right measurement / Right payment

Trial Use and Comment

Payment will be made under:

Pay Item	Pay Unit
Construction surveying (Construction)	Lump sum
Construction surveying (Minimum Plan)	Lump sum

Trial Use and Comment

III. REVIEW QUESTIONS

517.01(1)	Is the contract survey in accordance with the special provisions and the Department's current survey manual?
517.02(2)	Does the Surveyor possess a valid Virginia Surveyor License and are they experienced in highway construction survey stakeout work as identified in this section?
517.02(3)	Did the Contractor ensure that the survey operations listed in this section are performed by or under the direct responsibility, control and personal supervision of a surveyor who is licensed in Virginia as a Land Surveyor and is experienced in highway construction work?
517.02(4)	Is the Contractor preserving Department furnished centerline or baseline control, references and location benchmarks and, is the Contractor providing the Engineer a copy of all alignment references established by the contractor, in accordance with this section?
517.02(5) [03001601]	Has the Contractor provided to the Engineer a record copy of certified plats, survey drawings, field notes and computations, and stakeout information prior to use for all construction, including the specific requirements for "C" projects, Section 517.04 and "M" projects, Section 517.05?
517.02(6)	Did the engineer approve use of electronic data files prior to submission and are the files in a format compatible with the Department's existing computer hardware and software?
517.04/05(c)(f)	For Construction (C) or Minimum Plan (M) projects, did the Contractor provide temporary benchmarks in accordance with this section? Ref: 517.04(c) and 517.05(f)
517.04/05(d)(c)	For Construction (C) or Minimum Plan (M) projects, did the Contractor provide horizontal and vertical control for bridges in accordance with this section? Ref: 517.04(d) and 517.05(c).
517.04/05(e)(d)	For Construction (C) or Minimum Plan (M) projects, did the Contractor provide horizontal and vertical control for all box culverts, all pipe culvert installations (including single and multiple line installations) with a total hydraulic opening equivalent to 12.6 square feet and larger, and for all closed systems such as storm sewers, and sanitary sewers regardless of size, in accordance with this section? Ref: 517.04(e) and 517.05(d).
517.04/05(f)(e)	For Construction (C) or Minimum Plan (M) projects, did the Contractor provide horizontal and vertical control for all box culverts, all pipe culvert installations (including single and multiple line installations) with a total hydraulic opening equivalent to 3.1 square feet and up to 12.6 square feet, in accordance with this section? Ref: 517.04(f) and 517.05(e).
517.04/05(i)(h)	For Construction (C) or Minimum Plan (M) projects, Were right of way stakes placed at a minimum of 100 foot intervals on each side of the roadway or as directed by the Engineer, and in accordance with this section? Ref: 517.04(i) and 517.05(h).

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517.03(2)	Has the Engineer determined the validity of the Contractor's assertion in the written notice of a disagreement with the accuracy of the stakeout or survey work provided by the Department, and responded back to the Contractor within three (3) working days on how to proceed in accordance with this section?
517.06	Has the Department paid more than 60% for construction surveying without having the Contractor provide all surveying field notes, layouts, computations, certified plats, sketches and drawings?

IV. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review contract, plans, specifications, and field conditions.
- Contractor provides copy of current survey license.
- Contractor provides type of electronic format that will be utilized. (if intended)

Start:

- Ensure that survey personnel utilize required safety equipment.
- Review field layout with survey party.
- Inspector should ensure the contractor is aware of their responsibility is protect survey control established by the department and the survey control installed by the contractor or sub-contractor is also protected for deviation from the necessary accuracy required.

Intermittent inspection:

- Review and verify field stakeouts intermittently as layout progresses.
- Review and verify certified plats, sketches, and field notes are provided to VDOT prior to the use of the stakeout for construction.

Final Inspection:

- Review all document submittals from the surveyor for completeness.

Documentation Required:

- Certified Plats
- Field Notes
- Certified Sketches
- Surveyor proof of licensure

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• Field stakeout by Contractors surveyor
• Verify surveyor license is valid as required by specification.
• Use of field stakeout for construction
• Receive and review required documentation from contractor prior to the field stakeout being utilized for construction.
• Monitor contractor use of field stakeout
• Ensure all required plats, sketches, and notes are on file prior to payment.

Trial Use and

SECTION 518—TRAINEES ON CONSTRUCTION PROJECTS

I. INTRODUCTION:

a) Forms:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

518.01—Description

This work shall consist of providing the training specified herein as part of the Contractor's EEO Affirmative Action Program. This specification implements 23 CFR, Part 230, Subpart A, Appendix B.

518.02—Procedures

The Contractor shall provide each trainee with a copy of the specific program and upon completion of the training program a certificate showing the type and duration of training satisfactorily completed. The Contractor shall maintain records and furnish periodic reports documenting compliance with the requirements herein.

(a) **Number of Trainees**: The number of trainees for each contract shall be as specified. The number of trainees is determined by the District Civil Rights Manager (DCRM). If the Contractor sublets a portion of the contract, the Contractor shall determine how many trainees are to be trained by the subcontractor. The Contractor shall retain the primary responsibility for conforming to the training requirements imposed by this specification. The Contractor shall ensure that these training requirements are made applicable to the subcontract. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

(b) **Distribution of Trainees**: The number of trainees shall be distributed among the work classifications on the basis of the Contractor's needs and the availability of journeymen in the various classifications within a reasonable area of recruitment. The Contractor will be credited for each trainee employed by him under the Contract who is currently enrolled or becomes enrolled in an approved program.

Comment [1718]: Right Materials/Right Documentation

Comment [1719]: Right Quantity

Comment [1720]: Right Quantity

Trial Use and Comment

The enrollment of minorities, women, and other disadvantaged persons is approved and monitored by the DCRM. Trainees will be enrolled and approved by the DCRM on Form C-65 prior to the start of training.

(c) **Minorities and Women**: Training and upgrading of minorities and women toward journeymen status are primary objectives. The Contractor shall make every effort to enroll minority and women trainees by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees to the extent such persons are available within a reasonable area of recruitment. The Contractor shall demonstrate the steps taken in pursuance thereof prior to a determination as to whether or not he is in compliance with the requirements herein. This training commitment shall not be used to discriminate against any applicant for training, whether a member of a minority group or not.

(d) **Use of Journeymen**: No employee shall be employed as a trainee in any classification in which the person has successfully completed a training course leading to journeyman status or has been employed as a journeyman. The Contractor shall satisfy this requirement by including appropriate questions on the employee application or by other suitable means. The Contractor's records shall document the findings in each case.

(e) **Length and Type of Training**: The minimum length and type of training for each classification will be established in the training program selected by the Contractor and approved by the DCRM. The DCRM will approve a program if it is reasonably calculated to meet the EEO obligations of the Contractor and qualify the average trainee for journeymen status in the indicated classification by the end of the training period. Apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a state apprenticeship program (Virginia Department of Labor & Industry) recognized by the U.S. Department of Labor, Bureau of Apprenticeship and Training, will also be considered acceptable in meeting the trainee contract goal provided they are being administered in a manner consistent with the EEO obligations of the contract. Approval of a training program shall be obtained from the DCRM prior to the commencement of work in the classification covered by the program.

Training shall be provided in the construction trade classifications indicated in the *On the Job Training (OJT) Manual for Standard Pre-Approved Job Classifications.* The Contractor shall provide all training on state or federally funded projects of the Department.

(f) **Commencement of Training**: It is normally expected that a trainee will begin training on the project as soon as is feasible after the start of the work that requires the skill involved and will remain on the project as long as training opportunities exist in the work classification or until the trainee has completed the training program. It is not required that all trainees be on board for the entire duration of the

Comment [1721]: Right Documentation

Comment [1722]: Right Way

Comment [1723]: Right Time

Comment [1724]: Right Location

Comment [1725]: Right Time

Trial Use and Comment

contract. The number trained will be determined on the basis of the total number enrolled under the contract for the entire contract period.

(g) **Payment to Trainees**: Trainees shall be paid at least 60 percent of the appropriate prevailing minimum journeyman's rate for the first half of the training period, 75 percent for the third quarter of the training period, and 90 percent of the last quarter of the training period unless apprentices in an approved existing program are enrolled as trainees on the project. In such cases, the appropriate rates approved by the DCRM in connection with the existing program shall apply to all trainees being trained for the same classification who are covered by these requirements.

(h) **Failure to Provide Required Training:** The Contractor's failure to provide the required training damages the effectiveness and integrity of this Affirmative Action Program and circumvents the Department's federal mandate to bring women and minorities into the construction industry. Therefore, if the Contractor has failed by the end of the project to meet the required trainee contract goal, written good faith documentation shall be submitted indicating the reasons the trainee goal was not attained. This documentation shall be submitted to the DCRM, and should it be determined insufficient, the lack of commitment to this Affirmative Action Program will be relayed to the Engineer for inclusion in the Contractor's Performance Report for the project.

Efforts taken by a Contractor that results in the OJT contract goal being exceeded will be recognized for their support of the Department's commitment to assuring skill improvement opportunities for minorities and women in highway construction. To exceed an OJT goal is to enroll and graduate more trainees than the number specified in the contract.

518.03—Measurement and Payment

Except as otherwise noted herein, the Contractor will be paid $3.00 per hour for each employee who is trained in accordance with the approved training program. The DCRM can request approval by the Engineer that a Contractor be paid for training persons in excess of the trainee contract goal specified or for trainees enrolled on a contract without a trainee goal. This payment will be made even though the Contractor received additional training program funds from other sources provided such other sources do not specifically prohibit the Contractor from receiving other payments. The Department will pay the Contractor stipend $3.00 per training hour for training occurring on state or federally funded projects of the Department.

The Contractor will be credited for each apprentice/trainee employed on the project and reimbursed on the basis of hours worked listed on certified payrolls and the weekly submittal of trainee Form C-67. This form will serve as a record of trainee hours completed.

Comment [1726]: Right Payment

Comment [1727]: Right Payment

Comment [1728]: Right Documentation

Trial Use and Comment

If, in the judgment of the Contractor, Engineer, and DCRM, a trainee becomes proficient enough to qualify as a journeyman before the end of the prescribed training program and the Contractor so employs the trainee, full credit will be given toward the attainment of the trainee goal; however, the Contractor will be paid only for the actual trainee hours completed. The Department will pay the Contractor for only those training hours completed if the trainee does not complete training due to lay-off, termination, or resignation.

No payment will be made to the Contractor should the required training not be provided or the trainee is not hired as a journeyman and there is evidence of a lack of good faith on the part of the Contractor in complying with the requirements specified herein.

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Pre-Construction Meeting –EEO Representative will advise contractor of any and all necessary forms required and contact information

Start:

- Training should begin as soon as sufficient work exists to begin process

Continuous Inspection:

- The minimum length and type of training for each classification will be established in the training program selected by the Contractor and approved by the DCRM.
- The DCRM will approve a program if it is reasonably calculated to meet the EEO obligations of the Contractor and qualify the average trainee for journeymen status in the indicated classification by the end of the training period.

Final Inspection:

- The Contractor will be credited for each apprentice/trainee employed on the project and reimbursed on the basis of hours worked listed on certified payrolls and the weekly submittal of trainee Form C-67. This form will serve as a record of trainee hours completed.

Trial Use and Comment

Documentation Required:

EEO Forms C-65 and C67, Contract Special Provisions

IV. REVIEW QUESTIONS

• Was the Local EEO Representative notified prior to the Pre-Construction Conference?
• Has the contractor placed all posters and notifications on the bulletin board as required Section 107.14(2)a?
• Has the Contractor submitted the applicable forms for the Trainees?
• Has the Contractor maintained the records and reports as required in **Section 107.14**?
• Is the number of Trainees assigned to the project as outlined in the Special Provisions of the Contract?

V. CRITICAL INSPECTION POINTS

• **Pre Construction Meeting**
• **Enrollment of Trainee**
• **Commencement of Training**
• **Award of certificate when training complete**

Trial Use and Comment

SECTION 519 - SOUND BARRIER WALLS

I. INTRODUCTION:

PROCEDURES

Piles shall be driven in accordance with the requirements of **Section 403** except that the tolerance for the position of a single steel H-pile shall be ±1/2 inch. Piles for sound barrier walls shall not be driven on Saturdays, Sundays, or holidays or between 4:30 P.M. and 8:00 A.M. on other days. The portion of posts from the finished grade to the bottom end and the portion of the H-pile lapped with posts shall be painted with asphalt mastic after splicing. Voids between posts and piles created by the use of shims for plumbing posts shall be caulked prior to the application of asphalt mastic.

Joints and connections shall be secured so as to be structurally sound with no visible openings for sound transmission and shall not be a secondary source of noise attributable to vibration. The top face of the sound barrier wall shall be aligned to maintain a continuous appearance and shall not deviate from true alignment by more than 1/2 inch in 10 feet.

When precast panels are supported by a concrete foundation, shimming of panels may be required for proper alignment. Shimming methods and materials are to be submitted to the Engineer for approval prior to shimming.

Disturbed areas shall be graded and seeded in accordance with the requirements of **Section 603**.

Precast Sound Barrier Wall

Absorptive and reflective precast concrete panels and concrete post footings shall be constructed in accordance with the requirements of **Section 404 or 405**, except that patching of panels will not be allowed. Panels having deficiencies such as cracking, crazing, scaling, efflorescence or segregation; or panels having mottling of pigment, stain or finish will be rejected. The roadway side of the panel shall have a rustic board, fractured fin or other finish as specified, and the property side of the panel shall have a fuzzy raked or other finish as specified on plans. In addition, the color of the wall shall be approved by the Engineer. Disturbed areas shall be graded to maintain proper drainage, and shall be seeded in accordance with the requirements of **Section 603.**

Metal Sound Barrier Wall

Trial Use and Comment

The Contractor shall submit to the Engineer five copies of certifications from an independent testing laboratory certifying that the design of the sound barrier wall panel will provide the minimum sound transmission loss specified herein.

The Contractor may furnish the galvanized post and girts with the protective color-coating system specified for panels, thereby eliminating the related flashing covering, provided posts and girts conceal threads of bolts and screws.

The Contractor may furnish fixed bolted connections in lieu of welded connections provided he submits load calculations for the specific bolted connections and uses a safety factor of at least 3. Self-drilling screws may be used for locations where forces from the facial wind load will cause the shaft of the self- drilling screw to be in shear and not in tension.

Cut, marred, or scratched surfaces shall be repaired in accordance with the manufacturer's recommendations.

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a) <u>Forms</u>:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

519.01—Description

This work shall consist of furnishing and constructing sound barrier walls in accordance with these specifications and approved working drawings and within the specified tolerances for the lines, grades, and details shown on the plans or as established by the Engineer.

(a) **Acoustic Performance standards:**

1. Sound barrier walls shall provide a transmission loss of at least 23 dB(A) when tested in accordance with the requirements of ASTM E90 using the typical truck noise spectrum and shall have vibration-free joints and fittings.

2. Absorptive sound barrier walls shall be designed so that the absorptive portion on the highway side has a minimum noise reduction coefficient of 0.70 when measured in accordance with the requirements of ASTM C423.

3. Sound barrier walls shall be designed to minimize or eliminate gaps or openings to prevent transmission of sound through the barrier.

Comment [1729]: Right Way/Place

Trial Use and Comment

(b) **Design Standards:**

1. Structural design loadings for sound barrier walls shall be based on a design life of not less than 50 years. They shall be designed in accordance with the requirements of the current AASHTO Guide Specification for Structural Design of Sound Barriers except as modified herein. References in the AASHTO sound barrier specification to "an industry recognized specification" shall not apply. All concrete, steel, and aluminum members shall be proportioned with reference to the service load design methods (allowable or working stress design) of the current AASHTO Standard Specifications for Highway Bridges. Fatigue and traffic impact shall be considered in the design of these structures. Sound barrier walls subject to lateral earth pressure shall have those portions so loaded, designed in accordance with the aforementioned AASHTO specifications. In all cases, settlement shall also be considered.

2. Unless specified otherwise, this paragraph governs the selection of wind pressure coefficients in Virginia. Any sound barrier wall to be constructed within t one half mile of the shore of the Chesapeake Bay or the Atlantic Ocean shall be designed for exposure category D. All other ground-mounted sound barrier walls shall be designed for exposure category B2, and all other structure-mounted sound barrier walls shall be designed for exposure category C. The wind pressure to be applied to the full height of the wall shall be based on the height to the centroid of the loaded area. For structure-mounted walls, this height shall be measured from the surface of the feature over which the bridge or structure crosses (e.g. mean sea level of the Chesapeake Bay, normal water level at stream crossings, roadway surface on the low shoulder at highway intersections) or in the case of sound barrier walls mounted on retaining walls, measured from the prevailing ground elevation in the vicinity.

3. Unless specified otherwise, this paragraph governs the selection of wind speeds for design purposes (50-year mean recurrence interval) in Virginia. Sound barrier walls in Hampton Roads District shall be designed for a wind speed of not less than 100 mph. Walls in Fredericksburg, Northern Virginia and Richmond Districts shall be designed for a wind speed of not less than 90 mph. Walls in Bristol, Culpeper, Lynchburg, Salem and Staunton Districts shall be designed for a wind speed of not less than 80 mph. Any continuous wall crossing district boundaries may use the lower of the two adjacent wind speeds.

4 The vertical posts shall be proportioned to have a maximum deflection of no more than $^{h}/_{240}$ due to wind load, where "h" is the cantilever height of the post from the top of foundation to the top of the sound barrier wall. The unbraced length of the post for design shall not be less than "h" unless both flanges are sufficiently braced to allow a reduction of the unbraced length of the section. Post design shall account for all holes needed for connections. Wall panels and other supporting members shall be proportioned to have a maximum deflection of no more than $^{l}/_{240}$ due to wind load, where "l" is the length of the panel or member.

Comment [1730]: Right Way

Comment [1731]: Right Location

Comment [1732]: Right Way

Trial Use and Comment

5. Structure-mounted sound barrier panels shall not weigh more than 7.5 psf and the structure-mounted sound barrier system shall not weigh more than 15 psf. Posts for structure-mounted sound barrier wall panels shall not be spaced more than 8 feet on center. Posts shall be mounted on the outside of parapets only. Posts for ground-mounted sound barrier panels shall not be spaced more than 24 feet on center. The Contractor and wall manufacturer shall be responsible for the anchorage of the sound barrier wall to the structure to include the location of anchor rods, pattern or layout of rods, size, length of embedment, base plate for attachment, posts, etc. Slip forming of the elements of structures that are designed to receive sound barrier walls will not be permitted.

Comment [1733]: Right Material/Right Location

6. Anchor rod performance shall be evaluated against the net area of the anchor rod after reduction to account for threads. Anchor rods shall be checked against the effect of combined stresses in accordance with the following formula (found in the 2001 AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals):

$$\left(\frac{f_v}{F_v}\right)^2 + \left(\frac{f_t}{F_t}\right)^2 \le 1.0$$

Where:

F_t is the allowable normal stress on the rod, 0.5 x F_y

f_t is the predicted normal stress on the rod due to direct compression or tension and bending:

$f_t = f_a + f_b$ where:

f_a is the predicted stress on the rod due to direct compression or tension

f_b is the predicted stress on the rod due to bending about the rod's neutral axis

f_b shall be included in the computation of f_t whenever the clearance between the bottom of the leveling nuts and the top of the concrete foundation is greater than or equal to the diameter of the rod

F_v is the allowable stress on the rod due to direct shear, 0.3 x F_y

f_v is the predicted stress on the rod due to direct shear

Note: All stresses are based on the applied load acting on the net area after consideration for the reduction due to the presence of the threads.

e.g. $NetArea := 0.7854 \cdot \left(D - \frac{0.9743}{n}\right)^2$ and $S_x := 0.0982 \cdot \left(D - \frac{0.9743}{n}\right)^3$

where "D" is the diameter of the rod in inches and "n" is the number of threads per inch.

Trial Use and Comment

No mortar, grout or concrete shall be placed between the bottom of the base plate and the top of the concrete

7. Soil friction angle and strength of soils shall be used when designing foundations. Foundations shall be designed in accordance with the requirements of the current AASHTO Standard Specifications for Highway Bridges. Foundation designs may require pilings, caissons, or special design as indicated by subsurface investigations (soil reports and boring logs) to establish soil capacity.

8. When caissons are used, the soil at the surface to a depth equal to the required diameter of the caisson, but not less than two (2) feet or as required by the conditions, shall not be considered effective when calculating the required embedment of the caisson. The ground surface slope shall be taken into account when determining caisson embedment.

   An unfactored wind load shall be used in the analysis. Deflections and factors of safety for caissons shall be determined using actual wind loads not factored loadings.

   For axial capacity the caisson tip elevation shall provide a length of caisson such that at least two thirds of the total predicted resistance is provided by shaft resistance. Total vertical deflection of the caisson head, from settlement and elastic shorting of the caisson, is limited to one (1) inch under service axial design loads.

   The minimum area of longitudinal reinforcement for caisson type foundations shall be one percent of the gross area of the foundation section. In caissons where the wall post/beam is embedded to the bottom of the caisson, no reinforcement is required.

   The required allowable stresses for steel and concrete in the caisson may be modified by the allowable overstress permitted in the wind load condition.

9. The Brom's method may be used for the design of laterally loaded caissons less than twenty (20) feet in length. For Group II and Group IV where wind is a contributing load, a minimum safety factor of 2.25 shall be used if soil parameters are based on the results of standard penetration tests. When parameters are based on the results of subsurface exploration and laboratory testing programs as detailed in the current AASHTO Standard Specifications for Highway Bridges, or are set by the Department, a safety factor of 2.0 may be used.

   The preferred method of analyses for the design of laterally loaded caissons is the “p-y curve” method for the design and analysis of caissons under lateral loads, using public- domain computer program such as COM624P or commercially available software. The caisson embedment shall provide a

Comment [1734]: Right Way

Comment [1735]: Right Quantity

Trial Use and Comment

length where the second point of zero deflection is reached. The second point of zero deflection may be assumed to be the point on the deflection curve where the deflection is decreasing and becomes less than 0.02 inch. The total horizontal deflection at the head of the caisson is limited to 0.5 inch.

Temporary casing may be used to stabilize a drill hole, however, the casing shall be removed immediately prior to or while placing the concrete. If the drill hole can not be maintained other methods, such as wet hole construction with slurry, shall be used.

If at the time of placing concrete, water in the hole exceeds five (5) feet or 20% of the caisson length, whichever is greater, the concrete shall be placed by pump or tremie.

10. For walls on spread footings, a bearing capacity analysis shall be submitted as part of the design calculations and the safety factor against bearing failure shall be taken as 2.25 for Group II and Group IV where wind is a contributing load. The ground surface slope shall be taken into account when determining bearing capacity of the soil. The depth of the embedment of footings shall be in accordance with the requirements of the aforementioned current AASHTO Standard Specifications for Highway Bridges.

11. For walls on piles, foundation design shall be in accordance with the requirements of the current AASHTO Standard Specifications for Highway Bridges. The factor of safety shall be on the level of construction control as required in Subsection 4.4.6.2. The required factors of safety may be modified by the allowable overstress permitted in the wind load condition.

12. Where new sound barrier walls tie into existing barriers existing sound barrier walls and other structures shall be analyzed to determine if they are adequate for the addition of new loads, if the Contractor chooses to use them for support. The Contractor shall make any field measurements and observations necessary to analyze the existing structures and detail all connections. Alternatively, the new wall may be designed independent of existing structures with details for closing gaps.

13. The Contractor shall submit to the Department nine (9) copies of the working drawings and supporting calculations in accordance with the requirements of Section 105.10 to:

    Virginia Department of Transportation
    Location and Design Division
    Engineering Services
    1401 E. Broad Street
    Richmond, Virginia 23219

Comment [1736]: Right Documentation

Trial Use and Comment

Working drawings shall contain all specific details and dimensions (such as post spacings, post sizes, foundation details, and panel fabrication and attachment details) necessary for the complete review, construction and inspection of the work. The working drawings for Sound Barrier Walls shall also reflect coordination with the working drawings for retaining walls or bridges or other adjacent construction items where applicable. Working drawings and the accompanying calculations shall be sealed by a Professional Engineer holding a valid license to practice engineering in the Commonwealth of Virginia. Calculations using computer programs or spreadsheets shall include a description of the design methodology necessary to validate the results of the computer output.

Any changes to the working drawings by the Contractor after the initial submittal shall be clearly identified. Changes shall be identified on the working drawings and denoted in narrative (e.g. cover letter) and dated after marking all requested changes. This format shall be followed until all requested changes are completed to the satisfaction of the Engineer. Approval of these shop drawing shall not relieve the Contractor of the responsibility for accuracy of the drawings or conformity with the contract and site requirements. Approval will not indicate a check on dimensions.

519.02-Materials

Comment [1737]: Right Matetrial

The Contractor may furnish plastic, metal, concrete or in specific applications, wood sound barrier walls. Walls shall conform to the requirements of the contract documents, AASHTO material specifications and the following applicable specifications. Wall system designs shall have been pre-approved for use by the Department. Requirements for evaluation and approval of sound barrier wall may be obtained from the Air, Noise, and Energy section of the Environmental Quality Division.

(a) **Concrete** shall conform to the requirements of Section 217 and Sections 404 or 405 as applicable. Concrete for reflective sound barrier panels or concrete posts shall be Class A5. Concrete for footings or leveling pads shall be Class A3. All other concrete shall be Class A5 or Class A4. Sound absorptive concrete shall be considered a sound coating subject to other provisions in the specifications; the manufacturer's cited standards or proprietary materials. The use of systems employing such sound absorptive concrete materials shall require pre-approval of the Department.

(b) **Reinforcing steel** shall conform to the requirements of Section 223. Reinforcing steel requiring welding shall be ASTM A706, Grade 60, and shall be welded in accordance with the current AWS D1.4. All other reinforcing steel shall be ASTM A615, Grade 60, or ASTM A706, Grade 60. Threads on reinforcing steel bars shall

Trial Use and Comment

be UNC (coarse) Series, Class 2A as specified in ANSI B1.1. Welded wire fabric used to reinforce panels shall conform to the requirements of Section 223.

(c) **Aluminum** shall conform to the requirements **Section 229** for the use and shape specified. Welding of aluminum shall be performed in accordance with the requirements of the current AWS D1.2.

(d) **Steel piles** shall conform to the requirements of **Section 228.** The portion of steel piles that serve as a post shall be galvanized in accordance with Section 233 above the finished grade and to a point 2 feet below the finished grade.

(e) **Structural Steel** shall conform to the requirements of **Sections 226** and 407, and shall be galvanized in accordance with the requirements of **Section 233.** Painting of structural steel shall be in accordance with the requirements of **Section 411.**

(f) **Structural tubing** shall conform to the requirements of ASTM A500, **Sections 226** and 407, and shall be galvanized in accordance with the requirements of Section 233. Structural tubing serving as posts is subject to Charpy V-Notch Impact test requirements in accordance with the requirements of **Section 226**.

(g) **Miscellaneous steel** shall conform to the requirements of Sections 226 and 407, and shall be galvanized in accordance with the requirements of Section 233.

(h) **Asphalt mastic** shall conform to and be applied in accordance with the requirements of AASHTO M243.

(i) **Miscellaneous hardware** shall conform to the following: Anchor rods shall conform to the requirements of Section 226.02(c), and shall be galvanized in accordance with the requirements of Section 233. One nut and one washer shall be provided above and below the base plate at the connection to the anchor rods. The nut against the base plate shall be installed in such a way as to tension the anchor rod and create adequate friction between the nut and the base plate. There shall be no play or slack in the connection of the anchor rods to the base plate after the nuts have been tightened. The distance from the underside of the base plate to the top of the concrete shall be no more than the diameter of the anchor bolt plus one inch.

Bolts, nuts, and washers shall be high strength and conform to the requirements of **Section 226.02(h)** and shall be galvanized in accordance with the requirements of **Section 233**. Self-drilling screws shall be Class 410 stainless steel conforming to the requirements of FS QQ-S-763 and shall be cadmium coated in accordance with the requirements of ASTM B766.

(j) **Caulking sealant** shall conform to the requirements of FS TT-S-00230, TT-S-001543, or TT-S-001657. Exposed caulking shall be color-pigmented so as to match or be similar to the color of finished panels or as approved by the Engineer.

Trial Use and Comment

(k) **Steel flashings and caps** shall be of the same material and thickness as the metal panels. Protective coating requirements shall be the same as those for panels.

(l) **Elastomeric pads** shall conform to the requirements of ASTM D1056, Grade 1B3 C1, 1B4 C1, or 1B5 C1. Adhesives shall conform to the manufacturer's recommendations.

(m) **Interlocking panels** shall conform to the following: Metal panels shall be of a cold-formed, trapezoidal-faced configuration. The covering width of the panel face shall be at least 12 inches. Each panel shall have a male and female rib providing a friction interlock connection with adjacent panels. The friction interlock connection shall provide sufficient connection when two connected panels are held in the same vertical and horizontal positions.

(n) **Finish -** The sound wall panel finish of metal or plastic barrier shall be embossed or otherwise designed or treated to minimize light reflectance under wet conditions.

(o) **Protective color coating** for metal panels shall be System No. 1 or System No. 2 as specified on the plans. When the system is not specified, System No. 1 shall be furnished. The coating system shall be flat in accordance with the Federal Standard Number(s) specified on the plans or as approved by the Engineer.

1. **System No. 1** shall be either PVF plastic film (PVF_1) or urethane coating. System No. 1 coatings shall have an abrasion index of at least 16 liters per mil in accordance with the requirements of ASTM D968, shall be resistant to permanent graffiti markings, and shall produce an impervious finish free from cracks and crazings.

   a. **PVF_1** shall have a thickness of at least 1.5 mils per coated side and shall be applied at the factory to the thoroughly cleaned and pretreated galvanized steel in accordance with the requirements of ASTM D2092, Method F. The PVF_1 film shall be pigmented to obtain optimum color performance and shall be laminated to the steel with heat and adhesive to produce a uniform, durable coating.

   b. **Urethane coating** shall be acrylic or polyester material with a chromate-bearing epoxy prime coat, shall have a thickness of at least 1.2 mils per coated side, and shall be applied at the factory to the thoroughly cleaned, pretreated, and galvanized steel sheets. The urethane coating shall be inorganically pigmented to obtain optimum color performance and oven cured under quality controlled conditions to produce a uniform and durable coating.

Trial Use and Comment

2. **System No. 2** shall be PVF (at least 70 percent resin) enamel (PVF_2) with a dry film thickness of at least 1 mil per coated side and shall be applied at the factory to thoroughly cleaned and pretreated galvanized steel in accordance with ASTM D2092, Method F. The PVF_2 enamel shall be pigmented to obtain optimum color performance and oven baked under quality controlled conditions to produce a uniform, durable coating free from cracks and crazings.

(p) **Protective color coating** for concrete panels shall be a semiopague toner containing methyl methacrylate-ethyl acrylate copolymer resins with toning pigments suspended in solution at all times by a chemical suspension agent and solvent. Color toning pigments shall consist of laminar silicates, titanium dioxide and inorganic oxides. There shall be no settling or color variation. The use of vegetable or marine oils, paraffin materials, stearates or organic pigments in the coating formulation will not be permitted.

Physical properties of the coating shall be as follows:

Weight per gallon	8.3 pounds (min.)
Solids by weight	30 percent (min.)
Solids by volume	21 percent (min.)
Drying time	30 minutes (max.) at 70^0F and 50 percent humidity

Coating material shall not oxidize and shall show no appreciable change in color after 1000 hours when tested in accordance with ASTM D822; shall have excellent resistance to acids, alkalies, gasoline and mineral spirits when tested in accordance with ASTM D543; shall allow moisture vapor from the concrete interior to pass through when tested in accordance with ASTM E398 or D1653; and shall reduce the absorption rate of exterior moisture into the pores of the concrete surface when tested in accordance with Federal Specification TT-C-555 B.

Surface preparation, application rate and application procedures shall be as specified by the coating manufacturer, using airless spray equipment, having a minimum capacity of 1,000 psi and 1/2 gallon per minute. Coating shall not be applied when the air temperature is below 50^0F, to damp surfaces or when the air is misty or unsatisfactory for this work as determined by the Engineer.

The sound wall color coating shall be from the Department's approved products list of materials for absorptive concrete sound wall color coatings.

Comment [1738]: Right Documentation/Right Material

(q) Wood used for sound barrier walls shall conform to the requirements of Section 236 and shall be CCA preservative pressure treated with a minimum net retention of 0.60 pcf in accordance with American Wood Preservers Association UC4B. Panel design shall result in a sound transmission class of 38 or better when tested in accordance with the requirements of ASTM E90 or ASTM E413. Wood sound

Trial Use and Comment

barrier walls shall be from the Department's approved barrier systems. The use of wood sound barrier systems shall be limited to those applications specifically identified on the plans or in the contract documents.

(r) Plastic used in sound wall designs shall be of a high density, high impact resistant material such as, but not limited to; acrylic, fiberglass, polyethylene, polyvinylchloride, or polyurethane with antioxidant additives, UV stabilizers and capable of being produced with integral color pigmentation where such color is identified by project plans. Plastic sound barrier systems shall be pre-approved by the Department for use.

519.03 Procedures

The Contractor shall design the wall when traversing a grade in such a manner that the finish profile of the top panels shall be as uniform in height as possible. The top face of the sound barrier wall shall be aligned to maintain a continuous appearance and shall not deviate from true alignment by more than 1/2 inch in 10 feet.

(a) **Foundations**

Existing ground line elevations shall be established and verified by the Contractor prior to submitting working drawings. The Contractor shall remove and dispose of all above ground obstruction such as trees and other clearing and grubbing items unless otherwise directed by the Engineer.

The Contractor shall adjust foundations to avoid conflicts with pipes or utilities. Wall panel lengths may be shortened or lengthened so that foundation locations may be adjusted to avoid conflicts and clear existing pipes, utilities, and other underground obstructions. When a conflict cannot be avoided using this method, the Contractor shall submit his alternative design for the Department's written approval. The Contractor shall modify the design of wall foundations where foundations may conflict with the limits of proposed or existing rights-of-way or where foundation designs may leave a portion of the foundation exposed above the finished ground line. Such conflicts and proposed modifications shall be reviewed with the Engineer prior to installation. Where sound barrier walls are self-supporting, they shall be designed to prevent pipe or utility damage caused by excessive bearing loads when placed over pipes, utilities, or other underground obstructions.

(b) **Piles and Posts**

Piles shall be driven in accordance with the requirements of Section 403 except that the tolerance for the position of a single steel H-pile shall be ±1/2 inch.

Comment [1739]: Right Way

Comment [1740]: Right Way/Right Documentation

Comment [1741]: Right Way/Right Time

Trial Use and Comment

The portion of posts from the finished grade to the bottom end and the portion of the H-pile lapped with posts shall be painted with asphalt mastic after splicing. Voids between posts and piles created by the use of shims for plumbing posts shall be caulked prior to the application of asphalt mastic.

The Contractor may furnish the galvanized post and girts with the protective color-coating system specified for panels, thereby eliminating the related flashing covering, provided the posts and girts conceal threads of bolts and screws.

Structure-mounted sound walls shall have metal posts.

(c) **Panels**

Comment [1742]: Right Way/Right Documentation/Right Material

1. **General Requirements**

The patching of panels will not be permitted without the written approval of the Engineer. Where patching is permitted by the Engineer, it shall be performed in accordance with the manufacturer's recommendations. Cut, marred, or scratched surfaces shall be repaired in accordance with the manufacturer's recommendations. Panels having deficiencies such as cracking, crazing, scaling, efflorescence, segregation, mottling of the color coating or stains on the finish shall be rejected. Irregularities at panel edges that appear broken, ragged, chipped or dented to the extent that a gap appears once they are stacked will be cause for rejection.

Sound absorptive coating shall be permanently bonded or attached to the panel's core material and have the same service life as the core materials.

The absorptive finish of concrete panels shall meet the requirements of ASTM C666, Procedure B, for 300 cycles

Where sound barrier panels do not occupy the full width between the flanges of the sound barrier posts, panel attachment details shall be furnished with the working drawings. Such details shall also include material descriptions. Post flanges and panels shall overlap at least 1½ inches after installation. The face of the panel on the roadway side of the barrier shall fit tightly against the post flange for the full height of the panel after installation. Spacer blocks/wedges will not be permitted.

Joints and connections shall be secured so as to be structurally sound with no visible openings for sound transmission and shall not be a secondary source of noise attributable to vibration.

All lifting devices cast into panels shall be galvanized and flush with the panel.

Trial Use and Comment

2. Structure-Mounted Barriers

All structure-mounted sound barrier panels shall be metal or other pre-approved lightweight material. The bottom portion of the panels within 6 inches of the top of the parapet to which the wall is to be mounted shall not have an absorptive finish. The panels on structure-mounted sound barrier walls shall be oriented either vertically or horizontally to match any adjacent ground mounted sound barrier walls. Panel orientation shall be such that panels are free draining to prevent moisture buildup and possible corrosion. Structure-mounted sound barrier walls shall aesthetically match adjacent ground mounted barriers as to color unless stated otherwise in the contract. Anchor rods for structure-mounted walls shall be integrally cast into parapets. Concrete parapets or retaining walls shall not be slip formed when used as mounting structures for structure-mounted sound barrier walls. Connections between the panel and the posts and the sound barrier panel and the bridge shall account for the movement of the bridge as well as the expansion and contraction of the panels.

3. Ground-Mounted Barrier

Base Panels shall be a minimum height of 2 feet and shall be embedded in the ground a minimum of 6 inches to prevent sound leaks. A non absorptive durable finish is required on that portion of the base panels below ground and 6 inches above the ground line.

When panels are stacked, horizontal joints shall be aligned to create continuous horizontal lines; however, foundations and/or ground contact panels may be adjusted within the limits established herein to provide for the continuous horizontal alignment of joints. Horizontal joints formed where panels mate together and false or dummy joints (if present) must match in appearance and alignment. Once installed, the edges of stacked panels shall be neat, and sides that mate together shall be straight and true.

Reflective concrete sound barrier panels shall have all edges chamfered ¾ inch or rounded to ½ inch radius. V-shaped control joints, ⅜ – ½ inch deep, shall be scored into one side of panels less than 8 inches thick and both sides of panels 8 inches or more in thickness to control temperature and shrinkage cracking. These joints shall be no more than 8 feet on center.

All panel connection hardware and portions of metal base panels to be embedded in the ground shall be coated with asphalt mastic.

4. Sample Section

The Contractor shall erect a sample section of the ground-mounted wall at the job site prior to receiving final written approval to proceed with panel fabrication

Comment [1743]: Right/Material/Right Way

Comment [1744]: Right Way/Right Time/Right Material

Comment [1745]: Right Way/Right Documentation

Trial Use and Comment

from the District office. The sample section shall be three bays of panels with posts to show how panels shall be secured to posts with attachment hardware. Sample panels shall show the attachment area formed in the panel. Sample panels shall show color and finishes of both sides of the wall.

(d) **Drainage Requirements**

Comment [1746]: Right Way

Ground surface drainage shall be accommodated in the design. Sound barrier walls shall be designed to deter impoundment and trapping of water. Disturbed areas shall be graded in front and behind the sound barrier wall to control and dispose of roadway and slope drainage using a graded ditch or similarly functional drainage. The ground-mounted sound barrier posts and bottom sound barrier wall panel shall be designed with consideration for additional load created by the ditch slope where it rests against the wall.

Weep holes shall be provided in panels, where necessary, to facilitate proper drainage. Drainage design shall not create sound leaks.

Disturbed areas of earthwork shall be seeded in accordance with the requirements of Section 603.

(e) **Other Detail Requirements:**

Comment [1747]: Right Way

1. **Concrete clear cover** over reinforcing steel, except precast concrete panels, shall not be less than 3 inches for primary reinforcement and 2 ½ inches for ties and stirrups. Concrete clear cover shall not be less than 1 ½ inches for precast concrete panels. Concrete clear cover excludes any sound absorptive concrete finish.

2. **Steel reinforcement** shall be designed to resist in-service loads as described in 519.01(b) and handling loads resulting from manufacture, transport and installation. All concrete elements shall have at least enough reinforcement to satisfy the requirements in article 8.20, "Shrinkage and Temperature Reinforcement," aforementioned AASHTO specifications. Mechanical butt spliced connections shall develop at least 125% of the tensile yield strength of the bar. If welds are necessary, they shall be detailed on the working drawings.

3. **Anchor rods** shall be embedded into concrete a distance equal to or greater than the development length of an equivalent reinforcing steel bar in accordance with the article 8.25, "Development of Deformed Bars and Deformed Wire in Tension," AASHTO Standard Specifications for Highway Bridges. Hooked anchor rods shall not be used to reduce the embedment length. Anchor rods shall be enclosed in reinforcing steel ties over their full embedded length. These ties shall not be spaced more than 12 inches on center and shall not be less than #3 in size. A minimum of four anchor rods shall be used per post if the anchor rods have adequate capacity to resist 150% of the design loads; otherwise a minimum

Comment [1748]: Right Way/Right Quantity

Trial Use and Comment

of six anchor rods shall be used per post. Anchor rods shall not be heated or bent in the field to accommodate misalignment of anchor rods without approval of the Engineer. Anchor rods, washers and nuts of ground mounted sound barrier walls shall be coated with asphalt mastic both above and below base plates after installation.

4. **Epoxy or adhesive anchors, expansive anchors, split washers, and lock nuts** shall not be allowed. Multiple washers shall not be allowed as spacers for bolted connections or anchor rods.

5. **Base panel leveling pads** (support blocks), where needed, shall be cast-in-place reinforced concrete with steel dowels embedded in the concrete foundation.

6. **Precast concrete members**, including panels, shall not be lifted from casting beds until their design compressive strength is sufficient to prevent damage. Concrete shall have attained the minimum 28-day design compressive strength before members are shipped to the project site. During storage, stacked members shall be separated from each other by wood spacing blocks. Curing, storing, transporting, and handling of precast members shall be done in such a manner as to avoid excessive bending stresses and to prevent cracking, spalling, chipping or other damage. Units damaged by improper storage or handling shall be replaced at the Contractor's expense. Acceptable lifting and support points and directions of reactions shall be shown on the working drawings. The Contractor shall be responsible for the design and safety of the lifting devices used. Embedded lifting inserts and devices shall be steel and galvanized in accordance with the requirements of Section 233. Computations accompanying the working drawings shall demonstrate that stresses in the member are within the allowable range during shipping, handling, and installation using appropriate impact factors.

7. **Grout** between the base plate and concrete shall not be used.

519.04—Measurement and Payment

Sound barrier walls will be measured in square feet of surface from the finished grade to the sound attenuation line shown on the plans and from end to end of the wall, complete-in-place, and will be paid for at the contract unit price per square foot. The six inch minimum embedment in the ground of all base panels of ground mounted sound barrier walls will be considered incidental and will not be measured for separate payment. Structure-mounted sound barrier walls shall be measured in square feet of surface from the top of the parapet or mounting structure to the sound attenuation (noise abatement) line shown in the plans. This price shall include designing, furnishing; installation; providing modifications to avoid utility, Right-of-Way, foundation exposure, and tie-back conflicts; grading, seeding; disposing of

Comment [1749]: Right Way

Comment [1750]: Right Location

Comment [1751]: Right Way/Right Documentation/Right Payment/

Comment [1752]: Right Payment

Trial Use and Comment

surplus and unsuitable material; restoring property; and construction outside the grade or sound attenuation line. Excavation of tree roots, existing limited access fence and other clearing and grubbing items such as those identified in Section 301 required for the placement of walls shall be included in the square foot price bid of the sound barrier walls. The cost of foundation designs and supplemental geotechnical investigation and foundations shall be considered incidental and will not be measured for separate payment but shall be included in the price bid per square foot of sound barrier wall. Costs for ultrasonic and radiographic testing and all other quality control measures required by the specifications shall be included in the price bid per square foot of sound barrier wall.

After the second submittal of working drawings, costs for review shall be in accordance within the provisions of Section 105.10

Payment for sound barrier walls shall be made incrementally as construction progresses in accordance with the following percentages: 20 percent of the contract unit square foot price after completion of wall design and submission acceptance, 20 percent of contract unit square foot price after construction and installation of foundations and posts including posts caps, and geotechnical\subsurface investigation, testing where specified and if applicable, 45 percent of contract unit square foot price after installation of panels, and 15 percent of contract unit price after completion of sound barrier wall and color coating, if specified.

Where multiple walls are specified in the contract, incremental payments will not apply to individual walls but to all walls specific to the individual pay items listed.

Sound wall color coating will be paid for at the contract unit price per square yard, which price shall be full compensation for furnishing and applying the sound wall color coating, surface preparation and for all materials, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Sound barrier wall, absorptive	Square foot
Sound barrier wall, reflective	Square foot
Structure-mounted sound barrier wall, absorptive	Square foot
Structure-mounted sound barrier wall, reflective	Square foot
Sound wall color coating	Square yard

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Pre-Construction Meeting
- Pre-Activity Meeting
- Review Plans, shop drawings, location

Start:

- Verify Source of Material
- Review stakeout
- Inspect panels upon delivery prior to unloading from delivery truck
- Review contractor's lift plan and equipment to be used
- Review Manufacturer's recommendations
- Verify contractor's storage location and method of storage per manufacturer's recommendation

Continuous inspection:

- Verify each post location
- Verify stakeout to Certified Survey notes furnished by Contractor
- Inspect each panel as it is placed
- Use of cameras are highly recommended to verify condition when panel is placed and place pictures in electronic folders for future reference
- Verify that H-piles are driven to within +/-1/2 inch tolerance and in accordance with the section on bearing piles
- Verify the portion of the post below finished grade and portions of the H-pile lapped with the post painted with asphalt mastic after splicing and are voids caulked prior to painting?
- Verify joints and connections are secured so as to be structurally sound with no visible openings, and so as to transmit no noise through vibration?
- Verify that the alignment of the top face of the wall not deviate more than 1/2 inch in 10 feet?
- Verify all disturbed areas graded and seeded in accordance with the section on Seeding Section 603

Final Inspection:

- Verify and document that sound barrier walls are constructed in accordance with the plans, Special Provisions and Section 519

Documentation Required:

- Contractors certified survey notes
- Approved shop drawings

Trial Use and Comment

- Contract plans and special provisions
- Manufacturer's recommendations

IV. REVIEW QUESTIONS

519.02	Do soundwall materials conform to the requirements of this section?
519.03(1)	Are H-piles for sound barriers driven within a +/-1/2" tolerance and in accordance with the section on bearing piles?
519.03(2)	Is the portion of the post below finished grade and portions of the H-pile lapped with the post painted with asphalt mastic after splicing and are voids caulked prior to painting?
519.03(3)	Are joints and connections secured so as to be structurally sound with no visible openings, and so as to transmit no noise through vibration?
519.03(4)	Does the alignment of the top face of the wall not deviate more than 1/2 inch in 10 feet?
519.03(5)	Are disturbed areas graded and seeded in accordance with the section on Seeding?
519.03(a)	Are precast sound barrier walls constructed in accordance with this section?
519.03(b)	Are metal sound barrier walls constructed in accordance with this section?
519.03(C)	Are plywood sound barrier walls constructed in accordance with this section?
	Are H-piles for sound barriers driven within a +/- 1/2 inch tolerance and in accordance with the section on bearing piles?
	Is the portion of the post below finished grade and portions of the H-pile lapped with the post painted with asphalt mastic after splicing and are voids caulked prior to painting?
	Are joints and connections secured so as to be structurally sound with no visible openings, and so as to transmit no noise through vibration?
	Does the alignment of the top face of the wall not deviate more than 1/2 inch in 10 feet?
	Is the bottom panel properly supported in accordance with the plans?
	Are sound barrier walls constructed in accordance with the plans, Special Provisions and Section 519?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Pre-construction meeting/Pre-activity meeting**
• **Review location per contractor's certified survey notes**
• **Review approved source of materials**
• **Review plans, approved shop drawings, contract and special provision, manufacturer's recommendations**
• **Contractor's storage location, contractor's lift plan**
• **Alignment of post and panels**
• **Verify coatings**
• **Measurement and documentation of quantities**

Trial Use and Comment

SECTION 520- WATER AND SANITARY SEWER FACILITIES

I. INTRODUCTION:

This work shall consist of furnishing and installing necessary materials for water distribution systems and sanitary systems in accordance with these specifications and in conformity to the dimensions, lines, and grades shown on the plans or as established by the Engineer.

a) Forms:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

520.01—Description

This work shall consist of furnishing and installing necessary materials for water distribution systems and sanitary systems in accordance with these specifications and in conformity to the dimensions, lines, and grades shown on the plans or as established by the Engineer.

520.02—Materials

(a) **Pipe, fittings, and flanges** shall conform to the requirements of Section 232.

(b) **Gaskets and joint materials** shall conform to the requirements of Section 212.

(c) **Casing pipe** shall be 14-gage corrugated metal half-circle pipe conforming to the requirements of Section 232 except as modified for securing interlocked or nested connections.

(d) **Concrete blocks** shall conform to the requirements of Section 222.

(e) **Bricks** shall conform to the requirements of Section 222.

(f) **Hydraulic cement mortar** shall conform to the requirements of Section 218.

Comment [1753]: Right Way

Comment [1754]: Right Materials

Trial Use and Comment

(g) **Concrete** shall conform to the requirements of Section 217 and shall be Class A3.

(h) **Reinforcing steel** shall conform to the requirements of Section 223.

(i) **Curing material for concrete** shall conform to the requirements of Section 220.

(j) **Timber skids** shall conform to the requirements of Section 236, and the preservative and treatment shall conform to the requirements of Section 236.

(k) **Valves** shall conform to the requirements of AWWA C500, C504, C506, C507, C508, or C509 for the types and features specified.

(l) **Fire hydrants** shall conform to the requirements of AWWA C502 or C503 with the various features specified.

(m) **Water meters** shall conform to the requirements of AWWA C700, C701, C702, C703, C704, C706, C707, C708, or C710 for the type and features specified. Each meter shall be furnished with a meter box.

(n) **Corporation stops** shall be made of bronze or red brass conforming to the requirements of ASTM B62. The fitting design and thread dimension shall conform to the requirements of AWWA C800. The working pressure of the corporation stop shall be equal to that of the water main to which it is attached.

(o) **Castings** shall conform to the requirements of Section 224.

(p) **Nonshrink waterproof grout** shall conform to the requirements of Section 218.

(q) **Aggregate** shall conform to the requirements of Section 203. Aggregate for drain fields shall be No. 5.

520.03—Procedures

The Contractor shall be responsible for anticipating and locating underground utilities and obstructions in accordance with the requirements of Section 105.08.

When construction appears to be in close proximity to existing utilities, the trench(es) shall be opened a sufficient distance ahead of the work or test pits made to verify the exact locations and inverts of the utility to allow for changes in line or grade.

Connections to existing lines shall be made only after the proposed line is completed and approved by the Engineer. Connections shall be made in the minimum time

Comment [1755]: Right Way

Comment [1756]: Right Way / Right Time

Comment [1757]: Right Time

Trial Use and Comment

possible with minimum interruption of service. Work and interruptions in existing service shall be scheduled with the utility owner.

Existing water and sewer lines and appurtenances and manholes not required in the completed system shall be abandoned as directed by the Engineer. Abandoned materials shall become the property of the Contractor, unless otherwise noted on the plans, upon satisfactory replacement with the new installation. Abandoned pipe that is not removed shall be cleaned of debris and plugged at open ends with Class A3 concrete.

Existing manholes that are not required in the completed system shall be removed to at least 2 feet below the proposed subgrade or natural ground line and shall be filled with approved backfill in accordance with the requirements of Section 302.03 (a)2.g.

Disturbed property shall be restored prior to final acceptance. Restoration shall include, but not be limited to, replacing shrubbery, sod, or topsoil, including lime, fertilizer, seed, and mulch; replacing paved or finished surfaces with similar materials; and performing other work in accordance with the requirements of Section 107.08.

Sidewalks and streets shall be kept open for passage. The Contractor shall provide and maintain adequate and safe passage over excavations to accommodate pedestrians or vehicles as directed by the Engineer.

(a) **Protecting Water Supplies:** During the course of construction, the Contractor shall protect water supply facilities within the construction limits from contamination by sewage. The Contractor shall use the following criteria to govern the installation of water and sewer facilities in proximity of each other:

1. **Parallel separation:** Except as specified hereinafter, water lines shall be placed at least 10 feet horizontally from existing or proposed sanitary sewer lines, combination sewer lines, and sanitary sewer manholes. Sanitary sewer lines shall be placed at least 10 feet horizontally from existing and proposed water lines. This distance shall be measured from edge to edge. If local conditions prevent a lateral separation of 10 feet, a water line may be placed closer than 10 feet to a sewer or a sewer line may be placed closer than 10 feet to a water line if the top of the sewer pipe is at least 18 inches below the bottom of the water line. Where the vertical separation cannot be obtained, the sewer shall be constructed of mechanical joint water pipe. Gravity sewers shall be pressure tested, in place, to 50 pounds per square inch without leakage prior to backfilling. Force main sanitary sewer shall be pressure tested in accordance with the requirements of Section 520.04(c).

2. **Crossings:** Water and sewer lines that cross shall be placed to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer line. Where this vertical separation cannot be obtained, the sewer shall be constructed of mechanical joint or other approved water pipe for at least 10 feet on each side of the crossing.

Comment [1758]: Right Way

Comment [1759]: Right Way

Comment [1760]: Right Time / Right Way

Comment [1761]: Right Way

Comment [1762]: Right Way

Comment [1763]: Right Way / Right Location /Right Time

Comment [1764]: Right Way / Right Location / Right Time

Trial Use and Comment

Sanitary sewers and combined sewers crossing over a water line shall have a vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line. The support shall be adequate to prevent excessive deflection of joints and the settling on and breaking of the water line. The water or sewer line shall be centered at the point of the crossing so that joints will be equidistant and as far from each other as practicable.

Water lines shall not pass through or come in contact with any part of a sanitary sewer, combined sewer, or sanitary sewer manhole.

The Contractor shall immediately notify the Engineer if he becomes aware that the work will result in the violation of these criteria. Upon such notification, the Engineer will issue instructions concerning remedial measures.

(b) **Excavation:** Excavation, backfill, and compaction shall be performed in accordance with the requirements of Section 302 except that stone larger than 1 inch in diameter shall not be used in backfill until the pipe has a cover of at least 1 foot. The remainder of backfill to the original ground or to within 12 inches of the finished subgrade shall not include stone larger than 10 inches in its greatest dimension. Pipelines installed outside the roadway shall be backfilled in 8-inch layers and compacted to approximately 85 percent of the theoretical maximum density.

Comment [1765]: Right Way

Trenches for pipelines shall be excavated generally along straight lines, and bottoms shall be uniformly graded as required. Bedding material shall be placed in accordance with the plans. Where the trench bottom is in rock, it shall be excavated to at least 8 inches below the bottom of the pipe and backfilled with approved local or commercial bedding material. Pipe shall have a uniform bearing on a solid foundation for its entire length. Where pipe foundations are yielding, pipe shall be bedded on at least 8 inches of approved local or commercial bedding material. Bell holes, where applicable, shall be of sufficient size to ensure the making of proper joints.

Trenches below the grade line of the pipe shall be dewatered during installation of pipelines.

When work is not in progress for any reason, lines shall be securely closed.

Where adjacent pavements are to be retained, pavement removed for pipeline trenches shall be replaced in kind with equal or better material or as otherwise specified. After backfilling, the Contractor shall maintain a smooth riding surface until pavement repairs are completed.

(c) **Inspecting Pipe and Fittings:** Pipe and fittings shall be inspected for cracks and defects before they are lowered into the trench. Faulty pipe and fittings shall be removed from the site.

Comment [1766]: Right Way

Trial Use and Comment

(d) **Placing Pipe:** Water mains shall have a cover of at least 36 inches, and water service lines shall have a cover of at least 24 inches. Pipe, fittings, valves, hydrants, and accessories shall be carefully lowered into the trench to prevent damage to materials, protective coatings, and linings. Materials shall not be dropped or dumped into the trench.

If pipe, fittings, valves, hydrants, or accessories are damaged during handling, the damage shall be immediately brought to the Engineer's attention. The Contractor shall then submit to the Engineer, for approval, a method for repairing the damaged item. Damaged items shall be repaired as approved by the Engineer or shall be removed from the project.

Lumps, blisters, and excess coating shall be removed from ends of pipes that are to be joined. The inside of the bell and the outside of the spigot shall be wire brushed, wiped clean, dry, and free from oil and grease before pipe is placed. Foreign material shall be kept from entering pipe during placement.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to the correct line and grade. Pipe shall be secured in place with approved backfill material tamped under it except at bells. Precautions shall be taken to prevent dirt from entering the joint space. If it becomes necessary to deflect water main pipe during construction, the amount of deflection shall not exceed the manufacturer's recommendation.

(e) **Cutting Pipe:** Pipe for fittings or closure pieces shall be cut in a neat and orderly manner without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. The lining of the pipe shall not be damaged. Flame cutting of ductile iron or cast iron pipe with an oxyacetylene torch will not be permitted.

(f) **Joining of Pipe:** Gasket and joint lubricant for water facilities shall be a nontoxic, tasteless, and odorless substance that will not support bacteria. Gasket end joint lubricant for sewer facilities shall be as recommended by the manufacturer or as approved by the Engineer. Pipe that is not furnished with a depth mark shall be marked before assembly to ensure that the spigot end is inserted to the full depth of the joint. Field-cut pipe lengths shall be filed or ground to resemble the spigot end of such pipe as manufactured.

1. **Ductile iron pipe** shall be joined in accordance with AWWA C-111 and AWWA C-600.

2. **Steel pipe** shall be joined by field welding unless otherwise specified on the plans. Pipe ends shall comply with the requirements of AWWA C-206 for the type of field joint specified. Field-welded joints shall comply with the requirements of AWWA-206; flanged joints shall comply with the requirements of AWWA C-207, and rubber gasket joints shall comply with the requirements of AWWA M11.

Comment [1767]: Right Way

Comment [1768]: Right Way

Comment [1769]: Right Way / Right material

Comment [1770]: Right Way

Comment [1771]: Right Way

Trial Use and Comment

3. **Galvanized steel pipe** shall be joined by fittings in accordance with the manufacturer's recommendation.

4. **Copper pipe or tubing** shall be joined by fittings in accordance with the manufacturer's recommendation.

5. **PVC pipe** shall be joined by gasketed bell and socket joints in accordance with AWWA C-900.

6. **Concrete pipe** for water facilities shall have joints of the round rubber gasket type, unless otherwise specified, using either a bell and spigot joint or a double spigot and sleeve joint. Either joint shall be such that when the pipe is laid and the joint completed, the gasket will be confined within a groove or by shoulders on the bell and spigot. The contact surface in the joint shall be such as not to cause cutting of the rubber gasket during installation.

   Concrete pipe for sewer facilities shall be joined by using rubber gaskets. The gasket shall be continuous and fit snugly into the annular space between the overlapping surfaces of the assembled pipe joint to form a flexible watertight seal. The annular space between the gasket bearing surface of the assembled and centered joint shall be more than 75 percent of the uncompressed thickness of the applied gasket including the manufacturer's tolerances of the joint and gasket.

7. **Vitrified clay pipe** shall be joined with compression joints in accordance with ASTM C-12 and manufacturer's recommendation.

8. **PE pipe** shall be joined in accordance with AWWA C-901 and the manufacturer's recommendation.

9. **ABS pipe** shall be joined with a solvent cement joint in which pipe solvent cements into a coupling socket to form the joint. Primer for priming solvent cement joints shall be methylethyl ketone (MEK), and the cement shall be MEK containing a minimum of 20 percent by weight of dissolved ABS. Type OR joint is a mechanical-seal joint in which a gasket shall be compressed between the pipe and the bell coupling to form the joint closure.

(g) **Plugs, Caps, Tees, and Bends:** Plugs, caps, tees, and bends shall be anchored with reaction backing. Backing shall be concrete reaction blocks, metal reaction harnesses, or a combination thereof. Concrete shall be placed in accordance with the requirements of Section 404 and cured in accordance with the requirements of Section 316.04(j). Metal harness tie rods and clamps shall be of adequate strength to prevent movement and shall be galvanized or rustproofed by approved means.

(h) **Encasement Pipe:** Encasement pipe shall be installed in accordance with the requirements of Section 302.

Comment [1772]: Right Way

Comment [1773]: Right Way

Comment [1774]: Right Way

Comment [1775]: Right Way

Comment [1776]: Right Way

Comment [1777]: Right Way

Comment [1778]: Right Way

Comment [1779]: Right Way

Comment [1780]: Right Way

Trial Use and Comment

(i) **Casing Pipe and Concrete:** Casing pipe and concrete shall be constructed in accordance with plan details and the applicable requirements of Sections 302, 303, 316, and 406, with the half-circle sections of casing pipe nested or interlocked to obtain a satisfactory union of the two sections of pipe. Prior to installation, existing pipe to be encased shall be cleaned and foreign material removed.

(j) **Valves, Valve Boxes, and Manholes:** The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve with the box cover flush with the surface of the finished pavement. Manholes shall be constructed to permit minor valve repairs and protect the valve and pipe from impact where they pass through the walls.

(k) **Fire Hydrants:** Wherever a hydrant is set in pervious soil, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least 6 inches above the waste opening in the hydrant and to a distance of 1 foot around the elbow.

Wherever a hydrant is set in clay or other impervious soil, a drainage pit 2 feet in diameter and 3 feet in depth shall be excavated below each hydrant. The pit shall be filled compactly with coarse gravel or crushed stone mixed with coarse sand under and around the elbow of the hydrant to a level 6 inches above the waste opening. The drainage pit shall not be connected to a sewer.

(l) **Installing Corporation Stops:** Corporation stops shall be installed while the main is under pressure and at a 45-degree angle to the horizontal plane.

(m) **Concrete Encasement:** Concrete encasement shall be constructed in accordance with the requirements of Sections 302, 303, 316.04(j), 404, and 406.

(n) **Water Meters and Yokes:** The meter box shall not transmit shock or stress to the meter and shall be centered and plumb over the meter. The top of the box shall be flush with the surrounding surface.

(o) **Jacked Encasement Pipe:** Jacked encasement pipe shall be installed in accordance with the requirements of Section 302.03(a)1.

(p) **Sanitary Service Lateral Connection:** Connection shall be performed by approved methods prior to installation using wyes, bends, adapters, cleanouts, and necessary pipe. Existing service laterals shall mate with the new fitting, adapter, or pipe to produce a watertight joint.

(q) **Sanitary Manholes and Manhole Frames and Covers:** These items shall be constructed in accordance with the requirements of Section 302.03(c). A secure bond between the pipe and manhole wall shall be obtained. Flexible insert gaskets shall be used to obtain a watertight joint. The gasket style and composition shall be subject to the approval of the Engineer. Precast wall sections shall be seated with flexible joint

Comment [1781]: Right Way

Comment [1782]: Right Way

Comment [1783]: Right Way

Comment [1784]: Right Way

Comment [1785]: Right Way

Comment [1786]: Right Way

Comment [1787]: Right Way

Comment [1788]: Right Way

Comment [1789]: Right Way

Trial Use and Comment

sealant for their full circumference. Lift holes, defects, joints between sections, and frames and covers shall be sealed with nonshrink waterproof grout.

(r) **Sanitary Drop Connections:** Connections shall be constructed in accordance with the requirements of Sections 302, 303, 404, and 406.

(s) **Sewer Cleanouts:** Cleanouts shall be constructed in accordance with the requirements of Sections 302, 303, 404, and 406.

(t) **Conveying Sewage:** When it is necessary to contain or pump sewage during the adjustment of or connection to existing sewers, sewage shall be carried by a watertight conveyor to sewers or manholes approved by the Engineer or shall be disposed of in accordance with local and state health codes. Sewage shall not be allowed to flow onto or over any open surface.

(u) **Manhole Frame and Covers, Valve Boxes, and Other Castings Located Within the Paved Roadway, Shoulder, or Sidewalk:** These shall be constructed within a tolerance of ±0.05 foot of the finished grade.

(v) **Reconstruct Existing Sanitary Manhole:** This shall consist of the removal of the existing manhole to the point indicated on the plans or directed by the Engineer. Reconstruction shall be accomplished by using existing units and pavement rings or new units and adjustment rings to attain the proposed finished grade.

520.04—Testing

Water and sewer mains, appurtenances, and materials shall be tested for leakage after installation. Testing shall be performed in the presence of the Engineer. The Contractor shall provide water, plugs, equipment, tools, labor, materials, and incidentals necessary to perform the testing. If any section of a main or manhole under test shows leakage in excess of that specified, the Contractor shall make necessary repairs or replacements at his own expense. Testing shall be repeated until satisfactory results are obtained. Visible leaks shall be repaired regardless of the amount of allowable leakage.

(a) **Water Mains and Appurtenances:** New water mains and appurtenances shall be tested for leakage using the hydrostatic pressure test method in accordance with Section 4 of AWWA C600 and the following:

1. The duration of each test shall be at least 2 hours. Sections of main with concrete reaction backing shall not be tested until at least 5 days after the backing is placed. If the backing is high-early-strength concrete, the test may be performed 2 days after backing is placed.

Comment [1790]: Right Way

Comment [1791]: Right Way

Comment [1792]: Right Way

Comment [1793]: Right Way

Comment [1794]: Right Way

Comment [1795]: Right Time / Right Way

Comment [1796]: Right Time / Right Way

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2. Testing of tie-ins with existing mains shall be performed under the normal working pressure of the main involved. Visible leakage at these points will not be allowed during a period of at least 2 hours.

3. The hydrostatic test pressure shall be 100 pounds per square inch or 1.5 times the working pressure, whichever is greater, based on the elevation of the lowest point in the line or section under test and shall be corrected to the elevation of the test gage. The Contractor shall ascertain the specific working pressure of the water main from the utility owner. Leakage loss shall not exceed the allowable leakage (*L*) as determined by the following formula:

$$L = \frac{ND\sqrt{P}}{7{,}400}$$

Where:
L = the allowable leakage in gallons per hour;
N = the number of joints in the length of pipe line tested;
D = the nominal inside diameter of the pipe in inches; and
P = the average test pressure during the leakage test in pounds per square inch.

(b) **Gravity Sanitary Sewers:** Leakage shall be not more than 200 gallons per inch of pipe diameter per mile per day (24 hours) for pipe up to and including 24 inches in diameter and not more than 4,800 gallons per mile per day for pipe more than 24 inches in diameter for any section of the system, including manholes, when subjected to at least 4 feet of head above the line crown at the upstream manhole of the section being tested.

1. **Infiltration test:** When in the opinion of the Engineer the trench or excavation is sufficiently saturated as a result of natural ground water, tests may be made on the basis of infiltration. The Contractor shall measure the flow of water at the nearest downgrade manhole. Three series of measurements shall be made at not less than 1-hour intervals, and the results shall be reduced to an average. The average for a 24-hour period shall then be computed. If the pipeline or manholes fail to meet the test requirements, leaks shall be repaired and defective pipe and manholes shall be replaced at the Contractor's expense. The test shall be repeated until satisfactory results are obtained.

2. **Exfiltration test:** An exfiltration test shall be performed when the trench or excavation is dry and infiltration will not occur. The test shall be conducted as follows: The pipe shall be plugged at the lower manhole. The line and manhole shall be filled with water to a 4-foot level or to the top of the straight section if the manhole is less than 4 feet in height. The water shall stand until the pipe has reached maximum absorption and until trapped air has escaped (at least 4 hours). After maximum absorption has been reached, the manhole shall be filled

Comment [1797]: Right Way / Right Time

Comment [1798]: Right Way / Right Time

Comment [1799]: Right Way / Right Time

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to the original level. After 1 hour has elapsed, the difference in the level shall be recorded in terms of gallons. The 24-hour loss shall then be computed. If the pipe line system and manholes fail to meet test requirements, leaks shall be repaired at the Contractor's expense. The test shall be repeated until satisfactory results are obtained.

3. **Air test:** In lieu of the infiltration or exfiltration test for leakage, the Contractor may test the sewers by using low air pressures. In the event low air pressure tests are used, the manholes shall be tested by exfiltration. Inflatable stoppers shall be used to plug all lines into and out of the manhole being tested. The stoppers shall be positioned in the lines far enough from the manhole to ensure testing of those portions of the lines not air tested. The manhole shall then be filled with water to the top and a 12-hour soaking period shall be allowed prior to test measurement. The manhole shall be refilled to a mark, and at the end of 1 hour, the amount of leakage shall be measured. Leakage shall not exceed ½ gallon per hour. If the manhole fails to comply with the test requirements, leaks shall be repaired at the Contractor's expense. The test shall be repeated until satisfactory results are obtained. The low air pressure test shall be conducted in accordance with the following:

Comment [1800]: Right Way / Right Time

   a. After backfilling and prior to air testing, the Contractor shall eliminate discernable water leaks and remove debris. Tests shall be conducted from manhole to manhole or from manhole to terminus. Personnel shall not be allowed in manholes once testing has begun.

   b. Immediately before testing, the Contractor shall provide securely braced test plugs at each manhole and a suitable means of determining the depth of the ground water level above the inverts.

   c. The Contractor shall slowly add air to the portion of the pipe being tested until the internal air pressure is at a test pressure of 4 pounds per square inch above the invert or ground water table, whichever is greater, or until the pressure is equal to the hydraulic gradient, whichever is greater. If the test plug shows leakage, as determined by the Engineer, the Contractor shall relieve the pressure for at least 2 minutes. The Contractor shall then disconnect the hose and compressor. If the pressure decreases to 3.55 pounds per square inch, the time shall be recorded for the amount of time required for the pressure to drop from 3.5 to 2.5 pounds per square inch. The minimum allowable holding times will be as specified herein. Pipes that fail to maintain minimum holding times will not be accepted. Repairs, replacement, and retesting as specified by the Engineer shall be performed at the Contractor's expense.

      The minimum allowable holding time for an 8-inch sanitary sewer pipe that is required for the pressure to drop from 3.5 to 2.5 pounds per square inch is:

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Line Length	Time (sec)
25	18
50	35
75	53
100	70
125	88
150	106
175	123
200	141
225	158
250	176
275	194
300	211
350	227
400	227

The minimum allowable holding time for a 12-inch sanitary sewer pipe that is required for the pressure to drop from 3.5 to 2.5 pounds per square inch is:

Line Length	Time (sec)
25	40
50	79
75	119
100	158
125	198
150	238
175	277
200	317
225	340
250	340
275	340
300	340
350	340
400	340

(c) **Force Main Sanitary Sewers:** Leakage shall not exceed the allowable leakage (*L*) as determined by the following formula:

Comment [1801]: Right Way / Right Time

$$L = \frac{ND\sqrt{P}}{1850}$$

Where:
L = the allowable leakage in gallons per hour;
N = the number of joints in the length of pipe line tested;

Trial Use and Comment

D = the nominal inside diameter of the pipe in inches; and
P = the average test pressure during the leakage test in pounds per square inch.

The hydrostatic test pressure shall be maintained for at least 30 minutes at 100 pounds per square inch or 1.5 times the working pressure, whichever is greater, based on the elevation of the lowest point in the line or section under test and shall be corrected to the elevation of the test gage. The Contractor shall ascertain the specific working pressure of the force main from the utility owner. Visible leaks shall be satisfactorily repaired regardless of the amount of allowable leakage.

(d) **Offsets of Existing Pipe:** Offsets will not be subjected to hydrostatic pressure testing unless specified on the plans. After installation and connection to the existing mains, the offset shall be placed in service and left uncovered for visual inspection for at least 2 hours. Visible leaks shall be repaired to the satisfaction of the Engineer prior to acceptance of the offset. Offset of existing pipe for water mains shall be disinfected in accordance with AWWA C-651, Section 9.

Comment [1802]: Right Way / Right Time

520.05—Disinfecting Water Mains

Comment [1803]: Right Time / Right Way

New, relocated, and modified water mains and accessories shall be disinfected prior to tie-ins in accordance with AWWA C651.

If the initial disinfection fails to yield satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. After each group of samples is taken, the Contractor shall submit a written report to the Engineer that states the results of the tests.

520.06—Measurement and Payment

Comment [1804]: Right Measurement / Right Payment

Excavation and replacement of pavement removed for pipe trenches will not be measured for separate payment unless otherwise shown. However, minor structure excavation will be measured and paid for in accordance with the requirements of Section 303.06. When excavation is required below the proposed trench bottom, necessitating additional bedding material, the bedding will be measured and paid for in accordance with the requirements of Section 302.04.

Water mains, water service lines, sanitary sewer pipe, and sanitary sewer force mains will be measured in linear feet of pipe through all valves and fittings, complete-in-place, and will be paid for at the contract unit price per linear foot. This price shall include excavating when not a specific pay item for the utility in question; testing; disinfecting; backfilling; compacting; dewatering; disposing of surplus and unsuitable material; sheeting and shoring; bedding material; installing

Trial Use and Comment

pipe; connecting to existing lines or manholes; fittings less than 16 inches in diameter; reaction blocking; concrete anchor block; watertight welds; restrained joints; abandoning or removing lines, manholes, and other appurtenances; and restoring property. Pipe of one size, except for cast iron and ductile iron pipe, shall be combined into one contract item for the respective size of water main and sanitary sewer pipe. The salvage value of abandoned materials shall accrue to the Contractor and shall be reflected in the contract unit price for the respective replacement facility.

Encasement pipe and casing pipe and concrete will be measured in linear feet, complete-in-place, and will be paid for at the contract unit price per linear foot. This price shall include excavating, dewatering, sheeting and shoring, blocking, installing pipe, grouting, concrete encasement, reinforcing steel, masonry blocks, watertight bulkheads, backfilling, compacting, disposing of surplus and unsuitable material, and restoring property.

Jacked encasement pipe will be measured and paid for in accordance with the requirements of Section 302.04. This price shall include excavating, backfilling, disposing of surplus and unsuitable material, sheeting and shoring, blocking, bulkheads, and jacking.

Concrete encasement will be measured in linear feet of encased pipe or cubic yard of concrete, complete-in-place, and will be paid for at the contract unit price per linear foot or cubic yard. This price shall include excavating, sheeting and shoring, concrete, reinforcing steel, backfilling, compacting, and disposing of surplus and unsuitable material.

Sanitary service lateral connections will be measured in linear feet, complete-in-place, from the center line of the sewer main to the point of connection of sanitary service lateral and will be paid for at the contract unit price per linear foot. This price shall include excavating, backfilling, compacting, disposing of surplus and unsuitable material, sheeting and shoring, connecting to existing service lateral, and restoring property.

Sanitary drop connections will be measured in linear feet, vertical measure, complete-in-place, from the invert of the upper inlet pipe to the invert of the lower inlet pipe and will be paid for at the contract unit price per linear foot. This price shall include pipe and fittings, concrete, reinforcing steel, connections to sewer lines and manholes, excavating, bedding material, backfilling, compacting, disposing of surplus and unsuitable material, and restoring property.

Sanitary sewer manholes, frames and covers, and watertight frames and covers will be measured and paid for in accordance with the requirements of Section 302.04.

Trial Use and Comment

Sewer cleanouts (main or lateral) will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each. This price shall include fittings; riser pipe, frame, cover, and box; excavating; backfilling; compacting; disposing of surplus and unsuitable material; and restoring property.

Reconstruct existing sanitary manhole will be measured in linear feet, vertical measure, from the point of the removed section to the top of masonry on which the frame and cover is placed and will be paid for at the contract unit price per linear foot. This price shall include removing, salvaging and resetting frame and cover, reconstruction of manhole, new materials, excavation, backfilling, compaction, disposal of surplus of unsuitable material and restoring property.

Fire hydrants will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each. This price shall include excavating, dewatering, backfilling, compacting, connections, concrete blocking, pipe straps, crushed stone drain, disposing of surplus and unsuitable material, restoring property, and testing.

Water meters and boxes; water meter boxes and yokes; valves and boxes or manholes; and tapping sleeves, valves, and boxes or manholes will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each. This price shall include excavating, backfilling, and restoring property.

Bends, plugs or caps, reducers, and branches (tees, wyes, and crosses) will be measured in units of each and will be paid for at the contract unit price per each. This price shall include restrained joints, excavating, reaction blocking, testing, backfilling, sheeting and shoring, watertight welds, abandoning or removing existing lines as noted on the plans, and restoring property.

Offsetting existing pipe will be measured in linear feet of pipe parallel to the flow line between tie-in points, complete-in-place, and will be paid for at the contract unit price per linear foot. This price shall include fittings, couplings, restrained joints, excavating, testing, disinfecting, backfilling, compacting, dewatering, disposing of surplus or unsuitable material, sheeting and shoring, bedding material, installing pipe, connecting existing lines as noted on the plans, reaction blocking, watertight welds, abandoning or removing existing lines as noted on the plans, and restoring property.

Leak detectors will be measured in units of each. This price shall include pipe, return bends, bird screens, clamps, excavating, backfilling, and restoring property.

These prices shall include containing or pumping sewage during adjusting or connecting existing sewers and providing and maintaining adequate and safe passage over excavations to accommodate pedestrians or vehicles as directed by the Engineer.

Trial Use and Comment

Payment will be made under:

Pay Item	Pay Unit
Water main (Size and type)	Linear foot
Water service line (Size)	Linear foot
Encasement pipe (Size and type)	Linear foot
Casing pipe and concrete (Size)	Linear foot
Leak detector (Standard)	Each
Bend (Size)	Each
Reducer (Size)	Each
Plug or cap (Size)	Each
Branch (Size)	Each
Offset existing pipe (Size)	Linear foot
Valve and (box or manhole) (Size and type)	Each
Tapping sleeve, valve, and (Box or manhole)	Each
Fire hydrant (Standard and type)	Each
Water meter and box (Size)	Each
Water meter box and yoke (Size)	Each
Jacked encasement pipe (Size and type)	Linear foot
Sanitary sewer pipe (Size and type)	Linear foot
Sanitary service lateral connection (Size)	Linear foot
Sanitary sewer force main (Size)	Linear foot
Bend-force main (Size)	Each
Reducer-force main (Size)	Each
Plug or cap-force main (Size)	Each
Branch-force main (Size)	Each
Offset existing pipe-force main (Size)	Linear foot
Sanitary sewer manhole (Standard)	Linear foot
Manhole frame and cover (Standard)	Each
Sanitary drop connection	Linear foot
Valve and (box or manhole) (Size and type)-force main	Each
Tapping sleeve, valve, and (box or manhole) (Size)-force main	Each
Concrete encasement (Standard)	Linear foot or Cubic yard
Reconstruct existing sanitary manhole	Linear foot
Watertight manhole frame and cover (Standard)	Each

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review plans, field conditions, specification requirements, material documentation, construction procedures, measurement, and payment.
- Discuss material storage and handling methods with Contractor.
- Review excavation methods and safety with Contractor.

Start:

- Ensure approved materials are utilized and appropriate invoice and test coverage has been provided.

Continuous inspection:

- Pipe and structure installation, testing, backfill, and tie-ins.
- Measure pipe and appurtenances in accordance with contract requirements and record daily.
- Ensure approved materials are utilized throughout the installation process.

Final Inspection:

- Ensure all leak, bacteria, and density testing has been performed in accordance with contract requirements.

Documentation Required:

- Daily diary should indicate length and location of measurements and quantity for payment.
- Copies of all invoices, testing certifications, and manufacturer certifications should be on file in the project records.

IV. REVIEW QUESTIONS

Spec. #	
520.02	Do water and sewer materials conform to the requirements of this section?
520.05	Have all water mains and accessories been disinfected prior to tie-ins in accordance with AWWA C651?
520.03(1)	Have all underground utilities and obstructions been located in accordance with the general provisions of Section 105.08, Cooperation with Regard to Utilities? (2002 - Ref Section 105.07)
520.03(2)	Have the trenches been opened a sufficient distance ahead of the work or test pits made to verify the exact locations and inverts of the utility to allow for changes in line of grade?

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520.03(3)	Have provisions been made to maintain adequate and safe passage over excavations to accommodate pedestrians or vehicles?
520.03(a)	Are water supplies protected from contamination by sewage in accordance with this section?
520.03(b)	Is excavation, backfill and compaction performed in accordance with Section 302 and this section?
520.03(C)	Are pipe and fittings inspected for cracks and defects in accordance with this section?
520.03(d)	Is pipe placed in accordance with this section?
520.03(e)	Is pipe for fittings or closure pieces cut in a neat and orderly manner without damage to the pipe?
520.03(f)	Is pipe joined in accordance with this section?
520.03(g)	Are plugs, caps, tees, and bends placed in accordance with this section?
520.03(h)	Is encasement pipe installed in accordance with the Section 302, Drainage Structures?
520.03(i)	Prior to installation, has existing pipe to be encased been cleaned and foreign material removed?
520.03(j)	Are valves, valve boxes and manholes constructed in accordance with this section?
520.03(k)	Are fire hydrants set in accordance with this section?
520.03(l)	Are corporation stops made while the main is under pressure and at a 45-degree angle to the horizontal plane?
520.03(m)	Is concrete encasement constructed in accordance with Section 302 Drainage Structures, 303 Earthwork, 316.04(j) Curing Concrete Pavement, 404 Hydraulic Cement Concrete Operations and 406 Reinforcing Steel?
520.03(n)	Are water meters and yokes placed in accordance with this section?
520.03(o)	Is jacked encasement pipe installed in accordance with Section 302, Drainage Structures for Jacked Method of Pipe Culverts?
520.03(p)	Are sanitary service lateral connections made in accordance with this section?
520.03(q)	Are sanitary manholes and manhole frames and covers constructed in accordance with Section 302, Drainage Structures?
520.03(R)	Are sanitary drop connections constructed in accordance with Section 302 Drainage Structures, 303 Earthwork, 404 Hydraulic Cement Concrete Operations and 406 Reinforcing Steel?
520.03(s)	Are sewer cleanouts constructed in accordance with Section 302 Drainage Structures, 303 Earthwork, 404 Hydraulic Cement Concrete Operations and 406 Reinforcing Steel?
520.03(t)	Is conveying sewage performed in accordance with this section?
520.04(a)	Have water mains and appurtenances been tested for leakage in accordance with this section?
520.04(b)	Have gravity sanitary sewers been tested for leakage in accordance with this section?
520.04(C)	Have force main sanitary sewers been tested for leakage in accordance with this section?
520.04(d)	Are offsets of existing pipes placed in accordance with this section?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Materials Delivery**
• **Survey layout**
• **Start of excavation, bedding material (if required)**
• **Pipe installation (including structures, blocking, etc.)**
• **Pressure testing and bacteria sampling (if applicable)**
• **Backfill and tie-ins**

Trial Use and Comment

SECTION 521 – MAILBOX POST

I. INTRODUCTION:

This section provides guidance for the installation of mailbox posts, which will allow safe access for both the mail carrier and mail recipient to access the box, minimize the exposure to vehicular traffic, and allow pedestrians safe passage without excessive exposure to protruding objects.

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a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

521.01—Description

This work shall consist of replacing mailbox posts shown on the plans or designated as hazardous objects by the Engineer.

521.02—Materials

Post and mounting hardware shall conform to Standard Drawing RFD-1.

521.03—Procedures

The Contractor shall be responsible for damages incurred through negligence to existing mailboxes not designated for replacement during their removal, at their temporary location, and during resetting in accordance with the requirements of Section 105.15.

The placement and installation of the mailbox to be replaced shall be in accordance with Standard Drawing RFD-1 and the Department's Asset Management Division's *Best Practices Manual.*

Mailbox post types shall be single, double, or multiple.

The property owner may elect to furnish a new mailbox in lieu of remounting the existing mailbox, in which case the installation shall be at no additional cost to the Department or property owner.

Comment [1805]: Right Materials

Comment [1806]: Right Way / Right Time / Right Location / Right Documentation

Trial Use and Comment

521.04—Measurement and Payment

Mailbox posts will be measured and paid for at the contract unit price of each, complete-in-place, for the type specified. Price bid shall include furnishing and installing mailbox post and hardware; mounting the existing or new mailbox(s); removing the existing mailbox(s) and post(s); temporary relocation; setting new post; disposal of existing post(s); and for all materials, labor, tools, equipment, and incidentals necessary to complete the work.

Comment [1807]: Right Quantity / Right Pay

Payment will be made under:

Pay Item	Pay Unit
Mailbox post (Type)	Each

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review project prior to construction and note location of mailbox posts prior to removal and grading of the project.

Start:

- Confirm proposed dimensions of roadway and shoulder construction to ensure that the width from the edge of pavement to the face of the mail box will allow proper construction of the drainage ditch and back slope within the right of way.

Intermittent Inspection:

- Ensure that the turnouts are constructed with the correct taper length and offset from the edge of pavement, and that the turnout has an all weather surface.

Final Inspection:

- Ensure that the mailbox post is set plumb, that the box itself is level, and that the miscellaneous hardware meets the requirements detailed in Standard Drawing RFD-1.

Documentation Required:

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- Plans, Contract, and Standard Drawing RFD-1.
- Project Diary and Materials Notebook documentation.

IV. REVIEW QUESTIONS:

N/A

V. CRITICAL INSPECTION POINTS

• **Ensure Proper Turnout Geometrics**
• **Ensure Proper Installation of Mailbox and Post**

Trial Use and Comment

SECTION 601 – SELECTIVE TREE REMOVAL, TRIMMING, AND CLEANUP

I. INTRODUCTION:

With the approval of the Engineer or District Environmental Manager certain trees may be removed to lessen maintenance work and, at the same time, attain a variety of scenic effects. Undesirable trees may be removed to benefit the growth of more beneficial trees. A dense stand may be thinned to this advantage. The desired results of selective tree removal are natural scenery and orderly appearance. The results may be more natural and pleasing than from new plantings.

The Contractor will first remove the dead trees along with those designated as unwanted. Other trees to be removed for scenic effect should be marked. A clear understanding of the effect desired will eliminate the need for returning to select additional trees for removal.

When spraying herbicide, extreme caution is to be taken to spray areas only when wind is not blowing to avoid damaging nearby crops and trees. Also, there are certain types of grass seed that will be killed when herbicide spray is used. A note is usually on plans as to the type of seed which will be affected. If not, check with the Construction Manager or the District Environmental Manager.

Flowering trees (dogwood or evergreens such as holly and cedar) should not be disturbed. Shrubs such as wild azaleas should also be left. These species are designated by State law as desirable. The Inspector should learn to identify them.

Fruit trees should never be left in the median or in any area designated for selective thinning. Left to grow wild without the benefit of chemical spraying they will become diseased. This disease may be communicated to nearby orchards and damage marketable produce.

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a) Forms:

- **Intentionally Left Blank**

Trial Use and Comment

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

601.01—Description

This work shall consist of selective cutting and disposing of trees, shrubs, and vegetation to improve sight distance, create open vistas, or improve the appearance and condition of trees. This shall be accomplished by removing and disposing of rubbish and fallen and undesirable trees and shrubs, selective pruning, and spraying stumps with an approved herbicide to prevent sprouting.

601.02—Materials

Comment [1808]: Right Materials / Right Documentation

Herbicide shall conform to the requirements of Section 244.02(a).

601.03—Procedures

Comment [1809]: Right Way / Right Location

Trees and stumps shall be cut in such a manner that remaining stumps are not higher than 4 inches above the ground. Loose roots more than 1 inch in diameter and more than 1 foot in length shall be removed. Only those living trees and shrubs selected by the Engineer shall be removed. Trees to be removed shall be felled in a manner that will not damage the trees and shrubs to be preserved.

Debris shall be disposed of by burning or chipping or in accordance with the requirements of Section 106.04. Burning shall be performed in accordance with the requirements of Section 107.16. Fires shall be located and supervised so that they will not spread or damage vegetation. A mechanical chipper may be used, and the resulting chips spread thinly and uniformly within the immediate area or disposed of as directed by the Engineer.

(a) **Treating Stumps:** Stumps of living trees and shrubs shall be coated with an herbicide solution within 48 hours after they are cut. The exposed surface of stumps and exposed live roots shall be saturated with herbicide to the point of runoff.

Comment [1810]: Right Time

(b) **Trimming:** Branches and limbs that affect sight distance or the open vista and dead or diseased branches and limbs more than 2 inches in diameter that will hinder the healthy normal growth of trees shall be removed as designated by the Engineer. Cuts shall be made flush at the collar of the supporting trunk or limb.

The Contractor's operations and equipment used to perform selective trimming shall not damage trees and shrubs that are to remain. Climbing spurs or spikes shall not be used. Damage to the bark, limbs, and roots of trees and shrubs that are to remain

Trial Use and Comment

shall be repaired in a manner acceptable to the Engineer. Such repairs and the replacement in kind of those that cannot be satisfactorily repaired shall be at the Contractor's expense.

601.04—Measurement and Payment

Comment [1811]: Right Quantity / Right Payment

Selective tree removal, trimming, and cleanup will be measured in acres of surface area computed to the nearest 1/10 acre and will be paid for at the contract unit price per acre.

Payment will be made under:

Pay Item	Pay Unit
Selective tree removal, trimming, and cleanup	Acre

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review site to determine which tress are undesirable and mark them for removal.

Start:

- Establish method for disposing of debris that results from the Selective Tree Removal and/or Trimming, and ensure that all applicable environmental controls and permissions are in place prior to disposal.

Intermittent Inspection:

- Ensure that only those trees designated as undesirable are trimmed or removed.
- Ensure that herbicide spraying is done within 48 hours of cutting, if required.

Final Inspection:

- Ensure that cuts and trimmings are within the dimensions detailed in Section 601.03.

Trial Use and Comment

Documentation Required:

- Disposal Area permissions and approvals, if necessary.
- Project Diary and Materials Notebook Documentation.

IV. REVIEW QUESTIONS

N/A

V. CRITICAL INSPECTION POINTS

• **Review Location for Pre-marking of Trees**
• **Ensure Herbicide Spraying Within Required Timeframe**
• **Ensure proper cutting techniques**
• **Ensure proper disposal of debris**

Trial Use and Comment

SECTION 602- TOPSOIL

I. INTRODUCTION:

Topsoil is to be stripped (within limits of construction) and stockpiled within the right-of-way unless its presence will interfere with the orderly prosecution of the work. Topsoil should first be used from stockpiles located on private property. Any surplus topsoil remaining on private property after completion of the project topsoiling operations is to be moved by the Contractor onto the right-of-way and stockpiled, shaped and seeded as directed by the Engineer. Topsoil stored within the right-of-way will be available after the acceptance of the project for maintenance, erosion control, or use on landscape projects.

CONSTRUCTION METHODS

Handling and Placing Topsoil

Topsoil should not be handled when it is so wet that it will become densely compacted during its placement. Prior to placement of topsoil, the Inspector is to ascertain that there is no unauthorized change in kind or source of material.

Depth

Depth of topsoil may be determined by digging test holes at frequent enough intervals to assure that the minimum required depth shown on the plans is being placed.

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a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

602.01—Description

This work shall consist of applying topsoil in accordance with the requirements of these specifications and in conformity with the depths and limits shown on the plans or as established by the Engineer.

602.02—Materials

Comment [1812]: Right Materials / Right Location

Trial Use and Comment

(a) **Class A topsoil** shall conform to the requirements of Section 244.02(b)1.

(b) **Class B topsoil** shall conform to the requirements of Section 244.02(b)2.

602.03—Procedures

(a) **Submittals:** When Class B topsoil is specified, the Contractor shall submit soil test reports to the Engineer for Class B topsoil in accordance with the requirements of Section 244.02(b).

(b) **Preparing Areas to Receive Topsoil:** Unless otherwise designated on the plans or directed by the Engineer, areas designated to receive topsoil shall be graded, shaped, and then scarified or tilled by disking, harrowing, or other approved methods to a depth of approximately 2 inches. Topsoil shall be applied only when the subsoil is in a loose, friable condition. Subsoil on slopes that have been horizontally grooved in accordance with the plans shall not be loosened.

(c) **Applying Topsoil:** The loose depth of topsoil shall be sufficient to allow the area to conform to the elevations shown on the plans after topsoil settles. After topsoil has been applied, large clods, hard lumps, and stones larger than 3 inches in diameter; brush; roots; stumps; litter; and foreign material shall be removed from the area. Where residential or commercial yards exist, the size of the large clods, hard lumps, and stones shall not exceed 3/4 inch in diameter. Such areas shall be hand raked to provide a smooth yard suitable for mowing by a yard mower. When the topsoiling operation is complete, the area shall be in a condition to receive seed, sod, or plants without further soil preparation. Areas shall be seeded within 7 calendar days after topsoiling is completed.

602.04—Measurement and Payment

Topsoil will be measured in acres of surface area computed to the nearest 0.1 acre and will be paid for at the contract unit price per acre. For smaller areas, and/or as identified on the plans, topsoil will be measured and paid for at the contract unit price per cubic yard. Such areas will be identified and labeled on the plans for cubic yards of soil to be applied. This price shall include soil testing and provision of test reports; preparing areas to receive topsoil; furnishing, loading, transporting, and applying topsoil; finishing areas; and restoring damaged areas.

Payment will be made under:

Pay Item	Pay Unit
Topsoil (Class and depth)	Acre
Topsoil (Class and depth)	Cubic yard

Comment [1813]: Right Way

Comment [1814]: Right Documentation

Comment [1815]: Right Time

Comment [1816]: Right Quantity / Right Payment

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Ensure that the contractor has provided the soil test reports if Class B topsoil is specified.

Start:

- Ensure subsoil is properly prepared prior to placement of topsoil.
- Ensure areas for placement of topsoil are detailed or staked.

Intermittent Inspection:

- Ensure topsoil is being graded properly and to the proper depth.

Final Inspection:

- Ensure all deleterious material is removed from topsoil.
- Ensure areas are seeded within 7 days after topsoiling is completed.

Documentation Required:

- Soils test report for Class B Topsoil.
- Diary information to compute area or volume.
- Materials Notebook documentation.

IV. REVIEW QUESTIONS

602.01	Is topsoil spread only on designated areas to the depth shown on the plans or as established by the Engineer?
602.03(a)3	Is topsoil spread only when the subsoil is in a loose, friable condition?
602.03(b)	Are all areas designated to receive topsoil graded, shaped and then scarified or tilled by disking, harrowing, or other approved methods to a depth of approximately 2 inches?
602.03(c)1	Does the applied loose depth of the topsoil allow the area to conform to the elevations shown on the plans after the topsoil settles?
602.03(c)2	After applying topsoil, have large clods, stones > 3" in diameter, brush, roots, stumps, litter, etc been removed from the area?
602.03(c)3 [62000500]	Is the area seeded within 7 days after topsoil is applied?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Inspect Subsoil prior to placement**
• **Inspect for proper grading and depth of topsoil**
• **Ensure seeding is performed with 7 days**

Trial Use and Comment

SECTION 603- SEEDING

I. INTRODUCTION:

All varieties of seed delivered to the project must be in separate bags and accompanied by a certification. This affidavit should certify the lot number, number of pounds, percent germination, percent purity; percent weed seed, variety and kinds. All tests are to be conducted within the 6 month period prior to the season during which the seed is to be used. Prior to use, the inspector is to check to ascertain that the percent germination, percent purity, and percent weed seed conform to the plans and shall note such verification in the project diary.

Seeding materials stored on the job are to be protected from moisture, heat, and rodents. Kerosene and herbicides are also detrimental to germination and are not to be stored in the immediate vicinity of the seed. Seed contaminated by improper storage is not to be used.

The seed mixture will be shown on the plans. The Inspector should verify that the proper mixture is being used. The Inspector will document regular seeding (which includes mulch) or overseeding (which does not include mulch).

PROCEDURES

Drainage

Good drainage is essential to the successful growth of grasses. Depressions in the surface of slopes which will collect water are to be corrected prior to seeding.

Application of Lime

Liming is always a separate operation, prior to the application of seed or fertilizer. Regardless of the method used, limed areas must be "worked in" before other materials are applied. Lime must not be placed when the wind is so strong as to blow the lime away from the construction area because the rate of application may not be in conformance with the Specifications. The Contractor should be advised to change his construction method or stop the lime operation until weather conditions are more favorable.

Sowing Seed

Trial Use and Comment

The rate of seeding should be checked at the beginning of the seeding operation and frequently thereafter by comparing the area seeded with the measured quantity of seed applied. Seeding and fertilizing are usually accomplished by the hydraulic method since this method is the most economical and efficient. In this method seed and fertilizer are mixed in a tank of water to make slurry which is agitated and them pumped to a nozzle and sprayed onto the area to be seeded. The slurry must be agitated constantly during seeding operations to prevent separation of the materials and hence the application of an incorrect rate of fertilizer, seed, or mulch. If wood cellulose fiber is used as mulch, it may be added to the slurry. Straw is applied separately.

Record the amounts of each material, except water, placed in the slurry tank of the hydro-seeder. Mark the place where application of the load starts and where it ends. Measure the area. Simple calculations of the recorded data will provide the amount of each material applied to the area. This is the best way to be sure the desired coverage is achieved.

Areas designated for regular seeding are required to be covered with mulch. The mulch helps to anchor the seed and to retain moisture in the soil. Mulch may be either hay, straw, or the wood cellulose fiber type. Mulching of overseeded areas is not required. Hay and straw mulch are to be free from noxious weeds as far as possible. It should not be black and must be free from mold. If hay or straw mulch is placed accurately, the rate of application will be approximately 2 tons per acre (approximately l to l 1/2 inches loose depth) with not more than 10% of the area exposed. Hay or straw mulch must be applied within 48 hours after the seeding operation. It may be necessary to "anchor" the mulch to prevent the wind from blowing it away, by either tying it down with twine and stakes or by using an asphalt emulsion or commercial preparations suitable to anchor the mulch in place.

The asphalt is sprayed after the mulch is placed. The rate of application is usually from 0.025 to 0.10 gallons per square yard. Caution should be exercised in spraying the asphalt. If too much asphalt is placed, the seed will not germinate. If the film is too thin, the mulch will not be anchored.

Mulch and asphalt are to be immediately removed from the roadway, pavement shoulders and paved drainage ways. Mulch should not be allowed to clog drainage structures and other drainage ways.

Special commercial mulching materials may be used when approved or specified on the plans.

Seeding on Stabilized Shoulders

If the seeding on shoulders is to be done at the same time as on adjacent areas, they should be seeded in the same manner with the appropriate seed mixture.

Trial Use and Comment

The surface of the shoulder need only be loosened. Scarification of the shoulder is not desirable due to the stable nature of the surface; however, mulching and anchoring of the mulch is extremely important.

Temporary Seeding

When the grading operation is suspended for more than 15 days, in an area to be re-graded (uncompleted cut slopes, fill slopes and topsoil stockpiles), that area is to be fertilized, seeded and mulched with the mixture specified on the Roadside Development plans for that time of the year, as shown on the plans.

Seed mixture "P" is to be used only on areas that are to be re-graded and for that period of the year specified on the chart. If the finished grade has been completed in an area during the period when seed mixture "P" is required, the mixture from the previous period on the Roadside Development plan is to be used.

Protection from erosion during seasons of the year when temperatures are below 50^0 F is provided entirely by the mulch. The seed will, however, be held in place by the mulch until weather conditions are conducive to seed germination. Thus, a stand of grass will normally develop in the early Spring when conditions may be such that seeding operations cannot be performed.

METHOD OF MEASUREMENT

Fertilizer is to be measured in tons. Payment for fertilizer of other than the specified analysis is to be at the adjusted tonnage of equivalent nutrient value. Therefore, to equate used material to payment material, multiply the poundage used by the fertilizer conversion factor and convert to tons. Computations for equivalent fertilizer analysis are to be shown

The amount of lime, fertilizer and seed actually used on the project must be documented. The following procedures are to be followed:

Make spot checks of the Contractor's seeding operations to determine if the rates per acre are being applied as specified on the plans. Ensure that the Contractor makes adjustments as necessary.

Lime - Delivery tickets, signed by the Inspector, from material delivered to the project are to be used as a record. Transfer of excess materials to another project is to be made with the proper forms and recorded in project records.

Fertilizer - Delivery tickets, signed by the Inspector, from materials delivered to the project are to be used as a record with the same procedure as for lime.

Trial Use and Comment

Seed - The Inspector will remove the tag from each bag of seed used in the seeding operation and shall indicate the weight on the tag, if not given. When only a portion of a bag is used the tag will remain with the bag until the entire bag is exhausted. The Inspector will document regular seeding or overseeding in the daily diary.

a) Forms:

- C-25 – Source of Materials

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

603.01—Description

This work shall consist of furnishing and applying fertilizer, lime, mulch, and seed in the quantities specified for areas designated on the plans or selected by the Engineer.

603.02—Materials

(a) **Seed** shall conform to the requirements of Section 244.02(c).

(b) **Fertilizer** shall conform to the requirements of Section 244.02(d).

(c) **Lime** shall conform to the requirements of Section 244.02(e).

(d) **Mulch** shall conform to the requirements of Section 244.02(g).

603.03—Procedures

Unless otherwise specified, seeding operations shall be performed at the times specified in Sections 303.03(b) and 602.03(b). Seeding operations shall not be performed when the ground is frozen or when soil or weather conditions would prevent proper soil preparation and subsequent operations. When hydroseeding is performed, nozzles or sprays shall not be directed toward the ground in a manner that will cause erosion or runoff. The Contractor shall notify the Engineer at least 48 hours prior to beginning seeding operations.

(a) **Applying Lime:** Lime shall be uniformly applied to areas to be seeded at the rate of 2 tons per acre. Any approved method may be used.

Comment [1817]: Right time

Comment [1818]: Right Time

Comment [1819]: Right Way and right quantity

Trial Use and Comment

(b) **Preparing Soil:** After lime is applied, areas to be seeded shall be prepared in accordance with the following: Slopes 3:1 or flatter shall be loosened to a depth of approximately 3 inches by disking, harrowing, or other approved methods. Loosening of soil on excavated slopes steeper than 3:1 will not be required except to eliminate hard or crusted surfaces. Shoulders and embankment slopes steeper than 3:1 shall be loosened to a depth of approximately 1 inch. Clods, loose stones, and other foreign material larger than 3 inches in any dimension shall be removed and disposed of in accordance with the requirements of Section 106.04 or as approved by the Engineer. Gullies, washes, and disturbed areas that develop subsequent to final dressing shall be repaired before they are seeded.

Topsoil, when specified, shall be applied in accordance with the requirements of Section 602.

(c) **Applying Fertilizer:** When dry fertilizer is used, it shall be applied uniformly to the seeding areas at the time of seeding at the rate of 300 pounds of fertilizer per acre (approximately 45 pounds of nitrogen per acre or 1.0 pound of nitrogen per 1,000 square feet) or as directed by the Engineer. Slow release and slowly soluble fertilizer may be applied through a hydraulic seeder except for sulfur-coated urea (SCU). The method of application for fertilizer products will be approved by the Engineer prior to application of the fertilizer. When applied in liquid form or mixed with water, fertilizer shall provide the same value of nutrients per acre as specified for dry fertilizer. Fertilizer applied in liquid form shall be constantly agitated during application.

(d) **Applying Seed:** Regular seeding shall consist of uniformly applying seed, fertilizer, and mulch on prepared areas.

Overseeding shall consist of applying seed and fertilizer on areas prepared as directed by the Engineer.

Where temporary seeding is employed as a means of soil stabilization it shall consist of applying seed, fertilizer, and mulch in accordance with the rates specified in the plans or in Section 603.03 to stabilize areas on which grading operations are anticipated to be suspended for durations greater than 15 days. Where temporary seeding is required or directed by the Engineer, the cost for removal of vegetation once grading operations resume shall be included in the price of seeding.

For hydroseeding, seed shall be put in the mixture slowly to result in a uniform mixture before application. Hydroseeding mixtures shall be constantly agitated from the time of mixing until application on the seed bed and used within 8 hours from the beginning of mixing.

Comment [1820]: Right Way

Comment [1821]: Right Way

Comment [1822]: Right Way and right quantity

Comment [1823]: Right Way and Right Time

Comment [1824]: Right Way

Comment [1825]: Right material

Comment [1826]: Right payment

Comment [1827]: Right Way

Trial Use and Comment

If special seed is required in addition to the regular mixture, it will be furnished by the Department and shall be applied with the regular mixture at the Contractor's expense.

Leguminous seeds shall be inoculated or treated with approved cultures as specified by the manufacturer or directed by the Engineer before they are applied or mixed with other seeds to be applied. Seed shall be applied within 24 hours after treatment. When the hydroseeding method is used, leguminous seeds shall be treated with 5 times the amount of inoculant recommended by the manufacturer.

(e) **Applying Mulch:** Mulch shall be applied in a separate application within 48 hours after completion of the seeding operation. When straw or hay mulch is used, it shall be applied on seeded areas at the rate of approximately 2 tons per acre. When wood cellulose fiber mulch is used, it shall be uniformly applied at the rate of approximately 1,500 pounds net dry weight per acre. Mulch will not be required on overseeded areas.

Straw and hay mulch shall be applied to a uniform thickness in such a manner that not more than 10 percent of the soil surface will be exposed at the conclusion of the mulching operations. Wet straw or wet hay shall not be used. Straw or hay mulch shall be anchored to the seeded surface by spraying with wood cellulose fiber mulch at the rate of 750 pounds per acre; spraying with an emulsified asphalt at the rate of at least 100 gallons per ton of mulch in a manner that will protect adjacent property and pedestrian traffic areas; disking or punching the mulch partially into the soil; using approved netting; or using other materials or methods approved by the Engineer. The Contractor may use more than one method on the same project.

603.04—Measurement and Payment

Lime will be measured in tons and will be paid for at the contract unit price per ton.

Fertilizer will be measured in tons and will be paid for at the contract unit price per ton. When a grade different than that specified in the Contract is used, the tonnage quantity will be adjusted to the grade specified.

Seed will be measured in pounds of seed used and will be paid for at the contract unit price per pound. When bags of seed are transferred from project to project, certified scales shall be used for weighing the seed. Open bags will not be accepted for use.

Prices for seed, fertilizer, and lime shall include preparing seed beds; furnishing and applying seed; furnishing and applying mulch; and maintaining seeded areas until final acceptance.

Comment [1828]: Right Way

Comment [1829]: Right Way

Comment [1830]: Right Time

Comment [1831]: Right quantity

Comment [1832]: Right Way and Right Time

Comment [1833]: Right quantity

Comment [1834]: Right quantity

Comment [1835]: Right Way and right quantity

Comment [1836]: Right payment

Trial Use and Comment

Overseeding will be paid for at the contract unit price per pound of seed. This price shall include preparing seedbeds and furnishing and applying seed and additional fertilizer.

Mulch will not be measured for separate payment. The cost thereof shall be included in the price for seed.

Payment will be made under:

Pay Item	Pay Unit
(____) seed	Pound
(____) overseeding	Pound
Fertilizer (Ratio)	Ton
Lime	Ton

IV. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review specification requirements, material documentation, construction procedures, measurement, and payment.

Start:

- Area measured for payment and compute quantities of materials needed,

Continuous Inspection:

- Ensure proper grading and verify approved and adequate materials loaded into hydroseeder. Verify that contractor is placing material at a rate that is consistent with Specifications: Ensure they are covering all areas evenly and not just spraying all the material out of the tank in one area once they get to the end of a run.

Final Inspection:

- Collect green tag from each bag of seed, after signed by the Contractor, collect MSDS for each type of fertilizer on each delivery, ensure mulch is placed as required and monitor establishment.

Trial Use and Comment

Documentation Required:

- Source of Materials (Form C-25), invoices, MSDS for fertilizer, and green tags for seed.

IV. REVIEW QUESTIONS

603.03	Does seed, lime, fertilizer and mulch conform to the requirements of section 244.02? (Materials)
603.03(1)	Are seeding operations not performed when the ground is frozen or weather conditions would prevent proper preparation and subsequent operations?
603.03(2)	Did the Contractor notify the Engineer at least 48 hours prior to starting seeding operations?
603.03(a)	Is lime uniformly applied to areas to be seeded at the rate of 2 tons per acre?
603.03(b)1	After the application of lime, are 3:1 or flatter slopes loosened to a depth of approximately 3"?
603.03(b)2	After the application of lime, has the hard or crusted surfaces of excavated slopes, shoulders, and embankment slopes steeper than 3:1 been loosened to a depth of approximately 1"?
603.03(b)3	Is all material > 3" in diameter removed and disposed of in accordance with Section 106.04 Disposal Areas or as approved by the engineer?
603.03(b)4	Are gullies, washes, and disturbed areas that develop subsequent to final dressing repaired prior to being seeded?
603.03(c)	Is fertilizer uniformly applied in accordance with this specification or as specified by engineer?
603.03(d)1	Are hydroseeding mixtures constantly agitated and applied within 8 hours after mixing began?
603.03(d)2	Are leguminous seed inoculated before they are mixed with other seeds and applied within 24 hours of treatment?
603.03(d)3	Are leguminous seeds treated at 5 times the amount of the manufacturers recommendations when the hydroseeding method is used?
603.03(e)1	Is mulch applied within 48 hours after completion of the seeding operation?
603.03(e)2	When straw or hay mulch is used, is it applied uniformly at the rate specified?
603.03(e)3	When wood cellulose mulch is used, is it applied uniformly at a rate of approximately 1500 lb. (net dry weight) per acre?
603.03(e)4	Is straw or hay mulch applied to a uniform thickness so that no more than 10% of the soil surface is exposed?
603.03(e)5	Is straw or hay mulch anchored in accordance with this section?
603.03(e)6	Does the Contractor protect all adjacent property and pedestrian areas during the mulching operations?
603.04(1)	Does the Contractor furnish certified scales to weigh bags of seed transferred between projects?

Trial Use and Comment

603.04(2)	Does the Contractor maintain seeded areas until final acceptance of the project?

V. CRITICAL INSPECTION POINTS

• Measure area to receive seed, and compute quantity of materials needed.
• Witness materials loaded into hydroseeder.
• Collect signed green tags from each bag of seed and MSDS for fertilizer.
• Verify area receives adequate mulch, and that it is tacked.

Trial Use and Comment

SECTION 604—SODDING

I. INTRODUCTION:

Sod is a section of grass-covered surface soil held together by matted roots. This operation requires very close supervision and inspection to be effective.

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a) Forms:

- C-25 – Source of Materials

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

604.01—Description

This work shall consist of preparing sod beds; furnishing and placing sod; and furnishing and applying lime, fertilizer, topsoil, and water at locations designated on the plans or by the Engineer.

604.02—Materials

(a) **Sod** shall conform to the requirements of **Section 244.02(h)**.

(b) **Fertilizer** shall conform to the requirements of **Section 244.02(d).**

(c) **Lime** shall conform to the requirements of **Section 244.02(e).**

604.03—Procedures

(a) **Preparing Sod Beds:** Soil on which sod is to be placed shall be shaped to an even surface and graded to such an elevation that sod and adjacent surfaces will have a smooth contour.

Lime shall be uniformly applied to areas designated to receive sod at the rate of approximately 2 tons per acre.

Fertilizer shall be uniformly applied to areas designated to receive sod at the rate of 16 1/2 pounds of 15-30-15 fertilizer, or an equivalent quantity of 1-2-1 fertilizer, and

Comment [1837]: Right Way

Comment [1838]: Right quantity

Comment [1839]: Right quantity

Trial Use and Comment

10 pounds of ureaformaldehyde per 1,000 square feet. Following application of lime and fertilizer, the soil shall be thoroughly cultivated to a depth of 2 to 3 inches and sprinkled with sufficient water to moisten the cultivated soil.

(b) **Placing Sod:** Sod shall not be placed between June 1 and September 1 or at any time the ambient temperature is below 32 degrees F. Frozen sod shall not be placed, and sod shall not be placed on frozen soil. Sod shall be placed by hand, and joints shall tightly abut without overlapping. Open joints and gaps shall be plugged with sod that has been cut to the size and shape of the opening.

Sod shall be placed on sloping areas beginning at the bottom of the slope. Sod shall be placed in horizontal strips with the long edges of rectangular pads parallel to the contour. When practicable, horizontal joints shall be reasonably straight and vertical joints staggered. In areas where sod pads may be displaced by foot traffic during sodding operations, ladders or treaded planks shall be used.

Sod placed on slopes steeper than 2:1 shall be anchored in place with wood stakes driven flush with the top of the sod. Stakes shall be at least 8 inches in length with a cross-sectional area of approximately 1 square inch. The number and spacing of stakes shall be adequate to hold sod securely in place. Special attention shall be given to anchoring sod placed in drainage ditches, channels, and swales.

After sod has been placed, joints and gaps that were too small to be effectively plugged with sod shall be filled with loamy topsoil.

Sodded areas shall be watered thoroughly and rolled or tamped to press the root system of the sod into full contact with underlying soil.

Sodded areas shall be kept watered to maintain the life and growth of the sod until final acceptance.

604.04—Measurement and Payment

Sod will be measured in square yards of surface area, complete-in-place, and will be paid for at the contract unit price per square yard of surface area. This price shall include preparing sod beds; furnishing and applying lime, fertilizer, sod, and water; and maintaining sodded areas until final acceptance.

Payment will be made under:

Pay Item	Pay Unit
Sod	Square yard

Comment [1840]: Right Time and Right Way

Comment [1841]: Right Time

Comment [1842]: Right Way

Comment [1843]: Right Way

Comment [1844]: Right Way

Comment [1845]: Right Way

Comment [1846]: Right material

Comment [1847]: Right Way and right material

Comment [1848]: Right Way

Comment [1849]: Right Way

Comment [1850]: Right payment

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review specification requirement, material documentation, construction procedures, measurement, and payment.

Start:

- Measure area to receive sod and verify adequate seedbed preparation.

Continuous inspection:

- Obtain MSDS for fertilizer, verify proper seed bed preparation, and sod installation.

Final Inspection:

- Check for open joints and gaps, and verify that sodded areas have been tamped and watered.

Documentation Required:

- Source of Materials (Form C-25), invoices, and MSDS for fertilizer.

IV. REVIEW QUESTIONS

N/A

V. CRITICAL INSPECTION POINTS

• Verify that delivered material is from approved sources.
• Check the condition of the delivered materials.
• Check placement procedures.
• Verify that materials have been tamped and watered.

Trial Use and Comment

SECTION 605 – PLANTING

I. INTRODUCTION

Proposed planting plans are prepared by the Environmental Division primarily as a guide for locating plants. Questions or proposed changes are to be referred to the District Environmental Manager. It is important that the Inspector examine the plan location of plant material to see that the actual location on the ground is compatible with local conditions, such as, having trees in the proper relation to utility lines or views. Special care should be exercised to avoid placing trees in poorly drained areas.

The Contractor is to stake the location of all plants for the approval of the District Environmental Manager. Adjustments in location may then be made by the Engineer to correct for conditions at the site.

PLANTING SEASONS

Frozen ground and dry conditions in the nursery or collecting field are unfavorable weather conditions for transplanting. During or following a drought, the plants may not have stored up sufficient moisture to survive transplanting and after planting watering may not be sufficient. Never permit any bare roots to be exposed to the air without protection, such as, moist burlap, mud or wet peat moss.

The Roadside Development sheets in the plans normally establish the dates for planting. An extension of planting dates in the spring may be granted by the Engineer depending upon the weather conditions.

STORAGE

It is desirable to discuss the planting schedule with the Contractor before any work is begun. This will verify the placing of orders for the plants and their schedule of deliveries. There should be no laxity about requiring the Contractor to give advance notice of plant deliveries. Delivery tickets prepared by the shipper are to be furnished.

Before any plants are delivered, it should be determined whether a "heeling in" space will be required to store plants temporarily. If required, the trenches are to be opened up to avoid all possible delays when the plants arrive. "Heeling in" trenches should preferably be of lengths and depths to accommodate the shipment unless they can be conveniently dug concurrently with the "heeling in". The Contractor should open plant bundles and lay out the plants separately, backfill over the roots, compact the soil reasonably well over the roots and watch afterwards for settlements or cracks which would permit air to reach the roots.

PLANTING

Trial Use and Comment

Plants may settle and leave the roots too deep below the surface. A 3-foot ball may settle an inch and a 5-foot ball may settle 2 inches. Allow for such a settlement with large bare root plants and all balled stock. A large proportion of plant losses in heavy soil have been attributed to planting too deep. Roots of bare root plants should be spread in the same position in which they have been growing. The appearance of injured roots is justification for rejection.

Paper or pottery containers of potted plants are to be removed before planting, unless a "grow-through" type of container is used.

Backfilling: Wet soil should not be used for backfill because when compacted the air spaces would be too greatly reduced. It is desirable to backfill half the way, then fill the pit with water. After the water soaks away, the backfill can be completed. Backfilling should also be carefully done under balled material to prevent air pockets.

A mound of soil around the edge of each pit is generally formed after planting to serve as a cup to hold water during maintenance. Each plant should be thoroughly watered after backfilling.

STAKING AND GUYING

"Staking" is the use of one or more stakes set approximately parallel with the trunk of the tree to support it. "Guying" is supporting trees by three or more wires fastened to stakes. Staking and guying are shown in the Standards.

Staking or guying, where required, must be done immediately after or concurrently with planting operations. This prevents serious damage to the root system of unsupported trees which can result from any swaying of the top due to wind action. The guy wires are to remain in place until the trees are well established.

Staking

The intent of the Specification is that stakes are to be driven so that plant balls are not injured. Single stakes should be placed on the side to the prevailing wind. Double stakes appear best when parallel to the pavement.

Guying

Stakes or deadmen for guys are to be spaced equidistant around the tree. Stakes are to be driven in the ground at such an angle that each stake will be approximately perpendicular to its guy wire. On completion of the installation, all guys should be tight without having used more than half of the possible "take up" of turnbuckles or by driving stakes flush.

Trial Use and Comment

PRUNING

Pruning is to be accomplished within 48 hours after planting. A major portion of the pruning may be permitted while the plants are heeled in.

Whenever a plant is transplanted, some roots are necessarily lost. A proportionate amount of the top branches should be removed to balance this root loss. Side branches of young trees should be cut back, not thinned out. In general, 1 /3 of the branches should be removed in the process of cutting back and shaping rather than by thinning.

The leaders of single-stemmed trees should never be cut. Most shrubs and some vines may be pruned by removing older canes and intersecting branches only. Others need only heading back for some of the branches.

PERIOD OF ESTABLISHMENT

Watering is the most important maintenance item. It should be done as soon as there is any deficiency of rainfall, such as a week without rain, except when the plants are dormant. Excess watering can be injurious; roots kept too wet will show a blue color and give off an odor of decay.

Of next importance is weeding. Weeds affect the moisture supply for the plants. Hand weeding should be done by pulling rather than by cultivating.

Inspection should be made to determine damage by insects or disease. This is particularly important during the last part of May and early June when insects are prevalent.

Guy wires and cables must be kept tight.

GUARANTEE

Probably no part of the Specifications for planting is subject to a greater range of interpretation than such phrases as "a satisfactory living condition," or "in an unhealthy or badly impaired condition." The Engineer must know what is meant by these phrases in relation to each kind and size of plant in the contract. It is not enough that the plants be alive. If they are not in a healthy growing condition, there will be such evidence as an excess quantity of dead twigs, relatively few and small buds, a scarcity of leaves, small leaves, or leaves which are not of a healthy color. Dead and rejected plants must be promptly removed from the site.

METHOD OF MEASUREMENT

Project records should accurately denote the scope of the daily work and the reason for rejection of any plants. The shipping list furnished by the Contractor or the list accompanying deliveries from the heeling-in ground may be used for determining the

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type and number of plants received and planted. The list is to be signed by the Inspector and made a part of the project records.

At the end of each day, the number of units satisfactorily planted are to be entered in the project diary.

Wetland Mitigation Construction

GENERAL

Wetland mitigation construction requires close coordination between the Department's construction and the environmental staffs to ensure that the project goals of creating a successful wetland mitigation site and all permit requirements are met. The Project Inspector will fulfill the daily responsibilities of overseeing the Contractor's construction activities. The Project Inspector will receive technical assistance and direction from the Environmental Representative assigned to the site by the District Environmental Manager. The Environmental Representative will provide technical assistance and direction to the Project Inspector to ensure attaining the goals and objectives of the mitigation site design.

The Special Provisions describe site-specific construction and permit concerns that must be reviewed prior to construction. Another document that should be reviewed prior to construction is the Mitigation Narrative. The Project Inspector should contact the Environmental Representative to review this narrative. Developed to meet permit requirements, the Mitigation Narrative can provide valuable insight into the final site design and a detailed description of the environmental considerations, including key design components, the goals and objectives of the mitigation, intended water source and any design constraints that may affect the success of the site.

Documentation – All site reviews by the Environmental Representative during the contract period (including the Establishment Period) will be documented with a Mitigation Site Review Report (EQ-501), which will be immediately provided to the Project Inspector. All key decision points (itemized in Coordination below) will be documented, as appropriate. In the event that the Environmental Representative does not approve of a particular proposal by a Contractor, the Environmental Representative will work with the Contractor **through the Project Inspector** and attempt to resolve any issues in the original proposal that may have prevented approval. A Project Inspector's Checklist for Wetland Mitigation Sites is included at the end of the section as a guide for use by the Project Inspector and Environmental Representative.

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COORDINATION

The Project Inspector should contact and coordinate with the Environmental Representative regarding the construction of the wetland mitigation site(s) at the following points:

Project Showings

The Environmental Representative will present the general aspects of the wetland mitigation work in the contract and discuss relevant estimated contract quantities, methods of payment, site access, protection areas and other specific considerations or restrictions noted in the contract documents including water quality permits special provisions which potential Contractors should consider in their bid proposals.

Pre-Construction Conference

The Environmental Representative will discuss design details of the wetland mitigation work, and such items as permit requirements, sequence of construction, clearing limits, erosion and siltation control, storm water management, time of year restrictions, sources and handling of materials, site access, grading tolerances, soil amendments, plants and planting materials, planting procedures and seasons, plant establishment period, maintenance, inspections, and basis of work acceptance. The Environmental Representative will also address any technical questions the Contractor may have about the work and consider any proposed changes in the specified nature or sequence of the work. The Project Inspector will schedule a field review of the wetland mitigation site with the Contractor and the Environmental Representative before work begins. This field review will be used to confirm clearing limits for the mitigation work to discuss protection measures for any areas not to be disturbed, and to discuss any other aspect of the work before proceeding. The District Environmental Manager will ensure that flagging is placed as necessary any areas in the vicinity of the work that are to remain undisturbed by construction activities.

Source of Materials

Upon receipt from the Contractor, the Project Inspector will submit the Contractor's proposed sources of materials (Class B Top Soil, organic soil amendments, plants, seeds, and planting materials such as tree shelters, mulch, etc.) to the Environmental

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Representative for review and approval. (Note: the Contractor's submittal of his proposed list of sources for plant/seed material for wetland mitigation work is generally required by contract note or special provision within three months of the contract award.) Wetland seed providers shall obtain VDOT Green Tag certification, in accordance with special provisions and VDOT guidelines on nonstandard seeds. Organic amendments must meet specifications and associated laboratory test requirements described in Special Provisions prior to acceptance.

The Environmental Representative may inspect such materials as Class B Top Soil and organic soil amendments, if specified in the contract, at the proposed sources and require laboratory tests of such materials to ensure that contract requirements would be met prior to approving the sources.

Commencement of Construction

The Project Inspector shall send a copy of the Contractor's progress schedule (including revisions) for commencing wetland mitigation work to the Environmental Representative when available. The Environmental Representative will review the staked clearing limits for the mitigation work including construction access, staging, and stockpile areas prior to the Contractor commencing any clearing and grubbing activities. The Project Inspector will also notify the Environmental Representative within two business days of the commencement of earthwork operations in the wetland mitigation site(s).

Plan Changes

The Project Inspector will request the Environmental Representative review and approval of any Contractor proposal that would, by intention or effect, modify the design, project limits, hydrology, drainage, construction sequence, approval points and timing of or requirements for project completion as specified in the contract documents. Prior to implementation, the Project Inspector will secure written approval of the Environmental Representative for any adjustments proposed by the Contractor to the specifications or previously approved procedures, including, but not limited to, changes of grades or construction methods, wetland planting period, planting pattern and density, or plant installation and maintenance procedures. The Environmental Representative will coordinate and review proposed plan changes with the Mitigation Plan Project Manager and with regulatory agencies as necessary prior to approving changes to the plans or Specifications.

Requests for Substitutions

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Upon receipt from the Contractor, the Project Inspector will transmit all requests for any substitutions or adjustments to the materials or the sources of the materials to the Environmental Representative for approval before taking any action on the requests.

Confirmation of Subgrade Elevations

The Project Inspector will notify the Environmental Representative when the Contractor completes grading to the sub-grade elevation(s) of the wetland mitigation site. Prior to allowing any further work such as loosening the sub-grade material (if specified) or backfilling to the final design grade, the Inspector will request the Environmental Representative to review and approve the sub-grade elevation(s) or establish a modification of the sub-grade elevation(s) within two business days. On larger sites (greater than 1 acre), the Project Inspector will notify the Environmental Representative when the first portion of the site reaches the sub-grade elevation to minimize possible re-work.

Confirmation of Final Grade

Upon completion of the final grade of the wetland mitigation site, and before any planting or seeding of the wetland planting area, the Project Inspector will ensure that the Contractor performs an as-built topographic survey confirming that design grades are within specified tolerances, as stated in the design plans or special provisions. The Project Inspector will provide the Environmental Representative with a copy of the survey for the Environmental Representative to secure releases from the regulatory agencies. Following the receipt of the releases, the Environmental Representative will notify the Project Inspector that the Contractor may commence permanent site stabilization with the specified wetland seed mixture, as required by the water quality permit.

Disturbances of Approved Final Grades

The Project Inspector will require the Contractor to avoid the use of equipment that could rut, compact, pollute or otherwise harm the planting area. Any proposal by the Contractor to use such equipment in the planting area will be reviewed and approved by the Environmental Representative. The Contractor, at no additional cost to the Department, will repair damages to the final grade of the planting area caused by his use of equipment. Any discing or ripping after approval of final grades that is specified in a special provision to reduce soil compaction prior to seeding or planting operations, is not included in this prohibition.

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Hydrologic Monitoring Devices

The Inspector will notify the Environmental Representative when the locations of all hydrologic monitoring wells and are staked in accordance with the approved hydrological monitoring plan if installation of these devices is a contract item.

Pre-planting Hydrologic Monitoring

Pre-planting hydrologic monitoring by the Department is required by permit condition and must be conducted during the first three months of the growing season following final grade approval. The Environmental Representative will notify the Project Inspector when the site has been approved by the regulatory agencies for planting during the following planting season as required by the water quality permit. As noted by contract note or special provision, the regulatory agencies may require additional monitoring to confirm adequate soil moisture before releasing all or portions of the site for the planting.

Plant Material Inspection

The Project Inspector will notify the Environmental Representative at least two business days in advance of delivery of plant materials to the mitigation site. The Environmental Representative will then arrange to inspect the plants prior to installation. Plants in poor condition or otherwise not meeting contract requirements or originating from unapproved sources will generally be rejected. The Project Inspector may submit to the Environmental Representative a request from the Contractor that the Environmental Representative inspect plant materials that have been set aside and designated for use on the wetland mitigation site at previously approved, local sources. Such off-site inspection of plant material may be requested to avoid transport of material to the mitigation site, which may not meet the contract specifications. Should the Environmental Representative agree to inspect material off-site for the convenience of the Contractor, the Environmental Representative reserves the right to be provided with two business days notice prior to actual delivery to the mitigation site and to re-inspect and possibly reject material on-site that does not meet specifications.

Planting Inspection

The Project Inspector will notify the Environmental Representative when the Contractor begins installing plants on the wetland mitigation site and request an inspection of the planting procedures. The Project Inspector will also notify the Environmental Representative when all planting has been completed and request an inspection of the work. When the Environmental Representative is satisfied that the Contractor has

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performed the planting satisfactorily in the wetland mitigation area, he will provide the Project Inspector with written approval for the commencement of the Plant Establishment Period.

Establishment Period

The Inspector may request assistance at any time during the Establishment Period (normally two years in length) if there are questions about the plantings receiving proper care or required maintenance, or if the Inspector is concerned about any other aspect of the site such as stability of side slopes, wildlife browsing, flooding damage, invasive species, etc. on the site.

Final Planting / Mitigation Site Inspection

At the end of the Establishment Period when the Contractor and the Project Inspector believe the Site is ready, the Project Inspector will request that the Environmental Representative participate in conducting a Final Inspection of the wetland mitigation site. The Environmental Representative will note any discrepancies in the plantings or the maintenance of the site as a whole to the Project Inspector and specify any necessary remedial work by the Contractor in the mitigation area. Upon the Environmental Representative agreement that the Contractor has performed all work in the wetland mitigation area satisfactorily, the Project Inspector may notify the Residency Administrator that the mitigation work is complete.

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INSPECTOR'S CHECKLIST FOR WETLAND MITIGATION SITES

Project Number: _____ **Inspector:** _____

Project Location: _____

The Project Inspector overseeing construction of mitigation site(s), will receive technical assistance and direction from the Environmental Representative who is familiar with the design, goals and constraints of the work. The Project Inspector will contact the Environmental Representative at the following points to provide information or to seek technical guidance for the construction of the mitigation site:

☐ 1. Project Showing, Pre-Construction Conference, and preliminary site review - Request attendance of Environmental Representative when the meetings are scheduled.

☐ 2. Commencement of Construction - Notify Environmental Representative when a date is established and provide construction schedule.

☐ 3. Staking of Clearing Limits, including site access, staging and stockpile areas - Notify Environmental Representative when completed.

☐ 4. Non-Disturbance Areas - Request that any natural or cultural resources not shown on the plans that may be in the vicinity of anticipated construction activities are clearly identified by Environmental Representative with flagging.

☐ 5. Sub-Grade - Notify Environmental Representative when the Contractor achieves sub-grade elevations. If the site is greater than 1 acre, notify Environmental Representative when the first portion of the site will reach the specified sub-grade elevation before proceeding with filling and grading to final elevations.

☐ 6. Soil Permeability Tests – When required, provide Environmental Representative with the results of any permeability tests of the sub-grade when testing is specified by special provision.

☐ 7. Organic Backfill (composted yard waste) - Provide Environmental Representative with laboratory test reports of any specified composted yard waste to be used as an amendment of topsoil for review and approval prior to use.

☐ 8. Final Grades - Provide Environmental Representative a copy of As-Built Survey when final grading is completed for review and approval. (On larger sites, Environmental Representative may approve phasing of backfilling of sub-grade areas to final grades & As-Built Surveys).

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☐ 9. Seeding and Planting - Notify Environmental Representative when temporary or permanent seeding and planting are scheduled.

☐ 10. Use of Equipment - Notify Environmental Representative before Contractor is allowed to use any equipment on the final grades that might disturb or compact the planting surfaces.

☐ 11. Ground Water Monitoring Wells – If wells are to be installed by the Contractor, request Environmental Representative to review the staked locations of wells (based on an approved plan) and notify Environmental Representative when installation of wells is scheduled.

☐ 12. Plan Changes - Notify Environmental Representative of any proposed adjustments to site design, drainage, the planting scheme or materials so that he/she may review and approve such adjustments prior to implementation.

☐ 13. Sources of plant and planting materials - Provide Environmental Representative with a copy of the Contractor's proposed sources of plant and planting materials for review and approval.

☐ 14. Delivery of plant and planting materials - Notify Environmental Representative within two business days of scheduled delivery so the Environmental Representative can arrange to be on site to approve or reject such materials.

☐ 15. Beginning of Establishment Period - Request Environmental Representative review and approval of the completed planting work to begin the Establishment Period.

☐ 16. Two-Year Establishment Period - Notify Environmental Representative of any problems or concerns with site conditions, Contractor's care of the wetland planting or maintenance of the mitigation site during the Establishment Period.

☐ 17. Termination of Establishment Period - Notify the Environmental Representative when the Contractor believes the Establishment Period can be terminated and request the Environmental Representative to participate in a final inspection of the wetland mitigation site.

☐ 18. Replacements & Corrections – Notify Environmental Representative when the Contractor has completed any required replacements of plant material and request concurrence on termination of the 2- Year Plant Establishment Period.

☐ 19. Request concurrence from the Environmental Representative that the Contractor has satisfactorily completed any other adjustments or corrections within the site that were identified by the Environmental Representative at the Final Inspection (such as ground stabilization of adjacent areas and removal of E. & S. controls) prior to releasing the Contractor from all contract obligations for the mitigation site.

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a. Forms:

- C-25 – Source of Materials

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

605.01--Description

This work shall consist of furnishing and planting trees, shrubs, vines, and other plants of the kinds, sizes, and quantities specified on the plans or by the Engineer and maintaining and replacing plants as specified herein.

605.02--Materials

(a) **Plants** shall conform to the requirements of Section 244.02(i).

(b) **Drainage stone** shall conform to the requirements of Section 204.

(c) **Composted Yard Waste** shall conform to the requirements of Section 244.02 (j).

(d) **Geotextile Drainage Fabric** shall conform to the requirements of Section 245.

(e) **Topsoil** shall conform to the requirements of Section 244.02(b)

(f) **Horticultural Grade Perlite** shall conform to the requirements of Section 244.02(j).

(g) **Tree Tubes** shall conform to the requirements of Section 244.02(j)

(h) **Tree Anchors, Staking and Guying Materials** shall conform to the requirements of Section 244.02(j)

(i) **All other Misc. Planting Materials** shall conform to the requirements of Section 244.02(j) and 244.02(k).

605.03--Procedures

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(a) **Documentation of Confirmed Order:** The Contractor shall submit documentation to the Engineer of a confirmed order of all plant materials 60 days in advance of the proposed planting operation. The documentation shall list the source(s) of supply, all species by common and botanical name, specific variety, and cultivar in the sizes reserved. When special requirements are listed on the planting summary sheet, such as "Specimen Quality," or "Specimen Street Tree", etc., the documentation shall certify that the species reserved meet those specific requirements. Once the Documentation of Confirmed Order is received, the Engineer reserves the right to require sample photographs of materials to be supplied. The Engineer also reserves the right to inspect and approve the selection of plant materials at the source of supply prior to delivery. In the event that specific materials are not available, the Contractor shall submit a request for substitutions in accordance with the requirements of (*e*) herein.

(b) **Planting Season:** The Planting Season shall be from November 1, through March 31, unless otherwise identified on the plans. The Contractor shall notify the Engineer 48 hours prior to beginning work. All sources of supply, materials, construction schedule, and methods of construction shall be approved by the Engineer prior to beginning work on the project. Plants requiring either spring or fall planting only will be designated on the plans.

(c) **Sources of Supply:** All plants shall be obtained from a nursery certified by a "Certificate of Registration" in accordance with The Virginia Department of Agriculture and Consumer Services (VDACS), or by a comparable agency responsible for nursery inspection and issuance of a "Certificate of Registration" from the State of origin. A copy of the certification shall accompany each separate delivery of plant materials to the project site, and shall be submitted to the Engineer.

(d) **Inspecting and Identifying Plants:** Plants will be inspected and identified in accordance with the *Standardized Plant Names* prepared by the Editorial Committee of the American Joint Committee on Horticultural Nomenclature. The Engineer may inspect plants at any time and place. Plants will be inspected immediately prior to being planted. If plants are installed prior to inspection and found to be unsatisfactory, they shall be replaced with approved plants at the Contractor's expense.

(e) **Substitutions:** No change in the quantity, size, kind, or quality of plants from those specified will be permitted without the written approval of the Engineer. When requesting permission to substitute, the Contractor shall submit to the Engineer written evidence in accordance with the requirements of (a) herein that the specified plants are not available and shall suggest substitute plants that conform to the requirements of the Contract. The Contractor shall indicate the reduced cost, if any, that will accrue to the Department as a result of the substitution. The Engineer may delete plants from the Contract in lieu of approving substitutions.

(f) **Layout:** Plant locations and outlines of bed areas to receive plants shall be staked or marked by the Contractor and will be inspected by the Engineer for approval prior to plant installation. The Contractor shall notify the Engineer a minimum of 48 hours prior to

Comment [1851]: Right documentation and Right Time

Comment [1852]: Right documentation and Right Way

Comment [1853]: Right Time

Comment [1854]: Right Time

Comment [1855]: Right material and Right Location

Comment [1856]: Right documentation

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Comment [1858]: Right Way

Comment [1859]: Right Location

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scheduling the inspection. Planting shall not be permitted until the Engineer has approved the staking layout. Unforeseen conditions such as the location of traffic signs, utilities and drainage items may necessitate adjustments in plant locations, and such adjustments will only be permitted when approved in writing by the Engineer.

(g) **Delivery:** The Contractor shall notify the Engineer at least 48 hours in advance of the anticipated delivery date for plants. A legible copy of the invoice showing the kinds and sizes of plants in each shipment shall be submitted to the Engineer. A copy of the current Certificate of Nursery Inspection from the State of origin shall accompany each shipment of plants.

Comment [1860]: Right Time and right documentation

(h) **Labeling:** Plant material delivered to the project shall be legibly identified with a waterproof label as to the genus, species, and size of the plants. When plants are in bales, bundles, boxes, or other containers, a legible label indicating the genus, species, size, and quantity of the plants shall be attached to each container. A minimum of 10 percent of each species in each shipment shall be so labeled. Failure to comply with this identification labeling will be cause for rejection.

Comment [1861]: Right Way

(i) **Transporting and Protecting:** Plants transported to the project in open vehicles shall be covered with suitable covers securely fastened to the body of the vehicle. Closed vehicles shall be adequately ventilated to prevent overheating plants. Plants shall be kept moist, fresh, and protected at all times.

Comment [1862]: Right Way

(j) **Storing:** When plants are to be stored, they shall be stored at a location approved by the Engineer. Plants stored for more than 30 days shall not be used unless approved by the Engineer. Unless the Engineer approves other methods of storage, bare-root plants that are not planted within 24 hours after delivery shall be heeled-in in a moist trench dug in the ground. Bundles shall be opened, and plants shall be separated and placed singly in the trench with the roots spread in a natural position. Roots of each layer of plants shall be immediately covered in a manner satisfactory to the Engineer with moist, pulverized soil; moist sawdust; or other approved material. Root-covering materials shall be kept moist at all times. Shade shall be provided as directed by the Engineer. At the discretion of the Engineer, balled material, container-grown material, and plants in plantable pots that are not planted within 48 hours of delivery shall have their root zone protected by wet sawdust or other approved material. Rejected plants shall be removed from the storage area within 24 hours of rejection or, with the written approval of the Engineer, may be marked with yellow paint or otherwise made readily identifiable. If rejected plants have not been removed or acceptably marked within 24 hours, the use of plants from the storage area will not be allowed until rejected plants have been removed or identified by marking.

Comment [1863]: Right Way and Right Time

(k) **Planting:**

1. **Underground and Aboveground Conditions:** It shall be the responsibility of the Contractor to have marked, the location of all underground utilities with Ticket Information Exchange (TIE) / (Miss Utility) and all other applicable underground

Comment [1864]: Right Way and Right Time

Trial Use and Comment

utility providers such as sewer and water service, and VDOT traffic signal cable prior to digging. The Contractor shall be responsible for locating and working around aboveground utilities. If underground obstructions or any other unforeseen subsurface or above surface conditions that could interfere with a utility or become detrimental to plant growth are encountered, the Engineer may require that plant pits be enlarged or relocated or that the plants be deleted from the contract.

2. **Planting Trees or Shrubs on Slopes Steeper than 3:1:** Drainage requirements for trees or shrubs on slopes steeper than 3:1 will be determined by percolation tests, with no more than 3 tests per slope, as designated by the Engineer. Slopes for this test are determined from cut and fill slopes shown on the cross sections. Percolation testing shall consist of the following: The Contractor shall auger holes that are 12 inches in diameter and 24 inches in depth. Three holes shall be distributed across the slopes vertically and horizontally. The Contractor shall fill the holes with water and allow them to drain. If soil is extremely dry, fill holes twice and allow to drain. Fill holes again and measure rate at which water percolates into the soil. Water in holes should recede at the rate of 2 inches per hour (minimum) or pit modification for improving drainage shall be required.

3. **Preparing Planting Pits for Trees and Shrubs:** Planting pits shall be excavated to meet the minimum requirements VDOT Road and Bridge Standards unless otherwise indicated on the plans by detailed drawings. Sides of pits that become plastered or glazed shall be scarified. Surplus excavation and unsuitable material shall be disposed of in accordance with the requirements of Section 106.04 or as otherwise approved in writing by the Engineer. Preparation of the planting medium (soil mix) shall utilize 3 parts of the original excavated soil from the digging operation thoroughly mixed with 1 part composted yard waste, except where linear or oversize planting pits are specified on the plans.

If the Contractor determines that the original excavated soil is not suitable for reusing with amendments for achieving an acceptable growing medium, the Contractor shall notify the Engineer. The Engineer shall make a determination as to the quality of the soil, and if found to be unacceptable; will direct the Contractor to use topsoil or composted yard waste for use in the soil mix. In such cases, the planting pit, and unsuitable soils surrounding the pit shall be removed as directed by the Engineer. The Engineer reserves the right to have the original soil tested prior to making a determination for replacement.

4. **Preparing Plant Beds:** Plant beds shall be prepared by the Contractor in accordance with the following:

   a) Plant bed preparation shall only be required on slopes of 3:1 or flatter. Where grass and weeds are present, the Contractor shall treat the designated bed area(s) with a broad spectrum grass and weed killing herbicide at least two weeks prior to beginning bed preparation, or physically remove turf and weeds immediately before bed preparation. The entire area of the plant bed shall be

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cultivated to a depth of 4 inches by a rotary cultivator or other approved method. The Contractor shall then apply composted yard waste at a depth of three inches over the entire plant bed and re-till to form a homogenous soil medium. Soil shall be cultivated so that there are no clods larger than 2 inches in diameter.

b) Any remaining grass, sod, and weeds shall be removed from the bed. Rocks over 3 inches in diameter, clods, roots, and other objectionable material remaining on the surface shall be removed and disposed of in accordance with the requirements of Section 106.04 or as approved in writing by the Engineer. Individual planting pits shall not be dug until after the bed is prepared to the satisfaction of the Engineer.

c) Upon completion of planting, the bed shall be hand raked to an even surface and neatly edged with a "V" cut edge located a minimum of 12 inches from the root ball of plants along the outer edge of the bed. Mulch shall be applied to the entire bed area. On certain projects where mulched beds around large quantities of plant materials are used to control weed growth and are not intended as a prepared soil medium, tilling and application of composted organic material throughout the plant bed shall be waived when beds are labeled on the plans as "Bed Preparation Not Required".

5. **Linear Planting Pit:** Areas labeled on the plans and details as "Linear Planting Pit" shall be excavated to the horizontal and vertical dimensions indicated on the plans to receive soil mixture. Soil mixture shall consist of 1 part composted yard waste, and 1 part horticultural grade perlite, unless otherwise indicated in the contract documents, and shall include any necessary excavation required for installation of plant underdrain systems. Plant underdrain system(s), as applicable, shall be indicated on the plans, listed as a pay item and installed in accordance with plan details.

Soil mix for linear planting pits shall be installed in 6 inch lifts, lightly compacted by foot or other approved method, and moistened prior to proceeding with next lift. If settlement occurs prior to planting, additional soil mix shall be added at the direction of the Engineer. Prior to planting the Contractor shall till the linear planting pit to a depth of 4 inches, hand rake the area and adjust the grade adjacent to curb or sidewalk to receive 3 inches of mulch.

6. **Oversize Planting Pit:** shall be prepared in accordance with the plan details at locations shown on the plans. Backfill shall consist of one-half part native soil excavated from the plant pit, and one-half part composted yard waste. If native soil is determined by the Engineer to be unsuitable, 100 percent composted yard waste shall be used. If settlement occurs prior to planting, additional soil mix shall be added at the direction of the Engineer. After planting the planting pit shall be neatly edged except when the planting pit falls within a larger bed area.

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Trial Use and Comment

7. **Installing Trees and Shrubs:** Balled and burlapped and containerized plant materials shall be installed in plant pits in accordance with the requirements of the VDOT Road and Bridge Standards, unless otherwise indicated on the plans. Bare roots of plants shall be spread out in a natural position. Broken or bruised roots shall be pruned. After positioning plants in the planting pit and prior to backfilling, root ball wrapping materials, except metal root ball cages shall be cut and dropped to the bottom of the pit. Root ball wrapping materials shall not be removed from under the root ball. Metal root ball cages shall be cut and removed to a minimum of 6 inches below finished grade. Wrapping materials within root ball cages shall be cut or unwrapped to the same elevation as the cage. All other wrapping materials such as tags, twine and colored marking ribbon shall be removed from the plant unless otherwise directed by the Engineer. The soil mixture shall then be filled in around roots and lightly tamped. Light tamping around root balls shall be performed using a method approved by the Engineer. Foot tamping will be permitted in the bottom of pits before plants are installed, around root balls when there is ample room to accommodate the foot without damage to the ball, and in the planting of bare-root plants after roots have been covered with the soil.

   Backfill material in pits shall be saturated with water. The amount of water applied and method of application shall be approved by the Engineer. Failure to water properly at the time each plant is installed will be cause for rejection of the plant. Frozen backfill material shall not be used.

   Potted plants shall not be removed from their container until immediately before planting. Containers shall be removed by approved methods that will not damage roots or loosen soil balls. The sides of containerized materials shall be scarified prior to planting.

   When planted, watered, and fully settled, plants shall be vertical and shall stand at a height flush with the height of which they were growing.

8. **Handling Plants during Planting:** Roots of bare-root plants shall be kept covered with moist burlap or other approved material prior to planting. Forest tree seedlings and forest tree transplants shall be carried in a container filled with sufficient mud to puddle roots. When seedling roots have been coated with a protective material, the seedlings shall be protected in accordance with the U.S. Forest Service's recommendations relative to treatment of seedling roots while seedlings are being planted. Plants will be rejected if their roots are exposed to drying conditions at any time.

(l) **Forming Water Rings and Saucers:** Immediately after the installation of each plant, a saucer shall be formed around the plant pit. Soil used to form the saucer shall be compacted by tamping to prevent runoff of water from the pit. Saucers shall measure 4 to 6 inches in width, and 2 to 3 inches in height after tamping. Saucers will not be required for forest tree seedlings, or forest tree transplants. Water rings and saucers shall be formed

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on the wetland trees and shrubs planted on slopes and upland areas adjacent to the wetland.

(m) **Applying Mulch:** Mulch shall be applied uniformly to a 3-inch depth over the entire area of the plant pit or plant bed within 48 hours after completion of planting. Re-mulching at the terminus of the establishment period shall be applied at a depth of 1-1/2 inches. Mulch shall be anchored in a manner satisfactory to the Engineer. Mulch shall not be required for wetland trees and shrubs, or upland forest tree seedlings. Mulch shall be applied to wetland trees and shrubs on slopes and upland areas adjacent to the wetland.

(n) **Staking, Guying, Anchoring:** Each plant shall be staked and guyed or secured with below ground tree anchors immediately following planting, unless otherwise indicated in the Planting Plan Summary and General Notes. Below ground tree anchors shall be used when specified on detailed drawings in the plans. Staking and guying shall be required for wetland trees and shrubs on slopes and upland areas adjacent to the wetland.

(o) **Pruning:** Plants that have been freshly pruned before delivery will be rejected. If necessary, plants shall be pruned either immediately before or within 48 hours after they are planted. Pruning of trees and shrubs to be planted on projects shall consist of removing dead, diseased, broken or other branches deemed injurious to the health of the plant, and for removal of sprouts and sucker growth. Care shall be taken to preserve the natural character of the plant. Pruning shall be performed with tools and equipment in excellent working condition that are specifically designed for the appropriate work. All pruning shall be performed in accordance with the current American National Standards Institute (ANSI A300) and as directed by the Engineer. All debris removal including disposal from the pruning operation shall be the responsibility of the Contractor.

(p) **Pit Drains:** Pit drains or plant underdrain systems shall be installed as shown on the plans.

(q) **Tree Tubes:** This work shall consist of installing tree tubes on all seedling trees in accordance with the manufacturer's recommendations, the plans and product specifications.

605.04—Care of Plants

Plant care shall begin immediately after each plant is satisfactorily installed and shall continue until final acceptance. Care shall include but not be limited to replacing displaced mulch, repairing and reshaping water rings or saucers, maintaining stakes and guys as originally installed, watering when needed or as directed by the Engineer, and performing any other work required to keep plants in a healthy condition. Dead, defective, or rejected plants shall be immediately removed and replaced in accordance with the requirements of **Section 605.05(b)4**.

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Comment [1885]: Right Time
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Comment [1887]: Right Way
Comment [1888]: Right Time
Comment [1889]: Right Way

Trial Use and Comment

605.05--Establishment Period

(a) **Beginning of Establishment Period:** The establishment period shall begin on a date following completion of the planting (spring or fall), when the Contractor receives written confirmation from the Engineer, that all work has been completed in accordance with the requirements of this Section and the plans, and that all plants are living, healthy and in a viable growing condition as determined by the Engineer. Plants that are replaced in order to meet these initial specifications are not considered as "plant replacements."

(b) **Establishment Period:** The establishment period shall continue through a minimum of one growing season, and shall terminate on the date determined in writing by the Engineer. During the establishment period, the Contractor shall do all work necessary to keep the plants in a healthy growing condition, including, but not limited to the following:

1. **Watering:** The Contractor shall prepare and submit to the Engineer a schedule for watering in accordance with the frequency listed on the project summary sheet. However, the Contractor shall be responsible for watering as frequently as is necessary to maintain an adequate supply of moisture within the root zone of all plantings at all times or if there is less than 1 inch of rainfall in a seven day period during the months of April through September. Water shall not be applied at a force that will displace soil or mulch. Quantities and frequency of watering shown on the plans are for minimum estimating purposes only.

   a) The Engineer may require the use of watering needles or other approved methods to prevent displacement of soil, mulch and runoff of water. The Engineer may make periodic inspections to ascertain the adequacy of the Contractor's watering and the moisture content of the soil.

   b) The quantity of water supplied shall not be in excess of that normally required to ensure optimum growing conditions. Watering shall not commence until methods and equipment have been approved by the Engineer. The Engineer may require or suspend watering at any time.

2. **Notification and Scheduling:** When notified by the Engineer that watering is required, the Contractor shall begin watering within 48 hours with sufficient labor and equipment and shall continue to water daily where and as directed, without delays or interruptions, to ensure that the root zone does not become dry at any time. In the event the Contractor fails to begin watering operations within 48 hours after notification, the Engineer may proceed with adequate forces, equipment, and materials to perform the watering operations and the entire cost of the watering operations will be deducted from monies due the Contractor.

3. **All establishment period maintenance work**, except watering, shall begin within 7 working days after the Engineer notifies the Contractor that the establishment period has begun.

Comment [1890]: Right Time and right documentation

Comment [1891]: Right Time

Comment [1892]: Right documentation

Comment [1893]: Right Time

Comment [1894]: Right Time

Trial Use and Comment

4. **Plant Replacements:** Between the beginning and ending dates of the establishment period, plants that are dead, defective, or otherwise not in a healthy growing condition as determined by the Engineer shall be removed immediately at the Contractor's expense. Plant replacements shall be made once in the spring if required (Between March 1 and March 31), and once in the fall if required (Between November 1 and December 31), as necessary to replace dead or defective plant materials as directed by the Engineer. For each plant replaced, the first replacement, if required, shall be at the Contractor's expense. The second replacement, if required, will be paid for at 35 percent of the original contract unit price per each plant replaced.

5. **Stakes, and Guys**, **and/or Below Ground Tree Anchors** shall be repaired or replaced immediately as needed. Stakes and Guys shall be removed when no longer required as directed by the Engineer. Tree anchors shall remain in place.

6. **Eroded Saucer Rings** shall be repaired or replaced as needed and/or as directed by the Engineer.

7. **Mulch** shall be redressed as needed and/or as directed by the Engineer throughout the establishment period.

8. **Re-mulching**: When established as a separate pay item, remulching shall be reapplied to all individual plants and plant beds prior to the terminus of the establishment period at a rate of approximately 1 1/2 inch depth, uniformly over all individual plant pits and plant beds, and/or as directed by the Engineer.

9. **Vegetation Control** shall consist of the control and/or removal of weeds, grass and root growth from plant beds and mulched areas around individual plants. Such weeding shall be performed once in the month of May, June, July, August, and September for a total of five weeding operations over the duration of the establishment period. The Contractor shall submit a schedule for vegetation control for approval by the Engineer prior to the Contractor beginning vegetative control operations.

   a) Removal of weeds, grass and root growth may be completed by hand or through the application of "pre-emergent" and "post emergent" herbicides as approved by the Engineer. All herbicide applications shall be performed by certified pesticide applicators in accordance with the requirements of Section 601. Additional weeding may be performed when requested by the Engineer and with written agreement from both parties. The Engineer also reserves the right to delete individual weeding cycles at no cost to the Department when necessary. The Contractor shall be responsible for replacing plants that are damaged or that die due to the application of herbicide treatments.

   b) When herbicides are used for post emergent weed control, the weeds shall be cut to a height of 6 inches or as recommended by the manufacturer if

Comment [1895]: Right Way

Comment [1896]: Right Time

Comment [1897]: Right Time

Comment [1898]: Right payment

Comment [1899]: Right Time

Comment [1900]: Right Way

Comment [1901]: Right Way

Comment [1902]: Right Way

Comment [1903]: Right Time / Right Way

Comment [1904]: Right Time

Comment [1905]: Right documentation

Comment [1906]: Right Way

Comment [1907]: Add link

Comment [1908]: Right Way

Trial Use and Comment

necessary, prior to applying the herbicide. The Engineer reserves the right to change the frequency or delete specific areas scheduled for weed control. Other pesticides, adjuvants and plant growth regulators may be used when approved by the Engineer.

c) Turf maintenance which includes grass and other vegetation around individual plant pits, between groups of plant pits that are 15 feet on center or less, and around the perimeter of plant beds shall be cut to a height of approximately 4 inches. For each individual plant pit, group of plant pits, and plant beds, a perimeter extending 5 feet in width shall be maintained around the outermost plant pits and edge of beds where grass and other vegetation is present, and where such areas exist within the right-of-way or construction easement. Mowing shall be performed once in each month of May through September. Additional mowing may be performed when requested by the Engineer. The Engineer reserves the right to delete individual mowing cycles when deemed necessary by the Engineer.

10. **Additional Work**, including pruning of dead, broken or diseased branches, and seasonal spraying with approved insecticides and fungicides, shall be performed to ensure plant survival as approved or directed by the Engineer.

(c) **Termination of Establishment Period:** Any dead, missing, or defective plants shall be replaced as directed by the Engineer prior to termination of the establishment period. The Engineer shall be notified within 48 hours prior to beginning the replacement work.

The establishment period shall end on a date established by the Engineer, when the Contractor receives written notification from the Engineer that confirms all the requirements of (b) herein have been satisfactorily completed.

605.06--Guarantee

The Contractor's performance bond, furnished in accordance with the requirements of Section 103.05, shall provide for necessary maintenance during the establishment period and replacements in kind, or with a substitute acceptable to the Engineer, for plants that are not in a healthy growing condition or that have died back to the crown or beyond the normal pruning limit.

605.07--Measurement and Payment

Plants will be measured by an actual count of living plants in a healthy growing condition and will be paid for at the contract unit price per each. Plants that the Engineer deleted from the Contract will not be measured for payment. This price shall include furnishing and delivering plants and miscellaneous planting materials; preparing planting pits, except

Comment [1909]: Right Time

Comment [1910]: Right Way

Comment [1911]: right quantity

Comment [1912]: Right Time

Comment [1913]: Right documentation

Comment [1914]: Right documentation

Comment [1915]: Right payment

Trial Use and Comment

when established as a separate pay item, forming saucers; installing plant materials; watering, except during establishment period, applying fertilizer; back filling with approved soil mixture; staking; guying; anchoring; pruning; applying mulch, except to areas designated on the plans as plant beds, replacing dead or damaged plants; repairing, replacing and removing stakes and guys when no longer needed; and maintaining plants in a healthy growing condition until final acceptance.

Trees or shrubs planted on a slope steeper than 3:1 with pit modification as indicated in the Department's Road and Bridge Standard Section 1201.06 will be paid for at 125 percent of the price bid. Such price shall also include the cost of pit modification, stone and geotextile filter fabric. Percolation tests shall be included in the price bid for plants.

Replacements for plants lost during the establishment period because of theft, damage, or destruction caused by persons or equipment belonging to persons or organizations other than those engaged in performing the work or during delivery of the plants, or plants lost due to damage from animals either wild or domestic, will be paid for at the rate of 35 percent the contract unit price per each. If vandalism or vehicle damage is determined by the Engineer to be the cause the rate will be 50 percent the contract unit price per each. This price shall include all costs associated with furnishing and installing the replacement. Replacements for plants that die due to other reasons shall be replaced and paid for in accordance with the requirements of Section 605.05(b)4.

Bed Preparation will be measured and paid for in units of 100 square feet of surface area. This price shall include herbicide spraying of areas to be prepared for planting or physically removing turf and weeds, restoring areas to original grade with topsoil (as applicable) as directed by the Engineer, tilling soil, furnishing, delivering, and applying composed yard waste at the specified depth, tilling in composted yard waste, hand raking, neatly edging bed, and all incidentals necessary to prepare a healthy growing medium for planting.

Pit drains when detailed and established as a separate pay item on the plans will be measured and paid for in units of each, complete-in-place, which price shall include drainage stone, pipe, pipe grate, prefabricated drainage core, drainage/aeration cloth, and geotextile drainage fabric as designated on the plans.

Linear Planting Pit will be measured and paid for in units of cubic yards of excavated material required to achieve the horizontal and vertical dimensions indicated on the plans to receive soil mixture, including furnishing, delivering and storage of soil mixture materials to be used, and disposal of surplus excavated materials. Such price shall also include the cost of mixing and installing all components of the soil mix (horticultural grade perlite and composted yard waste), bed preparation, hand raking and adjusting surface to receive mulch, and furnishing and installing underdrain system(s) if indicated on the plans, including drainage stone, drainage/aeration cloth, prefabricated drainage core, geotextile drainage fabric, pipe, and pipe grate in accordance with the plans and detailed drawings, and all necessary incidentals complete in place.

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Oversize Planting Pit will be measured and paid for in units of each, which price bid shall include excavation and disposal of unsuitable material, provision, and installation of pit drain materials if shown as part of the plan details, installation of approved backfill material and mixing with composted yard waste.

Mulching will be measured in units of 100 square feet of surface area. Mulch for plant beds at the time of initial installation will be paid for at the contract unit price per 100 square feet. This price shall include furnishing, delivering, and applying mulch. No separate payment will be made for initial application or maintenance of mulch around plants that are not in continuous mulched plant beds. The cost thereof shall be included in the price for the plant.

Re-mulching, when established as a separate pay item, will be measured and paid for in cubic yards. This price shall include furnishing, delivering, and applying mulch to plant beds, and to plants in individual saucer rings prior to the terminus of the establishment period. Remulching does not include regular maintenance of individually mulched plants or plant beds for the duration of the establishment period.

Watering during the establishment period will be measured in units of 1000 gallons, and will be paid for at the contract unit price per unit, applied at the rates designated on the plans. This price shall include furnishing, delivering, and applying water and performing all other work in connection therewith and incidental thereto. No payment will be made for watering at the time of original planting or during the installation period until from plant installation until the start of the establishment period or whenever replacements are planted.

Vegetation Control will be measured and paid for on a unit basis. Compensation for weeding (removal of weeds, grass, and root growth) and turf maintenance shall be made on a Unit basis consisting of each complete project weeding and turf maintenance operation accomplished by the Contractor, including the removal and disposal of unwanted vegetation, application of pesticides, the performance of mowing around and between individual plants, and as reviewed and approved by the Engineer.

Tree Tubes will be measured and paid for at the contract unit price per each which shall include furnishing and installing the tube, including all incidentals necessary to complete the work. This price shall also include the removal and disposal of the tree tube at the end of the establishment period.

Payment will be made under:

Comment [1916]: Right payment

Pay Item	**Pay Unit**
(Name of) Plant (Size)	Each
Bed Preparation	Unit (100 square feet)
Pit Drain	Each
Linear Planting Pit	Cubic Yard

Trial Use and Comment

Oversize Planting Pit	Each
Mulching	Unit (100 square feet)
Re-mulching	Cubic Yard
Watering	Unit (1,000 gallons)
Vegetation Control	Unit
Tree Tube	Each

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting: Review specification requirements, material documentation, construction procedures, measurement, and payment. Meet with Contractor to establish their schedule for placing orders and their schedules for delivery. Contact District Environmental Manager to schedule approval of planting locations and schedule for inspections of the plant materials.

Start: Contractor to submit Documentation of Confirmed Order 60 days in advance of the proposed planting operation, and a 48 hour notification in advance of proposed delivery. Contractors are to stake planting beds and plant locations, and provide 48 hours prior to scheduling inspections. Plant material should be inspected, prior to being planted, by the Environmental Section. Verify that a Certificate of Registration and/or Certificate of Nursery Inspection from the State of origin accompany each delivery of plant material from a nursery. Location approval for any stored plant material.

Continuous inspection: Approval of plant pits and plant beds. Inspect planting, and mulching.
Percolation tests for planting pit installed on slopes steeper than 3:1. Monitor storage sites. Monitor pruning, staking, watering, and general plant care as required.

Final Inspection: Written confirmation for beginning of establishment period. Monitor and schedule weeding, re-mulching, plant replacement, and watering as needed. Written notification of end of establishment period

Documentation Required: Source of Materials (Form C-25), invoices, MSDS for fertilizer, Certificate of Registration and/or Certificate of Nursery Inspection from the State of origin for all plant material received from a nursery, Engineer's approval for composted yard waste, documentation of work performed and calculations as required for payment.

IV. REVIEW QUESTIONS

Spec. Ref.	
605.03	Does the Contractor notify the Department at least 48 hours prior to beginning work?
605.04	Does plant care begin immediately after installation and continue until final acceptance in accordance with this section?
605.03(a)	Does the Contractor obtain plants from approved sources?
605.03(b)2	Are plants inspected and identified in accordance with Standardized Plant

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	Names prepared by the Editorial Committee of the American Joint Committee on Horticultural Nomenclature?
605.03(c)1	Are changes in quantity, size, kind, or quality of plants requested in writing and approved by the Engineer?
605.03(c)2	When substitute plants are used, does the Contractor indicate the reduced cost, if any, that the Department will accrue as a result of the substitution?
605.03(d)	Are plant locations and layouts staked in ample time to allow inspection and approval by the Engineer prior to digging being started?
605.03(e)1	Does the Contractor notify the Engineer at least 48 hours prior to anticipated plant delivery?
605.03(e)2	Is a legible invoice showing kinds and sizes of plant material in each shipment delivered furnished to the Engineer?
605.03(e)3	Does a copy of the current Certificate of Nursery Inspection accompany each shipment of plants?
605.03(f)	Are shipments of plants labeled in accordance with this section?
605.03(g)	Are plants transported and protected in accordance with this section?
605.03(h)1	Are plants stored in accordance with the requirements of this section?
605.03(h)2	Are plants that have been stored over 30 days used only with the approval of the Engineer?
605.03(h)3	Are rejected plants removed from storage within 24 hours or marked with yellow paint or otherwise made readily identifiable?
605.03(i1)	Does the Contractor, at the Engineers discretion, relocate or delete plants from the contract that encounter underground obstructions or unforeseeable conditions?
605.03(i3)1	Are sides of pits that become plastered or glazed scarified?
605.03(i3)2	Is surplus excavation and unsuitable material disposed of in accordance with Section 106.04, Disposal Areas?
605.03(i4)1	Has the entire area of the plant bed been cultivated to a depth of at least 4 inches by a rotary cultivator before plant pits are excavated?
605.03(i4)2	Has grass, sod, weeds, rocks, clods, roots, and other objectionable material been removed from the plant beds?
605.03(i5)1	Are plants set in pits of soil mixture conforming to the materials section on RoadSide Development Materials for Soil Mixture to Backfill Planting Pits?
605.03(i5)2	Are bare roots spread out in a natural position?
605.03(i5)3	Are broken or bruised roots pruned?
605.03(i5)4	Is the soil mix filled in around roots and tamped?
605.03(i5)5	Is the backfill in the pits saturated with water?
605.03(i5)6	Have root ball wrapping materials, except metal root ball cages, been cut and dropped to the bottom of the pit?
605.03(i5)7	Have metal root ball cages been cut and removed to approximately 6" below finished grade?
605.03(i6)	If seedling roots have been coated with a protective material, are the seedlings protected in accordance with U.S. Forest Service recommendations?
605.03(j)	Is a saucer formed around each plant, except for plant beds, forest tree

Trial Use and Comment

	seedlings, and/ or transplants, immediately after installation?
605.03(k)	Is all planted material, except for forest tree seedlings and/or transplants, mulched no more than 48 hours after planting?
605.03(l)	Is each tree staked or guyed immediately following planting?
605.03(m)	Are deciduous trees wrapped within 48 hours after planting, but not prior to approval of the condition of their trunk by the Engineer?
605.03(n)	Is pruning of the plants performed immediately before or within 48 hours after planting?
605.05(a)	Is the beginning of the establishment period set in accordance with the requirements of this section?
605.05(b)1	Is the Contractor maintaining the plants during the establishment period?
605.05(b)2	When notified in writing by the Engineer, does the Contractor begin watering within 48 hours to ensure that the root zone does not become dry at any time?
605.05(b)3	Does maintenance work, except watering, begin within 10 days after the Engineer notifies the Contractor that the establishment period has begun?
605.05(b)4	Are plants pruned and mulch replaced as required?
605.05(b)5	Have stakes, guys, and eroded plant saucers been repaired, replaced, or removed as required?
605.05(b)6	Have plant beds and mulched areas around plants been kept free from grass and weeds, including root growth?
605.05(b)7	Has grass and other vegetation between individual plant pits that are not in beds been cut to a height of approximately 4 inches?
605.05(b)8	Is mowing performed once in June and once in September?
605.05(b)9	Are dead plants removed immediately?

V. CRITICAL INSPECTION POINTS

• Approval of plant material.
• Approval of planting locations.
• Approval of planting, mulching, staking, anchoring.
• Maintenance of plantings and monitoring of establishment period.

Trial Use and Comment

SECTION 606 - SOIL RETENTION COVERING

I. INTRODUCTION:

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

606.01—Description.

This work shall consist of furnishing and placing protective coverings for soil retention, including seed, fertilizer, lime, topsoil, and water, in accordance with the requirements of these specifications and in conformity to the dimensions, lines, and grades shown on the plans or as established by the Engineer.

606.02—Materials.

Materials shall conform to the requirements of **Section 244.02(k).**

606.03—Procedures.

(a) **Preparing Areas:** Two inches of topsoil shall be applied to the area to be covered. Drainage channels shall be shaped in accordance with the cross section shown on the plans and shall be rolled or tamped to compact soil in place before final shaping.

During shaping operations, a seedbed approximately 3/4 inch in depth shall be provided.

Stones, roots, and other objects that will prevent protective covering from making close contact with the seedbed shall be removed before covering is installed.

(b) **Applying Seed:** Seed shall be applied in accordance with the requirements of Section 603 except that mulch will not be required. Seed, fertilizer, and lime shall be applied prior to installation of protective coverings.

Comment [1917]: Right Materials

Comment [1918]: Right Way / Right Time

Comment [1919]: Right Way

Comment [1920]: Right Way

Comment [1921]: Right Material

Trial Use and Comment

Seeded areas adjacent to the channel or ditch that are disturbed during installation of covering shall be uniformly reshaped, reseeded, and mulched at the Contractor's expense.

(c) **Installing Soil Retention Coverings:** Coverings shall be installed in accordance with the standard drawings and manufacturer's recommendations.

(d) **Watering:** After coverings are installed, seeded areas shall be watered sufficiently to saturate the seedbed. Water shall be applied in a spray, and no additional watering will be required.

606.04—Measurement and Payment.

Protective coverings and soil stabilization mats will be measured in square yards of area covered, complete-in-place, in accordance with the nominal plan dimensions and will be paid for at the contract unit price per square yard. Overlaps, over widths, and cut slots will not be measured for separate payment. This price shall include furnishing, installing, and stapling soil retention coverings; smoothing and shaping ditch channels and waterways; preparing seed beds; and furnishing and applying topsoil, lime, seed, fertilizer, and water.

Payment will be made under:

Pay Item	Pay Unit
Protective covering (Standard)	Square yard
Soil stabilization mat (Standard and type)	Square yard

II. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- MSDS sheets required for all chemical products used on project. spec;200.03, testing and sampling chemicals prior to using on site**.**
- All seeding placed according to time of year seed blends provided by Vdot Landside, per contract, manufactures recommendations, plans, & spec; 603;, except no mulching will be used.

Start:

- Have all areas been correctly graded; to include 2 " topsoil compacted and provide a ¾ " seed bed area.
- Has all roots /stones and debris been removed from planned areas.

Comment [1922]: Right Way

Comment [1923]: Right Way

Comment [1924]: Right quantity/ Right Payment

Trial Use and Comment

Intermediately inspection:

- If all areas have been checked prior to installation of cover material.

Final Inspection:

- Has the area, been watered? Are laps and joints installed correctly? Are laps section correctly measured? Have staples and edges been completed according to Book of Standards/plan sheets.
- Has certified green seed tag /ticket been provided? Was items used from the preapproved products list?

Documentation Required:

- Certified Green tag seed ticket, provided for each bag used. Bag counts for lime & fertilized, to check rate used.
- Was items used from the preapproved products list?
- Daily quantity sheet, checked and agreed to for payment. Show sketches and calculations for record.

III. REVIEW QUESTIONS

• Has the Contractor placed 2 inches of topsoil shaped in accordance with the cross sections?
• Has the Contractor applied seed, fertilizer and lime prior to installing protective covering?
• Is the soil retention covering installed in accordance with the Standard Drawings and manufacturer's recommendations?
• Is the protective covering applied in the direction of water flow and lapped a minimum of 6 inches?
• Did the Contractor bury the top of the anchor slot 6 to 12 inches?
• Are the staples / wood stakes the proper size and length and placed properly according to the Standard Drawings?
• Did the Contractor trench in the edges of the coverings a minimum of 6 inches?
• Did the Contractor water the seeded areas after the covering was installed?
Are objectionable materials removed prior to placement of protective covering?
• Were seed, fertilizer, and lime applied to the area prior to installation of protective covering?(EC-2, EC-3 Ty. A or B)
• Have seeded areas adjacent to the channel or ditch that are disturbed during installation of covering uniformly reshaped, reseeded, and mulched at the Contractor's expense?
• Are the soil retention coverings installed in accordance with the standard drawings and the manufacturer's recommendations?

Trial Use and Comment

• Are check slots in protective covering placed at right angles to the water flow and extended 6 to 12 inches into the soil?(EC-2)
• Are check slots in protective covering within 100 feet of each other on slopes 4 percent or less and within 50 feet if the slope is more than 4%?(EC-2)
• Are overlaps installed in accordance with the Standard and/or the manufacturer's recommendations? (EC-2)
• Is the top of anchor slot in protective covering buried from 6 to 12 inches?(EC-2)
• Are #8 steel wire staples used which are a minimum of 6 inches in length for soil and 8 inches in length for sand?(EC-2)
• Are steel wire staples placed according to standard drawings ?(EC-2)
• Are all anchor slots, junction slots, check slots and terminal folds in jute mesh stapled not more than 9 inches apart across the width of the material?(EC-2)
• Are soil stabilization mats the type specified on the plans (A,B, or C)?
• Have the mats been overlapped three feet onto adjacent rolls ? (Ref. 2001 Book of Standards)(EC-3)

• Are the edges of the mats entrenched 6 inches?(EC-3)
• Have wooden or metal stakes, 12 inches minimum in length, been used to anchor stabilization mats except in sandy soils where 18" metal stakes are required? (EC-3,Ty.A or B)
• Are stakes placed according to standard drawings?(EC-3)
• Is the stabilization mat used in conjunction with standard EC-1 at the outlet end of pipe?(EC-3)
• Have wooden or metal stakes, 18 inches minimum in length, been used for EC-3, Ty. C installations?
• Have topsoil and seed been applied for EC-3, Ty. C per the standards?
• After coverings were installed, were seeded areas watered sufficiently to saturate the seed bed?

V. CRITICAL INSPECTION POINTS

• **Laps, edges, relief trenches, staples, Was correct material used?**
• **Was area prepared correctly? Was area watered in?**

Trial Use and Comment

SECTION 607 – HERBICIDE SPRAYING

I. INTRODUCTION:

This work consists of spraying an approved herbicide for control of weeds. Handling and application of herbicides is of a critical nature in that the materials are quite toxic and often non-selective as to vegetation killed

The Inspector should consult the District Environmental Manager prior to herbicides being applied and should keep thorough records on all applications of herbicides. The Inspector should ensure that the Contractor takes precautions when spraying, filling or flushing equipment to prevent contamination of streams, lakes or ponds.

a) Forms:

- Intentionally Left Blank

II. 2007 ROAD AND BRIDGE SPECIFICATIONS

607.01—Description

This work shall consist of applying an approved herbicide for the control of weeds in turfed areas as indicated on the plans or as designated by the Engineer.

607.02—Materials

Herbicide shall conform to the requirements of **Section 244.02(a).**

607.03—Procedures

Herbicide shall be applied in accordance with the manufacturer's recommendations. Herbicide shall not be applied when the ambient temperature is above 85 degrees F or below 60 degrees F. The spray pressure shall be at least 20 but not more than 30 pounds per square inch. Spraying shall not be performed when the vegetation is wet, when it appears that rain is imminent within 6 hours, or when the wind is blowing enough to scatter paper or trash.

607.04—Measurement and Payment

Comment [1925]: Right Material/ Right Quantity

Comment [1926]: Right Way / Right Quantity

Comment [1927]: Right Payment

Trial Use and Comment

Herbicide spraying will be measured in units of 1,000 gallons of mixture and will be paid for at the contract unit price per 1,000 gallons. This price shall include furnishing and applying herbicide.

Payment will be made under:

Pay Item	Pay Unit
Herbicide Spraying	Unit (1000 gallons)

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Certified Herbicide and Spray Technician by US Department of Agriculture.
- MSDS sheets and Manufacturers Safety Plan.
- Spray Agent mixed per manufactures specifications// per acre treatment. Shelf life of chemicals (use by date).
- Equipment tested, and calibrated.
- Equipment clean and ready for use daily.
- Work Zone required to complete spraying, Mobile operation?

Start:

- Weather; wind, rain, temperature limits for products being used.
- Was spray unit clean before herbicide, was prepared for proposed work, was there a known area to be treated.
- Was the water used in the preparation of the mix, allowable for use?
- Work Zone correct?

Continuous inspection: 1 inspector

Final Inspection: document locations, wind, temperature limits shown on daily quantity sheets.

Documentation Required:

- Daily quantity sheet, showing chemicals used, show chemical percentage, locations and total units used.

IV. REVIEW QUESTIONS

- N/A

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Mixing of herbicides, Water source, Tank clean up.**
• **Weather conditions continuously monitored and recorded.**

Trial Use and Comment

SECTION 608 – MOWING

I. INTRODUCTION:

This work consists of mowing areas as designated by the Engineer. Mowing is important not only for aesthetics but also to control weeds and promote the growth and spread of more desirable grasses. Areas should be mowed to a height no less than 4 inches.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD AND BRIDGE SPECIFICATIONS

608.01—Description

This work shall consist of mowing designated areas to a height of not less than 4 inches when and as directed by the Engineer until final acceptance.

Comment [1928]: Right Way

608.02—Equipment

Equipment used for mowing operations shall be mechanical with a cutting width of at least 5 feet.

608.03—Measurement and Payment

Comment [1929]: Right Payment

Mowing, when a pay item, will be measured in hours of operation and will be paid for at the contract unit price per hour. This price shall include equipment, operators, fuel, and lubricants.

Payment will be made under:

Pay Item	Pay Unit
Mowing	Hour

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Equipment and operator, PPE, checked prior to start up and approved by Engineer. Authorization to complete cut – location of cut.

Start:

- Safety will work zone be required for location?

Intermediate inspection: 1

Final Inspection:

- Grass Cleanly Cut, Trash Removal, any areas damaged by the mowing.(Scalping-Rutting-etc.)

Comment [1930]: Right Way

Documentation Required:

- **Start and end of mowing, documented and agreed to on daily summary report by contractor.**
- **Shows location to and from's;**

IV. REVIEW QUESTIONS

- N/A

V. CRITICAL INSPECTION POINTS

33

• **Start –hourly- ending time.**
• **Did they damage any slopes , ditches, signs, Etc.**

Trial Use and Comment

SECTION 609—TREE WELLS AND TREE WALLS

I. INTRODUCTION:

a) **Forms**:

- Intentionally Left Blank

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

609.01—Description

This work shall consist of constructing wells and walls to protect the root system of trees, shrubs, or other woody plants at the locations shown on the plans or as designated by the Engineer.

609.02—Materials

Aggregate shall conform to the requirements of Section 203.

PVC pipe shall conform to the requirements of Section 232(g).

Geotextile fabric shall conform to the requirements of Section 245.

Rubble for masonry shall conform to the requirements of Section 204.

609.03—Procedures

Excavation incidental to and necessary for constructing tree wells and tree walls shall be conducted in a manner that will not damage the root system. Ends and damaged sections of roots shall be cleanly cut. Roots with a diameter of more than 3 inches shall not be cut.

Before any earth fill that will exceed 12 inches in thickness is spread over the feeding root system of trees or shrubs to be protected by tree wells, an aeration layer of coarse gravel or stone ranging from 1/2 to 5 inches in size shall be spread over the entire area for a depth of at least 6 inches or at the rate of 3 inches for every 12 inches of earth fill where such fills will be more than 2 feet in depth. The layer of aggregate shall be covered with sufficient fine screenings to choke the top of the porous fill. Aggregate shall not be placed inside the tree well.

Comment [1931]: Right Material

Comment [1932]: Right Material

Comment [1933]: Right Material

Comment [1934]: Right Material

Comment [1935]: Right Way

Trial Use and Comment

609.04—Measurement and Payment

Tree wells and tree walls will be measured in cubic yards of masonry, complete-in-place, and will be paid for at the contract unit price per cubic yard of masonry. This price shall include excavation; drainpipe; and backfill, including aggregate.

Comment [1936]: Right Payment

Payment will be made under:

Pay Item	Pay Unit
Tree well (Standard)	Cubic yard
Tree wall (Standard)	Cubic yard

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Approve installer, approved equipment, approved materials in hand, and approved to start work by engineer.

Start:

- Right location, Right Tree / right size tree well, lay out tree well as marked out per the plan sheet / standards.

Intermediate inspection: 1 inspector

Final Inspection:

- Root ball not damaged during installation, Constructed per plan, coarse stone installed, drainage pipe installed.

Documentation Required:

- Quantity sheet number of cubic yards, with sketches for each well,

Trial Use and Comment

IV. REVIEW QUESTIONS

- N/A

V. CRITICAL INSPECTION POINTS

• **Beginning of tree well layout**
• **Prior to back fill, during backfill, drainage system(stone, pipe, fabric)**
• **completion**

Trial Use and Comment

SECTION 610 – GABIONS

I. INTRODUCTION:

This section covers how gabion stone baskets are fabricated, the excavation and backfill of the gabion stone sections, and placement of the units.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

610.01—Description

This work shall consist of furnishing and installing gabions in accordance with these specifications and in conformity to the lines, dimensions, and grades shown on the plans or as established by the Engineer.

Comment [1937]: Right Way

610.02—Materials

Comment [1938]: Right Material

(a) **Gabions** shall have a uniform horizontal width of at least 36 inches. Their dimensions shall be within ±3 percent of the manufacturer's stated sizes.

(b) **Wire mesh** shall conform to the requirements of **Section 223.02(a).**

(c) **Selvedge (or perimeter) wire** shall be at least 0.148 inch in diameter (9 gage) and shall conform to the requirements of **Section 223.02(a)** for wire mesh.

(d) **Tie and connection wire** shall conform to the requirements for the wire used in the mesh except that it shall be not more than two gages smaller.

(e) **Gabion stone** shall conform to the requirements of **Section 204**.

610.03—Procedures

Gabions shall be fabricated in such a manner that the sides, ends, lid, and diaphragms can be assembled at the construction site into rectangular baskets. Gabions shall be of single-unit construction whereby the base, lid, ends, and sides are woven into a single unit or whereby one edge of these units is connected to the base section of the gabion. The

Comment [1939]: Right Way

Trial Use and Comment

strength and flexibility at the point of connection shall be at least equal to those of the mesh.

If the length of the gabion exceeds its horizontal width, the gabion shall be equally divided into cells by diaphragms of the same mesh and gage as the body of the gabion. The length of each cell shall not exceed its width. The gabion shall be furnished with the necessary diaphragms secured in the proper position on the base so that no additional tying at the junction will be necessary.

Perimeter edges of the mesh forming the gabion shall be securely clip bound or selvedged in such a manner that the joints formed by tying the selvedges will have at least the same strength as the body of the mesh.

Tie and connection wire shall be supplied in sufficient quantity to fasten securely all edges of the gabion and diaphragms. At least two cross-connecting wires shall be in each cell whose height is one-third or one-half the width of the gabion. At least four cross-connecting wires shall be in each cell whose height equals the width of the gabion. The wire shall be secured through two open loops of the cage.

Comment [1940]: Right Material

Excavating and backfilling for gabions shall be performed in accordance with the requirements of Section 303. Gabions shall be placed on a smooth foundation, and the final line and grade shall be approved by the Engineer.

Comment [1941]: Right Material

Each gabion unit shall be assembled by binding the vertical edges with wire ties at approximately 6-inch intervals or by stitching a continuous piece of connecting wire around the vertical edges with a coil approximately every 4 inches. Wire ties or connecting wire shall be used to join units in the same manner as described for assembling. Internal tie wires shall be uniformly spaced and securely fastened in each cell of the structure.

A standard fence stretcher, chain fall, or iron rod may be used to stretch wire baskets and hold the alignment.

Gabions shall be filled with stone in a manner that will ensure alignment, ensure a minimum of voids, and avoid bulges. Rock and connection wires shall be alternately placed until the gabion is filled. After the gabion is filled, the lid shall be bent over until it meets the sides and edges of the gabion. The lid shall be secured to the sides, ends, and diaphragms with wire ties or connecting wire in the manner described for assembling.

Comment [1942]: Right Time

610.04—Measurement and Payment

Comment [1943]: Right Payment

Gabions will be measured in cubic yards, complete-in-place, and will be paid for at the contract unit price per cubic yard. This price shall include furnishing and installing gabions; excavating; backfilling with suitable material; compacting; and disposing of surplus or unsuitable material.

Trial Use and Comment

Minor structure excavation for gabions, when specified on the plans, will be measured and paid for in accordance with the requirements of Section 303.

Payment will be made under:

Pay Item	Pay Unit
Gabion	Cubic yard

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Ensure the proper materials for the assembly of gabion stone baskets on the construction site are approved.

Start:

- The correct material for the gabion stone baskets is delivered to the construction site to begin the construction of the baskets.

Continuous inspection:

- Check the area is excavated in accordance with Section 303.
- Check the gabion stone baskets are correctly assembled.
- Check the backfilling of the gabion stone baskets meets the requirements of Section 303.

Final Inspection:

- The gabion stone baskets are placed on final grade and ensure proper alignment.

Documentation Required:

- Invoices for the material.
- Completed Daily Report (DWR).
- Sketches and Calculations.

IV. REVIEW QUESTIONS

• Is the correct material for the gabion stone baskets been delivered?
• Is the Contractor assembling the gabion stone baskets in accordance with the specification?
• Has the excavation area for the gabion stone baskets been done in accordance with **Section 303**?
• Has the Engineer approved the final line and grade?
• Is the Contractor placing the gabion stone baskets in a proper alignment that meets the specification requirements?
• Is the backfilling of the gabion stone baskets in accordance with **Section 303**?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• Ensure the correct material is delivered for the gabion stone baskets.
• Ensure the gabion stone baskets are assembled correctly.
• Ensure the excavation is performed in accordance with the specifications.
• Ensure the Engineer has approved the final line and grade.
• Ensure the gabion stone baskets are placed correctly on the grade.
• Ensure the gabion stone baskets are backfilled in accordance with the specifications.

Trial Use and Comment

SECTION 700 - GENERAL

I. INTRODUCTION:

This section is for general construction items of work common to signing, signals and lighting.

Working Drawings

The Contractor shall submit seven copies of working drawings and catalog cuts including any design calculations of each item or piece of equipment to be furnished and installed on the project in accordance with Section 105. In lieu of submitting working drawings the Contractor may submit a letter indicating the brands, types, and models of equipment along with bid item numbers and approval numbers for equipment on the Department's "Pre-Approved Traffic Control Device Listing."

Procedures

Electrical Service

The electrical service location and date electrical service is needed should be determined early. The request for electrical service should be sent to the Regional Traffic Engineer with the following information as soon as possible:

a) **Forms**:

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II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

SECTION 700.01—Description

These specifications cover general construction items, methods, and procedures common to traffic control devices. Installation of materials shall be accomplished in accordance with the manufacturer's instructions except when otherwise indicated.

Comment [1944]: Right Material

700.02—Materials

(a) **Concrete** shall be Class A3 conforming to the requirements of **Section 217.**

(b) **Reinforcing steel** shall conform to the requirements of Section 223.

Trial Use and Comment

(c) **Paint** shall conform to the requirements of Section 231 and shall be applied in accordance with the requirements of Section 411 except on nonferrous materials, where it shall be applied in accordance with the requirements of the manufacturer's recommendations.

(d) **Galvanizing** shall conform to the requirements of Section 233.

(e) **Electrical items** shall conform to the requirements of Section 238.

(f) **Wood for posts and poles** shall conform to the requirements of Section 236 and shall be treated in accordance with the requirements of Section 236. Wood items shall be cut prior to treatment.

(g) **Steel** for fabricated items shall conform to the requirements of Section 226 and shall be fabricated, welded, and inspected in accordance with the requirements of Section 407.

(h) **Aluminum** for fabricated items shall conform to the requirements of Section 229 and shall be fabricated, welded, and inspected in accordance with the requirements of Section 407.

(i) **Poles, posts, and overhead and bridge-mounted sign structures** shall conform to the following:

1. **Conventional and offset lighting poles** shall be steel or aluminum.

2. **Overhead and bridge-mounted sign structures, signal poles (mast arm and strain), and high-mast lighting poles** shall be steel.

3. **Pedestal poles** with a nominal diameter of more than 2 inches shall be steel or aluminum. Pedestal poles 2 inches and less in nominal diameter shall conform to the requirements of Section 238 for metal conduit.

4. **Sign posts** shall be wood or steel.

Lighting, signal, and pedestal poles; sign posts; and overhead and bridge-mounted sign structures not designed to support variable message signs shall conform to the requirements 653 700.02 of the 1994 Edition of AASHTO's *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.*

Overhead and bridge-mounted sign structures, including "butterfly" structures, designed to support variable message signs shall conform to the requirements of the 2001 Edition of AASHTO's *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals* and the following clarifications:

Comment [1945]: Right Material

Comment [1946]: Right Material

Comment [1947]: Right Material

Comment [1948]: Right Material

Trial Use and Comment

- Basic wind speed shall be used in the designs. The alternate method for wind pressures provided in Appendix C shall not be used.

- When the installation location of the structures lies between isotachs, the basic wind speed shall be determined by using the higher adjacent isotach.

- Any optional design parameters indicated in the **AASHTO** specification that are "allowed when acceptable to the owner" shall not be used for the designs.

Steel poles, posts, and overhead and bridge-mounted sign structures shall be hot-dip galvanized after fabrication. Except when shop painting is required, steel poles and posts shall be given one shop coat of primer and two field coats of paint and the galvanization finish of overhead and bridge-mounted sign structures shall be field treated for paint retention and two coats of paint applied.

Signal, lighting, and pedestal poles shall be of a one-piece or sectional single unit, tubular form, and shall be round or multisided. Multisided poles shall have at least eight sides. Pole shafts and arms shall have a removable cap fastened by at least three screws.

Mast arms shall not deflect below the horizontal plane or exceed a rise of 3 percent of the arm length after loads are applied. Mast arm poles shall include an arm attachment flange plate continuously welded to the gusset and side plates. The gusset and side plates shall be continuously welded to the pole and each other. The flange shall be fabricated with four studs permanently attached for receiving nuts (attaching arm). The flange plate and pole shall have a 2 1/2-inch wiring hole with a grommet centered in the pattern.

Strain poles shall not exceed a dead load deflection of 3 percent of the distance between the base of pole and point of dead load attachment. The minimum bottom diameter of strain poles shall be 11 inches.

Signal poles shall have a steel "J" hook located inside the poles for wire suspension within 5 inches of the top.

Lighting, signal poles, and overhead structures shall have a grounding lug welded to the inside of the pole or structure easily accessible from the hand hole. The grounding lug shall be designed to secure the grounding electrode conductor and equipment-grounding conductor by inserting the conductor under a setscrew type of lug.

Signal poles, high-mast lighting poles, and overhead sign structures, including butterfly structures, shall have a minimum of six anchor bolts, each having a minimum diameter of 1 1/2 inch. The maximum space between the bottom of the base plate and the top of the foundation shall be no greater than the diameter of the anchor bolt plus 1 inch.

Comment [1949]: Right Way

Trial Use and Comment

No grout will be permitted between the base plate and the top of the foundation of overhead structures, mast arm, lighting, and signal poles. No lock nuts or split washers will be allowed with the anchor bolts.

(j) Anchor bolts shall be steel, conforming to the requirements of Section 226.02(c)2. The portion of anchor bolts beginning 4 inches below the top of the foundation and extending above the foundation shall be galvanized except when stainless steel is used.

Anchor bolts used with signal poles, high-mast lighting poles, and overhead sign structures, including butterfly structures, shall conform to the requirements of Section 517 of the 2001 Edition of AASHTO's *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.*

(k) **Breakaway support systems** shall conform to the requirements of the 1994 Edition ofAASHTO's *Standard Specifications for Structural Supports for Highway Signs, Luminaires,and Traffic Signals.*

1. **Breakaway couplers and skirt covers** shall be aluminum. Threaded studs, nuts, and washers shall be stainless steel or galvanized steel.

2. **Frangible bases** shall be aluminum.

3. **Slip bases** shall be galvanized steel or other approved noncorrosive metal.

(l) **Miscellaneous hardware** shall be brass, bronze, stainless steel, or galvanized steel.

700.03—Working Drawings

The Contractor shall submit working drawings to the Engineer, including design calculations and catalog cuts, in accordance with the requirements of Section 105.10 except that each copy shall be submitted with the manufacturer's name and address clearly noted. Submitted data for the following aluminum lighting poles shall also specifically address how fatigue was considered in the design of the poles:

1. Conventional aluminum lighting poles with a height of 40 feet or greater.

2. Offset aluminum lighting poles with a height of 20 feet or greater.

3. Other aluminum lighting poles with a height greater than 20 feet and a pole-top-mounted luminaire.

4. All aluminum lighting poles mounted on bridges

Fatigue may be addressed through the use of vibration dampening devices or through other means as determined by the manufacturer.

Comment [1950]: Right Material

Comment [1951]: Right Material

Comment [1952]: Right Material

Comment [1953]: Right Material

Comment [1954]: Right Material

Comment [1955]: Right Material

Comment [1956]: Right Way

Trial Use and Comment

In lieu of working drawings and catalog cuts, the Contractor may submit a letter indicating the brands, types, and models of equipment along with the approval numbers and contract item numbers. The Contractor shall include the words “Testing Required” with the approval numbers when materials testing is required for the equipment. The approval numbers shall be taken from the Department’s
Preapproved Traffic Control Device List. Any equipment on the list for which approval has been rescinded will not be allowed for use if the rescinded date is earlier than the receipt of bids for the project. Inclusion of equipment on the list does not ensure acceptance if contract requirements prohibit use of the equipment. The Contractor shall ensure that the equipment as furnished conforms to the requirements of the Department.

700.04—Procedures

(a) **Grounding Electrodes:** Grounding electrodes (rods) shall be installed in accordance with the requirements of the NEC or by other methods approved by the Engineer. Grounding electrodes shall be installed using a hydraulic/pneumatic/electric hammer drill driving device with an electrode drive bit to minimize damage to the electrode tip. The electrode drivebit shall be designed for 3/4-inch electrodes. Grounding electrodes shall include a grounding electrode conductor and grounding electrode clamp.

1. **Electrical service grounding electrode installations**: The following procedures apply only to installing electrical service grounding electrodes:

- Grounding electrodes and grounding electrode conductors shall be installed in the presence of the Engineer at a date and time mutually agreed upon.

- Grounding electrode and grounding electrode conductors shall be connected using exothermic welds. Exothermic welds shall be designed for the size conductor and grounding electrodes and shall be installed in accordance with the manufacturer’s instructions. Grounding electrode conductors and grounding electrodes shall be cleaned to remove oxidation and any other foreign material from the surface before performing the exothermic welds.

- Primary grounding electrodes shall not have a resistance to ground of more than 25 ohms. A 10-foot section of grounding electrode shall have a minimum of an 8-foot contact with soil. Grounding electrodes shall be spaced a minimum of 10 feet between all electrodes.

- Primary grounding electrodes shall be installed vertically to a depth of 40 feet or until refusal. If the vertical grounding electrode cannot be installed to a minimum of an 8-foot contact with soil, the Contractor shall install a grounding electrode at an angle of no more than 45 degrees to a depth of 40 feet or until refusal. If refusal occurs prior to installing the electrode to a minimum of an 8-foot contact with soil, the Contractor shall remove the electrode or cut it off 6 inches below grade and abandon it.

Comment [1957]: Right Documentation

Comment [1958]: Right Way

Comment [1959]: Right Way

Comment [1960]: Right Location

Trial Use and Comment

- Primary grounding electrodes complying with these requirements shall be augmented with an additional grounding electrode and connected in parallel to the primary grounding electrode to form a system. The augmented electrode shall be a single electrode driven to a depth of 4 inches below the finished grade. If refusal occurs prior to installing the electrode to a minimum of an 8-foot contact with soil, Contractor shall remove the electrode or cut it off 6 inches below grade and abandon it.

- Grounding electrodes shall be coupled at each section with couplers or exothermic welded splices. The grounding electrode conductor shall be installed to a depth of 18 inches below grade when connecting the primary electrode and augmented grounding electrodes.

- The Contractor shall install a JB-2C junction box at the primary grounding electrode location for access to the electrode for connection and testing. Groundingelectrode conductors shall be installed under the bottom flange of the JB-2C. The grounding electrode shall be centered in the bottom of the JB-2C with a minimum of 6 inches exposed. The JB-2C cover shall have the letters "VDOT ELEC" cast in the depression on the top.

The Contractor shall notify the Engineer of those location(s) where primary grounding electrodes do not conform to the following:

• Resistance does not measure 25 ohms or less.

• Grounding electrode does not have at least an 8-foot contact with soil.

For such locations, the Engineer will advise the Contractor how to proceed.

2. **Grounding electrode testing:** Primary grounding electrodes shall be tested after each 10-foot grounding electrode and/or section thereof is installed using the fall of potential (three-point measurement) method. After the primary grounding electrode is installed and tested, the Contractor shall connect to the augmented electrode(s) to conduct a system test. The Contractor shall disconnect the grounding electrode conductor from the service equipment ground bus and bonding bushing before testing the grounding electrodes/system. The Contractor shall test the grounding electrode as required by the manufacturer's instructions for the type of earth testing equipment. The Contractor shall record the readings on a form provided by the District Traffic Engineering Office. The completed form shall be signed and submitted to the Engineer after installation of the electrical service grounding.

(b) Excavation for Foundations: Excavation shall be performed in accordance with the requirements of **Section 401.**

Comment [1961]: Right Way

Comment [1962]: Right Location

Comment [1963]: Right Material

Comment [1964]: Right Way

Comment [1965]: Right Documentation

Comment [1966]: Right Location

Trial Use and Comment

(c) **Concrete Foundations:** Concrete foundations shall be constructed and cured in accordance with the requirements of Section 404 and shall rest on material that will adequately support the design load. The Contractor may secure the anchor bolts to prevent their movement during concrete placement with a No. 3 or smaller rebar. Rebar shall be attached to the anchor bolts with rebar twist ties. Exposed areas of concrete foundations shall be given a Class 7 finish in accordance with the requirements of **Section 404.** Items shall not be erected on concrete foundations until concrete has cured for at least 28 days or has obtained a compressive design strength of at least 3,000 pounds per square inch.

Foundations for overhead sign structures shall be spread footings unless inadequate soil conditions require deep foundation systems, i.e., drilled piers, driven piles. Drilled foundations may be permitted except for single-pole structures, i.e., overhead single-pole-in-end forms, cantilever, or butterfly.

Foundation designs for signal poles, high-mast lighting poles, and overhead sign structures shall be furnished by the Contractor. Designs shall indicate the cubic yard quantity of concrete required for the foundations. Foundations shall be designed to conform to the requirements of the same edition of **AASHTO**'s *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals* used for the structure it is supporting.
The Contractor shall accomplish at least one test bore, as approved by the Engineer, at each foundation location to determine the subsurface conditions prior to designing the foundation. Test bores shall be performed in accordance with any of the following three methods:

1) **ASTM D 420, ASTM D 1452, and ASTM D 1586**
2) **ASTM D 3441**
3. **ASTM D 4719**.

For areas west of I-95, the depth of the test borings shall be at least 15 feet; for areas east of I-95, the depth of the test borings shall be at least 30 feet. When test borings are performed in the median of I-95, their depth shall be at least 15 feet for areas north of the intersection with Route 250 and at least 30 feet for areas south of the intersection with Route 250. Soil conditions shall be tested at the ground level and then at depth intervals of 3 feet in accordance with any of the three methods stated.

When auger refusal or a count of 50 blows per inch occurs before a 15-foot depth due to rock, the rock shall be continuously cored for at least 5 feet and be sampled in accordance with **ASTM 2113**. Boring logs shall be properly identified to the actual site with the centerline station and the distance perpendicular from the centerline indicated. On projects where the roadway is existing and no centerline is being surveyed, alternate methods for identifying the location shall be submitted by the Contractor for the Engineer's records. Bore log data shall be submitted electronically in an approved format, in accordance with Materials Division Policy and the resulting borehole log shall be included with the shop drawing submittals for the foundation designs.

Comment [1967]: Right Location

Comment [1968]: Right Way

Comment [1969]: Right Material

Comment [1970]: Right Time

Comment [1971]: Right Documentation

Trial Use and Comment

The quantity of cubic yards of concrete that is indicated in the contract is an approximation. Payment will be made for the actual cubic yards of concrete based upon the foundation design supplied by the Contractor.

Test bores shall be performed within 5 feet of the foundation's location, as shown on the plans, or as directed by the Engineer.

(d) **Electrical Service:** Electrical service shall be installed in accordance with the requirements of the NEC and the local power company. Meter bases and current transformer cabinets will be furnished by the local power company. The Contractor shall make arrangements with the local power company for pickup of this equipment. The Department will request and pay for electrical service and temporary electrical service for items temporarily relocated or adjusted for the purpose of traffic control shown on the plans or directed by the Engineer. If the Contractor desires temporary service for his convenience, he shall arrange and pay for the service.

(e) **Poles, Posts, and Sign Structures:** The location of each pole, post, and sign structure shall be established by the Contractor with a stake bearing the number or identification designated on the plans. The Engineer, accompanied by the Contractor, will inspect the locations and advise the Contractor of any necessary adjustments. Poles, posts, and sign structures shall be made plumb after installation of loads by the use of nuts and flat washers above and below the base plate on each anchor bolt or by other approved methods.

If a pole, overhead sign structure, or span wire is to be located within 10 feet of an electric power line as measured in any direction, the Contractor shall immediately inform the Engineer. The Contractor shall not install the equipment until the Engineer has reviewed and advised the Contractor of any relocation or to proceed with the work.

A noncorrosive metal identification tag shall be permanently attached approximately 30 inches above the foundation to each signal, pedestal, and lighting pole; overhead sign structure; bridge-mounted sign structure; and steel sign post except U-channel sign posts and square tube steel. The tag shall be of sufficient size for 1/4-inch lettering, single-spaced between lines, and shall be attached by noncorrosive screws or rivets.

The tag shall be imprinted with "VDOT" except when the structures are located within an incorporated town or city on a primary or secondary roadway, where it shall be imprinted with the municipality's name unless otherwise noted on the plans or directed by the Engineer. The tag shall also be imprinted with the following:

1. Manufacturer's name on all tags.

2. Manufacturer's unique ID number on all tags.

Comment [1972]: Right Payment

Comment [1973]: Right Way

Comment [1974]: Right Pay

Comment [1975]: Right Location

Comment [1976]: Right Way

Comment [1977]: Right Material

Trial Use and Comment

3. Date of manufacture on all tags.

4. Signal poles: gage and length of pole and mast arm(s).

5. Pedestal poles: gage and length of pole.

6. Lighting poles: gage and length of pole and luminaire arm(s); electrical phase circuit designation.

7. Overhead sign structures: gage and length of pole and span.

8. Steel sign posts: I-beams: length, size, and weight per foot of post.

When transformer bases are used, bolt covers shall be installed on pole anchor bolts. Bolt covers shall be designed to allow ventilation of the nut and anchor bolt.

Poles shall be provided with hand holes that face away from traffic. Hand holes shall be at least 3 by 5 inches unless otherwise specified and shall be provided with a gasket and cover with an 18-inch-long galvanized chain with a minimum breaking strength of 300 pounds welded to the inside of the pole at the bottom of the hand hole opening and to the inside of the cover to prevent accidental loss. The cover shall be attached to the pole with noncorrosive captive screws, and attachment holes shall be drilled and tapped.

When required by the plans, the Contractor shall supply a terminal strip consisting of 24 double-pole terminals. The terminal strip shall be constructed of noncorrosive materials and shall be located on the outside of the pole just above the hand hole. A continuously welded frame and a removable, weatherproof, gasketed cover designed to enclose both the hand hole and terminal strip shall be provided.

(f) **Breakaway Support Systems:** Breakaway support systems shall be installed on lighting poles when required by the plans and on pedestal poles except when used for power service. Breakaway support systems shall be installed in accordance with the requirements of the manufacturer's recommendations.

Comment [1978]: Right Way

(g) **Conductor Cables:** Conductor cables in conduit runs more than 100 feet in length shall be installed with the use of an approved lubricant or pulling compound. Cleaning agents and lubricants that have a deleterious effect on cable coverings shall not be used.

Comment [1979]: Right Way

Aerial cables that extend more than 20 feet shall be supported by a span wire or reinforced with a copper-clad, galvanized, or stainless steel wire for self-support. Cable rings shall be used to attach conductor cables to the supporting wire; however, lash

Trial Use and Comment

wire may be used to attach interconnect cable when no other conductor cables are attached to the same span wire. Vinyl tape shall be used as shown on the plans to prevent sag. When aerial cables enter a service entrance head, an 8-inch drip loop shall be formed.

Bends in single or multiple conductor cables shall have a bend radius of at least 5 times the outside diameter of the cable.

Conductor cables shall be installed with the slack length coiled in junction boxes. The coiled length shall be sufficient to allow cables to extend at least 2 feet above junction boxes.

Solderless terminals shall not be used for connecting conductor cables having solid conductors to terminal posts.

Splices in lighting conductor cables will be permitted only at accessible locations. Splices in service entrance conductor cable will be permitted only for connection to the utility company's service conductor cables. Splices will not be permitted in signal and interconnect conductor cables.

Splices in lighting and service entrance conductor cables shall be made in accordance with the requirements of the NEC and the following additions and exceptions. Conductor insulation shall be removed only to the amount necessary to install the connector. Exposed conductors shall be wire brushed and cleaned before splicing. Splices shall be made with properly sized non-insulated butt-end connector compression sleeves for single conductors or split bolts for branch circuit connections. Conductor connections shall be made mechanically and electrically secure. Crimping tools used on compression sleeves shall be designed for the application and sized to the splicing connectors.

Splices shall be covered with an insulation rated equal to or higher than the voltage rating of the conductor cable. Single and branch circuit conductor splices shall be properly re-insulated and made water resistant by one of the following methods:

- Two layers of rubber electrical tape shall be applied half-lapped with the first layer extending the length of the disturbed insulation and the second layer extending at least 1 inch onto clean undisturbed insulation of each conductor. Rubber electrical tape shall be stretched and wrapped tightly to eliminate air gaps. Rubber electrical tape shall be 660 700.04 molded around irregular shapes and multiple conductors for smooth insulation buildup. Over the rubber electrical tape, at least two layers of vinyl electrical tape shall be applied half-lapped with each layer overlapping the end of the proceeding layer by at least 1 inch onto clean, undisturbed insulation. The splice and at least 1 inch of adjacent clean insulation shall be covered using an acceptable water-resistant sealing compound for electrical splices;

Comment [1980]: Right Material

Trial Use and Comment

- Heat-shrink tubing properly sized shall be installed extending at least 3 inches onto each end of clean, undisturbed insulation. End seams around two or more adjacent conductors shall be sealed and made water resistant; or

- The splice kit shall be properly sized to extend at least 3 inches onto each end of clean, undisturbed insulation.

Single conductor splices within a multi-conductor cable shall be re-insulated using heat shrink tubing.

Re-jacketing of multi-conductor cables shall be accomplished using heat-shrink tubing properly sized.

Heat-shrink tubing shall be heated using a non-contact flameless device or a flamed heat source device equipped with a shield to prevent the flame from coming in contact with the tubing.

Breakaway connectors shall be installed on luminaire conductors and on signal conductors for signal head assemblies on pedestal poles. Breakaway connectors shall be fused for the hot conductors and nonfused for the grounded conductor. Breakaway connectors shall be located in the hand hole of the pole.

Signal and interconnect cable terminal strips shall be sealed with a moisture block compound to prevent moisture from entering the open cable end. The compound shall be soft, pliable, and easily removable and shall be used in accordance with the manufacturer's recommendations.

Termination of interconnect cable will be allowed only in a master controller cabinet, local controller cabinet, or terminal enclosure. The cable shield shall be grounded at each termination point. Whenever the cable is entered for connection to equipment, each wire of the cable shall be connected to a terminal post position.

The Contractor shall conduct a Megger test on the installed interconnect cable and shield, for which a reading of 100M ohms shall be required. Testing for 300-volt cable shall be performed at 200 volts, and testing for 600-volt cable shall be performed at 500 volts. Cables shall be disconnected from controller cabinet terminals during testing.

Service entrance and lighting conductor cables shall be marked in accordance with the requirements of Article 310–11 of the NEC. Markings shall be continuous and permanent. Signal and interconnect conductor cables shall be marked in accordance with the requirements of the applicable **IMSA specification.**

Prior to energizing an electrical system, the Contractor shall demonstrate to the Engineer that the system is clear and free from short circuits, open circuits, and unintentional grounds. Faulty circuits shall be repaired or replaced by the Contractor at his expense.

Comment [1981]: Right Way

Comment [1982]: Right Location

Comment [1983]: Right Material

Comment [1984]: Right Way

Comment [1985]: Right Payment

Trial Use and Comment

1. Electrical service and lighting conductor identification:

Grounded conductors: Insulated grounded conductors (Neutrals) shall be identified by a continuous white or gray outer finish except that those larger than No. 6 AWG may be identified by three continuous white stripes on other than green insulation along its entire length.

Comment [1986]: Right Material

Equipment grounding conductors: Equipment grounding conductors shall be bare, covered, or insulated. Covered or insulated equipment grounding conductors shall have a continuous outer finish that is either green or green with one or more yellow stripes.

Ungrounded conductors: Ungrounded conductors, whether used as a single conductor or in multiconductor cables, shall be finished to be clearly distinguishable from grounded, grounding, and equipment grounding conductors. Ungrounded conductors shall be identified by a continuous color-coding outer finish by phase and system except that those larger than No. 6 AWG may be identified only at readily accessible locations by marking tape, tagging, or other approved means in accordance with NEC requirements.

Color-coding shall be as follows:

Circuit Designation	Color Code
2-wire circuits, 120 volts; 3-wire circuits, 120/240 volts; 3-phase, 4-wire wye circuits, 208/120 volts; and 3-phase, 4-wire delta circuits, 240 volts	
Phase A or Line A	Black
Phase B or Line B	Red or orange*
Phase C	Blue
Grounded Conductor (Neutral)	White or gray** (see exception above)
Equipment Grounding Conductor	Bare, green, or green with one/more yellow stripes
3-phase, 4-wire wye circuits, 480/277 volts; 3-phase, 3-wire delta circuits, 480 volts	
Phase A	Phase A
Phase B	Phase B
Phase C	Phase C
Grounded Conductor (Neutral)	Grounded Conductor (Neutral)
Equipment Grounding Conductor	Equipment Grounding Conductor

*For 3-phase, 4-wire delta circuits, Phase B shall be the high leg and shall be orange.
**For outer covering of conductors of different systems that is contained within the same enclosure, refer to Article 200 of the NEC.

Electrical service and lighting conductors shall be permanently identified in accessible locations (hand holes, transformer bases, junction boxes, control centers, etc.) with non-ferrous metal tags or nylon tags attached to the conductor. Identifications shall be stamped or engraved on the metal tags and lettered with permanent ink on the nylon tags. Identifications shall be legible and shall indicate the electrical phase. Lighting conductors shall also indicate the electrical phase circuit designation. When the conductors are within a multi-conductor cable, the tag shall be attached to the cable jacket and shall indicate the required information for all conductors on one tag. If the

Comment [1987]: Right Way

Trial Use and Comment

conductors of a multi-conductor cable have been exposed for splicing, connections, etc., the conductors shall be tagged in lieu of the cable jacket.

2. **Signal and interconnect cable** jackets shall be permanently identified by integral-impregnated color coding. Color coding for signal cable shall be as follows:

Cable Insulation Color	14/12 Cable	14/7 Cable	4/4 Cable	14/3 Cable
Red	Red	Red	Red	Don't Walk
Orange	Yellow	Yellow	—	—
Green	Green	Green	Green	—
Red with black tracer	Red	—	—	—
Orange with black tracer	Yellow	—	—	—
Green with black tracer	Green	—	—	—
Blue	Green	Green	—	—
White with black tracer	Yellow	Yellow	—	—
Black	Red	Red	Yellow	Walk
Black with white tracer	Spare	—	—	—
Blue with black tracer	Spare	—	—	—
White	AC Ground	AC Ground	AC Ground	AC Ground

Signal and interconnect cables shall be permanently identified in the controller cabinet, junction boxes, hand holes, and other accessible locations. Signal conductor cables shall also be identified in the hand hole of poles if the cables are attached to terminal strips in the hand hole. Identifications shall be indicated on nonferrous metal tags or nylon tags attached to the cable with nylon cable ties. The identification shall be stamped or engraved on the metal tags and lettered with permanent ink on the nylon tags. Identifications shall be legible and shall conform to the following:

a. **Signal cable**: phase and location of signal head; e.g., 1 NB left-turn head; 1 NB inside left-turn head; 2 SB through-lane heads; 1 left-turn head and 6 through-lane heads; 2 Ped head NW Quad.

b. **Interconnect cable:** description and direction from location (if cable is a spare). The word "spare" shall be included after "inter." The direction from location is required only in the controller cabinet, e.g., Inter. NB; Inter. Spare NB; Inter. WB; Inter.

(h) **Conduit Systems:** Conduit systems shall be rigid except where contract documents specify otherwise. PVC, fiberglass, and metal conduit runs shall have the minimum number of couplings permitted by the use of standard conduit lengths. Ends of conduit sections that must be field cut shall be reamed smooth. PE conduit shall be installed in continuous unspliced runs between enclosures. Field-threaded portions of metal conduit shall be galvanized. Except for expansion couplings, conduit sections shall be connected with couplings so that ends will abut squarely inside couplings.

Joint-sealing solvent shall be used as recommended by the conduit manufacturer. Where necessary, ends of each length of nonmetallic conduit shall be tapered by machining to provide joints that are tight after assembly.

Comment [1988]: Right Way

Comment [1989]: Right Way

Comment [1990]: Right Location

Comment [1991]: Right Way/ Location

Comment [1992]: Right Material

Comment [1993]: Right Way

Trial Use and Comment

Conduits shall be continuous and watertight between outlets. Deformed conduit shall not be used. Conduits shall be free from kinks or defects that would cause damage to conductor cables when pulled. Conduits shall be installed so that moisture will drain properly to electrical junction boxes or drainage tees with drip spouts.

After installation, each conduit shall be tested in the presence of the Engineer for obstructions. A suitable rigid or flexible mandrel having a diameter at least 80 percent of the inside diameter of the conduit shall be pulled through each conduit run. Obstructions shall be removed, and the conduit repaired at the Contractor's expense.

Comment [1994]: Right Time

Comment [1995]: Right Payment

After testing, individual non-metallic conduit runs more than 150 feet in length that are to remain empty shall be equipped with a woven polyester or aramid pull tape having a tensile strength of at least 1,100 pounds and less than 15 percent elongation at yield. Pull rope shall not be used in non-metallic conduit. Twelve inches of pull tape shall be doubled back into the conduit at each end. Metallic conduit runs more than 150 feet in length that are to remain empty shall be equipped with either a pull rope or tape having a tensile strength of at least 1,100 pounds. Twelve inches of pull tape or rope shall be doubled back into the conduit at each end.

Open ends of unused conduit shall be closed with watertight plugs or caps to seal against moisture. Open ends of conduits with conductors installed shall be sealed with an approved soft, pliable, and easily removable waterproof sealant. The sealant shall not have a deleterious effect on cable coverings.

Metal conduit systems shall be bonded. When a nonmetallic conduit system is used, the Contractor shall furnish and install an equipment grounding conductor to maintain a bonded system in accordance with the requirements of the NEC.
Non-metallic conduit with non-metallic cable (fiber optic) within shall be equipped with a No. 8 locator wire.

Wherever conduit crosses a structural expansion joint, conduit shall be provided with an expansion fitting. The fitting shall permit longitudinal movement of the amount specified on the plans.

1. **Exposed conduit systems** shall be fabricated of heavy-wall PVC, fiberglass, or metal, with not more than four bends between any two outlets. The angular sum shall be not more than 360 degrees. When heavy-wall PVC or fiberglass conduit is accessible to public contact, it shall be covered with a protective shield conforming to the requirements of **Section 238** for a distance of at least 8 feet above the adjacent finished grade. Splice boxes or pull boxes shall be of a size that will allow proper termination of conduit and connection of conductor cables as required by the NEC. Conduit shall be terminated by means of approved fittings or bushings.

Comment [1996]: Right Material

Comment [1997]: Right Way

2. **Buried conduit systems** shall be installed in straight lines between outlets. When obstructions are encountered during installation and conduit cannot be

Comment [1998]: Right Way

Trial Use and Comment

economically located elsewhere, the obstruction shall be bypassed by offsetting the conduit line in accordance with the requirements of the Standard Drawings. Required conduit bends shall be installed with a bend radius of at least 5 feet. Conduit bends in structures and foundations shall be installed in accordance with the requirements of the NEC. The use of a pipe tee or vice for bending conduit will not be permitted.

When conduit is to be installed under an existing roadway, entrance, or fixed object and open cutting is not permitted, conduit shall be installed by an approved directional boring method. Conduit for the directional boring method shall be PVC designed specifically for the directional boring operation or high-density PE. With the approval of the Engineer, the Contractor may elect to use the jacked method to install a pipe sleeve for installation of the required conduit at no additional cost to the Department.

Comment [1999]: Right Location

Comment [2000]: Right Material

Open cut areas shall be backfilled in accordance with the requirements of **Section 302**.

(i) **Junction Box Covers:** If a special tool or wrench is needed to remove a cover, the Contractor shall furnish the Engineer five such tools.

(j) **Hydraulic Cement Concrete Sidewalk:** When disturbed by the installation of equipment, sidewalk shall be replaced in accordance with the requirements of **Section 504** along existing joint lines.

Comment [2001]: Right Way

700.05—Measurement and Payment

Concrete foundations will be measured and paid for in units of each or cubic yards of concrete as applicable. When paid for in cubic yards of concrete, no payment will be made for concrete in excess of the cubic yards of concrete required by the foundation design unless otherwise approved by the Engineer. This price shall include foundation design, concrete, reinforcing steel, stub poles, anchor bolts, bolt circle templates, grounding equipment, conduits, excavating, backfilling, compacting, disposing of surplus and unsuitable material, and restoring existing areas.

Comment [2002]: Right Payment

Electrical service will be measured in units of each and will be paid for at the contract unit price per each. This price shall include service poles, safety switches or breaker boxes, service entrance conductor cables from the utility company's service box, conductors to the safety switch and circuit breaker box, conduits and fittings on poles and steel supports, conduit straps or clamps, meter base, service entrance heads, thimbleye bolts, steel supports, wireway, junction boxes for grounding electrode and utility service, excavation, concrete, and pickup and installation of meter base and current transformer cabinet.

Comment [2003]: Right Payment

Trial Use and Comment

Luminaire arms will be measured in units of each and will be paid for at the contract unit price per each. This price shall include pole mounting brackets, fittings, and mounting hardware.

Lighting poles will be measured in units of each and will be paid for at the contract unit price per each. This price shall include pole shafts, luminaire arms, grounding lugs, hand holes and covers, caps, identification tags, anchor bases, bolt covers, bracket arms, and breakaway support systems.

Signal poles will be measured in units of each and will be paid for at the contract unit price per each. This price shall include pole shafts, mast arms, grounding lugs, hand holes and covers, caps, fittings, anchor bases, bolt covers, and identification tags.

Overhead and bridge-mounted sign structures will be measured in units of each and will be paid for at the contract unit price per each. This price shall include structural units and supports, hand holes and covers, grounding lugs, walkways and handrails, electrical systems including conduit and fittings, and identification tags.

Sign posts will be measured in linear feet and will be paid for at the contract unit price per linear foot. This price shall include clamps, identification tags, and breakaway base assemblies.

Pedestal poles will be measured in units of each and will be paid for at the contract unit price per each. This price shall include caps, breakaway support systems, hand holes and covers, grounding lugs, identification tags, and anchor bases and bolt covers.

Wood poles will be measured in units of each and will be paid for at the contract unit price per each. This price shall include thimbleye bolts, guy wires with guards and anchors, excavating, backfilling, compacting, disposing of surplus and unsuitable material, and restoring existing areas.

Conductor cables will be measured in linear feet and will be paid for at the contract unit price per linear foot. This price shall include conductors, breakaway connections, markings and identifications, splice kits, electrical tape, testing, and connections.

Conduit will be measured in linear feet and will be paid for at the contract unit price per linear foot. This price shall include conduit bodies, fittings, bonding systems, pull ropes, pull tapes, plastic spacers, No. 8 locator wire when required, pull or splice boxes with an area of 512 cubic inches or less, supports, and protective metal shields.

Trench excavation will be measured in linear feet and will be paid for at the contract unit price per linear foot. This price shall include trenching, encasing, backfilling, locator tape, compacting, disposing of surplus and unsuitable material, and restoring existing areas.

Junction boxes will be measured in units of each and will be paid for at the contract unit price per each. This price shall include concrete collars, frames and covers, tools to

Comment [2004]: Right Payment

Comment [2005]: Right Payment

Comment [2006]: Right Payment

Comment [2007]: Right Payment

Comment [2008]: Right Payment

Comment [2009]: Right Payment

Comment [2010]: Right Payment

Comment [2011]: Right Payment

Comment [2012]: Right Payment

Comment [2013]: Right Payment

Comment [2014]: Right Payment

Trial Use and Comment

remove the cover, ground rods, ground conductors, grounding lugs, knockouts, cable racks, aggregate, excavating, backfilling, compacting, disposing of surplus and unsuitable material, and restoring existing areas. These prices shall include providing the required finish.

Test bores will be measured in units of each and will be paid for at the contract unit price per each. This price shall include the test bore, rock sampling, and determination of the soil and rock condition.

Comment [2015]: Right Payment

Electrical service grounding electrode will be measured in units of each, per 10-foot electrode or portion thereof, and will be paid for at the contract unit price per each. This price shall include testing, exothermic welds, grounding electrode(s), electrode couplers, grounding conductor, and report documentation.

Comment [2016]: Right Payment

Bored conduit will be measured in units of linear feet and will be paid for at the contract unit price per linear foot for the size specified. The price shall include conduit; fittings; couplings; and, when required, No. 8 locator wire, bonding systems, and pull rope or tape.

Comment [2017]: Right Payment

Payment will be made under:

Pay Item	Pay Unit
Concrete foundation (Standard, type, and size)	Each or Cubic yard
Electrical service (Standard and type)	Each
Luminaire arm (Length)	Each
Lighting pole (Standard, luminaire mounting height, and length of luminaire arm)	Each
Signal pole (Standard, length, number, and length of arms)	Each
Overhead sign structure (Location)	Each
Bridge-mounted sign structure (Location)	Each
Sign post (Type and size)	Linear foot
Pedestal pole (Standard and length)	Each
Wood pole (Class and length)	Each
Conductor cable (Size/number)	Linear foot
Conduit (Type and size)	Linear foot
Trench excavation (Standard)	Linear foot
Junction box (Standard)	Each
Test bore	Each
Electrical service grounding electrode (10 foot)	Each
Bored conduit (size)	Linear foot

Comment [2018]: Right Payment

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Are working drawings submitted as required?
- The electrical service location and date electrical service is needed should be determined early.
- Communicate with contractor and T&E to ensure the sites for foundations are reviewed in the field prior to installation of poles.
- Find a location for electrical service.

Start:

- Review field conditions with T&E prior to ordering poles.
- Ensure the material meet the requirements as specified.
- Ensure the working drawings submitted as required.

Continuous inspection:

- Ensure ground rounds include a No. 6 bare copper wire and ground wire clamp.
- Ensure the concrete foundations constructed as required and are field reviewed to ensure each foundation is located correctly.
- After installation, each conduit is to be tested for obstructions. When conduits are clear of obstructions, empty conduits shall be equipped with pull ropes as specified.
- Make sure the concrete foundation reaches the required 3000 psi compressive strength prior to erecting the remainder of the items.
- Concrete foundations are flush with the ground or no more than 4” above ground.
- Ensure all non-corrosive metal tags attached as specified.
- Ensure that all hand holes are provided as specified.
- Ensure that all conduit systems and conductor cables are being installed as per the specification.

Trial Use and Comment

Final Inspection:

- Conduit is marked and specified.
- Concrete foundations are flush with the ground or no more than 4" above ground.
- Poles are to be provided with 3 inch by 5 inch hand holes complete with covers and gaskets. Hand holes are to be attached with non-corrosive tap screws and are to face away from the roadway.

Documentation Required:

- All DWR's are complete and match the pay items in Site Manager and there are enough invoices to cover the items paid.
- Materials Notebook is complete and accurate.

Trial Use and Comment

IV. REVIEW QUESTIONS

700.03(2)	In lieu of submitting working drawings and catalog cuts, did the Contractor submit a letter indicating the brands, types, and models of equipment along with the approval numbers and contract item numbers?
700.03(3)	Does the Contractor include the words "Testing Required" with the approval numbers when material testing is required for the equipment?
700.04(a)	Are ground electrodes installed according to this section?
700.04(c)1	Are concrete foundations constructed and cured in accordance with Section 404, Hydraulic Cement Concrete Operations?
700.04(c)2	Have all concrete foundations reached their required 3,000 psi compressive strength or 28 day time limit prior to any item being erected on them?
700.04(c)3	Have foundation designs for signal poles, high mast lighting poles, and overhead sign structures been furnished by the contractor?
700.04(c)4	Have test bores been performed in accordance with the requirements of this section?
700.04(c)5	Have test bore logs been submitted in accordance with the requirements of this section?
700.04(e)2	Has the location of each pole, post, and sign structure been established by the Contractor with a stake bearing the number or identification designated on the plans?
700.04(e)3	If a pole, overhead sign structure, or span wire is located within 10 feet in any direction of an electric power line, did the Contractor notify the Engineer immediately?
700.04(e)4	Has a noncorrosive metal tag been permanently attached to each signal, pedestal and lighting pole, overhead sign structure, and I-beam steel sign post (except U-channel sign post) approximately 30 inches above the foundation?
700.04(e)5	Are hand holes provided on poles, and are they located on the side away from traffic?
700.04(e)6	Are the hand holes at least 3 inches by 5 inches and provided with a cover, gasket, and safety chain?
700.04(f)	Are breakaway support systems installed in lighting and pedestal poles when required by the plans in accordance with this section?
700.04(g)	Has conductor cables been installed in accordance with this section and has a megger test been performed?
700.04(h)	Have conduit systems been installed in accordance with this section?
700.04(h1)	When accessible to the public, was PVC or fiberglass conduit covered with a protective shield for a distance of at least 8 feet above finished grade?
700.04(j)	When disturbed by the installation of equipment, was sidewalk replaced in accordance with Section 504, Sidewalk, Steps and Handrail along existing joint lines?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• Does the material meet the requirements as specified?
• Ensure working drawings submitted as required and approved.
• Ensure the ground rounds include a No. 6 bare copper wire and ground wire clamp.
• Ensure T&E have reviewed the locations for the concrete foundations.
• Ensure the concrete foundation reach the required 3000 psi compressive strength prior to erecting of items on them.
• Ensure the non-corrosive metal tags attached as specified.
• Ensure the conduit systems and conductor cables installed as specified on the plans and a pull rope is installed in empty conduit.
• Ensure the hand holes provided according to the specifications.
• The Inspector must verify that the staked location of the foundation is correct. After excavation, the Inspector must verify that the base upon which the foundation will be placed is suitable material. Reinforcing steel must be placed and anchored in accordance with the Road and Bridge Standards or the plans.
• The top of the foundation is to be flush when mounted in or adjacent to sidewalks and 4 inches above the ground level in all other areas. The foundation is to be backfilled and compacted as specified.

Trial Use and Comment

SECTION 701 – TRAFFIC SIGNS

I. INTRODUCTION:

The proper use of traffic signs is critical to ensure the safety of the traveling public. Materials used must conform to the Specifications and proper location and installation must be in accordance with the **Manual for Uniform Traffic Control Devices (MUTCD)**. Inspectors should contact the District Traffic Engineer for assistance as needed.

MATERIALS

The Inspector is to ascertain that all materials have been approved for use by test reports or "Certificates of Compliance" and documented in the Materials Notebook. Visual inspection is to be made of the condition of material at time of arrival and for compliance with plans, Specifications and approved drawings. Should a question arise in regard to acceptability of a material or finished sign, the Inspector is to refer the matter to the Construction Manager for clarification. Substitution of a similar item for the specified or previously approved item is not to be permitted unless specifically authorized in writing by the Engineer.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

701.01—Description

This work shall consist of furnishing, fabricating, refurbishing, and erecting signs as specified on the plans.

701.02—Materials

Reflective sheeting shall conform to the requirements of **Section 247**.

701.03—Procedures

(a) **Fabrication:**

Trial Use and Comment

1. **Aluminum welds:** Aluminum shall be welded in accordance with the requirements of **Section 407**.

2. **Sign panels:** Panels shall be fabricated of aluminum 0.100-inch thickness and shall be smooth, flat, and free of metal burrs and splinters. Sign panels for overlays shall be 0.080-gage aluminum alloy conforming to the requirements of **Section 229.02(a).**

3. **Applying reflective background sheeting:** Sheeting shall be applied in accordance with the requirements of the manufacturer's recommendations.

   A single piece of applied sheeting shall be at least 4 by 4 feet on sign panels 16 square feet or more in area, except for sign panels fabricated with fluorescent prismatic lens orange sheeting. Sign panels 16 square feet or more in area and fabricated with fluorescent prismatic lens orange sheeting shall consist of sheeting at least 4 by 2 feet except that one piece of sheeting may be less than 2 feet wide to obtain the exact dimension required. Joints, splices, or laps will not be permitted on sign panels less than 16 square feet in area except for the following:

   a. One factory splice from the roll will be permitted.

   b. One joint will be permitted on fluorescent prismatic lens orange signs when one dimension of the panel is greater than 36 inches and less than 48 inches.

   When more than one width of sheeting, except fluorescent prismatic lens orange, is applied to a sign panel, sheeting edges shall form a vertical butt joint or may overlap not more than 3/8 inch. Where horizontal joints are used, except for fluorescent prismatic lens orange sheeting, the bottom edge of the top sheeting shall lie over the top edge of the next lower sheeting in a shingle lap of not more than 3/8 inch. Multiple pieces of fluorescent prismatic lens sheeting shall be installed with a gap 1/32 to 1/16 inch between the edges. Sheeting shall be carefully matched to maintain uniform shading and prevent contrast between widths of sheeting.

   The finished sign shall be free from cracks, gaps, streaks, wrinkles, blisters, discoloration, buckles, and warps and shall have a smooth surface of uniform color.

4. **Letters, numerals, arrows, symbols, borders, and other features of the sign message:** Features of the sign message shall conform to the requirements of the **MUTCD**. Units of the sign message shall be formed to provide a continuous stroke width with smooth edges; present a flat surface free from warps, blisters, wrinkles, burrs, and splinters; and conform to the following:

Comment [2019]: Right Way

Comment [2020]: Right Way

Comment [2021]: Right Documentation

Comment [2022]: Right Way

Comment [2023]: Right Way

Trial Use and Comment

a. **Type L1, screen process, applied:** Features shall be produced by a direct or reverse screening process approved by the Engineer. Sign messages and borders that are darker than the sign field shall be applied to the reflective sheeting by a direct process. Sign messages and borders that are lighter than the sign field shall be produced by the reverse process in which the message and border are outlined by a color that is darker than the paint or the sheeting on the sign field. Transparent colors, inks, and paints used in the screening process shall be of the type and quality recommended by the sheeting manufacturer.

Screening shall produce a uniform color and tone. Edges of the legend and borders shall not have blemishes.

Signs shall be air dried or baked in accordance with the manufacturer's recommendations to provide a smooth, hard finish.

b. **Type L2, plastic film sheeting, applied:** Features of the sign message shall be cut from plastic film sheeting of the color specified on the plans. Sheeting shall be an elastomeric pigmented film suitably compounded and processed, coated on one side with an adhesive, and covered with a paper liner that shall be removable from the adhesive without being moistened. Adhesive shall be activated by heat or a solvent recommended by the sheeting manufacturer and shall be suitable for use with a hand roller, squeeze roller, or vacuum applicator that will form a durable bond to wood, metal, plastic, porcelain enamel, paint lacquer, and reflective sheeting. Sheeting shall be at least 0.002 and not more than 0.0035 inch in thickness and sufficiently opaque so that its color will be unaffected by the color of the sign field.

c. **Type L3, cutout, reflective sheeting, and pressure applied:** Features of the sign message shall be cut from approved reflective sheeting of the color specified on the plans. Sheeting shall have heat-activated or pressure-sensitive adhesive and be applied to the background sheeting in accordance with the requirements of the manufacturer's recommendations.

d. **Type L4, overlay film, pressure applied:** Features of the sign message are created by using a background sheeting of the color needed for the sign message and then applying the overlay film with the sign message areas removed from the film. The overlay film shall be transparent and shall be of the color needed to provide the correct background color of the sign.

5. **Joining sign base panels:** Horizontal joints will not be permitted. Where multiple vertical panels adjoin, the face and edges shall be milled or finished to a tolerance of ±1/32 inch from a straight plane such that no gap more than 1/16 inch is allowed between panels.

Comment [2024]: Right Way

Comment [2025]: Right Way

Comment [2026]: Right Way

Comment [2027]: Right Way

Comment [2028]: Right Way

Comment [2029]: Right Way

Comment [2030]: Right Way

Trial Use and Comment

6. **Applying the sign message:** Features shall be straight, properly spaced, smooth, and free from irregular edges.

7. **Sign finishing:** The complete outer edge, splices, messages, and borders of signs shall be sealed after application to the sign panel. Sealant material and its application shall be in accordance with the sheeting manufacturer's recommendations.

8. **Rejected sign messages:** Sign messages rejected by the Engineer shall be immediately obliterated by the Contractor.

(b) **Transporting and Storing Signs From the Fabricator:** Signs shall be transported in accordance with either of the following methods.

1. Signs shall be transported in cardboard cartons with a slipsheet covering the sheeting. The slipsheet shall be paper with a plastic coating on one side with the plastic placed toward the sign sheeting in accordance with the sheeting manufacturer's recommendations. Not more than 10 signs may be placed in one carton. Signs shall alternate face-to-face, back-to-back, throughout the carton. A microfoam pad at least 1/16 inch in thickness shall be placed between signs placed face to face. Cartons shall be placed vertically within a container designed to elevate boxes above ground level and provide lateral structural support. Cartons shall not be exposed to moisture during transportation; or

2. Signs shall be transported on an open truck or trailer bed with vertical racks for attachment of signs. Racks shall be designed to provide lateral structural support and allow the free flow of air around the sign face. Large signs may be transported on an open truck or trailer bed in shipping containers consisting of framing around edges of signs. Framing shall be nontreated lumber that will provide support for the sign without allowing pressure on the sign sheeting. Each container may house two signs positioned with the sign sheeting facing toward the inside. Signs shall be held in place in containers through the use of metal stiffeners attached to the framing, T-bars and Z-bars, and horizontal stiffeners. Shipping containers shall be secured in the vertical position for transportation.

Signs transported in cardboard cartons shall be stored in original shipping containers in a dry, enclosed location providing protection from extreme heat and humidity. Signs transported on racks or in wooden containers shall be stored on vertical racks designed to elevate signs above ground level, provide lateral structural support, and allow the free flow of air around the sign face. Signs shall not be stored where they are subjected to water runoff.

Signs may be removed from storage and installed on their structural supports before the structure is erected. The structure along with the sign shall be erected

Comment [2031]: Right Way

Comment [2032]: Right Way

Comment [2033]: Right Way

Comment [2034]: Right Way

Comment [2035]: Right Way

Comment [2036]: Right Way

Comment [2037]: Right Time

Trial Use and Comment

within 24 hours after removal of the sign from storage. During this time period, the sign and its structural support shall be stored at a sufficient angle to facilitate water runoff from the sign while preventing the sign from coming in contact with the ground.

Signs shall not be banded together, covered with tarps, stored flat, or subjected to pressure on the sign sheeting.

Signs transported or stored in cardboard cartons that have been exposed to moisture to the extent that moisture has entered the cartons will be rejected. The Contractor shall immediately obliterate the sign message and remove rejected signs from the project.

(c) **Transporting and Storing Relocated Signs:** Relocated signs shall be transported and stored in a manner that will not allow pressure to be placed on the sign sheeting. Relocated signs shall be stored in their vertical position above ground level. Relocated signs that have been removed from their structure shall be stored in accordance with the requirements of (b) herein.

(d) **Erection:** Vertical clearance for overhead and bridge-mounted sign structures shall be no less than 19 feet 0 inch and no more than 21 feet 0 inch from the bottom of the lowest mounted sign panel to the crown of the roadway unless otherwise specified on the plans. Walkway or luminaire assemblies shall have a vertical clearance of no less than 17 feet 6 inches from the bottom of the assembly to the crown of the roadway. Sign panels shall be installed during a sequence of construction as required to provide necessary traffic control. When possible, sign panels shall be installed at a time when covering of the sign message will not be needed. When this is not possible, a porous cloth cover rendering the sign message nonvisible shall be placed over the sign sheeting, folded over the sign edges, and secured to the back of the sign panel. Sign panels shall be securely fastened to posts or supports and erected plumb. Stud breakage of 10 percent or less of the total number of studs may be repaired with rivets. If breakage exceeds 10 percent, the sign panel will be rejected.

Ground-mounted signs shall be horizontally angled at 93 degrees between the face of the sign and the centerline of the roadway.

Vertical and horizontal spacing between signs shall be 1 inch.

A neoprene gasket 1/16 inch in thickness shall be used between the seat of the galvanized steel post clamps and the framing unit.

Illumination of signs shall be in accordance with the requirements of Section 705.

Damage to reflective sheeting may be repaired and edge sealed in accordance with the requirements of the manufacturer's recommendations and the following: Sign

Comment [2038]: Right Way

Comment [2039]: Right Way

Comment [2040]: Right Way

Comment [2041]: Right Way

Comment [2042]: Right Way

Comment [2043]: Right Way

Comment [2044]: Right Material/ Right Location

Comment [2045]: Right Way

Trial Use and Comment

patch material shall be of the same type and color as the surrounding sheeting and shall have at least the same life expectancy. Patching will not be permitted on any letter, numeral, arrow, symbol, or border. Where the number, size, or spacing of patches is more than the following, the sign will be rejected and shall be replaced at the Contractor's expense:

Sign Face Area (sq ft)	Max. No. of Patches	Max. Size of Patches (sq in)	Min. Spacing Between Patches (in)
24.99 or smaller	No patching allowed		
25 to 49.99	1	1	0
50 to 99.9	2	1	6
100 to 199.9	3	2	6
200 or larger	4	3	12

Superficial damage to sign panels may be repaired using proper methods to obtain a smooth and flat panel. Sign panels that have more than superficial damage will be rejected and shall be replaced at the Contractor's expense.

Overlays and demountable message including borders existing on the signs shall be removed to facilitate the installation of the new overlayment. Bullet holes and bent sections shall be flattened so that the sign face is free of projections and large indentations to facilitate installation of the new overlayment.

Overlayments 3 feet or less in total horizontal dimension shall be accomplished with one panel. Overlayments greater than 3 feet in total horizontal dimension shall be accomplished with panels no less than 3 feet wide except that one panel per overlayment may be less than 3 feet wide to obtain the exact horizontal dimension required. Joints shall be tightly butted and not overlapped.

Overlay panels shall be erected with aluminum rivets. Rivets shall be no less than 3/16 inch in diameter and of such length as to fasten the panels securely and form a head conforming to the manufacturer's recommendations. Rivets shall be located on 1-foot centers, positioned 1 inch from each panel's edge, around the sign's perimeter. Where overlayment panels are 30 inches or greater in width, a column of rivets shall be installed on 1-foot centers down the centerline of the panel. Rivets shall be installed in such a sequence as to prevent buckling of the panels.

In the Hampton Roads District, at installations where the existing sign panel is attached by stud welds to the horizontal supports, 3/8-inch galvanized bolts, washers, nuts, and fiber washers shall be used in addition to rivets to attach the overlay panels. Bolts shall be located in alignment with each horizontal support (z-bar, t-bar), positioned 1-foot from each panel's edge, and spaced on 1-foot-maximum spacings along each horizontal support. At locations where existing

Comment [2046]: Right Payment

Comment [2047]: Right Way

Comment [2048]: Right Paymentment

Comment [2049]: Right Way

Comment [2050]: Right Way

Comment [2051]: Right Way/Right Material

Comment [2052]: Right Way/Right Location

Trial Use and Comment

stud welds and panel clips are in the area of the proposed bolt locations, the bolts shall be relocated as needed to miss these. Nuts shall be tightened only to the point just before the sign panel begins to buckle in that area.

701.04—Measurement and Payment

Sign panels will be measured in square feet and will be paid for at the contract unit price per square foot. This price shall include background sheeting, sign messages, framing units, and hanger assemblies.

Overlay sign panels will be measured in square feet of sign panels without deductions for rounding corners. Overlay sign panel will be paid for at the contract unit price per square foot, which price shall be full compensation for verifying the size and color of overlayment panel; removal of existing overlayment and demountable messages including borders; and fabricating, furnishing, and installing overlayment.

Payment will be made under:

Pay Item	Pay Unit
Sign panel	Square foot
Overlay sign panel	Square foot

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Get all approved source of materials for all sign, steel and concrete.
- Obtain a sample of any material not on VDOT approved list.
- Review and approve shops drawings for foundations, structures, and sign panel, as required.
- Review Road and Bridge Standards Section 1300.
- Obtain copies of the Manufacture Recommendations
- Discuss traffic control for work.
- Review Contract quantities

Start:

- Review and approve all sign locations in the field.
- Ensure that all signs are stored and protected properly.

Continuous inspection:

- Inspect sign panels upon receipt.
- Ensure proper foundation depth, size, and location to meet Standards for size of sign panel being installed. Perform any and all required materials test on foundation.
- Ensure that proper break away is installed correctly for sign size and location.
- Ensure that size post size is matched up to foundation type and sign panel size.
- Check sign attachment to post.
- Check height and distance from each of travel way of signs.
- Measure sign panel and post height for payment purposes.

Final Inspection:

- Ensure all disturb areas are seeded.

Trial Use and Comment

Documentation Required:

- Summarize daily work activity in DWR.

IV. REVIEW QUESTIONS

Spec. Ref.	
701.02	Did the reflective sheeting used in traffic signs conform to the requirements of the Materials Section 247, Reflective Sheeting?
701.03(a2)	Are sign panels smooth, flat, and free from metal burrs and splinters and fabricated of aluminum 0.100 inch in thickness?
701.03(a3)1	Was the prohibition on joints, splices, or laps on sign panels less than 16 square feet in area, except for one factory splice from the roll or for sign panels fabricated with fluorescent prismatic lens orange sheeting, adhered to?
701.03(a3)2	When more than one width of sheeting, except fluorescent prismatic lens orange, has been applied to a sign panel, do sheeting edges form a vertical butt joint or overlap <= 3/8 inch or overlap not more than 3/8 inch shingle style for horizontal joints?
701.03(a3)3	Are the finished sign panels free from cracks, gaps, streaks, wrinkles, blisters, discoloration, buckles, and warps and have a smooth surface of uniform color?
701.03(a4)	Do all of the messages, symbols, and other features of the sign message conform to the requirements of the MUTCD?
701.03(a6)	Are lines of message and features straight and properly spaced with letters, numerals, and borders smooth and free of irregular edges?
701.03(a7)	Has the complete outer edge, splices, messages, and borders of the signs been sealed?
701.03(b)(C)	Have all new or relocated signs been transported, stored, and protected in accordance with the requirements of these sections?
701.03(d)	Have sign panels been installed in accordance with this section?
701.03(d)1	When sign panels are installed prior to their need, was a porous cloth cover rendering the message nonvisible placed over the sign panel and properly secured?
701.03(d)2	Is damage to reflective sheeting repaired in accordance with the requirements of this section?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• Obtain shop drawings and their approvals prior to working.
• Double check sign message spelling prior to the signs being manufactured.
• Stake all sign locations
• Inspect sign panels as they arrive to the project for defects and to ensure proper handling and storage.
• Inspect assembly if any field assembly is required.
• Ensure that foundation requirements are met prior to post or sign installation.
• Measure sign panel size and document it prior to installation.

Trial Use and Comment

SECTION 702—DELINEATORS

I. INTRODUCTION:

The proper installation of delineators on guardrail, barriers, parapets, railings, and along the roadside is necessary to ensure the safety of the traveling public. Inspectors should refer to the Road and Bridge Standards or the plans for proper placement.

a) Forms:

- Section Intentionally Left Blank

Method of Measurement

Road edge delineators are measured in units of each installed. Guardrail, barrier, and railing delineators are considered incidental to the construction of those items and are not measured for separate payment.

1. Are delineators installed at the specified spacing?

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

702.01—Description

This work shall consist of furnishing and installing road-edge, barrier, or guardrail delineators of the type specified in accordance with these specifications and in conformity with the lines and dimensions on the plans or as established by the Engineer.

702.02—Materials

(a) **Fabrication** of aluminum panels with reflective sheeting shall conform to the requirements of **Section 701**.

(b) **Reflective sheeting** shall conform to the requirements of **Section 247** and shall be the same color as the adjacent pavement marking.

(c) **Plastic lens retroreflectors** shall conform to the requirements of **Section 235** and shall be the same color as the adjacent pavement marking.

(d) **Plastic panels** shall conform to the requirements of **Section 235.**

(e) **Aluminum panels** shall conform to the requirements of **Section 235**.

Comment [2053]: Right Material

Trial Use and Comment

(f) **Adhesive** for attaching delineators to guardrail and barrier shall be as recommended by the manufacturer.

702.03—General Requirements

(a) **Road-edge Delineators:**

1. **Interstate road-edge delineators** shall consist of two types.

   a. Type I shall be an aluminum panel with reflective sheeting.

   b. Type II shall be a plastic lens retroreflector.

2. **Standard and special road-edge delineators** shall be an aluminum panel with reflective sheeting.

(b) **Barrier and Guardrail Delineators:** Barrier and guardrail delineators shall have no less than 7.0 square inches of retroreflective sheeting and shall have no more than 5 inches of vertical projection when installed. The delineator shall be fabricated from a flexible plastic panel.

702.04—Procedures

(a) **Road-edge delineators** shall be placed as shown on the standard drawings.

(b) **Barrier and guardrail delineators** shall be applied to clean dry surfaces in accordance with the manufacturer's recommendations. Loose material and dirt shall be removed from concrete by wire brushing and from steel by appropriate methods. When recommended by the manufacturer, a primer shall be used.

Delineators shall be installed on barriers and guardrails that are within 15 feet of the edge of the pavement.

Barrier delineators shall be installed on the top surface of the barrier wall except that barriers greater than 36 inches in height, barriers with glare screens or handrail attached, and barriers located in construction work zones shall have the delineators installed at a height of approximately 24 inches above the roadway. Delineators installed on the sides of barrier shall be positioned so that the reflective surface lies in the vertical plane facing oncoming traffic. Barrier delineators shall be installed using an adhesive as recommended by the delineator's manufacturer.

Guardrail delineators shall be installed on the web of the guardrail posts. Where guardrail blockouts are installed, delineators shall be installed on the web of the

Comment [2054]: Right Material

Comment [2055]: Right Material

Comment [2056]: Right Location

Comment [2057]: Right Way

Comment [2058]: Right Location

Trial Use and Comment

blockouts. Where weak post guardrail and cable guardrail systems are installed, delineators shall be manufactured to fit on the web of the guardrail posts; no field cutting or adjustments will be allowed. If a bolting system is used to attach the delineators to the posts, the bolting system shall be such that no drilling of the guardrail posts or blockouts is necessary. Where wooden support posts or blockouts are used, delineators shall be attached with screws or by an adhesive system as recommended by the manufacturer. Screws shall be stainless steel or galvanized.

Spacing for delineators on barrier or guardrail shall be on 80-foot centers unless otherwise indicated. Delineators mounted on guardrail and barriers located in curves on interchange ramps shall be spaced in accordance with the spacing for interstate road-edge delineators as shown on the standard drawings except that the maximum spacing shall be 80 feet.

Where the center-to-center spacing for delineators on guardrail cannot be obtained due to post spacing, the delineators shall be installed to provide spacing that is not greater than the spacing indicated herein.

702.05—Measurement and Payment

Road-edge delineators will be measured in units of each and will be paid for at the contract unit price per each. This price shall include sign post, fasteners, retroreflective elements, excavation, and backfill.

Comment [2059]: Right Payment

Barrier and guardrail delineators are considered incidental to barrier and guardrail construction and will not be measured for separate payment unless specified in the Contract. When specified in the Contract for installation on existing barriers and guardrail, delineators will be measured in units of each and paid for at the contract unit price per each. This price shall include surface preparation, adhesive, fasteners, and retroreflectors.

Payment will be made under:

Pay Item	Pay Unit
Road-edge delineator (Standard and type)	Each
Barrier delineator	Each
Guardrail delineator	Each

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Review specifications, plans, materials, construction procedures. Discuss traffic control.

Start:

- Observe the contractors installation. Surface should be clean.

Continuous inspection:

- Inspector should be on site when delineators are being installed to assure the right location. Make sure the color is correct. Check road edge delineators to assure they are installed at the specified distance from edge of pavement. Are delineators installed at the specified height and spacing.

Final Inspection:

- Make sure the delineators are installed according to the plans and specifications.

Documentation Required:

- Measurement and payment are accurate.
- Contractor needs to furnish sources.

IV. REVIEW QUESTIONS

• Are delineators the same color as the adjacent pavement markings?
• Are road edge delineators installed at the specified distance from edge of pavement?
• Are delineators installed at the specified height?
• Are delineators installed at the specified spacing?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Ensure that the Contractor has utilized the correct materials.**
• **Ensure the delineators are in the correct location and color.**
• **Ensure the pay items are correct according to the tickets and site manager.**

Trial Use and Comment

SECTION 703—TRAFFIC SIGNALS

I. INTRODUCTION

Work under this section consists of furnishing, installing, modifying, relocating or removing traffic signal equipment. Since this work differs so much from normal roadwork, it is desirable that the Inspector make a special effort to learn the terminology unique to this work and to contact the District Traffic Engineer for advice. This knowledge is necessary in order to communicate effectively with the Contractor's personnel.

a.) <u>Forms:</u>

- **Intentionally Left Blank**

II. <u>2007 ROAD & BRIDGE SPECIFICATION and the 7R's</u>

703.01—Description

This work shall consist of furnishing and installing traffic signal equipment in accordance with these specifications and as shown on the plans or as directed by the Engineer. The terminology used herein and on the plans shall be as generically interpreted by manufacturers in the field except that certain terminology shall be interpreted as follows:

(a) **Auxiliary equipment:** separate devices used to add supplementary features to a controller, such as conflict monitors, load switches, and flashers.

(b) **Manufacturer:** the company that assumes the responsibility for producing and assembling the equipment and that is responsible for guaranties and warranties for the equipment.

(c) **System:** the coordination of traffic signals through a time relationship or by interconnection of controllers with a master controller or computer to permit coordinated movement along a street(s).

(d) **System manufacturer:** the company or system supplier that assumes the responsibility for procuring and assembling the equipment and that is responsible for guaranties and warranties for the equipment.

703.02—Equipment

Comment [2060]: Right Material

Trial Use and Comment

Traffic signal controllers, master controllers, auxiliary equipment, and flashers for operating flashing beacons furnished by the Contractor shall be certified by the manufacturer as conforming to the requirements of NEMA TS-1 and any exceptions and additions stated herein unless otherwise specified. The manufacturer shall also provide certification from an independent testing laboratory that the model of controller, auxiliary equipment, and flasher furnished conforms to NEMA environmental standards and test procedures. Controllers and auxiliary equipment shall be the manufacturer's standard design. Controllers shall be furnished completely housed in a weatherproof cabinet. Controllers and auxiliary equipment shall operate from a 120-volt, 60-Hz, single-phase, AC power supply. The manufacturer's name, model number, serial number, and part identification number shall be permanently attached to the cover of the equipment. The Contractor shall furnish the manufacturer's instructions for installing and maintaining the equipment.

Comment [2061]: Right Material, Right Documentation

The Contractor shall provide at least 15 hours of training for Department personnel in the operation, timing, maintenance, and repair of the signal equipment supplied by the Contractor. Training shall consist of at least 50 percent hands-on training. Training shall be held at a location specified by the Engineer and conducted by a qualified instructor representing the equipment manufacturer. Training material shall contain "hand-outs" for each attendee that shall serve not only as subject guidance, but also as quick reference material for future use by the students. The Contractor shall also provide training on VHS tapes or video disc (DVD).

Comment [2062]: Right Time, Right Location

The Contractor shall secure assistance from the manufacturer as necessary to produce, implement, and fine-tune the controller, coordination, and preemption timings required to provide for an orderly movement of traffic as approved by the Engineer. Coordination timings shall include plans for morning and afternoon peak hours and off-peak conditions. The Department will furnish traffic counts for the Contractor's use in producing the timings within 30 days of the Contractor's request to the Engineer. The Contractor shall furnish to the Engineer three copies of the timing data and documentations used in calculating the timings. These data shall be submitted for approval 60 days prior to timing implementation. When specified on the plans, the Department will supply the final timing plan for implementation and fine-tuning by the Contractor. The Contractor shall request the final timing plan at least 90 days in advance of implementation.

Comment [2063]: Right Time

Comment [2064]: Right Time

(a) **Traffic Signal Controllers:** Controllers shall be eight phase, traffic actuated, solid state, and digital. Controllers shall be capable of operation in a closed loop traffic control system by the addition of a communication module/board and closed loop system software. No additional changes to the controllers shall be required. Controllers shall be completely modular consisting of a main frame and plug-in modules/boards that can be secured in place but easily removed for inspection and servicing.

Comment [2065]: Right Material

Controllers shall also include the following programmable features:

- Volume density functions.

Trial Use and Comment

- Pedestrian functions.

- Four signal overlaps with extension timing capability to allow the overlap green to extend beyond the parent green by a user programmable time. Amber and all red clearances shall be programmable for the overlaps when extension timing is used.

Phasing:

- Concurrent phasing.

- Sequential phasing in ascending numerical order.

- Concurrent phasing on one side of the barrier (compatibility line) and sequential phasing on the other side.

- Reversal of phases in the same ring on the same side of the barrier.

Soft recall: Places a demand on a phase(s) when no other calls exist.

Conditional service: Allows an odd phase to be reserviced after the even phase but prior to crossing the barrier provided the following conditions are met:

- Even phase in the same ring has gapped out and is resting.

- A call exists across the barrier.

- Even phase in the opposite ring is still extending with enough time left in its max timer. Time shall be equal to or greater than the minimum green of the phase about to be served plus the even-phase-same-ring's clearance times.

Last car passage: Allows for timing a full passage time when a phase gaps-out.

Security code:

- When enabled, a user-specified security code is required to be entered before data may be changed. Security access shall be automatically rescinded 10 minutes after the last user keystroke or 10 minutes after access if there are no user keystrokes. Viewing of data shall not require the entering of the security code. In closed loop systems, central equipment shall have free access to data within the local controllers via the master controller regardless of security codes imposed at the local controllers.

- Controllers shall have an auxiliary connector mounted on the front panel that will allow the following functions to be accomplished in accordance with the Electronic Industries Association's RS-232C interface standard.

Comment [2066]: Right Time

Comment [2067]: Right Location

Trial Use and Comment

Accomplishment of these functions shall be capable while the controllers are in normal operation without any adverse effects.

Data transfer: All user-entered data shall be transferable to other controllers of the same manufacturer and model through the use of a data transfer cable connected to the auxiliary connector on the controllers. Messages shall be displayed on the LCD when transfer is completed and when there is an error in transmission. The Contractor shall furnish two data transfer cables to the Department unless otherwise indicated on the plans.

Comment [2068]: Right Way, Right Material

Downloading and uploading of data:

- Menu-driven computer software developed by the controller manufacturer shall provide for the downloading and uploading of user-entered data between the controllers and an IBM or IBM-compatible computer with a 20MB minimum hard drive and operation of the following functions.

  —Creation, review, and modification of user entered data.

  —Creation, review, and modification of intersection configurations including, but not limited to, graphic display of intersection geometrics, laneage, street names, phases, and overlaps. Standard intersection geometric graphics consisting of at least a four-leg approach, tee, offset tees, and diamond interchanges that are user-selectable for use in creating intersection configurations shall be included in the software.

  —Transfer of user-entered data except real time and date from one intersection's database to another intersection's database.

  —Comparison of an intersection's database and reports stored on disk to that uploaded from the intersection's controller. Differences shall be indicated.

  —Storage and retrieval of an intersection's database and configurations to and from diskettes.

  —Printout of an intersection's database through a printer.

  —Display of controller status while connected to the controller.

- The number of intersections whose database and configurations can be stored, retrieved, and downloaded from and to a diskette shall be limited only by the availability of space on the diskette. Each intersection file shall be uniquely identified and accessible by an alphanumeric name. Cross-referencing of the alphanumeric name to the intersection name shall be provided if different.

Comment [2069]: Right Material

Trial Use and Comment

- Connection of the controller to the computer shall be accomplished through the use of a cable with a DB-9 female connector on one end for connection to the computer and the appropriate connector on the other end for connection to the controller auxiliary connector.

- The Contractor shall furnish the manufacturer's certification that software on an approved format_and connecting cables are available that will provide for operation of the specified functions.

Comment [2070]: Right Documentation

Printing:

- User-entered data and reports shall be capable of being downloaded to a serial printer in a usable format. Data to be printed shall be selectable by the user from at least the following submenus:

  —Controller
  —Coordination
  —Time base coordination
  —Preemption.

Comment [2071]: Right Way, Right Material

- Terminologies other than those listed may be used provided they are readily identifiable to the user. Connection of the controller to the printer shall be accomplished through the use of a cable with a DB-25 male connector on one end for connection to the printer and the appropriate connector on the other end for connection to the controller auxiliary connector. The Contractor shall furnish two cables to the Department unless otherwise indicated on the plans. Messages shall be displayed on the LCD indicating when printing is completed and when there is an error in transmission.

- Controllers shall have internal traffic-adjusted system coordination (hardwire), non-interconnected system coordination (time base), and preemption. Coordination commands shall be accepted and responded to by the controllers regardless of the phasing used. Controllers shall have coordination outputs to allow its use as a master controller transmitting coordination commands based upon time of day.

Coordination:

Comment [2072]: Right Way, Right Time

- Coordination shall provide for at least four cycle lengths, three offsets per cycle plan, three splits per cycle plan, three permissive periods per split plan, eight force-offs per split plan, and remote flash operation. Shortway smoothing routine shall be provided to smooth coordination plan cycle and offset changes.

- Traffic-adjusted system coordination shall be designed to operate with an impulse through an interconnect cable from a master controller.

Trial Use and Comment

- Non-interconnected system coordination shall be designed for coordination of signals based upon time of day and without the use of interconnect cable.

In addition to the coordination requirements, minimum program functions shall conform to one of the following two types:

Type 1	Type 2
150 event times	180 event times
150 time of day functions	48 time of day functions
10 day programs	7 day week program
8 week programs	99 exceptions to the week program
1 year program	synch reference by time and event
10 unique exceptions to the year program	3 auxiliary outputs
synch reference by time and event	Max II selection
3 auxiliary outputs	Phase reversal
Max II selection	
Phase reversal	

Definitions:

- An event time is an hour, minute, and second of a 24-hour day. A time of day function can occur at any of these times.

- A time of day function is a selection of a coordination plan condition or the time switching of an output.

- A day program is a list of the time of day functions for the day. These events specify which coordination plan conditions are selected and which outputs switch during the day.

- A week program specifies which day program shall be used on each day of the week.

- A year program specifies which week program shall be used during each week of the year.

- An exception to the year program causes a day program different from that in the year program to be used on a specific day.

Preemption:

Internal preemption shall provide at least one railroad preemption plan and four emergency vehicle preemption plans that will interrupt the normal operation of the controller upon actuation and initiate a special sequence of operation as shown on

Comment [2073]: Right Way, Right Material

Trial Use and Comment

the plans. Preemption operation shall be programmable to proceed sequentially through the preemption intervals and hold at the end of a specified interval. Intervals in the preemption plan during which normal cyclic operations resume shall be programmable. Priority of preemption plans shall be programmable or shall be fixed based upon the plan number.

Activation of railroad preemption during the timing of an emergency vehicle preemption will cause the emergency vehicle preemption to clear immediately through normal clearance intervals and initiation of the railroad preemption. Railroad preemption shall be displayed for the duration of the preemption call.

Emergency vehicle preemption timings shall be programmable from at least 0 to 99 seconds. The capability of a delay between the time the emergency vehicle preemption plan input is asserted and the implementation of the preemption plan shall be provided. The timing range for this delay shall be at least 0 to 99 seconds. Emergency vehicle preemption inputs shall be capable of operating in lock and non-lock modes. When programmed non-lock, termination of the input prior to implementation of the preemption plan shall not initiate preemption operation.

Controllers shall be programmed for all required functions through a menu driven keyboard and a LCD except for the following, which may be programmed with dip switches or a combination of keyboard and dip switches.

- Phasing other than NEMA standard dual ring concurrent.
- Phase reversals.
- Security code on and off.
- Startup signal display indication.

The LCD shall be capable of displaying at least four lines of 20 characters each. The LCD shall have backlighting and automatically adjusted or selectable contrast levels for optimum viewing.

Backlighting shall be automatically extinguished within 1 hour after the last keyboard operation. A main menu and submenus shall be provided on the LCD that lists categories in the English language from which the user may select. Entering of data outside allowable timing ranges shall result in the controller rejecting the data. Controllers shall have circuitry for monitoring the cycling of the microprocessor. Upon determination that the microprocessor is not cycling, this circuitry shall automatically cause the intersection to be placed in flashing operation. Active status indications of controller, coordination, and preemption features and timings shall be displayed on the LCD using alphanumeric characters. In addition to the indications required by NEMA, the following indications shall be displayed:

- **Controller status:**

  —Time and date
  —Overlaps in service

Trial Use and Comment

—Interval timings
—Stop time applied
—Phase omit active
—Ped omit active
—Recall type
—Variable initial timing
—Time before reduction timing
—Gap time
—Last car passage active.

- **Coordination status:**

—Command source, e.g., manual, telemetry, time base coordination, interconnect, free or flash
—Cycle, split, and offset number active
—Cycle length
—Offset time
—Local cycle timing
—Master cycle timing
—Offset seeking indication
—Telemetry and interconnect failure indications
—Vehicle permissive period active
—Ped permissive period active
—Hold active
—Auxiliary output circuit number active.

- **Preemption status:**

—Preemption number active
—Preemption interval
—Preemption timing.

Real-time clock:

Controllers shall have an internal 99-year real-time clock referenced to the 60-Hz AC power line. The clock shall be easily set to the nearest second of the year. A crystal oscillator shall be provided to maintain clock accuracy to at least 0.005 percent (50 PPM) when on stand-by power. Clock time and date shall be maintained for at least 60 days during periods of power loss. If clock standby power is exhausted during a line voltage power failure, time base coordination shall be prevented from operation. Automatic corrections shall be made for Daylight Saving Time.

Data entered by the controller user except for time and date shall be maintained during power outages through the use of an Electrically Erasable Programmable Read Only Memory (EEPROM).

Comment [2074]: Right Material

Trial Use and Comment

Unless otherwise specified, the controllers shall be furnished to operate initially as follows:

- Single Entry.
- Start in Major Street through phase green interval.

(b) **Flashers for Operating Flashing Beacons:** Flashers shall be solid state, double circuit, and shall be furnished complete in a weatherproof cabinet. The cabinet shall be fabricated of welded sheet aluminum at least 0.125 inch in thickness.

The cabinet shall have transient protection conforming to the requirements of (d)3.b. herein for field wiring, a door gasket, and a standard police panel lock with two keys. A radio frequency interference filter rated at 20 amps, terminal block, and a 20-amp circuit breaker shall be mounted in the cabinet. The cabinet shall be provided with removable hub plates tapped for 1-inch conduit at the top and bottom and shall be equipped with brackets for wood-pole mounting or with adjustable bands for steel-pole mounting as specified on the plans.

(c) **Master Controller:** Master controllers shall be solid-state, digital, traffic-adjusted controllers adaptable to fully actuated local controllers. They shall provide for at least three cycle lengths, three independent offsets per cycle, and free operation and shall be capable of volume-density computations. Master controllers shall be from the same manufacturer as the local controllers furnished by the Contractor.

(d) **Cabinets:** Cabinets for traffic signal controllers and master controllers shall be weatherproof and constructed of welded sheet aluminum, 0.125-inch minimum. Cabinet mounting attachments shall be durable, corrosion resistant, and of heavy-duty construction.

Cabinets shall be at least 54 inches in height, 44 inches in width, and 24 inches in depth and shall be large enough to provide for ease of maintenance of the controller and auxiliary equipment. The maximum width and depth shall be such that the cabinet will fit entirely on the standard CF-1 foundation. The cabinet bolt pattern shall be rectangular, with dimensions of 40 5/8 inches in width and 18 1/2 inches in depth. Anchor bolts shall be 3/4 inch in diameter and at least 16 inches in length with a 5-inch L bend.

1. **Doors:** Cabinet doors shall provide full access to the cabinet interior and shall have gaskets to ensure weatherproofing. A small recessed police panel with a separate access door shall be provided in the front door of the cabinet. The main door shall be equipped with the Department's standard tumbler lock No. 9R48773 or the municipality's standard tumbler lock and shall be keyed. The police panel shall be provided with a standard police panel lock. Two keys for each lock shall be provided the Engineer. Hinges shall be stainless steel and continuous. The main door shall have a door stop arrangement that will allow it

Comment [2075]: Right Material

Comment [2076]: Right Material

Comment [2077]: Right Material

Comment [2078]: Right Material

Trial Use and Comment

to be firmly positioned at both 90 and 135 degrees, ±10 degrees. The locking mechanism for cabinets shall be a three-point draw roller system. Rollers shall be fabricated from nylon with a diameter of at least 8/10 inch. The door opening shall be double flanged on all four sides.

A panel shall be mounted on the inside of the main door of the master controller cabinet and shall consist of the following four functional switches: auto-manual, manual cycle selector (three cycles), manual offset selector (three offsets), and manual synch.

2. **Police panel:** The police panel shall be furnished with two toggle switches, each labeled for its purpose. One switch will be used to place the signal in flashing operation and shall not affect the power being supplied to the controller and conflict monitor. The cyclic operation of the controller shall not be affected by this switch. Upon placement of the switch from the automatic position to the flash position, the intersection shall immediately be placed in flashing operation. Upon placement of the switch from the flash position to the automatic position, the signals shall immediately be placed in automatic operation in the major street through phase green interval. The second switch shall be used to disconnect power to the controller. The backside of the police panel shall have an aluminum cover over the switches and their wiring connections. When required by the plans, a third toggle switch with a handle control shall be furnished that will allow manual operation of controller phasing.

3. **Interior:** The interior of cabinets shall be of sufficient size to provide adequate ventilation of the equipment housed therein. Cabinets shall contain at least three adjustable shelves or equivalent supports with enough space to hold the controller, 20 single-channel detector amplifiers, and required auxiliary equipment. Vertical mounting channels for the shelves shall be continuous and shall allow for adjustable shelf placement ranging 5 inches from the bottom to 5 inches from the top of the cabinet. Wiring panels (terminal blocks) shall be neatly finished and clearly and permanently marked with identifications applied by silk screening. Conductors shall be neatly arranged in the cabinets and bundled in groups with cable ties. Conductors running to panels other than the resistor panel on the left side of the cabinet shall be positioned below the resistor panel with the nearest conductor being at least three inches from the bottom resistor position. Conductors connected to terminals located on the door shall be bundled and sheathed. The bundled conductors shall not obstruct access to other circuits and terminals in the cabinet. The controller equipment and terminals shall be arranged within the cabinet so that they will not interfere with the entrance, tracing, and connection of conductors. Unless cable is passing through the cabinet uninterrupted, incoming and outgoing conductors shall have each wire connected to terminal post positions.

Cabinets shall be wired in accordance with Section 10 of NEMA TS-1 for NEMA configuration 8 and the changes and additions noted herein. The cabinet shall

Comment [2079]: Right Material

Comment [2080]: Right Material, Right Way

Trial Use and Comment

also be wired to produce controller pin connector functions, including those on auxiliary connectors. Wiring that is connected to the back panel shall be of adequate length to allow the back panel to be placed in position for maintenance.

When exclusive/permissive left-turn phasing is being used, the red output from the load switch for the left-turn phase shall be connected to ground through a 1.5K-ohm resistor. The resistor shall conform to the requirements of MIL-R18546D, Type RE70G1501. Heat sink compound shall be applied to the housing base prior to attachment. Wiring shall be soldered to the resistors and the connections shall then be covered with heat shrink tubing. On unused phases, red outputs shall be wired to AC+. Wiring shall be readily accessible and shall not require the back panel to be lowered for disconnection of the wiring.

Cabinet wiring shall be provided for railroad preemption whereby the selection of the following is easily accomplished through the use of simple hand tools: (1) 115 VAC or ground true outputs, and (2) normally open or normally closed contacts.

The Contractor shall provide five blue and white prints of the controller circuit diagram. The blue and white prints shall be produced from the original drawing and shall be clear and legible. The Contractor shall install two copies of the circuit diagram inside the cabinet in a readily accessible waterproof enclosure and shall furnish three additional copies to the Engineer. The waterproof enclosure shall be securely attached to the cabinet with studs welded to the cabinet and nuts. The enclosure shall have noncorrosive metal grommets for use with the studs.

A listing indicating terminal numbers with a description of their use shall be attached to the cabinet door and overlaid with a clear, plastic covering. Edges of the plastic shall be sealed with a clear waterproofing compound.

Comment [2081]: Right Documentation

Detector harness cables shall be stranded copper and shall be not sized less than No. 22 AWG rated at 300 volts. Other AC and DC circuit wiring shall be in accordance with NEMA TS-1. Ribbon cable and printed circuit boards will not be allowed for cabinet wiring. Loop detector harnesses shall include wires connected to the two reserved pins in the connector. At the end of the harnesses, these wires shall be folded back and tied to the harnesses with nylon cable ties. Loop input wiring in the loop detector harnesses shall have soldered on spade connectors for attachment to the detector panel terminals. Heat shrink tubing shall be installed over the soldered connections.

Controller cabinets shall be wired to provide output signals for the controller to the loop detector amplifiers so that the delay feature of the associated phase is inhibited during the green interval.

Trial Use and Comment

Outgoing traffic signal circuits shall be the same polarity as the line side of the power supply. The common return of signal circuits shall be the same polarity as the ground side of the power supply. The power supply shall be grounded to the ground bus of the controller cabinet. The ground bus, neutral bus, and logic ground bus in the cabinet shall be copper.

When the time-based coordination feature of the controller is used to establish a coordinated system with controllers operating fully actuated, the controller cabinet shall be wired to inhibit mainline through, right turn, and pedestrian detectors when coordination is not in free operation.

Transient protection shall be provided in traffic signal controller and master controller cabinets for the following:

a. **Main AC power input:** Transient protection for the AC power input shall be connected on the load side of the main AC circuit breaker. The transient protection shall (1) withstand a 15,000-ampere surge current with an 8 by 20 microsecond wave form, 20 times at 3-minute intervals between surges, without damage to the suppressor; (2) limit the surge voltage to a 2,000-volt peak; and (3) limit follow current to an appropriate level to prevent tripping of the main circuit breaker of the cabinet or enclosure.

b. **Interconnect cable and field wiring:** Transient suppression for field wiring shall be installed on the front of the back panel. Transient suppression for interconnect cable and field wiring, except loop detector lead-in cable, shall (1) clamp the surge voltage to a level no greater than twice the peak operating voltage of the circuit being protected and (2) withstand a surge current of 1,000 amperes with an 8 by 20-microsecond wave form, six times at 1-second intervals between surges, without damage to the suppressor.

c. **Loop detector lead-in cable:** The panel shall be located on the right side near the front of the cabinet and above the level of the lowest shelf. A preemption test switch with necessary wiring shall be located on this panel. Transient suppression for loop detector lead-in cables shall not affect the operation of inductive vehicle loop detectors and shall (1) protect detector unit loop inputs against differential (between the loop lead) surges and against common mode (between loop leads and ground) surges, (2) clamp the surge voltage to 25 volts or less when subjected to repetitive 300-ampere surges, and (3) withstand repetitive 400-ampere surges with an 8 by 20-microsecond wave form without damage to the suppressor.

4. **Accessory and auxiliary equipment:** As a minimum, traffic signal controller cabinets shall be furnished with the following:

Comment [2082]: Right Way, Right Material

Comment [2083]: Right Material

Trial Use and Comment

a. Removable, noncorrosive metal back panel (13-gage minimum) that shall incorporate a swing-down design to allow it to be placed in at least a 60-degree angle below the vertical position when the top attachment mechanisms are removed. The design shall use noncorrosive metal hinges or pins of adequate number and strength to support the back panel and attached equipment.

b. Removable, noncorrosive metal detector panel (13-gage minimum) at least 35 inches in length and 6 1/2 inches in width with two rows of barrier terminal blocks. Each row shall consist of 48 double-pole terminals rated at 4,000 volts r.m.s., 30 amps, and be able to accommodate up to 10-gage solid wire. The panel shall be wired in accordance with the following:

(1) 16 double-pole terminals for vehicle calls (2 per phase)

(2) 4 double-pole terminals for pedestrian calls (1 each for phase 2, 4, 6, and 8)

(3) 3 double-pole terminals for detector +115 VAC

(4) 3 double-pole terminals for detector AC Common

(5) 3 double-pole terminals for ground

(6) 3 double-pole terminals for detector logic ground

(7) 8 double-pole terminals for 115 VAC delay override

(8) 4 double-pole terminals each for phase 1, 3, 5, and 7 for vehicular detector field wiring

(9) 10 double-pole terminals each for phase 2, 4, 6, and 8 for vehicular detector field wiring.

c. Removable, noncorrosive metal auxiliary panel(s) (13-gage minimum) with terminals wired for auxiliary connector(s) functions

d. Removable, noncorrosive metal detector test panel (13-gage minimum), readily accessible when the main cabinet door is opened, providing vehicle inputs through a momentary switch to each of the 8 phases and pedestrian inputs to phases 2, 4, 6, and 8.

e. Ground fault convenience receptacle.

f. Removable, noncorrosive metal power panel (13-gage minimum) located on the right side near the front of the cabinet. A clear Plexiglass shield with

Trial Use and Comment

openings for manual operation of breakers shall be installed over the panel with standoffs and thumbscrews.

g. Two circuit breakers. One circuit breaker, which shall be isolated from the power supply for the signal and control equipment, shall be rated at least 20 amps and shall operate the vent fan, ground fault convenience receptacle, and lamp. The second circuit breaker shall be rated at least 20 amps or as required by the loading and shall operate all other equipment, including the signal load. Separate terminal strips shall be provided for each circuit breaker and an unfused terminal for the neutral side of the power supply line.

h. Screened and louvered vent designed to prevent rain entry, with a 14 by 20 by 1-inch standard furnace vent filter. The filter tray shall be sized to house and secure the filter in place. The screen shall be constructed from at least 0.031-inch aluminum with 1/8-inch diameter openings positioned on 3/16-inch staggered centers. The screen shall be placed on the inlet side of the filter and held in place by the filter or silicone adhesive.

i. Screened air exhaust opening under the top overhang.

j. Thermostatically controlled vent fan with a screened guard in the top section of the cabinet with a capability of exhausting at least 100 CFM. The thermostat shall be adjustable from 80 degrees F to 130 degrees F. Degree markings shall be indicated on the thermostat in 10-degree increments.

k. Radio frequency interference filter rated at 50 amps.

l. Transient protection devices.

m. Dual-circuit flasher, 15 amp rating over the temperature range of -34 degrees C to +74 degrees C conforming to NEMA standards with an LED indicator for each circuit.

n. Fluorescent lamp, ordering code #F20T12/D, and an on/off door switch located in the cabinet so that it will provide for the unobstructed illumination of controller timing adjustments. A toggle switch mounted on the cover behind the police panel, and a momentary switch operated by the door shall be connected in-line for operation of the lamp.

o. Twelve-channel NEMA stand-alone conflict monitor with its own power supply and an LCD. The monitor shall have an internal 99-year real-time clock referenced to 60 Hz AC power line. Clock shall be easily set to the nearest second of the year from the front panel. A crystal oscillator shall be provided to maintain the accuracy of the clock to at least 0.005 percent (50PPM) when on standby power. Clock time and date shall be maintained

Trial Use and Comment

for at least one year during periods of power loss. Automatic corrections shall be made for Daylight Saving Time.

In addition to NEMA requirements, the conflict monitor shall have user-selectable features for monitoring simultaneous dual indications on a channel and controller amber clearance intervals. The intersection shall be placed in flashing operation if the controller amber clearance interval is less than a fixed minimum and when programmed dual indications occur simultaneously on a channel. If power loss occurs after a failure, the conflict monitor shall be capable of displaying, upon restoration of power, the indications on at the time of power loss. The conflict monitor shall log at least nine previous faults and 10 power interruptions and restoration by date and time in non-volatile memory.

Conflict monitor shall have an auxiliary connector mounted on the front panel that will allow transfer of data to a printer. Connection of the conflict monitor to the printer shall be accomplished through the use of a cable with a DB-25 male connector on one end for connection to the printer and the appropriate connector on the other end for connection to the conflict monitor auxiliary connector. The Contractor shall furnish two cables to the Engineer Upon command, current date and time, monitor configuration, and previous faults and power interruptions and restorations shall be printed in a usable format without disrupting normal monitor operation. Previous faults shall indicate channel indications on and time and date of fault occurrence.

The LCD shall have display indications in conformance with NEMA and the following changes and additions:

(1) Four individual indications per channel displaying active red, yellow, green, and walk inputs. Indications shall be displayed using the following symbology: R = red, Y = yellow, G = green, and W = walk. The monitor shall be capable of displaying the indications simultaneously for all active inputs.

(2) Amber clearance failure indication.

(3) Dual indication.

(4) Program card compatibility phases.

(5) Date, time, and type of fault condition including channel indications on for logged faults.

(6) Date and time for power interruptions and restorations.

(7) Current date and time.

Trial Use and Comment

p. Wired signal, pedestrian, and overlap load switch mounting bases (16) wired for the following from left to right: 8 phases, 4 overlaps, and pedestrian movement for phases 2, 4, 6, and 8.

q. Twelve solid-state signal load switches (signal and overlap) conforming to NEMA standards, each having LED indicators for active input and output circuits. The load switch shall have a 15-amp rating over the temperature range of -34 degrees C to +74 degrees C.

r. Six flash-transfer relays with a rating of 1/4 H.P. at 120 VAC; 30 AMP, 120/240 VAC; 20 AMP, 28 VDC.

s. One or more field wiring terminal(s) for each light circuit plus one terminal for the common conductors but not fewer than one for every four signal circuits. Signal common terminals shall be grounded to the cabinet.

t. Two switches inside the main cabinet on the cover behind the police panel that provide the same functions as the switches in the police panel.

u. Removable, noncorrosive metal resistor panel (13-gage minimum) located on the left side near the bottom of the cabinet. The panel shall be of sufficient size to mount four resistors adequately. Resistors shall be mounted horizontally, one below the other, in the following order from top to bottom: phase 1, phase 3, phase 5 and phase 7.

(e) **Signal Heads:** Signal head sections used in installing intersection control beacons and hazard identification beacons shall be the same as those described herein for standard traffic signal head sections.

Comment [2084]: Right Material

Cast aluminum signal head sections shall be used for span wire installations, free-swinging mast arm installations, and pedestal-mounted installations that use only slipfitters. Cast aluminum or polycarbonate signal head sections may be used for all other installations.

1. **Traffic signal lamp wattages** shall be as follows: 60-watt lamps for 8-inch amber flashers, 100-watt lamps for all other 8-inch sections, 100-watt lamps for 12-inch amber flashers, and 150-watt lamps for all other 12-inch sections.

2. **Traffic signal backplates** shall be specifically manufactured for the type and brand of signal heads used to ensure proper fit with a border width of 5 inches and shall be without louvers and of one-piece construction with the exception of those for five-section cluster signal heads, which may be a maximum of five pieces.

Trial Use and Comment

3. **Standard traffic signal head sections** shall conform to the requirements of the ITE Standard for Vehicle Traffic Control Signal Heads and Section 238 and shall include cap visors.

4. **Selective view traffic signal head sections** shall conform to the requirements of Section 238, shall permit the visibility zone of the indication to be determined optically, and shall not require hoods or louvers. The projected indication shall be selectively visible or veiled within 15 degrees of the optical axis. No indication shall result from external illumination, and one light unit shall not illuminate another unit.

   The optical system and materials shall be composed of a lamp with a collar, an optical limiter-diffuser, and an objective lens. The lamp shall be a three-pronged sealed beam having an integral reflector with stippled cover and shall be coupled to the diffusing element with a collar that includes a specular inner surface. The diffusing element shall be discrete or integral with the convex surface of the optical limiter.

   The optical limiter shall provide an accessible imaging surface at focus on the optical axis for objects 900 to 1,200 feet away and shall permit an effective veiling mast to be variously applied as determined by the desired visibility zone. The optical limiter shall be provided with a means for positive indexing and shall be composed of heat-resistant glass.

   The objective lens shall be a high-resolution annular incremental lens hermetically sealed within a flat laminant of weather-resistant acrylic or an approved equal. The lens shall be symmetrical in outline and capable of being rotated to any 90-degree orientation about the optical axis without displacing the primary image.

   The optical system shall accommodate the projection of diverse, selected indications to separate portions of the roadway such that only one indication will be simultaneously apparent to any viewer. The projected indication shall conform to ITE transmittance and chromaticity standards.

   Die-cast aluminum parts shall have a chromate preparatory treatment. The exterior of the signal case, lamp housing, and mounting flanges shall be finished with high-quality baked enamel primer and finish paint. The lens holders and interior of the case shall be optical black.

   The signal case and lens holders shall be predrilled for backplates and visors. Hinge and latch pins shall be stainless steel. Access openings shall be sealed with weather-resistant rubber gaskets.

   The signal shall mount to a standard 1 1/2-inch traffic signal fitting as a single section, a multiple section face, or in combination with other signals. The signal

Trial Use and Comment

section shall be provided with an adjustable connection that permits incremental tilting from 0 to 10 degrees above or below the horizontal plane while maintaining a common vertical axis through the couplers and mounting. The terminal connection shall permit external adjustment about the mounting axis in 5-degree increments. The signal shall be mountable with ordinary tools and capable of being serviced with no tools.

Attachments, such as visors, backplates, and adapters, shall conform and readily fasten to existing mounting surfaces without affecting the water and light integrity of the signal.

Lamp fixtures shall be composed of a separately accessible housing and integral lamp support; an indexed ceramic socket; and a self-aligning, quick-release lamp retainer. Electrical connection between the case and lamp housing shall be accomplished with an interlock assembly that disconnects the lamp holder when opened. Each signal section shall include a covered terminal block for clip or screw attachment of lead wires. Concealed No. 18 AWG stranded and coded wires shall interconnect sections to permit field connection within any section.

Each signal section shall include an integral means of regulating its intensity between limits as a function of individual background illumination. Lamp intensity shall be at least 97 percent of the uncontrolled intensity at 1,000 footcandles and shall decrease to 15 ± 2 percent of maximum at less than 1 footcandle. Response shall be essentially instantaneous and proportional to any detectable increase in illumination from darkness to 1,000 footcandles and damped for any decrease from 1,000 footcandles.

The intensity controller shall be composed of an integrated directional light sensing and regulating device interposed between the lamp and wires. It shall be compatible with a 60-Hz input and responsive within the range of 105 to 135 volts. Output may be phase controlled, but the device shall provide a nominal terminal impedance of 1,200 ohms open circuit and a corresponding holding current.

The signal head shall be optically programmed in accordance with the manufacturer's recommendations.

5. **Pedestrian signal heads** shall conform to the requirements of ITE Standards for Pedestrian Traffic Control Signal Indications and Section 238.

6. **Lane-use control signal heads** shall conform to the requirements of ITE Standards for Lane-Use Traffic Control Signal Heads and Section 238.

(f) **Illuminated Traffic Control Signs:** Signs shall be square or rectangular weatherproof units. Only internal illumination shall be used. When illuminated, the

Comment [2085]: Right Material

Trial Use and Comment

message shall be white on an opaque background. The sign face or cover shall consist of a polycarbonate lens. The housing shall be sheet aluminum at least 0.125 inch in thickness finished with two coats of flat black paint.

The size and arrangement of letters forming the message shall conform to the requirements of the *Federal Standard Highway Signs Booklet* or an adaptation approved by the Engineer. When activated, the message shall be clearly readable at all times at a distance of 200 feet in all atmospheric conditions except dense fog. The message shall be controlled by a time clock or another type of actuation as specified on the plans. Signs shall illuminate instantly without a "warm-up" requirement or a continuously energized ballast. When signs are de-energized, the message shall not be readable.

(g) **Detectors:**

1. **Magnetic detectors** shall consist of a sensitive magnetic circuit housed in a lightweight metal cylinder approximately 2 inches in diameter, approximately 20 inches in length, and shall be equipped with two 35-foot (minimum) stranded leads.

2. **Magnetic detector amplifiers** shall be solid-state and properly connected to sensor(s) to produce, upon vehicle actuation, an output through a relay that has both normally closed and normally open circuits. A fail-safe design shall be incorporated so that a constant detection signal for control equipment will be provided in the event of a power loss. The unit shall be housed in a mechanically sound metal enclosure designed to allow stacking of multiple units having maximum dimensions of 3 inches in height, 6 inches in width, and 8 inches in depth. An 8-pin MS connector for making external detector connections, an adjustable sensitivity control, and a visual vehicle actuation indicator shall be provided on the front panel of the amplifier enclosure. The amplifier shall provide stable operation within an ambient temperature range of -30 degrees F to +135 degrees F when operating from a 120-volt, 60-Hz, single-phase AC power supply with a nominal power consumption of 5 watts or less. A fuse of a suitable ampere rating shall be provided to protect the power supply of the detector amplifier. Fuses shall be easily replaceable from the front panel.

3. **Inductive loop detectors** shall conform to the requirements of the performance characteristics required by NEMA TS-1.

   The manufacturer of the loop detector amplifier shall provide a certification from an independent testing laboratory that the model furnished complies with NEMA Environmental Standards and Test Procedures.

   Loop detector amplifiers shall be a single-channel, shelf-mounted, relay-output type with indicator lights on the front panel and delay and extension detection features. When the delay feature is used, it shall be inhibited during the green

Comment [2086]: Right Location

Comment [2087]: Right Material

Comment [2088]: Right Material

Comment [2089]: Right Material

Trial Use and Comment

interval of its associated phase. The detector amplifier shall be adequately fused, and fuses shall be easily replaceable from the front panel.

4. **Pedestrian detectors** shall be pushbutton operated at low voltage (not more than 15 volts AC or 24 volts DC).

703.03—Procedures.

Equipment shall be installed so that it is ready for full operation.

(a) **Prosecution of Work:** The Contractor shall not discontinue the operation of an existing signal without the approval of the Engineer. Requests for discontinuance shall be made at least 48 hours in advance.

While modifying or replacing existing traffic signals, the Contractor shall provide necessary traffic controls for maintenance of traffic, as approved by the Engineer. Traffic flow shall be maintained during the modification or replacement. Normal or routine maintenance that is not attributable to the Contractor's operations will remain the responsibility of the Department or local municipality.

When the Contractor begins modifying or replacing existing signal equipment or placing new signal equipment in operation, he shall maintain and repair the equipment until final acceptance. If the equipment malfunctions during the Contractor's working hours or during peak traffic hours as determined by the Engineer, the Contractor shall take immediate action to maintain the normal flow of traffic and make necessary repairs as expeditiously as possible that will cause the least interference with traffic.

The Contractor shall furnish the Engineer with the name and telephone number of the supervisory employee of his company who will be responsible for responding to repair calls during nonworking hours. If a signal malfunctions, the Contractor shall make necessary repairs within 4 hours from the time of notification. If the Contractor fails to make the repairs within 4 hours, the Department may make the repairs in accordance with the requirements of Section 104. This shall in no way relieve the Contractor of his responsibility for maintaining and completing the work.

When replacing or modifying an existing coordinated signal system, the Contractor is not required to maintain the existing system coordination unless directed to do so by the Engineer.

(b) **Equipment Color:** The color of metal equipment shall be obtained by applying two coats of paint. The color of plastic equipment shall be obtained by impregnating the color into the plastic. When painting of aluminum and galvanized metal equipment is required, the equipment surface shall be treated to ensure adherence of the paint. Signal head color shall be Federal Yellow except that the inside of the visors

Comment [2090]: Right material

Comment [2091]: Right Way

Comment [2092]: Right Way

Comment [2093]: Right Time

Comment [2094]: Right Documentation

Comment [2095]: Right Way, Right Material

Trial Use and Comment

shall be flat black. Backplates (both sides) and signal leveling attachments shall be flat black.

(c) **Refurbishing Existing Equipment:** Existing equipment to be retained shall be cleaned. Existing metal equipment to be retained shall be repainted as specified herein.

(d) **Mounting Controller Cabinets:** Pole-mounted controller cabinets shall be attached to metal poles or signal pedestals by means of brackets secured by encircling clamps made for the purpose and to wood poles by means of lag screws and plates bolted through the back of the cabinet or by encircling clamps made for the purpose.

Ground-mounted cabinets shall be installed on a concrete foundation.

(e) **Installing Signal Heads:** At new or modified traffic signal installations, each signal head shall be covered with a durable, nontransparent cover upon installation. The Contractor shall maintain the cover until the signal is put into operation.

Housings shall be joined at the top and bottom in accordance with the manufacturer's specifications to form complete signals. Unused ends of sockets shall be closed with ornamental cap screws. Joints shall be rendered weatherproof by a suitable combination of lead and steel washers.

1. **Standard and selective view traffic signal heads** shall be installed so that there is at least 8 feet between lines drawn perpendicular to the center of any two adjacent signal heads that provide indications to the same approach. The Contractor shall verify the location and alignment of each signal head for orientation to its approach lane(s) prior to installing the signal conductor cable. If the location of the signal head designated on the plans is not oriented correctly with the applicable approach lane(s), the Contractor shall determine the proper location(s) and submit supportive data to the Engineer for review.

   The bottom of the housing of a pedestal-mounted or bracket-mounted signal face adjacent to the pavement shall be at least 8 but not more than 15 feet above the sidewalk or, in the absence of a sidewalk, above the pavement grade at the center of the roadway.

   Balance adjusters shall be installed with span wire hanger assemblies. Lock washers shall be used with nuts on the balance adjuster, and the vertical eyelet bolt shall have a cotter key inserted through a hole in the center of the bolt. The hole shall be located approximately two threads from the bottom of the bolt. The vertical eyelet bolt shall be secured from movement with a lock nut.

   Serrated teeth on hanger assemblies shall be of the correct number and size to mate properly with the teeth on the signal heads.

Comment [2096]: Right Way

Comment [2097]: Right Way

Comment [2098]: Right Way, Right Location, Right Material

Comment [2099]: Right Location, Rght Material

Trial Use and Comment

The lowest point of the signal head assembly, including backplates and tether wire attachments, suspended over the roadway shall be at least 15 feet for mast arm installations and at least 16 feet for span wire installations above the pavement grade at the center of the roadway. The bottom of the signal head housing shall be not more than 19 feet above the pavement grade at the center of the roadway for mast arm and span wire installations.

2. **Pedestrian signal heads** shall be mounted with the bottom of the lower signal unit at least 7 but not more than 10 feet above the sidewalk and shall be placed in the line of vision of pedestrians using the applicable crosswalk. When mounted on the same support with vehicular signal indications, signal groupings shall be at least 1 foot apart. Pedestrian indications shall be below vehicular indications.

3. **Lane-use control signal heads** shall be installed to operate in accordance with the *MUTCD.* The lowest point of the signal head assembly suspended above the roadway shall be in accordance with (e)1. herein.

4. **Signal lamps** shall be installed in signal heads in accordance with the ITE Standard for Vehicle Traffic Control Signal Heads.

5. **Backplates** shall be attached with bolts, washers, and lock nuts or self-tapping screws and washers. The number of bolts or self-tapping screws required shall be at least 8 for a three-section signal head assembly, 10 for a four-section assembly, and 12 for a five-section assembly. Bolts, screws, and washers shall be of a noncorrosive metal or shall have a noncorrosive outside coating.

(f) **Installing Illuminated Traffic Control Signs:** Illuminated signs used to control right or left turns shall be mounted directly over or adjacent to the affected traffic lane(s) at the height prescribed for standard traffic signals. When mounted with standard and selective view traffic signal indications, illuminated traffic control signs and signals shall be separated so as to prohibit physical contact.

(g) **Installing Detectors:** The location of detectors shall not deviate more than ±2 feet from the location(s) shown on the plans unless the Contractor submits a detailed drawing showing the exact location of the detector(s) in question and secures the written approval of the Engineer. Detector lead-in cable shall be continuous and unspliced from the detector to the detector panel terminals.

Splices between loop or magnetic detector conductors and the lead-in conductors shall be allowed only in signal junction boxes. A separate splice kit shall be used for each lead-in cable. These splices shall be joined, made mechanically secure, and then tested electrically. When the mechanical connection has been shown to be electrically functional under operational conditions, it shall be soldered with a fusible metal or alloy. Each splice shall then be covered with one layer of half-lapped, 3/4-

Comment [2100]: Right Way, Right Location

Comment [2101]: Right Way, Right Location

Comment [2102]: Right Way

Comment [2103]: Right Location

Comment [2104]: Right Location, Right Documentation, Right Material

Trial Use and Comment

inch self-bonding rubber tape and one layer of half-lapped, 3/4-inch vinyl tape. The tape shall be installed so at least 3/4 inch of the insulation is covered by the tape. The splice shall then be installed in a splice kit.

Detector and detector lead-in cable shall be installed with the slack length coiled in the junction boxes. The coiled length shall be sufficient to allow the cables to extend at least 2 feet above the junction boxes.

Detector and detector lead-in cable jackets shall be permanently identified in the controller cabinet and junction boxes. Identifications shall be indicated on nonferrous metal tags or nylon tags attached to the cable with nylon cable ties. The identification shall be stamped or engraved on the metal tags and lettered with permanent ink on nylon tags. Identifications shall be legible and shall conform to the following:

- **Detector lead-in cable:** phase and location (lane and setback distance from stop line) of detector: e.g., 1 NB stop line left-turn lane loop 2 SB 200 feet through lanes mag.; 6 NB stop line inside through-lane loop; 2 Ped NW Quad.

- **Detector cable:** phase and location of detector: e.g., 1 NB left-turn lane loop; 2 SB through-lane mag.; 6 NB inside through-lane loop; 6 NB outside through-lane loop.

1. **Magnetic detectors:** Magnetic detectors shall be encased in heavy-wall PVC conduit 3 inches in diameter installed in a trench cut to a depth of 15 inches and shall be surrounded with at least 3 inches of sand. When approved by the Engineer, the sensing element, encased in PVC conduit, may be installed in a hole bored parallel to the surface and at the required depth.

   Magnetic detector circuits shall not be run in the same cable sheath with conductors carrying signal power.

2. **Inductive loop detectors:** Slots shall be sawed into the pavement, cleaned with pressurized water at a minimum of 50 pounds per square inch, and then dried with filtered compressed air before loop conductors are installed and sealed. One-inch lengths of PE foam backer rod shall be installed in the slot at slot intersection points and on 2-foot-maximum centers between those points after installation of the loop conductors. The backer rod diameter shall be 1/2 inch for 3/8-inch slots, 5/8 inch for 1/2-inch slots, and 3/4 inch for 5/8-inch slots. Sealant shall conform to the requirements of Section 212. Loops shall be installed in the presence of the Engineer.

   Loop detectors shall not be installed in pavement that has been open cut, repaired, or rebuilt in a manner where the pavement structure is not sound and continuous in the area of the proposed loop installation. When loop detectors

Comment [2105]: Right Material, Right Location, Right Way

Comment [2106]: Right Location, Right Material Right Way

Trial Use and Comment

are to be installed in existing pavement, the Contractor shall first field inspect the loop locations and advise the Engineer of any such locations that have been open cut, repaired, or rebuilt. The Engineer will direct the Contractor in locating the loop detectors.

A Megger reading of at least 100M ohms shall be obtained for each loop detector (cable and shield). This test shall be made at 500 volts immediately before the sealant is installed and again after the sealant has set at least 24 hours. Cable shall be disconnected from the detector amplifier during testing.

Comment [2107]: Right Way

Comment [2108]: Right Time

Loop cable shall be installed without damaging the cable or its insulation. Damaged cables shall be replaced at the Contractor's expense. Cable shall be installed with no kinks or curls and no straining or stretching of the insulation and shall be secured as deep in the slot as possible. When loop cable crosses pavement joints, an 8-inch section of flexible plastic sleeve shall be installed to prevent damage from pavement shifts. A blunt object, similar to a wooden paint stirrer, shall be used to seat the loop cable. The two ends of the loop conductor cable between the roadway loop and the junction box shall be twisted together, with approximately two turns per running foot.

The lead-in cable shield (drain wire) shall be connected to ground at the controller cabinet only. The lead-in cables shall have soldered on spade connectors for attachment to the detector panel terminals. Heat shrink tubing shall be installed over the soldered connections.

3. **Pedestrian detectors:** Pedestrian detectors shall be mounted on supports as indicated on the plans. Breakaway connectors shall be installed on conductor cables for pedestrian detectors on pedestal poles. Breakaway connectors shall be fused for the hot conductor and nonfused for the grounded conductor. The location of the breakaway connectors shall be in the hand hole of the pedestal pole.

Comment [2109]: Right Way, Right Location

(h) **Rigging Details:**

1. **Overhead span wire:** Where a 1/4-inch span wire terminates at a wood or steel pole, it shall be attached to a 5/8-inch thimbleye bolt and secured with two 2-bolt clamps. Where a 1/2-inch span wire terminates at a wood or steel pole, it shall be attached to a 3/4-inch thimbleye bolt and secured with two 3-bolt clamps.

Comment [2110]: Right Way, Right Material, Right Location

Span wires shall be unspliced and unjointed and tightly drawn to the desired height and position while the pole is maintained in the vertical position.

Saddle clamps, strand connectors, and strain insulators shall be designed for the size of the span wire and shall meet or exceed the strength of the span wire.

Trial Use and Comment

Down guys shall be used on wood poles and shall be the same type of cable used in span wires. They shall be attached to the pole in the same manner and at the same height as span wires. Lateral guys placed over the roadway shall be strung to maintain a vertical clearance of at least 17 feet 6 inches. Lateral guys and down guys shall be tightly drawn in a manner to secure the pole while its vertical alignment is maintained. Metal or approved plastic gutters shall be installed on down guys. Sidewalk struts shall be provided where the vertical distance from the sidewalk to the down guy is less than 8 feet.

Integral messenger cable may be used for interconnect cable runs in lieu of span wire support. Signals, signs, or other equipment shall not be suspended from integral messenger cable.

Obstructions shall be bypassed by the use of special brackets or pole extensions.

2. **Tether wire:** Tether wire shall be unspliced and unjointed and attached to a pole by means of a 5/8-inch thimbleye bolt, a two-bolt clamp, and a guy sleeve. Tether wire shall be drawn in a manner to secure the attached signal head against movement caused by wind loads. Signals, signs, or other equipment shall not be suspended from tether wire.

(i) **Testing Equipment:** After energizing the signal installation, the Contractor shall demonstrate to the Engineer that electrical components are in proper working order. Faulty electrical components shall be repaired or replaced by the Contractor at his expense.

Upon completion of electrical tests, the Contractor shall conduct a demonstration test of each signalized intersection for 30 continuous days. The Contractor shall provide personnel to fine-tune and correct deficiencies in traffic signal installation(s) during the 30-day test period at his own expense. If any portion of the signal installation(s) is replaced or repaired, the portion shall be subjected to an additional 30-day test immediately after replacement or repair.

Testing of the traffic signal system master controller and system coordination shall be conducted after completion of the demonstration test of each signalized intersection.

A Phase I test and debugging period of at least four consecutive calendar days shall begin after the system has been installed and approved by the Engineer. The test period shall conclude with a formal successful demonstration of the proper operation of system functions.

Upon successful completion of the Phase I test, the system shall undergo a Phase II operational test of at least 30 days. During this period, the system shall be programmed to provide on-line traffic control. The Phase II test will be considered

Comment [2111]: Right material, Right Way

Comment [2112]: Right Way

Comment [2113]: Right Way/Right Time

Comment [2114]: Right Time

Comment [2115]: Right Time

Comment [2116]: Right Time

Trial Use and Comment

complete and the system acceptable when all system functions demonstrate full compliance with the specifications. If failures occur, tests shall be stopped. After corrections are made, a new 30-day test shall commence.

Prior to final acceptance, the Contractor shall furnish the Engineer written certification that the system control equipment has been installed in accordance with the manufacturer's specifications.

703.04—Measurement and Payment

Comment [2117]: Right Payment

Master controllers will be measured in units of each and will be paid for at the contract unit price per each. This price shall include timing data, timing implementation, training, controller cabinets, back panels, power panels, detector panels, auxiliary panels, circuit diagrams, manufacturer's instructions, relays, auxiliary equipment, flexible cables, grounding systems, transient protection devices, radio frequency interference filters, wiring, and fittings.

Controllers will be measured in units of each and will be paid for at the contract unit price per each. This price shall include timing data, timing implementation, training, controller cabinets, back panels, power panels, detector panels, auxiliary panels, police panels, thermostatically controlled fan units in the cabinet with a vent, flashers, local flasher switches, radio frequency interference filters, signal switches, main switches, police hand controls, conflict monitors, flasher relay assemblies, power relays, signal control assemblies, lamp receptacles and ground fault convenience receptacles, circuit diagrams, flexible cables, grounding systems, transient protection devices, and fittings.

Traffic signal head sections will be measured in units of each and will be paid for at the contract unit price per each. This price shall include mountings, molded terminal blocks, visors, backplates, fittings, realignments, lamps, and optical adjustments or LED modules as required.

Pedestrian signal heads will be measured in units of each and will be paid for at the contract unit price per each. This price shall include mountings, LED indication modules, molded terminal blocks, visors, fittings, and realignments.

Detector amplifiers will be measured in units of each and will be paid for at the contract unit price per each. This price shall include connecting cables and fittings.

Magnetic detector sensing elements will be measured in units of each and will be paid for at the contract unit price per each. This price shall include the sensing element with leads, PVC conduit, trenching, backfilling, compacting, boring, sand, and repairing the pavement structure.

Pedestrian pushbuttons will be measured in units of each and will be paid for at the contract unit price per each. This price shall include fittings and sign(s).

Trial Use and Comment

Flashers for flashing beacons will be measured in units of each and will be paid for at the contract unit price per each. This price shall include cabinets, mounting hardware, transient protection devices, radio frequency interference filters, power panels, grounding systems, and fittings.

Saw cuts will be measured in linear feet and will be paid for at the contract unit price per linear foot. This price shall include cutting, cleaning, drilling, disposing of surplus material, backer rods, and loop sealant material.

Hanger assemblies will be measured in units of each and will be paid for at the contract unit price per each. This price shall include pipe, brackets, clamps, balance adjusters, tether wire attachments, leveling devices, and fittings.

Illuminated traffic control signs will be measured in units of each and will be paid for at the contract unit price per each. This price shall include enclosure cabinets, sign messages, lens, lamps, internal electrical wiring and components, louvers, mounting attachments, grounding systems, and fittings.

Tether wire will be measured in linear feet from connection point to connection point and will be paid for at the contract unit price per linear foot. This price shall include thimbleye bolt assemblies and fittings.

Span wire will be measured in linear feet, from connection point to connection point, and will be paid for at the contract unit price per linear foot. This price shall include thimbleye bolt assemblies, conductor cable supports, and fittings.

Cable terminal enclosures will be measured in units of each and will be paid for at the contract unit price per each. This price shall include weatherproof enclosures, foundations, terminals, terminal panels or racks, grounding systems, and fittings.

Loop detector cable and lead-in cable will be measured and paid for in accordance with the requirements of Section 700.05.

Cleaning, painting, and grouting of existing equipment retained in signal modifications will not be measured for separate payment but will be considered incidental to other items of work.

Payment will be made under:

Pay Item	**Pay Unit**
Master controller	Each
Controller	Each
Traffic signal head section (Size and type)	Each
Pedestrian signal head (Standard)	Each

Trial Use and Comment

Detector amplifier (Type)	Each
Magnetic detector sensing element (Standard)	Each
Pedestrian pushbutton	Each
Flasher	Each
Saw cut	Linear foot
Hanger assembly (Standard, [ ]-way)	Each
Illuminated traffic control sign	Each
Tether wire (Size)	Linear foot
Span wire (Size)	Linear foot
Cable terminal enclosure (Standard)	Each

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:
Review plans and ensure that local entities are aware of project and have reviewed contract to avoid possible delays due to non conformance to local area requirements.

Start: Review contractor's daily work schedule to insure proper inspection occurs during daily activities. Verify that items being used are tested and approved. Ensure that contractor has a certified WZTC on site prior to setting up traffic control also certified individuals that will be necessary throughout their submitted daily activities.

Continuous inspection: Continuous inspection should be utilized while contractor is setting up traffic control and are in roadway and during placement of concrete. Inspector to verify the Megger readings obtained for each inductive loop detector.

Intermediate Inspection: Intermediate inspection can occur during operations where action is repetitive and can be reviewed prior to contractor covering up or closing off access for inspection.

Final Inspection: Verify that all daily activities have been reviewed and all quantities and documentation have been supplied to inspector and recorded as needed. Prepare as built drawings if any changes have been made to location or material. District Traffic Signal Group to perform final inspection.

Trial Use and Comment

Documentation Required: Documentation recording where, how much and what kind of material was utilized for daily activities. Approved source of materials (Form C-25), invoices, delivery tickets for items used. Results of Megger testing.

IV. REVIEW QUESTIONS

SPEC.#	
703.01	Are the traffic signals being installed in accordance with the specifications, plans, or as directed by the Engineer?
703.02(1)	Has the manufacturer provided certification from an independent testing lab that controller model, auxiliary equipment, and flasher conform to NEMA environmental and test procedures and any exceptions stated herein unless otherwise specified?
703.02(2)	Are controllers furnished completely housed in a weatherproof cabinet?
703.02(3)	Has the Contractor furnished the manufacturer's instructions for installing and maintaining the equipment?
703.02(4)	Does the Contractor furnish the Department 3 copies of the timing data and documents used in calculating the timings 60 days prior to timing implementation?
703.02(5)	Did the Contractor request the final timing plan at least 90 days in advance of implementation?
703.02(d3)	Has the Contractor installed 2 blue and white prints of the circuit diagram inside the controller cabinet and furnished 3 additional copies to the Engineer?
703.02(e)	Are cast aluminum signal heads used for span wire installations, free-swinging mast arm installations, and pedestal-mounted installations that use only slipfitters?
703.02(e2)	Are traffic signal backplates specifically manufactured for the type and brand of signal heads used to ensure proper fit with a border width of 5 inches, of one piece construction, and without louvers?
703.02(e3)	Do standard signal head sections conform to the ITE Standard for Vehicle Traffic Control Signal Heads and Section 238, Electrical and Signal Components?
703.02(e4)	Do selective view traffic signal head sections conform to the requirements of Section 238, Electrical and Signal Components?
703.02(e5)	Do pedestrian signal heads conform to ITE Standards for Pedestrian Traffic Control Signal Indications and Section 238, Electrical and Signal Components?
703.02(e6)	Do Lane-use control signal heads conform to ITE Standards for Lane-Use Traffic Control Signal Heads and Section 238, Electrical and Signal Components?
703.03(a)1	Did the Contractor obtain approval from the Engineer at least 48 hours prior to discontinuing operation of an existing signal?

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703.03(a)2	Does the Contractor provide necessary traffic control for maintenance of traffic, as approved by the Engineer, while modifying or replacing existing traffic signals?
703.03(a)3	Has the Contractor furnished the Engineer with the name and telephone number of the supervisory employee responsible for responding to repair calls during non-working hours?
703.03(a)4	Does the Contractor repair signal malfunctions within four hours from the time of notification?
703.03(e)	Have new or modified signal heads been covered with a durable, non-transparent cover until put into operation?
703.03(e1)1	Has the Contractor verified the location and alignment of each signal head for orientation to its approach lane(s) prior to installing the signal conductor cable?
703.03(e1)2	Is the bottom of the housing of all pedestal or bracket-mounted signal faces adjacent to the pavement at least 8 but not more than 15 feet above the sidewalk or pavement grade at the center of the roadway?
703.03(e1)3	Is the lowest point of the signal head assembly, including backplates and tether wire attachments, at least 15 feet for mast arm and 16 feet for span wire installations above the pavement grade at center of roadway?
703.03(e2)1	Are pedestrian signal heads mounted with the bottom of the lower signal unit at least 7 but no more than 10 feet above the sidewalk?
703.03(e2)2	When mounted on the same support, are pedestrian indications mounted below vehicular indications and are they at least 1 foot apart?
703.03(g)	Has the Contractor submitted a detailed drawing for the Engineer's written approval if detector locations vary more than (+/-) 2 feet from plan location?
703.03(g2)1	Are inductive loop detectors not installed in pavement that has been open cut, repaired, or rebuilt in a manner where the pavement structure is not sound and continuous?
703.03(g2)2	Were Megger tests performed before and after sealant installation in accordance with the requirements of this section?
703.03(h)	Do rigging details conform to the requirements of this section?
703.03(i)1	Does the Contractor conduct a demonstration test of each signalized intersection for 30 continuous days?
703.03(i)2	Have Phase I & II tests of the traffic control signal system master controller and system coordination been conducted upon completion of the demonstration test for each signalized intersection?
703.03(i)3	Did the Contractor furnish the Department written certification that the system control equipment has been installed in accordance with the manufacturer's specifications?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Verify all materials are approved prior to use**
• **Verify all materials meet shop drawings requirements and contract requirements**
• **Verify and receive documentation that District Traffic Division has accepted product**

Trial Use and Comment

SECTION 704 – PAVEMENT MARKINGS AND MARKERS

I. INTRODUCTION:

The proper installation of pavement markings and pavement markers is necessary to provide positive guidance to vehicular traffic, bicyclists, and pedestrians in all types of weather and light conditions.

a) Forms:

- **Form C-85**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

704.01—Description

This work shall consist of establishing the location of pavement markings and installing pavement markings, pavement markers, and reflectorized material on specified pavements in accordance with these specifications, the *MUTCD*, and as directed by the Engineer.

704.02—Materials

Comment [2118]: Right Material / Right Documentation

The Contractor shall use an approved inventory tracking system for all materials received from the manufacturer. Shipment of materials from such inventory shall be accompanied by a signed form C-85 containing the following certification statement:

> *Material shipped under the certification has been tested and approved by VDOT as indicated by laboratory test numbers listed hereon.*

a) **Pavement Markings** shall conform to the requirements of section 246.

b) **Glass Beads** shall conform to the requirements of section 234.

c) **Pavement Markers** shall conform to the requirements of section 235.

704.03—Procedures

Comment [2119]: Right Way / Right Documentation / Right Time

Trial Use and Comment

The Contractor shall have a certified Pavement Marking Technician present during pavement marking operations.

Pavement markings shall be installed on new roadways prior to opening the roadway to traffic. Pavement marking installation shall be completed within the time limits herein on roadways where the pavement markings have been removed or obscured and the roadway is open to traffic unless otherwise directed by the Engineer. Installation of Type B, Class VI, pavement markings on asphalt roadways are not applicable to these requirements if they are inlaid with the last pass of the asphalt roller or directly after the asphalt roller using a separate roller. Installation of edge lines on roadways where the existing pavement markings have been removed or obscured are also required within these time limits unless otherwise indicated by the Engineer. Exceptions to the below time limits will be granted only for weather restrictions, and installation of epoxy resin pavement markings on new pavement shall not commence until after 24 hours of final surface placement.

Pavement marking installation on roads having traffic volumes of 10,000 ADT or more shall be completed within 24 hours after the end of the workday where the pavement markings were removed or obscured.

Pavement marking installation on roads having traffic volumes between 3,000 and 10,000 ADT shall be completed within 48 hours after the end of the workday where the pavement markings were removed or obscured.

Pavement marking installation on roads having traffic volumes of less than 3,000 ADT shall be completed within 72 hours after the end of the workday where the pavement markings were removed or obscured.

If the Contractor will not have pavement markings installed within the time limits specified, the Contractor shall install Type D construction pavement markings within the same time limits and maintain such until the final pavement markings can be installed. The cost of installing, maintaining, and removing the Type D construction pavement markings shall be borne by the Contractor at no cost to the Department.

When establishing the location of pavement markings, the Contractor may mark the locations on the roadway by installing premarkings. Premarkings shall be accomplished using Type D (removable, any class) tape, chalk, or lumber crayons except special pavement markings such as stop lines, crosswalks, messages, hatching, etc., shall be made using chalk or lumber crayons. Premarkings shall be of the same general color as the pavement markings being premarked. When tape is used as premarking, premarking shall consist of 4- inch by 4-inch-maximum squares or 4-inch-maximum diameter circles spaced at 100-foot-minimum intervals in tangent sections and 50-foot-minimum intervals in curved sections. At locations where the pavement marking will switch colors, e.g., gore marking, the ends of the markings may be premarked regardless of the spacing. When chalk or lumber crayon is used as premarking, the entire length of the pavement marking may be premarked. Premarkings shall be installed whereby their installation shall not

Comment [2120]: Right Paymentment

Comment [2121]: Right Material

Comment [2122]: Right Location

Trial Use and Comment

affect the adhesion of the pavement markings. When Type D tape is used as the premarking and the lateral location of such premarkings to the final pavement markings exceeds 6 inches, the premarkings shall be removed at no cost to the Department.

(a) **Pavement Markings:** Pavement markings shall be white or yellow markings as required by the *MUTCD* for the specific location or as specified by the Engineer and shall be installed in accordance with Table VII-1 unless otherwise recommended by the manufacturer and approved by the Engineer. The Contractor shall furnish a copy of the manufacturer's installation recommendations to the Engineer.

The Contractor shall perform quality control testing for application thickness and glass bead rate in accordance with VTM-94 at the beginning of each workday and every 3 hours thereafter. The Contractor shall be responsible for providing the apparatus indicated in VTM-94 that are needed to perform the quality control testing. Testing shall be performed in the presence of the Engineer.

The Contractor shall maintain a daily log (Form C-85) for both temporary and permanent pavement markings and markers. Entries in the log shall be made in ink, shall be legible, and the log shall be signed by the Contractor and delivered to the Engineer by the end of each workday.

Pavement line markings shall consist of stop lines, crosswalks, and solid or skip lines used for, but not limited to, dividing lanes, marking edges, channelizing, outlining and marking safety zones around objects, and forming islands and parking lot stalls.

1. **Crosswalks and stop lines** shall be installed using Type B, Class I or IV, markings.

2. **Solid lines or skip lines** shall be installed using Type A or Type B markings as specified.

Comment [2123]: Right Paymentment

Comment [2124]: Right Way / Right Documentation / Right Time

Comment [2125]: Right Time

Trial Use and Comment

TABLE VII-1
Pavement Markings

Type	Class	Name	Surface Temp. at Time of Application	Film Thickness (mils)	Pavement Surface	Application Limitations
A		Traffic paint	50°F+	15 ± 1 when wet	AC HCC	May be applied directly after paving operations
B	I	Thermoplastic Alkyd	50°F+	90 ± 5	AC	May be applied directly after paving operations
	I	Thermoplastic Hydrocarbon	50°F+	when set	AC	Do not apply less than 30 days after paving operations
	II	Polyester resin	50°F+	15 ± 1 when wet	HCC	Needs to be coned
	III	Epoxy resin	50°F+	20 ± 1 when wet	AC HCC	Pavement surface needs to be at least 1 day old
	IV	Plastic-backed preformed Tape	(Note 4)	60 - 90	AC HCC	Manufacturer's recommendations
	VI	Patterned preformed Tape	(Note 4)	20 min (Note 1) 65 min (Note 2)	AC HCC	Manufacturer's recommendations
D	I & II	Removable tape	(Note 4)	(Note 3)	AC HCC	Construction zone pavement marking
E		Removable black tape (Non-Reflective)	(Note 4)	(Note 3)	AC	Construction zone pavement marking for covering existing markings
F	I & II	Temporary markings	(Note 4)	40 max	AC HCC	Construction zone pavement marking

Note 1: Thinnest portion of the tape's cross section.

Note 2: Thickest portion of the tape's cross section.

Note 3: In the event the manufacturer's recommendation for film thickness is less than used when the material was tested by the National Transportation Product Evaluation Program or other Department-approved test facility, the minimum values used during installation shall conform to the test values indicated on the approved list for the specific marking.

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Note 4: In accordance with manufacturer's recommendation.

Pavement message markings shall be installed using Type B, Class I, IV, or VI, markings and shall include, but not be limited to, school zone markings, railroad crossing markings, disabled parking symbols, elongated arrows, word messages, etc. The word SCHOOL shall be formed with characters that are 10 feet in height where permitted by the normal roadway width. School zone markings shall extend transversely across both lanes of two-lane roadways and across two or more approach lanes of roadways of three or more lanes. Disabled parking symbols shall be 41 inches in height, 36 inches in width, and shall use a 4-inch stroke width for the lines.

The Contractor shall protect the public from damage attributable to pavement marking operations. The Contractor shall be responsible for the complete preparation of the pavement surface, including, but not limited to, removing dust, dirt, loose particles, oily residues, curing compounds, concrete laitance, residues from eradication, and other foreign matter immediately prior to installing pavement markings. The pavement surface shall be dry at the time of installation when tested in accordance with VTM-94. The Contractor shall be responsible for providing the apparatus indicated in VTM-94 that are needed to perform the moisture test. Marking material shall not be applied within 24 hours following rain or other inclement weather.

Comment [2126]: Right Time

Liquid markings shall be applied so as to prevent splattering and overspray and shall be protected from traffic until track free by the use of guarding or warning devices as necessary. If a vehicle crosses a marking and tracks it or if splattering or overspray occurs, the affected marking and resultant tracking shall be removed and new markings applied at the Contractor's expense.

Equipment shall also be thoroughly cleaned between changes in colors of materials.

Pavement markings shall have clean and well-defined edges without running or deformation; shall be uniform, free of waviness; shall be straight on tangent alignment; and shall be on a true arc on curved alignment. The widths of pavement markings shall not deviate more than 1/4 inch on tangent nor more than 1/2 inch on curves from the required width. The length of the gap and the length of the individual stripes that form skip lines shall not deviate more than two inches. The length of the gap and individual skip line shall be of such uniformity throughout the entire length of each that a normal striping machine will be able to repeat the pattern and superimpose additional striping upon the existing marking. Glass beads shall be applied at the rate specified herein and shall be evenly distributed over the entire surface of the marking. Beads shall be applied to the surface of liquid markings by a bead dispenser attached to the applicator that shall dispense beads simultaneously on and in the just-applied marking. The bead dispenser shall be equipped with a cut-off control synchronized with the cut

Trial Use and Comment

off of the applied marking material so that the beads are applied totally to the completed line. Beads shall be applied while the liquid marking is still fluid. Approximately 70 percent of beads shall be buried in the marking, and the remaining 30 percent shall be 50 to 60 percent embedded in the surface. Beads installed on crosswalks and stop lines on roadways with curbs only (no gutter) may be hand applied for two feet at the end of each line next to the curb with 100 percent of the beads embedded 50 to 60 percent in the surface.

Markings found to be unacceptable shall be removed, and new markings applied at the Contractor's expense.

Comment [2127]: Right Paymentment

1. **Type A markings:** Paint may be applied to asphalt concrete and hydraulic cement concrete pavements. Paint shall not be applied over existing pavement markings of other materials unless the existing marking is 90 percent removed. Paint may be applied over existing paint markings.

   Comment [2128]: Right Way

   Paint shall be applied with a line painting machine that is capable of hot spraying paint directly onto the pavement surface with a uniformity of feed through its nozzles for widths of 4 through 8 inches. The machine shall be capable of applying two pavement stripes, either solid or skip, at the same time when double line markings are required. Paint tanks on the equipment shall be equipped with a mechanical agitator and paint shall be thoroughly mixed and heated such that it will not track within 60 seconds after its application.

   Non-truck mounted equipment shall be self-propelled and regulated to allow for calibration of the amount of material applied.

   Glass beads shall be applied to the surface of the paint at the rate of 6 pounds per gallon of paint.

2. **Type B markings:** Equipment shall be capable of providing mixing, heating, and agitation of material. Material shall be uniformly heated throughout the system in accordance with the manufacturer's recommendations. Thermoplastic material shall be maintained in the heating kettle and applied to the road surface at a minimum temperature of 400 degrees F. Heating kettles shall be equipped with an automatic thermostatic control device. The Contractor shall furnish a properly calibrated infrared instrument for the purpose of measuring the actual temperature of molten thermoplastic material. Multi-component material shall be applied using internally injected guns for the mixing of catalyst and hardener.

   Comment [2129]: Right Way

   Non–truck mounted equipment for application of thermoplastic material shall be of the screed extrude type with a screw drive or shall be self propelled and regulated to allow for calibration of the amount of material applied. Non–truck mounted equipment for application of polyester and epoxy resin material shall

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be self-propelled and regulated to allow for calibration of the amount of material applied.

a. **Thermoplastic (Class I)** material shall be applied only on asphalt concrete pavements and shall be applied by screed extrude, ribbon gun, or spray equipment. Alkyd thermoplastic may be applied directly after the paving operations; however, hydrocarbon thermoplastic shall not be applied less than 30 days after the paving operations.

Alkyd and hydrocarbon materials shall not be mixed together. Equipment shall be thoroughly cleaned before types of material are changed.

Thermoplastic shall not be applied over existing pavement markings of other materials unless the existing marking is 90 percent removed. Thermoplastic may be applied over existing thermoplastic markings. For concrete bridge decks that occur in asphalt roadways, Type B, Class VI, tape shall be used.

Primer/adhesive shall be applied to asphalt concrete surfaces more than 2 years old and shall be from the same manufacturer as the thermoplastic.

Glass beads shall be applied to the surface of the marking at the rate of 7 pounds per 100 square feet.

b. **Polyester resin (Class II)** material shall be applied only on hydraulic cement concrete pavements. Polyester resin shall not be applied over existing pavement markings of other materials unless the existing marking is 90 percent removed. Polyester resin may be applied over existing polyester resin markings.

Glass beads shall be applied to the surface at the rate of 8 pounds per gallon of material.

c. **Epoxy resin (Class III)** material shall be applied only to asphalt concrete pavement more than 1 day old and hydraulic cement concrete pavement. Epoxy resin shall not be applied over existing pavement markings unless the existing marking is 90 percent removed.

Glass beads shall be applied by the gravity method to the surface at the rate of 25 pounds per gallon of material.

d. **Plastic-backed preformed tape** shall be installed in accordance with the manufacturer's recommendations and as denoted herein. Tape may be applied to asphalt concrete and hydraulic cement concrete pavements. Tape may be installed immediately following the final rolling of the new asphalt concrete surface. Tape shall not be applied over existing

Comment [2130]: Right Material / Right Way / Right Time

Comment [2131]: Right Quantity

Comment [2132]: Right Material / Right Way

Comment [2133]: Right Quantity

Comment [2134]: Right Way / Right Material / Right Time

Comment [2135]: Right Quantity

Comment [2136]: Right Way / Right Material / Right Documentation / Right Time

Trial Use and Comment

pavement markings of other materials unless the existing marking is 90 percent removed.

Primer/adhesive shall be used for all installations except when tape is applied immediately following the final rolling of the new asphalt concrete surface and shall be from the same manufacturer as the tape.
Tape for pavement line markings shall be applied by an application cart as recommended by the manufacturer. Tape shall be tamped into place with a tamper cart with the weight as recommended by the manufacturer. The use of a vehicle to ride over the markings for tamping will not be permitted.

(b) **Eradication:** Eradication of pavement markings for restriping when required shall be in accordance with the requirements of Section 512 except only 90 percent removal of the existing markings is required.

(c) **Pavement Markers:**

1. **Snow-plowable raised pavement markers** shall be installed by cutting two parallel grooves into the pavement at the depth and dimensions recommended by the manufacturer. Grooves shall be parallel to the adjacent pavement marking. Grooves shall be cut with saw blades having a diameter to match the curvature of the steel casting bottom and keels. Keel surfaces shall be free from scale, dirt, oil, grease, or any other contaminant that might reduce bonding.

   Casting keels shall be bonded in the saw-cut grooves in the manner recommended by the manufacturer of the marker. The bonding material shall be from the Department's approved list or as recommended by the manufacturer of the marker. Noses of the casting shall be installed flush with the pavement surface. The installed height of the raised pavement marker shall be approximately 1/2 inch above the pavement surface. The ambient temperature at the time of installation of the snow-plowable raised pavement markers shall be at least 50 degrees F.

   The top of reflectors shall be mounted flush with the top of the casting.

2. **Raised pavement markers** shall be bonded to the pavement surface in accordance with the manufacturer's recommendations. Bonding material shall be from the Department's approved list or as recommended by the manufacturer of the marker except that epoxy shall not be used on asphalt concrete pavements.

704.04—Measurement and Payment

Comment [2137]: Right Way

Comment [2138]: Right Way / Right Documentation

Comment [2139]: Right Time

Comment [2140]: Right Quantity / Right Payment

Trial Use and Comment

Pavement line markings will be measured and paid for at the contract unit price per linear foot. This price shall include the pavement marking material, surface preparation, quality control tests, daily log, guarding devices, primer/adhesive, and glass beads.

Pavement message markings will be measured and paid for at the contract unit price per each per location. This price shall include the pavement marking material, surface preparation, quality control tests, daily log, guarding devices, primer/adhesive, and glass beads.

Pavement markers will be measured and paid for at the contract unit price per each. This price shall include prismatic retroreflectors, pavement cutting, adhesive, and castings.

Eradication of pavement markings will be measured and paid for in accordance with Section 512.

Payment will be made under:

Pay Item	Pay Unit
Pavement line marking (Type and/or class and width)	Linear foot
Pavement message marking (Message)	Each
Pavement marker (Type, [ ]-way, and/or type pavement)	Each

Trial Use and Comment

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Ensure that a pavement marking plan sheet is included in the plans, a pavement marking description is included in the contract assembly, or that Traffic Engineering has provided guidance on the type and locations of markings required.

- Ensure that the contractor has a Certified Pavement Marking Technician.

Start:

- Ensure pavement condition is dry and meets the requirements for the type of making / maker being installed.

- Ensure that the Contractor's premarking / layout is in accordance with the plans or contract.

Continuous inspection:

- Ensure that the proper material is being applied in accordance with the specifications and the manufacturer's recommended installation documentation.

- Ensure that the line markings / markers are installed at the proper width / dimensions.

- Observe the Contractor performing field quality control testing, in accordance with VTM-94, at the start of the marking operation and every 3 hours thereafter. Document the time that actual marking placement begins, and the results of these tests.

Final Inspection:

- Ensure that the Contractor delivers a complete, accurate C-85 to the Engineer by the end of each workday.

Documentation Required:

- Complete set of manufacturer's installation instructions for all pavement markings / markers.
- C-85

- Materials Information / Approved List Documentation

- Project Diary and Materials Notebook Documentation

Trial Use and Comment

IV. REVIEW QUESTIONS

Spec. #	
704.02(1) [74004800]	Does the Contractor provide copies of certified delivery tickets for all pavement marking materials? (C-85)
704.02(2)	Do all materials conform to the requirements of this section?
704.03(1)	Did the Contractor have a certified Pavement Marking Technician present during pavement marking operations?
704.03(2)	Were pavement marking installations completed within the time limits given in this section for new and resurfaced roadways?
704.03(3)	Did the Contractor install and maintain Type D markings within the same time limits if the intended markings could not be placed within the required time limits?
704.03(a)01	Are the pavement markings white or yellow for the specific location as required by the MUTCD or as specified by the Engineer?
704.03(a)02	Are pavement markings installed in accordance with Table VII-1 unless otherwise recommended by the manufacturer and approved by the Engineer?
704.03(a)03	Did the Contractor furnish a copy of the manufacturer's installation recommendations to the Engineer?
704.03(a)04	Did the Contractor, in the presence of the Engineer, perform quality control testing for application thickness and glass bead rate at the beginning of each workday and every three hours thereafter?
704.03(a)05	Was Form C-85: Pavement Marking, Contractors Daily Log and Quality Control Report, maintained according to the requirements of this section?
704.03(a)06	Were crosswalks and stop lines installed using Type B, Class I or IV markings?
704.03(a)07	Were solid lines or skip lines installed using Type A or Type B markings as specified?
704.03(a)08	Were pavement message markings installed using Type B, Class I, IV, or VI markings?
704.03(a)09	Did the Contractor protect the public from damage attributed to pavement marking operations?
704.03(a)10	Did the Contractor prepare the roadway surface in accordance with this section immediately prior to the installation of pavement markings?
704.03(a)11	Was the pavement surface dry at time of application with no material being applied within 24 hours following rain or other inclement weather?
704.03(a)12	Were liquid markings applied so as to prevent splattering and overspray and protected from traffic until track free?
704.03(a)13	Were pavement markings applied evenly and have a uniform application and appearance, exhibit good workmanship, and appear clearly visible at all times?
704.03(a)14	Were glass beads applied at the specified rate and evenly distributed over the entire surface of the marking?
704.03(a)15	Were beads applied to the surface of liquid markings, unless otherwise noted, by a dispenser that is equipped with a synchronized cut-off

Trial Use and Comment

	control and attached to the applicator?
704.03(a1)	Were Type A markings installed according to the requirements of this section?
704.03(a2)1	Did non-truck mounted equipment conform to the requirements of this section for thermoplastic, polyester, and epoxy resin application?
704.03(a2)2	Were Type B markings, which include Thermoplastic, Polyester Resin, Epoxy Resin, and Preformed Tape, installed according to the requirements of this section?
704.03(c1)	Was the installed height of snow plowable raised pavement markers approximately 1/2 inch above the pavement surface and nose of casting installed flush with pavement surface?
704.03(c1)3	Was the bonding material used to install the casting from the departments approved list and mixed correctly?
704.03(c2)	Were raised pavement markers installed in accordance with section?

Trial Use and Comment

V. CRITICAL INSPECTION POINTS

• **Ensure pavement is properly prepared and marked prior to start up of marking operation.**
• **Ensure line markings and/or markers are the proper color, width, and dimension for the location at which they are being applied.**
• **Observe the Contractor performing the field quality control testing at the start of marking operations and every 3 hours thereafter. Document the results.**
• **Ensure that the Contractor provides a complete and accurate C-85, that has been prepared in accordance with Section 704.03(a), and that the C-85 is delivered to the Engineer by the completion of each work day.**

Trial Use and Comment

SECTION 705 – LIGHTING SYSTEMS

I. INTRODUCTION:

This section covers the furnishing, installing, and testing procedures required for lighting systems. In addition, information regarding modifying or relocating existing lighting systems is addressed that conforms to the requirements of the specifications.

a) Forms:

- **Intentionally Left Blank**

II. 2007 ROAD & BRIDGE SPECIFICATION and the 7R's

705.01—Description

This work shall consist of furnishing, installing, and testing proposed lighting systems and modifying or relocating existing systems in accordance with these specifications and in conformity to the lines and details shown on the plans or as established by the Engineer.

705.02—Materials

Photoelectric controls shall conform to the requirements of Section 238.

Comment [2141]: Right Material

705.03—Procedures

The Contractor shall verify or locate the origin of the power source and verify voltage when modifying, removing, or relocating existing electrical systems and shall advise the Engineer at least 48 hours prior to the anticipated time of de-energizing any portion of the electrical system. Work shall be performed in accordance with the requirements of NEC and the standards of the local power company.

Comment [2142]: Right Location

(a) **Luminaires for Roadway Lighting:** Luminaires shall be installed in accordance with the manufacturer's recommendations. Luminaires shall be adjusted for maximum illumination and uniformity on the pavement or sidewalk as directed by the Engineer.

(b) **Sign Luminaires:** Luminaires shall be shielded to eliminate glare or extraneous light on the roadway and shall provide a maximum-to-minimum uniformity ratio of 1:1 to 6:1 when installed. When tested at the center of a 10-foot-square test panel, the luminaire shall provide at least 30 average initial footcandles and a

Comment [2143]: Right Material

Trial Use and Comment

gradient (ratio of illumination on any two adjacent square feet of sign surface) of 2:1 or less.

(c) **High-Mast Luminaire Assemblies:** Assemblies shall consist of a head frame assembly; luminaire ring; luminaire(s); winch assembly; a fail-safe mechanism to prevent accidental lowering of the luminaire ring; and incidentals necessary to raise, lower, supply, and control power to the luminaire ring. When an electric drill is required for raising and lowering the assembly, one drill shall be provided for each set of five high-mast luminaire assemblies or fraction thereof.

1. **The lowering system** shall be compatible with the lighting pole and capable of raising and lowering a luminaire ring with eight luminaires.

2. **The head frame assembly, luminaire ring, and canopy** shall be of a material that is resistant to weather, corrosion, and ultraviolet rays. The centering arms of the assembly shall provide stabilization of the luminaire ring during raising and lowering operations and shall maintain contact with the lighting pole for at least 2/3 of its length. A fail-safe latching mechanism shall be included in the head frame assembly that will remove the tension from the lowering cables when the luminaire ring is attached.

3. **The winch assembly** shall include power cables of 600-volt, multi-conductor No. 10 (minimum), UL Type SO; lowering system cables of stranded stainless steel of sufficient strength and number to support and lower the luminaire ring and luminaires; and a 1/2-inch heavy-duty reversing electric drill or electric motor suitable for operation at the voltage shown on the plans. The winch assembly shall have a remote control that allows operation at least 15 feet from the lighting pole and shall be designed for lowering and raising the assembly by hand.

4. **A junction box with a prewired terminal block** shall be furnished on the lowering ring with provisions for a photoelectric control. A circuit breaker shall be mounted in the hand hole area of the lighting pole. A watertight twist-lock power receptacle and plug shall be provided for de-energizing the luminaire ring during raising and lowering operations and providing power for testing luminaires in the lowered position.

(d) **Ballast:** The ballast shall be compatible with the luminaire and shall be a multivolt type capable of operating on 120-, 208-, 240-, and 277-volt electrical services. Ballasts for luminaires with lamp wattages of 150 watts or less may be nonregulating or regulating, having a power factor of more than 90 percent. Ballasts for luminaires with lamp wattages more than 150 watts shall be regulating. Nonregulating ballasts shall regulate lamp wattage within a line voltage variation of ±5 percent. Regulating ballasts shall regulate lamp wattage within a line voltage variation of ±10 percent. The Contractor shall certify that ballasts serving high-pressure sodium luminaires have a volt-watt characteristic curve that intersects the

Comment [2144]: Right Quantity

Comment [2145]: Right Way , Right Material

Comment [2146]: Right Material

Comment [2147]: Right Way

Comment [2148]: Right Material

Comment [2149]: Right Material

Comment [2150]: Right Material

Trial Use and Comment

lamp voltage limit lines at points between the wattage limit lines throughout the full range of the lamp life and rated ballast line voltages. The basic and allowed variable volt-watt characteristic curves shall not intersect the wattage limit lines.

Ballasts and starting aids shall be capable of operating with the lamp in an open condition for 6 months without significant loss of ballast life and starting the lamp at temperatures as low as –20 degrees F.

(e) **Control Centers:** Enclosures for control centers shall be NEMA 3R with provisions for locking. Electrical equipment shall be UL listed for the use indicated on the plans. Door openings for control center cabinets shall be at least 8 inches wider than the enclosed widest panelboard or other installed equipment whichever is wider. When multiple door control centers are provided, the door openings for each door shall be identical.

(f) **Testing Electrical Components:** After energizing the lighting system, the Contractor shall demonstrate to the Engineer that electrical components are in working order. Faulty components shall be repaired or replaced by the Contractor at his expense.

The Contractor shall perform an operational test of the completed system under normal operating conditions for at least 3 consecutive days. Defective materials or improper installations shall be corrected by repairs or replaced by the Contractor at his expense.

(g) **Electrical Equipment Containing Polychlorinated Biphenyl (PCB):** This work shall consist of determining, removing and disposing of electrical equipment containing PCB as a dielectric fluid or paste. Electrical equipment consists of, but is not limited to, capacitors, ballasts and transformers. Electrical equipment found in offset luminaires are excluded from the requirements of this section and need not be inspected for PCB contamination.

1. **Determination:** The Contractor shall determine if the electrical equipment that is to be removed contains PCB. This determination shall be made prior to removal of the equipment in accordance with the following:

   a. Check the nameplate on the equipment to determine if any of the following trade names for PCB is indicated.

ALC	DK	Nepolin
Apirolio	Dykanol	Non-Flammable Liquid
Aroclor	EEC-18	No-Flamol
Aroclor B	Elemex	Phenoclor
Asbestol	Eucarel	Pydraul
ASK	Fenclor	Pyralene
Askarel	Hyvol	Pyranol

Comment [2151]: Right Material

Comment [2152]: Right Way

Comment [2153]: Right Way

Comment [2154]: Right Way

Comment [2155]: Right Material

Trial Use and Comment

Capacitor 21	Iclor	Pyroclor
Chlorextol	Interteen	Saf-T-Kuhl
Chlorinol	Kanechlor	Santotherm
Clorinol	Kennechlor	Santotherm FR
Clorphen	Magvar	Santovac 1 and 2
Diaclor	MCS 1489	Therminol

b.. If these trade names are not indicated on the nameplate of the equipment and the equipment is not labeled as not containing PCB, the Contractor shall contact the equipment manufacturer for a determination of the existence of PCB in that equipment. The Contractor shall provide the information requested by the manufacturer, which will include at least the type, model, and serial number of the equipment. If the manufacturer indicates PCB does not exist in the equipment, the Contractor shall request that documentation in writing on the manufacturing company's letterhead stationery. The documentation shall include all information needed to verify the piece of equipment referenced.

c.. If the procedures herein do not allow determination of the existence of PCB or if the manufacturer will not provide the necessary documentation in writing, the Contractor shall assume that PCB is contained within that equipment.

d. The Contractor shall notify the Engineer in writing of the determination of the existence of PCB in each piece of electrical equipment that could contain such. This documentation shall also include the name, representative's name, and telephone number for each company contacted to determine the existence of PCB. If the Contractor was able to obtain written confirmation from the manufacturer that PCB was not in a particular piece of equipment, the Contractor shall furnish the manufacturer's original letter to the Engineer.

2. **Removal and Disposal:** The Contractor shall follow the Environmental Protection Agency's guidelines and the Virginia Department of Environmental Quality's guidelines for the removal, transportation, disposal, and spills of PCB-laden materials. The Contractor shall provide the shipping manifest and all other correspondence concerning the removal and disposal of PCB-laden materials to the Engineer.

705.04—Measurement and Payment.

Luminaires will be measured in units of each and will be paid for at the contract unit price per each. This price shall include the body, slipfitters, refractors, ballast, reflectors, sockets with lamps, conductor cables to the termini at the base, photoelectric controls and sockets, adjustment, and testing. Luminaires for sign lighting will not be measured

Comment [2156]: Right Material

Comment [2157]: Right Way

Comment [2158]: Right Way

Comment [2159]: Right Documentation

Comment [2160]: Right Way

Comment [2161]: Right Payment

Trial Use and Comment

for separate payment but shall be included in the price for overhead and bridge-mounted sign structures.

High-mast luminaire assemblies will be measured in units of each and will be paid for at the contract unit price per each. This price shall include the luminaire rings, lowering devices with head frames and assembly, winch assembly, electric raise/lower units, lowering cables, conductor cables to the termini at the base, luminaire units, lamps, photoelectric controls and sockets, testing, and adjustments.

Control centers will be measured in units of each and will be paid for at the contract unit price per each. This price shall include conduits, metal enclosures, ground rods, conductor cables, anchor bolts and templates, excavating, concrete, safety switches, panel boards, contactors, circuit breakers, photoelectric controls, terminal blocks, selector switches, testing, and adjustment**.**

Determination of electrical equipment containing PCB will not be measured for separate payment, and the cost thereof shall be included in the price bid for the removal of the electrical equipment.

Removal and disposal of electrical equipment containing PCB will be paid for in accordance with the requirements of **Section 109.05** for extra work.

Payment will be made under:

Pay Item	**Pay Unit**
Luminaire (Size and type)	Each
High-mast luminaire assembly (Number of luminaires, size, and type)	Each
Control center (Standard and type)	Each

III. FOUR STEP INSPECTION PROCEDURE

Pre-start planning meeting:

- Shop Drawing Submittals, Consult with Traffic Engineering for a field review prior installation.

Start:

- Once the shop drawings are approved and a field review has been completed. Observe the contractors operation and ensure safety is in accordance with the specifications.

Continuous inspection:

- Make sure the contractor is working with approved shop drawings.

Trial Use and Comment

Final Inspection:

- Traffic Engineering shall review the final inspection.
  Ensure DWR's match the pay items.

Documentation Required:

- Approved Shop Drawings
- Document field reviews
- Accurate DWR's

IV. REVIEW QUESTIONS

705.03(1)	Does the Contractor verify or locate the origin of the power source and verify voltage when modifying, removing, or relocating existing electrical systems?
705.03(2)	Does the Contractor notify the Engineer at least 48 hours in advance of his anticipated time of de-energizing any portion of the electrical system?
705.03(a)	Are the luminaires for roadway lighting installed in accordance with this section?
705.03(b)	Are sign luminaires installed in accordance with this section?
705.03(C)	Are high-mast luminaire assemblies installed in accordance with this section?
705.03(d)	Are ballasts installed in accordance with this section?
705.03(e)	Are control centers installed in accordance with this section?
705.03(f)	Are electrical components tested in accordance with this section?

V. CRITICAL INSPECTION POINTS

• Ensure all payments match DWR's and invoices.
• Ensure that all materials are approved and types are correct.
• Located areas for signals on plans or in contracts and mark off these areas if possible in the field with T&E prior to installing.
• Since this work differs so much from normal roadwork, it is desirable that the Inspector make a special effort to learn the terminology unique to this work and to contact the Regional Traffic Engineer for advice.
• Controllers are to be furnished completely housed in a waterproof cabinet. The manufacturer's instructions for installing and maintaining the equipment shall be provided by the Contractor.

Trial Use and Comment

• The Contractor shall perform the proper tests and demonstrations.
• Ensure the lights work properly.

Trial Use and Comment

CONSTRUCTION RESOURCE GUIDEBOOK
COMMENT FORM

TO: Lloyd B. Arnold, PMP:
Email: Lloyd.Arnold@vdot.virginia.gov

FROM:

PHONE:

EMAIL:

DATE:

SPECIFICATION:

SECTION:

PAGE#:

LINE#:

Recommendation:

Purpose:

Background:

Impacts:

Conclusion:

Trial Use and Comment

Appendix A-1

Department Equipment

Engineering Equipment

Inspection on many projects requires the use of engineering instruments such as levels, theodolites, electronic measuring devices or total stations. These instruments are assigned by District Construction Management staff.

Instruments are to be tested for adjustment at regular intervals. This should be done by performing field tests by the person using the instrument. However, the Project Inspector is charged with the responsibility of seeing that it is done and that the instruments are kept in adjustment. The instrument should never be disassembled or adjusted except by an authorized instrument repairman.

When not in use, instruments should be kept in their respective boxes. Never leave an instrument "set up" unless an employee of the Department is present to protect it. Before climbing a fence or similar obstacle, the instrument should be placed on the other side with the tripod legs spread. Under no circumstances should a boxed instrument be placed in a vehicle so that it can bounce around or overturn.

Instruments, under ordinary circumstances, should be maintained and carried in their original storage boxes. Should circumstances require that an instrument be shipped, it should be clamped on its spindle and paper packed carefully and snugly around it in the box.

The magnetic needle must be kept clamped at all times, except when a compass reading is being taken. After such readings are made and recorded, the needle should immediately be reclamped.

Precaution should be used to ensure that engineering equipment is not exposed to any form of precipitation. If the instrument has been exposed to falling weather, it must be wiped dry as soon as possible, in any event, as soon as brought indoors.

Tripods should be protected from the weather when not in use and the threads protected by using the tripod cap. Instrument boxes should be kept clean and free of dust. Loose objects shall not be stored or transported in instrument boxes.

Trial Use and Comment

Engineering instruments and laboratory equipment are delicate, precision equipment. Results are reliable only when instruments and equipment are properly used, handled, and maintained. Remember that instrument and equipment repair work is costly and time consuming.

The Project Inspector is responsible for all instruments assigned to the project. In case of theft or accident caused by negligence or misuse, the person responsible can be assessed the cost of replacement or repairs, unless conclusive evidence is given that the occurrence was unavoidable. For these situations, the Project Inspector must make a written report to the Construction Manager explaining the details as follows:

1. Name of person in charge of instrument and person directly responsible.
2. Location where accident or theft occurred.
3. Cause, give full information.
4. Make and serial number of instrument.
5. Extent of damage.
6. General condition of instrument exclusive of damage.

Vehicular Equipment

An employee should not operate any piece of mechanical or motorized equipment unless familiar with the correct operating procedures. Regulations prohibit any employee from operating any motorized equipment unless he has an approved operator's card for that particular type of equipment. These cards may be secured from the Resident Mechanic.

Any accident involving State equipment and causing personal injury or property damage should be reported to and investigated by the State Police. Insist upon an investigation by the State Police before leaving the scene of an accident. The State Safety Engineer and/or District Safety Engineer should also be notified.

A "Driver's Report of Equipment Accident" is furnished with every piece of State equipment. These indicate the information the operator must secure if that piece of equipment is involved in an accident. This information should be delivered to the residency office.

Trial Use and Comment

Remember that all Department-owned vehicles are public property. You, as an operator, are expected to set a good example by:

1. Observing all traffic laws.
2. Practicing courtesy in driving.
3. Maintaining all safety devices in operating condition.
4. Keeping the vehicle properly serviced and clean.
5. Practicing defensive driving.
6. Abiding by all current Safety Rules.
7. Properly securing the vehicle when unattended.

Publication & Links

Publications are available from the residency and district offices. All inspection personnel should have available the following items either by computer and/or hard copy:

1. Site Manager access.
2. *Road and Bridge Specifications* book.
3. *Road and Bridge Standards, Volumes I and II*.
4. *Manual of Instruction, Materials Division*.
5. *Work Area Protection Manual*.
6. *Erosion and Sedimentation Control Handbook.*
7. *Guard Rail Installation Training Manual.*
8. *Claims Manual*
9. Current Instructional Memorandum.
10. *Post-Construction Manual*

Trial Use and Comment

11. *Survey Manual*

12. *External VDOT Construction Website*

Trial Use and Comment

Appendix B

Terms for Subgrade and Pavement Structures

General

Subgrade may consist of:

1. In-place materials.
2. Imported material
3. Hydraulic cement stabilized in-place or imported material.
4. Lime stabilized in-place or imported material.

In contracts that include the construction of the pavement structure, the subgrade must be prepared in conformance with the "Subgrade and Shoulders" section and other appropriate sections of the Specifications governing treated and select materials.

Subbase may consist of:

Mineral aggregate.

Base may consist of:

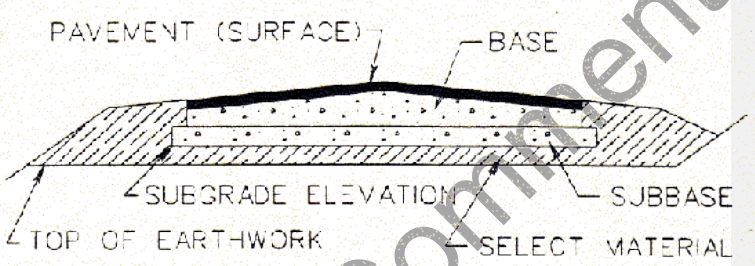
1. Mineral aggregate.
2. Asphalt cement concrete.
3. Hydraulic cement concrete.

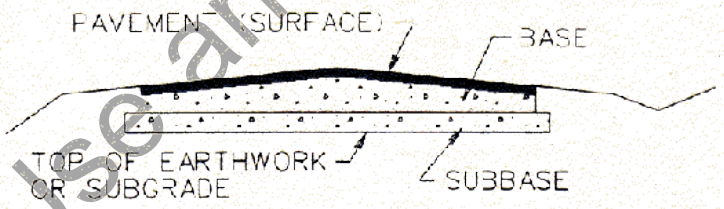
Pavement surface may consist of:

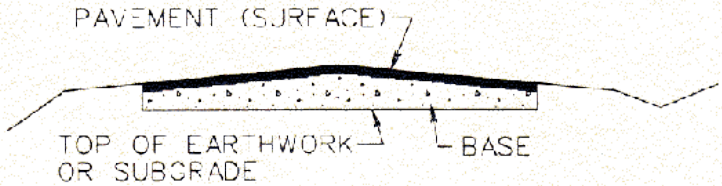
1. Asphalt cement concrete.
2. Hydraulic cement concrete.
3. Asphalt surface treatment.
4. Calcium chloride or sodium chloride treatment.

Trial Use and Comment

LOCATION OF SUBGRADE AND PAVEMENT STRUCTURE COURSES







Trial Use and Comment

Appendix C

Project Records

General

The "keeping" of project records, including the preparation, assembly, and preservation of such records is considered to be one of the most important duties and responsibilities which the Engineer delegates to the Inspector.

Field notes constitute a written record of pertinent information, measurements, and observations regarding the project. They should be kept according to uniform practices. Detailed sketches should be shown on daily diary sheets.

Project diaries and project records are to be reviewed by the Construction Manager, Area Construction Engineer or District Construction Engineer on at least a monthly basis. A record of this review, signed by the reviewer, will be made part of the project records and a summary of the findings of this review shall be made in the project diary.

Accuracy

Record exactly what was done at the completion of the item rather than depending on memory at a later time. When it is necessary to add data to notes previously prepared, the additional item should be dated and initialed. Always enter notes directly into the record.

Clarity

Plan your entries so that data can be orderly arranged. Do not make ambiguous statements. Show neatly dimensioned sketches for clarity. Assume that the person who will use your notes has no familiarity with the work.

Legibility

Use standard symbols and abbreviations to keep notes concise. Use plain lettering to avoid confusion.

Completeness

Show all pertinent measurements and observations. Use a degree of accuracy consistent with the operation. If in doubt about the need for the data, record it.

Self Checking

Trial Use and Comment

Notes should be so kept that the work can be checked without returning to the field. Persons familiar with the project should be able to verify the accuracy of the work from the information contained in the notes. Use positive controls.

Project records consist of, but not limited to, the following:

1. Copy of the Contract and Special Provisions.
2. A complete set of plans that include the latest revisions.
3. Notice to Proceed, Form C-20.
4. A copy of the "Report of Starting and Completion of Project," Form C-5.
5. A copy of Subletting Requests, Form C-31.
6. A copy of all approved Work Orders, Form C-10.
7. One copy of approved working drawings and shop plans that are required for the project.
8. Copies of all utility plans and agreements when the Project Inspector inspects such work.
9. Inspector's Daily Utility Reports, Form UT-7, for utility and railway work.
10. A copy of the project's correspondences and reports.
11. A copy of the Right-of-Way Agreement between the Commonwealth and the property owners within, and adjacent to, the project limits.
12. Records of work performed under Force Account Specifications, Forms C-115, and C-116.
13. Copies of all shutdowns issued on contracts, Form C-12, and correspondence relative to extensions of time.
14. Electronic Project Diary
15. Source of Materials
16. Materials Test Reports
17. Work Zone Inspection Checklists
18. Materials Invoices / Delivery Tickets
19. Materials Notebook.
20. A complete and accurate file should be kept on the project concerning information pertaining to Equal Opportunity and Form C-67 for on-the-job training by the Contractor.
21. Copy of Form C-79 Summary of Time, Theoretical and other measurements, signed by both the Contractor and the Inspector. Form C-79 is to be printed and signed at least monthly to coincide with the monthly pay voucher. This form may be printed and signed more often as deemed necessary and mutually agreed upon by the Contractor and Inspector.
22. Progress Estimate.
23. Progress Schedule, Working Schedule, Plan of Operations, or CPM.
24. As built plans, if required.
25. Contractor's weekly payroll or payroll roster.
26. copies of CPE annual / final reports signed by the Contractor
27. copies of CPEi reports signed by the Contractor
28. copies of CPEs reports signed by the sub-contractors
29. Form C-107 Construction Runoff Control Inspection Form

Trial Use and Comment

30. Copy of SWPPP and all Environmental permits pertaining to the project.
31. Items that fall under Project Communication and Decision Making process.
32. Letter naming Project Safety Officer and Work Zone Cooridinator.
33. Copies of emailed correspondence pertaining to the project.
34. Copy of approved Disposal Areas.

Project Diary

The Project Inspector is required to maintain an electronic diary in Site Manager for each contract. The electronic diary entries will be made daily and must be completed by noon on the following day.

The project diary should contain a day-to-day record of all significant occurrences relating to the project. It must be complete, concise, and accurate. The Project Diary should include the following information:

1. Day of week, month, date of the month and year.

2. Daily weather conditions and temperature range.

3. Record of instructions given to the Contractor. In the event a controversy arises, record all pertinent information.

4. Information relative to the progress of work being done by the Utility Company in moving their facilities (lines, cables, poles, pipes,). Note causes for delay and its effect on the Contractor's progress.

5. Pay items

6. Note any authorized extra work, force account work, etc. being performed and refer to Inspector's Daily Report for detailed information.

7. Any unusual occurrences, resulting in personal injury or property damage, such as damage caused by blasting operations or Contractor's equipment.

8. When physical conditions of the work are encountered that are unusual or are materially different from those expected, record the following information:

    i. Detailed description of the unusual conditions encountered.

Trial Use and Comment

ii. An estimate of the net effect the unusual conditions have upon the progress of the work.

iii. The increase in the working force required to overcome the unusual conditions encountered.

iv. Equipment and materials used and other pertinent information which would be of value should a claim result.

9. If construction progress is not satisfactory, entries in the diary should substantiate this fact. In addition to the information previously listed the diary should include:

10. The actual activities of the Contractor.

11. The rate that the Contractor is performing these operations.

12. The activities that the Contractor could and should be accomplishing but is not.

13. The efforts made at the project level to have the Contractor improve upon his progress.

    Note: The opinion of the Inspector is valuable when it is documented by facts. Do not hesitate to list the full particulars in the diary. Seemingly minor details may become important at a later date.

14. Periodic wage rate interviews with Contractor's employees (Laborer, Equipment Operator, etc.,) to determine proper classification and wage rate compliance.

15. Discussions with property owners, official visitors, and the representatives of various utilities, railroads or other governmental agencies should also be entered in the diary.

16. All official phone calls should be recorded.

17. Final disposition of salvageable materials.

18. Welder Certifications - Record the Welder's name, type, and position of weld qualified and certification number.

19. Note any assigned Inspector who is on vacation, sick leave, or on temporary assignment to another project.

Trial Use and Comment

20. Summary of findings of Construction Manager's, Area Construction Engineer's or District Construction Engineer's monthly review.

Trial Use and Comment

Inspector's Daily Work Report

Each Inspector is to complete a Daily Work Report (DWR) on the construction activities he/she personally inspects for that day. However, if more than one Inspector is involved in the inspection of a single construction activity, only one need be written for that activity.

The Inspector's daily report is to include the following information:

1. Contractor's working force and equipment used. (The equipment can be listed weekly or monthly if changes are recorded daily.) Note equipment condition if efficiency is affected thereby.

2. Record of locations of pertinent items of work in progress. Description of the work being performed, including quantities of work, the quality of workmanship, difficulties encountered and method of correction, and the results of Inspectors checks or tests.

3. Information as to time, materials, working force and equipment used for authorized extra work, i.e., claims, force account.

4. Material accepted on visual inspection or material rejected.

5. Structural footings information should include:

   a) Description of the material encountered, such as type of clay, sand, gravel, rock, etc.

   b) Condition of the foundation, such as firm, soft, level, sloping rock, results of probes.

   c) Elevation of foundation.

   d) Date of approval.

   e) Person approving.

6. Measurements taken as dimensional checks and for determination of pay quantities. Include dimensioned sketch where such will prove helpful in preparing the dairy. Show detailed sketches on daily diary sheet.

7. Notes on the work as required by the Inspection manual.

The Inspector's Daily Reports and the Project Diary should be completed promptly but not later than noon of the following workday.

Trial Use and Comment

State Force Operations

Certain items of work such as signs, guardrail, fence, and right-of-way monuments may be designated to be accomplished using State Forces.

To obtain uniformity and insure proper administration and documentation of this work, the following procedures are established:

1. Plans

a. Items to be handled by State Forces are to be selected at design stage of plan development.

b. Items to be handled by State Forces are to be summarized on the plans separately from the work to be performed by the contractor.

2. FHWA Approval

Scheduling and Contract Division obtains approval from FHWA to use State Forces for the construction of the selected items on a participating basis, based upon Total Estimated Cost (TEC).

3. Detailed Estimate

The detailed estimate is to show State Force Work.

4. Diary and Summary

a. As these items of work are being performed, the Project Inspector is to make the appropriate entries in the project diary.

b. All work performed by State Forces is to be summarized separately from that done by contract and clearly identified as such.

5. Cost Keeping Records

a. All costs, except engineering, involved in performing the State Force work are to be charged to the project as nonparticipating, Activity 733.

b. All engineering costs are to be charged to the applicable engineering activity of the project as participating on Federal-aid projects and as nonparticipating on State financed projects.

Trial Use and Comment

c. As any item of work by State Forces on an individual section within the contract is completed, Form A-50 (Report of Force Account Work on Federal Projects) is to be completed. The TEC to be used in completing Form A-50 will be that shown on the detailed estimate furnished to the District.

d. At the time each Form A-50 is completed, a copy of Form A-11 (Debit and Credit Memorandum) is to be prepared, crediting Activity 733, and debiting Activity 633 of the appropriate project section with a sum equal to that shown on the Form A-50. The costs shown on Form A-11 are to be classified by items and not by labor, materials, and equipment. The TEC to be used in completing Form A-11 will be the same as that price used in preparing Form A-50. The Forms A-50 and A-11 are to be submitted together through the District to the Fiscal Division.

6. Exceptions

a. The procedures outlined in Item 5 c. and d. will not apply to projects financed with 100 percent State funds or for nonparticipating items on Federal-aid projects.

b. In the event the FHWA approves the financing of State Force work on an actual cost basis for an individual project, separate instructions will be issued on a project by project basis.

Trial Use and Comment

APPENDIX D – SEE SURVEY MANUAL

Click below to view Survey Manual:

- http://www.extranet.vdot.state.va.us/locdes/Electronic%20Pubs/survey_manual_2010/pdf/vdot_survey_manual.pdf

Trial Use and Comment

Appendix E

SAFETY RULES

These rules shall be posted and kept posted in all buildings, shops and storage sheds owned or leased by the Department of Transportation. All employees will abide by these safety rules. Each new employee, hired contract employee, and hired vehicle/equipment operator shall be given a copy of these safety rules and their contents shall be explained to them by their immediate supervisor or VDOT supervisor contact.

CONSTRUCTION AND MAINTENANCE

1. Hard hats shall be worn by ALL employees while participating in or observing all types of field work when outside of a building or outside of the cab of a vehicle, and by all employees exposed to, participating in or supervising buildings under construction.

2. Regulation respiratory equipment shall be worn by all employees while performing those tasks specified in the Department's Respiratory Protection Program.

3. Adequate eye protection shall be worn by participants and other employees in the proximity of grinding breaking of rock and/or concrete, while using brush chippers, operating chain saws, striking metal against metal or when working in situations where the sight may be in jeopardy. In addition to eye protection, face protection in the form of face shields shall be worn when operating chain saws, feeding chippers, and when pulling brush to a chipper when the chipper is in operation.

4. Safety boots shall be worn by all employees in those positions specified in the Department's Safety Footwear Policy.

5. Safety Vest shall be the minimum high-visibility safety apparel worn by all employees exposed to vehicular traffic and construction equipment as specified in the Virginia Work Area Protection Manual, Section 6D.03.

6. Standards and guidelines of the current Virginia Work Area Protection Manual shall be used when setting, reviewing, and removing traffic controls.

7. All flag persons will be certified according to the Virginia Flagger Certification Program.

8. Seat belts shall be worn by all vehicle/equipment operators as specified in the Department's Seat Belt Policy.

Trial Use and Comment

9. Riding on running boards and getting on or off any equipment while the equipment is moving is prohibited. Jumping from truck beds or from equipment when ladders, steps and dismounting devices have been provided is prohibited. Boarding and descending from equipment shall be done by facing the equipment and by maintaining three-point contact.

10. Vehicles used to transport employees shall have seats firmly secured and adequate for the number of employees to be carried. Under no circumstances shall more employees be transported than can be safely seated. Employees who are in the process of training another employee may, in controlled circumstances, ride for short distances with the permission of supervisory personnel.

11. Only state employees and persons on official state business are allowed to be transported in state vehicles.

12. No person shall be permitted to position themselves under any raised load or between hinge points of equipment without first taking steps to support the load by the placing of a safety bar or blocking.

13. Explosives shall be purchased, transported, stored, used, and disposed of by a Virginia State Certified Blaster in possession of a current criminal history record check and a commercial driver's license with hazardous materials endorsement and a valid physician's certificate. All federal, state, and local regulations pertaining to explosives must be strictly followed.

14. All electrical tools shall be adequately grounded or double insulated. GFCI protection must be installed in accordance with the National Electrical Code (NEC) and current Virginia Occupational Safety and Health (VOSH) regulations of the Department of Labor and Industry (DLI). If extension cords are used, they shall be free of defects and designed for their environment and intended use.

15. Before any employee performs any servicing, maintenance, repairs on any machinery or equipment where the unexpected energizing startup or release of any type of energy could occur and cause injury, the machinery or equipment will be rendered safe to work on either being locked or tagged out. VDOT's policy entitled "Policy for the Control of Hazardous Energy Sources and Electrical Hazards-Lockout and Tagout" will be strictly followed.

16. Only authorized persons in accordance with the VDOT policy entitled "Policy for the Control of Hazardous Energy Sources and Electrical Hazards- Lockout and Tagout" are permitted to do service, maintenance, or repairs on machinery and equipment.

Trial Use and Comment

17. No person shall enter a confined space without training, permits and authorization.

18. All new equipment operators are to be examined in accordance with the Asset Management Division's policy (Equipment Section Procedures 3.20- "Authorization to Operate Equipment and Licensure Requirements"). Employees shall be properly instructed in the safety regulations necessary for the safe and efficient operations of equipment and the proper maintenance thereof.

GENERAL

19. Report all personal injuries and equipment accidents to your supervisor immediately.

20. A five-minute safety meeting will be held each morning before the work party departs.

21. Any action such as horseplay on work operations will not be tolerated.

22. In order to promote safer working conditions, good housekeeping will be maintained in all our facilities and work sites.

23. Smoking is prohibited inside all offices, buildings and inside equipment and any vehicles owned or paid for by the state. This includes tractors and backhoes, as well as vehicles that are leased or rented with state funds. The Governor's Executive Order # 41 (2006) on smoking will be in effect.

24. Smoking or the use of a torch, lantern, spark producing device, etc., or any open flame within 50 feet of gasoline or other flammable liquids, is prohibited.

25. Transporting any type of empty, filled or partially filled flammable containers or explosives in the passenger compartment of any vehicle/equipment carrying employees is prohibited.

26. Open fires must not be built within 200 feet of any point where bituminous, flammable or hazardous materials are stored or are being transferred.

27. No open flame shall be used to inspect or examine drums, tank cars or other containers in which bituminous, flammable, or hazardous materials have been stored.

28. The use of gasoline to start a fire or as a cleaning agent is prohibited.

29. Under no circumstances shall equipment motors or engines be operated or started when fuel leaks are present.

Trial Use and Comment

30. When welding or assisting in this operation, employees shall use regulation hoods. When cutting or burning metals, approved eye protection shall be used. Welding on tanks, distributors or any other container of bituminous or flammable materials used for transporting or storage shall not be done unless the proper safeguards are taken. All bituminous or flammable material tanks are to have wide open vents while work is being done. Before welding, the container is to be steamed, flushed and ventilated for 48 hours to remove all fumes. Tanks will be checked with explosive meter before welding is performed.

31. Asphalt kettle burners shall be lighted or re-lighted in accordance with the manufacturer's Instructions and shall be operated per the manufactures' instructions for operation and safety.

32. Undermining a soil, sand or gravel pit, a soil, shale or gravel bank, or any other excavation, is prohibited. The provisions of Virginia Occupational Safety & Health regulation (VOSH) 'Excavation Standard, Construction Industry' (16 VAC 25-170-10 et seq.) shall be strictly followed.

33. No employee shall enter waters without wearing an approved water safety device, e.g., U.S. Coast Guard approved life jackets or buoyant work vests. This instruction remains in effect even if a boat is used in the water negotiation process.

34. Fall protection is required:

- When an employee is exposed working at elevated heights of six feet (6) or greater when engaged in construction related activities.

- When doing non-construction related activities at VDOT facilities, fall protection is required when an employee is exposed to heights of four feet (4) or greater. Such fall protection will comply with Virginia Occupational Safety & Health (VOSH) General Industry regulation (1910 Subpart D) "Walking-Working Surfaces."

- When working from the basket of aerial lifts, an employee shall wear a personal fall arrest system (PFAS) with an attached lanyard connected to an approved manufacturer's anchorage point on the equipment. Employees shall not work in the baskets of aerial lifts such as bucket trucks, platform trucks, and other equipment when over the top of moving traffic.

35. **All backing incidents are preventable.** The same attention and awareness required to operate a vehicle in the forward direction must be used when backing a vehicle. Where there is limited sight distance, obstructions, or limited maneuverability, a ground guide or spotter must be used, if available. If a spotter

Trial Use and Comment

or ground guide is not available, have a **G.O.A.L** – **Get Out And Look** to avoid a backing incident. When parking a vehicle, pull through parking is preferred or parking in a safe and legal location free of obstructions to avoid backing altogether. In addition, back-in parking of state vehicles should be practiced at all times, unless situations do not allow.

Trial Use and Comment

ADDITIONAL VDOT REFERENCES:

- 2001 Road and Bridge Standards
- 2008 Road and Bridge Standards
- Drainage Manual
- Guardrail Installation Training (GRIT) Manual
- Instructional & Informational (IIM)
- Plan Reading Guide
- Policy Manual for Public Participation in Transportation Projects
- Road and Bridge Specifications
- Road Design Manual
- Survey Manual
- Traffic Engineering Manual

Trial Use and Comment