

FOURTH AMENDMENT

TO

ASSIGNMENT AND ASSUMPTION

AGREEMENT

DATED AS OF May 16, 2014

BY AND AMONG

**VIRGINIA DEPARTMENT OF TRANSPORTATION,
an Agency of the Commonwealth of Virginia**

AND

BIZZACK CONSTRUCTION, LLC

AND

ALPHA NATURAL RESOURCES, LLC

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This **FOURTH AMENDMENT TO THE ASSIGNMENT AND ASSUMPTION AGREEMENT** (this "Amendment") is made and entered into as of May 16, 2014, by and between the Virginia Department of Transportation (the "Department"), an agency of the Commonwealth of Virginia (the "Commonwealth"), Alpha Natural Resources, LLC ("Alpha"), and Bizzack Construction, LLC ("Bizzack"), with reference to the following facts:

RECITALS

WHEREAS, pursuant to the Public-Private Transportation Act of 1995 (the "PPTA"), §§56-556, *et seq.*, of the Code of Virginia (1950), as amended (the "Code"), the Department and Kellogg, Brown and Root ("KBR") executed (i) a Comprehensive Agreement (the "Comprehensive Agreement") dated January 11, 2002, concerning the design, construction and maintenance of a controlled access highway called the Coalfields Expressway (the "CFX Project") and (ii) a Design-Build Contract (the "Design-Build Contract") dated January 11, 2002, concerning the CFX Project;

WHEREAS, on January 11, 2006, the Department, Alpha, Pioneer Group, Inc. ("Pioneer") and KBR entered into an Assignment and Assumption Agreement (the "Assignment Agreement") pursuant to which KBR assigned all of its rights and obligations under each of the Comprehensive Agreement and the Design-Build Contract to Alpha and Pioneer, and Alpha and Pioneer assumed all of KBR's rights and obligations under the Comprehensive Agreement and the Design-Build Contract, subject to certain obligations and conditions as set forth therein and which provided further, that all of Alpha's and Pioneer's obligations under the Comprehensive Agreement and the Design-Build Contract would be suspended in order to allow good faith negotiations between the Department, Alpha, and Pioneer for the purpose of modifying the Comprehensive Agreement and the Design-Build Contract to reflect the potential use of the value of Alpha's and Pioneer's coal reserves and expertise in mining and large-scale earth moving operations to reduce estimated CFX Project development costs;

WHEREAS, upon engaging in initial good faith negotiations for the purpose of modifying the Comprehensive Agreement and Design-Build Contract, the Department, Alpha, and Pioneer concluded that insufficient information was available to determine whether such an alternative approach to the development of the CFX Project was feasible;

WHEREAS, on January 11, 2007, the Department, Alpha, and Pioneer entered into a First Amendment to the Assignment and Assumption Agreement (the "First Amendment to Assignment"), which provided, among other things, for the development of a limited feasibility study to determine whether the use of Alpha's and Pioneer's resources would result in a cost-effective approach to the development of the CFX Project;

WHEREAS, pursuant to the First Amendment to Assignment, Alpha and Pioneer each completed and submitted to the Department a limited feasibility study (individually a “Study” and together the “Studies”), which includes alternative horizontal and vertical alignments that generally traverse coal reserve areas controlled by Alpha and Pioneer or their affiliates, estimates of the quantity of and costs to excavate earthen material along the alignments to develop a rough-grade roadbed, and conceptual plans for using a portion of the value of marketable coal reserves recovered during the development of the rough-grade roadbed (defined as the surface elevation of the rough-grade roadbed prior to the placement of subgrade material) as an offset to CFX Project development costs;

WHEREAS, on September 10, 2008, the Department, Alpha, and Pioneer entered into a Second Amendment to the Assignment and Assumption Agreement (the “Second Amendment to Assignment”), for the development by Alpha of a rough-grade roadbed (the “Hawks Nest Section”) because the opportunity for cost savings were likely to expire before the Department, Alpha, and Pioneer were able to complete negotiation of modifications to the Comprehensive Agreement, including the Design-Build Contract and certain other project agreements assigned to and assumed by Alpha and Pioneer (collectively, the “Principal Contract Documents”);

WHEREAS, effective as of April 10, 2009, Pioneer changed its name from Pioneer Group, Inc. to Rapoca Energy Company (“Rapoca”);

WHEREAS, on December 5, 2011, the Department, Alpha, and Rapoca entered into a Third Amendment to the Assignment and Assumption Agreement (the “Third Amendment to Assignment”), as amended, for the development by Alpha of the preliminary engineering and preliminary design analyses and services necessary to allow the Department to evaluate the practicability of developing two sections, the Pound Connector and Doe Branch sections, because the opportunity for such cost savings were likely to expire before the Department, Alpha, and Rapoca were able to complete negotiation of modifications to the Principal Contract Documents;

WHEREAS, effective as of July 31, 2013, Rapoca entered into a purchase and sale agreement, pursuant to which Bizzack, Inc., the controlling member of Bizzack, acquired 100% of the stock of Rapoca and Rapoca assigned all of its rights, obligations, and privileges under the Principal Contract Documents to Bizzack, which assignment, in accordance with the Comprehensive Agreement, was approved by the Department;

WHEREAS, on January 27, 2014, the Department, Alpha, and Bizzack entered into a letter agreement to extend the date for the completion of negotiations for modifications to the Principal Contract Documents specified in the First Amendment to Assignment (as previously extended by letter agreements) from January 30, 2014, to January 30, 2015;

WHEREAS, concurrent with the execution of this Amendment, the Department, Alpha, and Bizzack have executed that certain First Addendum to First Amendment to Assignment and Assumption Agreement (the “First Addendum”) pursuant to which Bizzack has assigned to Alpha its rights to negotiate with the Department for the design and construction of the proposed interchange linking Phase II of the U.S. Route 460 Connector to the Hawks Nest Section of the CFX Project (the “Interchange”) and Alpha has assigned to Bizzack its rights to negotiate with the Department for the design and construction of the Alpha Portion;

WHEREAS, consistent with the prior amendments to the Assignment Agreement, the Department, Alpha, and Bizzack continue to be of the opinion that the development of the alternative alignments identified in the Studies in order to take advantage of the potential value of Alpha’s and Bizzack’s coal reserves and expertise in recovering said reserves potentially to offset a portion of the CFX Project development costs is unique and complies with the intent of the General Assembly s expressed in § 56-558(A)(1-3) of the PPTA;

WHEREAS, consistent with the prior amendments to the Assignment Agreement, the Department, Alpha, and Bizzack agree that the CFX Project, as proposed in the Studies, must be designed, permitted, and constructed in a phased approach, and the parties currently are negotiating extensive modifications to the Principal Contract Documents;

WHEREAS, the Department wishes to develop the Poplar Creek section of the CFX Project’s alternative alignment as detailed in Pioneer’s Study and expanded by the inclusion of the Alpha Portion (collectively, the “Poplar Creek Section”) to finished grade roadbed;

WHEREAS, before proceeding with the development of a finished grade roadbed on the Poplar Creek Section, certain design and engineering must be accomplished;

WHEREAS, consistent with the Principal Contract Documents, the Poplar Creek Section is to be developed by Bizzack, not Alpha;

NOW, THEREFORE, in consideration of the covenants contained herein and for other good and valuable consideration, the receipt and adequacy of which are hereby acknowledged, the Department, Alpha, and Bizzack agree as follows:

1. **Definitions.** All capitalized terms used in this Amendment, but not expressly defined in this Amendment, have the respective meanings set forth in Exhibit A attached to this Amendment.

2. **Purpose of This Amendment.** The purpose of this Amendment is to provide for the development by Bizzack of the preliminary engineering and preliminary

design analyses and services necessary to allow the Department to evaluate the practicability of developing the Poplar Creek Section.

3. **Scope of Work.**

(a) **Poplar Creek Section.** The Poplar Creek Section is a limited access facility located in Buchanan County Virginia with a total length of approximately five (5) miles and is further described in Exhibit B.

(b) **Criteria for the Work.** Bizzack shall perform the preliminary engineering and preliminary design analyses and services for the Poplar Creek Section (the “Work”), pursuant to the requirements set forth in this Amendment (including the Technical Requirements set forth as Exhibit C). The Work shall include procuring and furnishing all materials, equipment, services, and labor reasonably inferable from this Amendment. Preliminary engineering services shall include but not be limited to surveying, designing Embankments, designing Cut Slopes, slope stability, roadside development, designing Roadways, drainage, storm water management, erosion and sediment control, designing temporary traffic control devices, preparation and delivery of the TMP, design of Bridges and other structures, and design of necessary Surplus Materials Areas and Borrow Areas. All design professional services related to the Poplar Creek Section shall be supervised and sealed by professionals properly licensed in the State.

(c) **Deliverables.** As part of the Work, Bizzack shall deliver to the Department the items specified in Section 4 of this Amendment (collectively, the “Deliverables”). The Department shall make payments in accordance with the payment schedule described in Section 4 of this Amendment.

(d) **Contract Price.** The contract price for the Work paid by the Department shall be a fixed price of \$11,800,000 (the “Contract Price”).

(e) **Contract Time.** Bizzack shall complete the Deliverables and obtain the Department’s approval of the Deliverables no later than September 21, 2015.

(f) **Notice to Proceed.** The Department shall issue to Bizzack a Notice to Proceed with the Work concurrent with the execution of this Amendment.

4. **Deliverables and Schedule.**

(a) **Deliverables.** As part of the Work, Bizzack shall prepare the Deliverables set forth below.

- i. Preliminary Field Inspection Plans;

- ii. Public Hearing Plans;
- iii. Field Inspection Plans;
- iv. Preliminary Plan (30% - Stage 1) for Bridges;
- v. Intermediate Plans (60%) for Bridges;
- vi. QA/QC Plan for Design;
- vii. Geotechnical Engineering Report;
- viii. Mineral Reserve Study;
- ix. Baseline Schedule; and
- x. Jurisdictional Delineation Report.

(b) Design Public Hearing. If a Design Public Hearing for the Poplar Creek Section is not held within 120 days of completion of the Work, or such other period of time as may be agreed by the parties, the Contract Price will be reduced by \$22,600.

(c) Initial Baseline Schedule. The Initial Baseline Schedule, which is attached as Exhibit D to this Amendment, shall be the basis for monitoring Bizzack's performance of the Work until such time as a Baseline Schedule has been approved by the Department in accordance with Section 4(c).

(d) Baseline Schedule. Within 30 days of the Amendment Date, Bizzack shall submit to the Department for its review and approval the proposed Baseline Schedule. The proposed Baseline Schedule shall be a CPM schedule consistent with the Initial Baseline Schedule that includes, among other things, the order in which Bizzack proposes to carry out the Work, including each stage of design and the times when submissions, approvals, or consents by the Department are required. Bizzack shall address all comments received from the Department on the proposed Baseline Schedule until the Department approves the proposed Baseline Schedule. Upon approval by the Department, the Baseline Schedule will replace the Initial Baseline Schedule and shall become the basis for monitoring Bizzack's performance of the Work. The Department reserves the right to withhold approval for all or part of Bizzack's Applications for Payment until such time as the Department approved the proposed Baseline Schedule. The Baseline Schedule and any required updates shall conform to the requirements set forth in the Technical Requirements.

(e) Review and Approval of Deliverables. The Department shall have 21 days following the receipt of a complete submission to approve the submission or reject with comments relevant to the submission.

5. **Payment.**

(a) Schedule of Payments.

i. Bizzack will submit to the Department as part of its submission of the Baseline Schedule, pricing for the value of each Work Package, consistent with the Work Breakdown Structure (the “Earned Value Schedule”).

ii. The Earned Value Schedule shall include values for all items comprising the Work and shall serve as the basis for the monthly progress payments made by the Department to Bizzack during Bizzack’s performance of the Work.

(b) Monthly Progress Payments.

i. On the 25th day of each month following issuance of the Notice to Proceed, Bizzack shall submit its application for payment for the Department’s review and approval (the “Application for Payment”) in a form reasonably acceptable to the Department.

ii. The Department shall make payments monthly in accordance with the following earned value breakdown. Bizzack shall earn 20 percent of the value of a Work Package upon the initiation of such Work Package and Bizzack shall earn the remaining 80 percent of the value of a Work Package upon completion of such Work Package.

iii. QA/QC shall be an integral part of each Work Package. As part of each Application for Payment that includes a completed Work Package, Bizzack’s designated QAM shall certify that each Work Package has been completed in accordance with this Amendment and that all required QA/QC tests, measurements, permits, or other requirements have been completed and all non-conformance reports relative to the respective Work Package have been resolved. Bizzack shall submit along with each Application for Payment evidence of the QA/QC reviews, including any checklists, summary data, high-level/outline calculations or design checks, evaluations of the Work, and other relevant documentation that the QA/QC reviewer relied on to make a determination that the Work is complete and conforms to the requirements of this Amendment.

iv. The Application for Payment shall constitute a representation by Bizzack that the applicable portion of the Work has been

performed consistent with this Amendment and has progressed to the point indicated in the Application for Payment.

v. The Department shall pay Bizzack all undisputed amounts due within 30 days of receipt of a complete Application for Payment.

(c) Withholding of Payments. If the Department determines that Bizzack is not entitled to all or part of an Application for Payment, it will notify Bizzack in writing at least seven days prior to the date payment is due. Such notice shall indicate the specific amounts the Department intends to withhold, the reasons and contractual basis for the withholding, and the specific measures Bizzack must take to rectify the Department's concerns. Bizzack and the Department will attempt to resolve the Department's concerns prior to the date payment is due. If the parties cannot resolve such concerns, Bizzack may pursue its rights under the dispute resolution process set forth in Section 16.

6. Governmental Approvals.

(a) The design proposed by Bizzack shall comply with all Governmental Approvals, including the draft written re-evaluation for Section III(B) of the Coalfields Expressway, dated April 5, 2011 (the "Re-Evaluation").

(b) Should the design proposed by Bizzack require additional environmental review, Bizzack shall provide the Department with all necessary support, including engineering work and analysis, necessary for the Department to complete such additional environmental review at no additional cost to the Department.

(c) Should a Design Public Hearing be held after Bizzack submits the Field Inspection plans, Bizzack shall not be responsible for updating the Field Inspection Plans to address public comments received at the Design Public Hearing. The required updates to the Field Inspection Plans will be performed as part of a future agreement providing for the final design of the Poplar Creek Section.

7. Monthly Reports.

(a) On the tenth day of each month following issuance of the Notice to Proceed, Bizzack shall submit a report to the Department describing, among other things, the progress and status of the Work. Each report shall include:

- i. a detailed description of the progress of the Work, including each stage of design;
- ii. charts showing the status of all design documents;

iii. copies of quality assurance documents, quality control documents, and test results;

iv. safety statistics, including but not limited to, details of any hazardous incidents and activities relating to field investigations;

v. monthly updates to the Baseline Schedule (as applicable) and the related narrative; and

vi. unresolved claims or disputes that involve requests for extension to the Contract Time or adjustment to the Contract Price.

(b) The Department shall have the right to withhold approval for all or a portion of an Application for Payment if Bizzack fails to provide a monthly report to the Department or the monthly report is materially incomplete. For purposes of this Section 7(b), a monthly report shall be deemed to be materially incomplete if the Department is unable to reasonably ascertain the status, progress, or quality of the Work from such monthly report.

8. **Change Order.**

(a) A Change Order is a written instrument issued after the Amendment Date signed by the Department and Bizzack, stating their agreement upon each of the following (as applicable): (i) the scope of the change in the Work; (ii) the amount of the adjustment in the Contract Price, if any; and (iii) the extent of the adjustment to the Baseline Schedule, if any.

(b) All changes in the Work authorized by applicable Change Order shall be performed under the applicable terms and conditions of this Amendment, as amended from time to time, except as otherwise provided in such Change Order. The Department and Bizzack shall negotiate in good faith and as expeditiously as possible the appropriate adjustments for such changes.

(c) If the Department requests a proposal for a change in the Work from Bizzack and subsequently elects not to proceed with the change, a Change Order shall be issued to reimburse Bizzack for reasonable costs incurred for services involved in the preparation of such proposal.

9. **Change Directive.**

(a) A Change Directive is a written order prepared and signed by the Department, directing a change in the Work when a Change Order cannot be secured because of: (i) time constraints due to an emergency or urgent circumstances beyond the reasonable control of either party; or (ii) a failure of the parties to reach agreement on the

terms of an adjustment in the Contract Price, the payment schedule, and/or an adjustment to the Baseline Schedule despite adequate opportunity to negotiate and good faith efforts on the part of each party to reach agreement.

(b) The Department and Bizzack shall negotiate in good faith and as expeditiously as possible the appropriate adjustments for the Change Directive. Upon reaching an agreement, the parties shall prepare and execute an appropriate Change Order reflecting the terms of the agreement.

(c) If the Department issues a Change Directive pursuant to Section 9(a) above, the Department will make interim payments to Bizzack on a monthly basis for Bizzack's reasonable and documented costs incurred in performing the Work in question, subject to subsequent adjustment through the dispute resolution procedures set forth in Section 16 of the this Amendment.

(d) Notwithstanding anything herein to the contrary, the Department shall have no right to issue any Change Directive that (i) interferes or conflicts with any mining permit or any other related permit or authorization to conduct mining activities in Wise County, Virginia, Dickenson County, Virginia, or Buchanan County, Virginia (such as, for example, a Section 404 Clean Water Act permit, a state-issued National Pollutant Discharge Elimination System permit, or any other such authorization) issued by any governmental or regulatory body, agency or authority to Bizzack or any of its affiliates (individually, a "Mining Activities Permit"); (ii) infringes upon or eliminates any right available to Bizzack or any of its affiliates pursuant to any Mining Activities Permit; or (iii) increases the exposure to liability for any obligation, duty, risk or warranty of Bizzack or any of its affiliates pursuant to any Mining Activities Permit. Any provision in such Change Directive in contravention of this Section 9(d) shall be void *ab initio* and of no effect.

10. **Resources Commitment.** Bizzack, at its own cost and expense, shall furnish all necessary resources and related services to develop and complete the Work in accordance with this Amendment. Bizzack reserves the right to subcontract the Work consistent with any applicable State or Federal regulatory requirements, but shall remain directly responsible for the performance of all Work.

11. **Design Professional Services.** Bizzack shall provide through qualified, licensed design professionals employed by Bizzack, or procured from qualified, independent licensed design consultants, the necessary design services, including engineering, surveying and other design professional services, for the preparation of the required drawings, specifications, and other design submittals to permit Bizzack to complete the Work consistent with this Amendment. All design professional services related to the Work shall be supervised by professionals properly licensed in the State. The standard of care for all design professional services performed in execution of the

Work shall be the care and skill ordinarily used by members of the design profession practicing under similar conditions at the same time and locality of the Work.

12. **Work Product.**

(a) Bizzack shall retain ownership of all Work Product it produces until the earlier of the following dates, at which time ownership shall vest solely in the Department, free and clear of all claims, liens and encumbrances:

(i) The date on which the Department has provided an approval to Bizzack that a Deliverable under this Amendment is consistent with the scope and requirements of this Amendment and all outstanding issues and deficiencies in such Deliverable on the part of Bizzack have been resolved; or

(ii) The date on which this Amendment is terminated, for any reason.

At such date, Bizzack shall execute and deliver such assignments and other instruments as the Department may require for transferring ownership of the Work Product to the Department and shall deliver possession of all such Work Product to the Department.

(b) Certain of Bizzack's Work Product and certain other records of which the Department may obtain a copy under this Amendment may constitute information and materials exempt from disclosure under provisions of the Virginia Freedom of Information Act; namely, Virginia Code Section 2.2-3705.6(11). Should any records become the subject of a request for public disclosure, the Department shall comply with applicable law.

(c) The Department shall have the right to use the Work Product without Bizzack's participation on the CFX Project or for any subsequent procurement by the Department on another project; provided, however, such use of the Work Product by the Department shall be at the Department's sole risk. By this Amendment, Bizzack neither warrants nor represents that the Work Product is suitable for use in the development of the CFX Project, or another project, without Bizzack's participation or modification. The Department waives any rights to seek recovery from Bizzack for any claims, damages, liabilities, losses and expenses arising out of or resulting from the Department's use of the Work Product in the development of the CFX Project or another project without Bizzack's participation.

13. **Record Maintenance and Retention of Records.** Bizzack shall keep full and detailed accounts and exercise such controls as may be necessary for proper financial management, using accounting and control systems in accordance with generally accepted accounting principles. During the performance of the Work and for a period of five (5) years after final payment hereunder, the Department and the Department's

accountants shall be afforded access from time-to-time, upon reasonable notice only, to review records that relate to Bizzack's applications for payment for the Work pursuant to Section 4 above.

14. **Changes in Described Roles and Responsibilities.** This Amendment is limited to the roles and responsibilities as described in this Amendment. Any expansion or changes to such roles or any other amendments or modifications of this Amendment, if agreed upon by the parties, will be agreed to, in writing, in a negotiated supplement to this Amendment executed by the affected parties. By way of example, a modification of the provisions related to the Work shall be pursuant to Section 8 or Section 9 of this Amendment, without the necessity of Alpha's signature or approval.

15. **Default.**

(a) The term, for purposes of this Amendment, "Event of Default" shall mean the failure of the Department or Bizzack to materially fulfill its respective individual obligations described in this Amendment.

(b) In the case of an Event of Default by a party to this Amendment, the defaulting party, upon receipt of written notification from the non-defaulting party, will have ten days to cure any breach resulting in such Event of Default or for such longer period as may be reasonably necessary to cure such breach up to a maximum cure period of 60 days.

(c) If the party receiving notice of an Event of Default disagrees that a default has occurred, the party claiming default shall be allowed to submit the matter for dispute resolution pursuant to Section 16.

(d) If an Event of Default is uncured or unresolved, either party shall be allowed to submit the matter for dispute resolution pursuant to Section 16.

(e) The Department, Alpha, and Bizzack mutually waive and release any and all rights they might otherwise have under law or equity to recover indirect, incidental or consequential damages of any nature, whether arising in contract, tort or any other legal theory. In no event shall the total liability of the Department, including payments made or payable under this Amendment, exceed the Contract Price.

16. **Dispute Resolution.**

(a) The parties shall attempt to resolve any dispute that may arise between or among the Department and Bizzack under this Amendment through best efforts and good faith negotiations between authorized representatives of the Department and authorized representatives of Bizzack identified in Section 20 below, in accordance

with this Section. In conducting such negotiations, the Department and Bizzack recognize that in drafting this Amendment it is impracticable to make provisions for every contingency that may arise during its term. Accordingly, in order to achieve the resolution of any dispute concerning matters for which this Amendment provides no clear guidance, the Department and Bizzack concur in the principle that this Amendment is intended to operate between them in fairness.

(i) With respect to matters pertaining to the Work, the Department's Project Manager and Bizzack's Project Manager will meet to review and resolve contract disputes. In the event of failure to resolve a dispute at this level within fifteen (15) days, then either party may request that the dispute be elevated to the Department's Bristol District Administrator and Bizzack's Designated Representative (as identified in Section 20).

(ii) In the event of failure to resolve a dispute at this level within thirty (30) days after such request is made, either party may request, which request shall include all pertinent correspondence and information, that the dispute be elevated to the Department's Chief Engineer and Bizzack's Designated Representative (as identified in Section 20).

(iii) In the event of failure to resolve a dispute at this level within forty-five (45) days after such request is made, either party may request that the dispute be elevated to the Department's Commissioner and Bizzack's Designated Representative (as identified in Section 20).

(iv) If a dispute remains unresolved after the parties participate in the process set forth in this Section 16 for more than sixty (60) days following referral to the Commissioner and Bizzack's Designated Representative (as identified in Section 20), either party shall be entitled to bring a civil action, which shall be filed, heard and decided in the Circuit Court of the City of Richmond and shall be the exclusive jurisdiction and venue for any such civil actions brought by any party against any other party; *provided, however*, that the foregoing does not affect any claims or matters which are governed by a different dispute resolution procedure set forth in any other agreement between the parties.

(b) In the event the Department, acting in good faith and prior to the approval of a certain Deliverable pursuant to Section 4, notifies Bizzack that it is invoking the dispute resolution provisions of this Section 16 with respect to the adequacy of such Deliverable, then the Department will pay to Bizzack, in relation to such Deliverable, sixty-seven percent (67%) of the applicable amount that would otherwise be payable pursuant to the terms of Section 5. The remaining thirty-three (33%) of any such payment shall be paid upon the sooner of the Department's issuance of written approval of such Deliverable or resolution of the matter through the dispute resolution procedures of this Section 16.

(c) Each party shall bear its own attorney's fees and costs in any dispute or litigation arising out of or pertaining to this Amendment, and no party shall seek or accept an award of attorney's fees or costs.

17. **Termination for Public Convenience and Suspension of All or Part of Work.**

(a) The Department may terminate for public convenience the rights and obligations conveyed or required by this Amendment at any time by giving written notice of the termination to Bizzack. If the Department intends to take such action, it shall deliver to Bizzack a notice (a "Notice of Termination for Public Convenience").

(b) After receipt of a Notice of Termination for Public Convenience, and except as directed by the Department, Bizzack shall immediately proceed as follows, regardless of any delay in payment of any amounts due under this Section 17, with respect to the terminated Work: (i) transfer and deliver to the Department or its designee, as directed by the Department: (1) the Work for which the Department has paid Bizzack pursuant to Section 5; and (2) copies of, and all rights, title and interest of Bizzack in and to: (a) all completed or partially completed drawings (including plans, elevations, sections, details and diagrams), specifications, records, reports, books, samples, surveys, information and other Work Product that would have been required to be furnished to the Department if the Work had been completed; and (b) all intellectual property developed specifically for the Department under this Amendment; and (ii) complete performance of all Work not terminated.

(c) In the event Bizzack receives a Notice of Termination for Public Convenience, Bizzack shall be paid by the Department amounts due for Work performed prior to the date of the termination under the terms of this Amendment including its reasonable costs incurred on any Deliverable commenced but not completed; *provided, however*, that in no event shall the payment exceed the amount that would be due if the Deliverable had actually been completed.

(d) Upon receiving Notice of Termination for Public Convenience, neither the Department nor Bizzack shall have any continuing duty to the other under this Amendment with respect to the Work terminated, except as expressly provided by this Section 17 or those provisions of this Amendment that are intended to survive termination of this Amendment (such as Section 18(b)).

(e) The amount otherwise due Bizzack under this Section 17 shall be reduced by the amount of any valid claim which Department may have against Bizzack in connection with this Amendment.

18. Compliance and Indemnity.

(a) Bizzack shall: (i) comply with the laws of the State, and all other applicable laws whether or not mentioned or specified herein, during its performance of the Work; and (ii) maintain (or cause to be maintained) insurance coverage as described by Exhibit E (attached hereto and incorporated herein).

(b) Bizzack shall, subject to conditions contained in Section 12(c) of this Amendment, indemnify, protect, defend, hold harmless and release the State, the Department, the Commissioner of Highways, the CTB, and all elected representatives, appointed officials, commissioners, officers, members, employees, authorized agents and authorized representatives of any of them (each a “State Indemnitee”) from and against: (a) all third party claims arising from the unlawful acts, omissions, negligence or willful misconduct of Bizzack, its affiliates, employees, subcontractors or their employees as a result of, or in connection with, performance of the Work, excluding the portion of liability that is attributable to the unlawful acts or omissions, negligence or willful misconduct of a State Indemnitee; (b) any claim that the Work, or any part thereof, or the operation or use of the Work or any part thereof, constitutes infringement of any United States patent or copyright, now or hereafter issued, excluding any suit, claim or proceeding based on infringement or violation of a patent or copyright, relating solely to a particular process or product of a particular manufacturer specified by Department and not offered or recommended by Bizzack to Department; and (c) provided that the Department is not in breach of its contractual obligation to make payments to Bizzack for the Work, all claims brought against any State Indemnitee as a result of the failure of Bizzack, or those for whose acts it is responsible, to pay for any services, materials, labor, equipment, taxes or other items or obligations furnished or incurred for or in connection with the Work. The provisions of this Section 18(b) shall survive the expiration or termination of this Amendment for any reason.

(c) Bizzack shall adhere to Federal regulations as required by United States Code Title 23 eligible projects to the extent applicable to the Scope of Work as described in Exhibit B.

19. Notification Procedures.

All notifications, requests, approvals, consents, and determinations referenced in this Amendment shall be in writing, shall be sent to the individuals designated pursuant to this Section 19, by personal delivery, first class U.S. mail (postage prepaid), nationally recognized overnight courier service, facsimile transmission to such individual (with confirmation of delivery), or email, at the street address, facsimile number, or email address provided for that individual below, and shall be deemed given or delivered when received by the recipient.

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Bizzack Construction, LLC
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Lexington, KY 40509
Facsimile: (859) 299-0480
Email: gtaylor@bizzackconstruction.com

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The Department:

Chief Engineer
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Office of the Attorney General
900 East Main Street
Attention: Transportation Section Chief
Richmond, VA 23210
Facsimile: (804) 786-9136

20. **Designation of Representatives.**

(a) Each of the parties to this Amendment designate the individuals identified below as that party's representative, who shall be authorized to make decisions on behalf of, and to bind that party, on matters relating to this Amendment, including the amendment, waiver, or modification of any of the terms of this Amendment. A party may designate additional or alternative representatives and/or notice recipients, by delivery of prior notice to the other parties.

Bizzack:

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CFX Program Manager
Virginia Department of Transportation
870 Bonham Road
Bristol, VA 24203
Facsimile: (276) 645-4874
Email: mandy.cox@vdot.virginia.gov

21. **Approvals.** In all cases where approvals, consents or determinations are required to be provided hereunder, such approvals or consents shall not be withheld unreasonably and such determinations shall be made reasonably and timely, except as otherwise expressly provided by this Amendment.

22. **Public Correspondence and Communications.** The parties shall notify the other parties prior to the submission of any written correspondence related to the Poplar Creek Section to any representative of the media, or to a third party for the purpose of publication to the general public. Such communications may include, but are not limited to, a press release, an opinion document, or other similar instrument.

23. **Assignment.**

(a) The Department may transfer and assign its interests in this Amendment and any other CFX Project agreements to any other public agency or public entity as permitted by law, *provided, however*, that the successor or assignee has assumed all of the Department's obligations, duties and liabilities under this Amendment and the CFX Project agreements then in effect and provided Alpha and Bizzack with reasonable assurances of legal and financial authority to honor and perform same.

(b) Neither Alpha nor Bizzack shall assign its rights or obligations under this Amendment, without the prior written consent of the Department, which consent shall not be unreasonably withheld. In exercising its right to consent or to withhold its consent to an assignment, the Department may consider, among other things, (i) the absence of reasonable assurances of the legal authority of the assignor or proposed assignee to effect such assignment or the legal authority and/or financial capacity of the proposed assignee to perform the assignor's obligations; and (ii) the availability of guaranties and other security offered by the proposed assignor to ensure performance of the proposed assignee.

(c) If any party changes its name, such party agrees to promptly furnish each of the other parties with written notice of change of name and appropriate supporting documentation.

(d) Subject to this Section, this Amendment shall be binding upon and inure to the benefit of the parties hereto and their successors and permitted assigns.

24. **Disadvantaged Business Enterprises.** It is the policy of the Department that Disadvantaged Business Enterprises ("DBE") as defined in 49 CFR Part 26 shall have the maximum opportunity to participate in the performance of federally funded contracts. A list of Virginia Department of Minority Business Enterprise certified DBE firms is maintained on its web site (<http://www.dmb.state.va.us/>) under the **DBE Directory of Certified Vendors**. Bizzack is encouraged to take all necessary and

reasonable steps to ensure that DBE firms have the maximum opportunity to compete for and perform services for this Amendment, including participation in any subsequent supplemental contracts. If Bizzack intends to subcontract a portion of the Work, Bizzack is encouraged to seek out and consider DBE firms as potential sub-contractors. Bizzack is encouraged to contact DBE firms to solicit their interest, capability and qualifications. Any agreement between Bizzack and a DBE firm whereby the DBE promises not to provide services to other contractors is prohibited.

25. **Governing Law and Venue.** This Amendment shall be governed by and construed in accordance with the laws of the State. Venue for any legal action arising out of or relating to this Amendment shall lie in the Circuit Court of the City of Richmond, Virginia.

26. **No Third Party Beneficiaries.** Nothing contained in this Amendment is intended to or shall be construed to create or confer any rights, benefits or remedies upon, or create any obligations of the parties hereto toward, any person or entity not a party to this Amendment.

27. **Counterparts.** This Amendment may be executed in two or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

28. **Entire Agreement.** THIS FOURTH AMENDMENT TO THE ASSIGNMENT AND ASSUMPTION AGREEMENT CONSTITUTES THE ENTIRE AND EXCLUSIVE AGREEMENT BETWEEN THE PARTIES RELATING TO THE SPECIFIC MATTERS COVERED HEREIN AND THEREIN. ALL PRIOR OR CONTEMPORANEOUS VERBAL OR WRITTEN AGREEMENTS, UNDERSTANDINGS, REPRESENTATIONS AND/OR PRACTICES RELATIVE TO THE FOREGOING, EXCLUDING THE COMPREHENSIVE AGREEMENT, THE ASSIGNMENT AND ASSUMPTION AGREEMENT, THE FIRST AMENDMENT TO ASSIGNMENT, THE SECOND AMENDMENT TO ASSIGNMENT, AND THE THIRD AMENDMENT TO ASSIGNMENT ARE HEREBY SUPERSEDED, REVOKED AND RENDERED INEFFECTIVE FOR ANY PURPOSE. THIS AMENDMENT MAY BE ALTERED, AMENDED OR REVOKED ONLY BY AN INSTRUMENT IN WRITING SIGNED BY EACH PARTY HERETO, OR ITS PERMITTED SUCCESSOR OR ASSIGNEE. NO VERBAL AGREEMENT OR IMPLIED COVENANT SHALL BE HELD TO VARY THE TERMS HEREOF, ANY STATUTE, LAW OR CUSTOM TO THE CONTRARY NOTWITHSTANDING.

29. **Appropriation and Allocation.** The Department's payment of any damages or any other amounts due and owing by the Department under this Amendment shall be subject to appropriation by the General Assembly and allocation by the CTB

therefor; *provided that*, upon determination of such damages or such other amounts not already appropriated and allocated, the Department shall with all practical dispatch consistent in all respects with applicable law and its obligations under this Amendment (i) deliver to the Governor and the Director of the Department of Planning and Budget of the State, before December 1 with respect to any such payment requested to be appropriated by the next regular session of the General Assembly, a statement of the amount of any such payment due or expected to be due and a request that the Governor include in his budget to be delivered to the next session of the General Assembly a provision that there be appropriated such amounts for such purpose to the extent required, from any legally available funds, (ii) use its diligent efforts to have (A) the Governor include, in each biennial or any supplemental budget the Governor presents to the General Assembly, the amounts set forth in any statement delivered pursuant to (i) above, (B) the General Assembly appropriate and reappropriate, as applicable, such amounts to or on behalf of the Department for the purpose of paying any damages or other amounts due and owing by the Department under this Amendment, and (C) the CTB allocate such appropriated amounts as applicable for payment, and (iii) notify Alpha or Bizzack promptly upon becoming aware of any failure by (A) the Governor to include such amounts in his budget delivered to the next session of the General Assembly, (B) the General Assembly to appropriate such amounts during such next session of the General Assembly or (C) the CTB to so allocate such amounts for payment.

[Signatures appear on next page]

IN WITNESS WHEREOF, the parties, intending to be legally bound, have executed this Amendment on the date first written above.

VIRGINIA DEPARTMENT OF TRANSPORTATION,
an agency of the Commonwealth of Virginia

By: _____
Charles A. Kilpatrick, P.E.
Commissioner of Highways

BIZZACK CONSTRUCTION, LLC,
a Kentucky limited liability company

By: _____

Its: _____

ALPHA NATURAL RESOURCES, LLC,
a Delaware limited liability company

By: _____

Its: _____

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By: _____

Its: _____

ALPHA NATURAL RESOURCES, LLC,
a Delaware limited liability company

By: _____

Its: _____

EXHIBIT A
DEFINITIONS

| Acronym | Definition |
|----------------|--|
| .DGN | Bentley Microstation Drawing (3D CADD) |
| .PDF | Portable Document Format |
| .XER | Primavera proprietary exchange format |
| AASHTO | American Association of State Highway Transportation Officials |
| ACR | Activity Cost-loading Report |
| AMRL | AASHTO Materials Reference Laboratory |
| ASTM | American Society for Testing and Materials |
| CADD | Computer-Aided Design and Drafting |
| CBR | California Bearing Ratio |
| CCRL | Cement and Concrete Reference Laboratory |
| CD | Compact Disc |
| CPM | Critical Path Method |
| CRR | Corrosion Resistant Reinforcing |
| CRSP | Colorado Rockfall Simulation Program |
| CTB | Commonwealth Transportation Board |
| DBE | Disadvantaged Business Enterprise |
| DEQ | Department of Environmental Quality |
| DMME | Department of Mines, Minerals and Energy |
| DTM | Digital Terrain Model |
| EMS | Emergency Medical Service |
| ESC | Erosion and Sediment Control |
| FEMA | Federal Emergency Management Administration |
| FHWA | Federal Highway Administration |
| FI | Field Inspection Plans |
| H&HA | Hydrologic and Hydraulic Analysis |
| HEC | Hydrologic Engineering Center |
| HEC-RAS | Hydrologic Engineering Center – River Analysis System |
| HPS | High Performance Steel |
| I&IM | Instructional and Information Memoranda |
| KBR | Kellogg, Brown & Root |
| LFRD | Load Resistance Factor Design |
| MOI | Memorandum of Instructions |
| MOT | Maintenance of Traffic |
| NAAQS | National Ambient Air Quality Standards |
| OSHA | Occupational Safety and Health Administration |
| PE | Professional Engineer |

| | |
|-------|---|
| PFI | Preliminary Field Inspection |
| PH | Public Hearing or Public Hearing Plans |
| PPTA | Public-Private Transportation Act |
| PVC | Polyvinyl Chloride |
| QA | Quality Assurance |
| QC | Quality Control |
| QA/QC | Quality Assurance/Quality Control |
| QAM | Quality Assurance Manager |
| RQD | Rock Quality Designation |
| SDI | Slake Durability Index |
| SMCRA | Virginia Surface Mining Control & Reclamation Act |
| SPCN | Special Provision Copied Note |
| SWM | Storm Water Management |
| SWPPP | Storm Water Pollution Prevention Plan |
| TMP | Traffic Management Plan |
| TOC | Traffic Operations Center |
| UCS | Unconfined Compressive Strength |
| VAC | Virginia Administrative Code |
| VSMP | Virginia Stormwater Management Program |
| WBS | Work Breakdown Structure |

Alpha is defined in the recitals.

Alpha Portion means that portion of the CFX Project for the rough-grade roadbed of the Hawks Nest Section (VA State Plane System South (Feet), coordinates X = 10413400.49 and Y = 3639636.572) from station 1645+00 shown on the as-built plans to existing State Route 614.

Amendment means the Fourth Amendment to Assignment and Assumption Agreement dated as of the Agreement Date, and all exhibits and schedules thereto, as supplemented or further amended from time to time.

Amendment Date means the date written on the cover page of the Amendment, which date will be the date on which the parties have executed and delivered this Amendment.

Application for Payment is defined in Section 5.

Assignment Agreement is defined in the recitals.

Backfill means material used to replace, or the act of replacing, Material removed during construction. The term “Backfill” may also denote Material placed, or the act of placing, Material adjacent to structures.

Baseline Schedule is defined in Section 4 of the Amendment.

Baseline Schedule Narrative is defined in Exhibit C.

Bizzack is defined in the recitals.

Borrow means Suitable Material from sources outside the Roadway that is used primarily for Embankments.

Borrow Areas means sites from which Borrow is obtained.

Bridge means a structure, including supports, that is erected over a depression or an obstruction, such as water, a highway, or a railway, that has a track or passageway for carrying traffic.

CFX Project is defined in the recitals.

Change Directive is defined in Section 9 of the Amendment.

Change Order is defined in Section 8 of the Amendment.

Coal Synergy means the road construction concept that applies large-scale earth-moving techniques common to the coal industry, as well as recovery of marketable coal reserves, to reduce road development costs.

Coalfields Expressway means the approximately 55 mile long four-lane limited access highway between Pound, Virginia and the West Virginia state line.

Code means the Code of Virginia (1950), as amended.

Commissioner of Highways (Commissioner) means the appointed chief executive officer of the Department or any successor in function.

Comprehensive Agreement is defined in the recitals.

Contractor means Bizzack.

Contract Price is defined in Section 3 of the Amendment.

Contract Time is defined in Section 3 of the Amendment.

Cranes Nest Section is defined in the recitals.

Culvert means a structure that is not classified as a Bridge which provides an opening under any roadway.

Cut Slope (See also **Fill Slope**) means a surface plane generally designated by design, which is formed during excavation below existing ground elevations that intersects with existing ground at its termini.

Data Date means the last date on which the Contractor records progress with respect to the Work in the form of actual dates, percent of work completed, revised remaining duration, or actual quantities or costs.

Day or day means a calendar day.

Deliverable is defined in Section 4 of the Amendment.

Department means the Virginia Department of Transportation, an agency of the State, and any other state agency succeeding to the powers, authorities, and responsibilities of the Department invoked by or pursuant to this Amendment.

Department of Mines, Minerals and Energy (“DMME”) means the State agency regulating the mineral industry that provides programs that serve citizens living near mining operations, mining labor groups, the mineral industry and environmental groups.

Design-Build Contract is defined in the recitals.

Design Public Hearing means a hearing held for public review of Plans after the Commonwealth Transportation Board approves a route location, or for projects that do not require extensive relocation, before Department is committed to a specific design, held after a project field inspection is held and Plans are completed to a stage that all right of way limits and lines (including easements), SWM basins, noise wall locations, retaining wall locations and construction limits, and major design features are delineated on the Plans and identified clearly, within the parameters of the information known to date.

Designated Representative is defined in Section 20 of the Amendment.

Disadvantaged Business Enterprise (DBE) is defined in Section 24 of the Amendment.

Diversions has the meaning set forth in 4 VAC 25-130-816.43.

Earned Value Schedule is defined in Section 5 of the Amendment.

Elkins Section is a section of the Coalfields Expressway approximately 11.5 miles in length that extends approximately three miles from a connection with the Poplar Creek Section east of Route 614 to State Route 643.

Embankment means a structure of soil, soil aggregate, soil-like Materials, or broken rock between the existing ground and subgrade.

Event of Default is defined in Section 15 of the Amendment.

Exchange is defined in the recitals.

Field Inspection Plans means design plans prepared in accordance with Form LD-436 representing approximately 75% of the complete design effort and corresponding to the culmination of the detailed design phase, as outlined in IIM-LD-226.5 and referenced in the Department's Road Design Manual.

Fill Slope (See also ***Cut Slope***) means a surface plane formed during the construction of an Embankment above existing ground elevations that intersects with existing ground at its termini.

First Amendment to Assignment is defined in the recitals.

General Assembly means the General Assembly of the State.

Geotechnical Engineer is defined in Exhibit C.

Geotechnical Engineering Report is defined in Exhibit C.

Governmental Approval means any authorization, consent, approval, license, lease, ruling, permit, certification, exemption, variance, order, judgment, decree, declaration, certification, filing, recording, permit (including, where applicable, conditional permits), right of way or registration by, from or with any unit of government, including each and every environmental, construction, operating, or occupancy permit, that is required by Law for Performance of the Work.

Grundy Tie-In means the segment of the Poplar Creek Section from the Coalfields Expressway mainline to Route 460 near Grundy, Virginia, as shown on Attachment 1 to Exhibit B.

Hawks Nest Section is defined in the recitals.

Initial Baseline Schedule is Exhibit D.

Interchange is defined in the recitals.

Intermediate Plan (60%) for Bridges is defined in Exhibit C.

Jurisdictional Waters means any stream or wetland meeting the criteria for Waters of the United States as defined by the Clean Water Act of 1972, 33 U.S.C. 1251 *et seq.*

KBR is defined in the recitals.

Known Underground Mine Works means Underground Mine Works present on the Site

that the Contractor shall identify and document in the Plans based on reasonable diligence search and geotechnical borings in accordance with Exhibit C.

For purposes of this definition, “reasonable diligence” means the determination of horizontal and vertical location of Underground Mine Works within the proximity of the Site by performing the following activities, which in each case shall be documented and available for Department review

- (a) Review the public record, including, but not limited to, publications and access provided by DMME as of the Amendment Date;
- (b) Review DMME records for deep mine permits;
- (c) Conduct field reconnaissance to locate and make field measurements of abandoned mine openings or areas of previous activity that could reflect previous mine openings;
- (d) Meet with the primary mineral lease holders and each of their applicable subsidiaries, to review available company data regarding deep mine voids;
- (e) Conduct interviews with local land owners and tenants to ascertain the extent of deep mining activities where mineral leases are not controlled by the primary mineral lease holders identified in paragraph (d);
- (f) Review USGS topographic maps for locations of documented deep mine openings;
- (g) Review USGS geologic maps for locations of documented deep mine openings;
- (h) Review the Department’s CFX Project digital terrain model maps to identify existing contour benches associated with coal seams to aid in determination of the elevations of the deep mines; and
- (i) Review all available borings and “e-logs” for elevations of coal seams to aid in determination of the elevations of the deep mines.

Law means all applicable federal, state and local laws, codes, ordinances, rules, regulations, orders and decrees of any unit of government, in each case applicable to performance of the Work. The term Law includes (a) all obligations applicable to projects receiving federal funding or other federal-aid assistance, including, but not limited to, all obligations under Federal Highway Administration federal-aid projects and (b) federal and State laws related to public records.

Material means any substance that is used in the Work specified in this Amendment.

Mineral Reserve Study is defined in Exhibit C.

Mining Activities Permit is defined in Section 9 of the Amendment.

MOI is defined in Exhibit C.

Notice of Intent means a letter delivered to a landowner in advance of entering the landowner's property for the purpose of conducting surveys or geotechnical investigations.

Notice of Termination for Convenience is defined in Section 17 of the Amendment.

Notice to Proceed is defined in Section 3 of the Amendment.

Plans means the approved plans and profiles, which may include Standard Drawings, survey data, typical sections, summaries, general notes, details, plan and profile views, cross-sections, special design drawings, computer output listings, supplemental drawings, or exact reproductions thereof, and all subsequently approved revisions thereto which show the location, character, dimensions, and details of the Work specified in the Contract.

Poplar Creek Section is defined in Section 3 of the Amendment.

Preliminary Field Inspection Plans means design plans prepared in accordance with Form LD-436 representing approximately 20% of the complete design effort and corresponding to the culmination of the scoping phase, as outlined in IIM-LD-226.5 and referenced in the Department's Road Design Manual.

Preliminary Plan (30% - Stage 1) for Bridges is defined in Exhibit C.

Principal Contract Documents is defined in the recitals.

Professional Engineer ("PE") means an engineer holding a current and valid license to practice engineering in the State.

Project ROW is a geographic concept that means the ROW acquired or to be acquired for the Poplar Creek Section.

Public Hearing Plans means design plans prepared in accordance with Form LD-436 representing approximately 40% of the complete design effort and corresponding to the culmination of the preliminary design phase, as outlined in LLM-LD-226.5 and referenced in the Department's Road Design Manual.

Public-Private Transportation Act of 1995 ("PPTA") is defined in the recitals.

Quality Assurance Manager ("QAM") means Bizzack's designee responsible for

providing quality assurance (“**QA**”) and certifying that Bizzack is implementing quality control (“**QC**”) of the Work, and ensuring conformance of the Work with this Amendment.

QA/QC Plan means the plan (or plans) that detail(s) how Bizzack will provide QA and QC for the design elements of the Poplar Creek Section.

Rapoca is defined in the recitals.

Re-Evaluation is defined in Section 6(a) of the Amendment.

Roadway means the portion of a highway within the limits of construction and all structures, ditches, Channels, and waterways which are necessary for the correct drainage thereof.

Second Amendment to Assignment is defined in the recitals.

Schedule Update has the meaning set forth in Exhibit C.

Scope of Work has the meaning set forth in Exhibit B.

Site means the land or premises on which the Project is located. The “Site” includes (a) the Project ROW, (b) all Borrow sites, and (c) all Surplus Material Area(s).

Special Provision (“SP”) means a document that sets forth specifications or requirements that are not covered by the Standard Specifications.

Special Provision Copied Note (“SPCN”) means a document that sets forth other specific specifications or requirements.

State means the Commonwealth of Virginia.

State Indemnitee is defined in Section 18 of the Amendment.

Study is defined in the recitals.

Surface Mining Control & Reclamation Act (“SMCRA”) means (a) “SMCRA of 1977” (30 U.S.C. §§1201 to 1328), the federal law, and (b) the “Virginia Coal Surface Mining Control and Reclamation Act of 1979” (§§ 45.1-226 to 270.7 of the Code, the State Law, in each case that focuses both on regulation of active coal mining and reclamation of Underground Mine Works, among other matters. SMCRA includes Legal Requirements for “Standards of Performance” set forth in the federal and State SMCRA laws.

Surplus Materials Area(s) has the meaning set forth in Exhibit C.

Technical Requirements means the Technical Requirements included as Exhibit C, as the same may be revised in accordance with this Amendment.

Third Amendment to Assignment is defined in the recitals.

Underground Mine Works means an underground mining operation that has been abandoned or is currently active.

Utility means a public, private, cooperative, municipal and/or government line, facility or system used for the carriage, transmission, and/or distribution of cable television, electric power, telephone, data, or other telecommunications, telegraphy, water, gas, oil, petroleum products, steam, chemicals, swage, storm water not connected with the highway drainage and similar systems that directly or indirectly serve the public. The term “Utility” specifically excludes (a) storm water lines connected with the highways drainage and (b) traffic signals, street lights, and electrical systems for Project Roadways.

Work is defined in Section 3 of the Amendment.

Work Breakdown Structure (“WBS”) means a hierarchically-structured grouping of project elements that organizes and defines the total scope of the Poplar Creek Section. Each descending level is an increasingly detailed definition of a project component. Project components may be products (a product-oriented WBS) or tasks (a task-oriented WBS).

Work Package(s) means a deliverable at the lowest level of the WBS. The Work may be divided into activities and “Work Packages” may be used to identify and control Work flows in the organization.

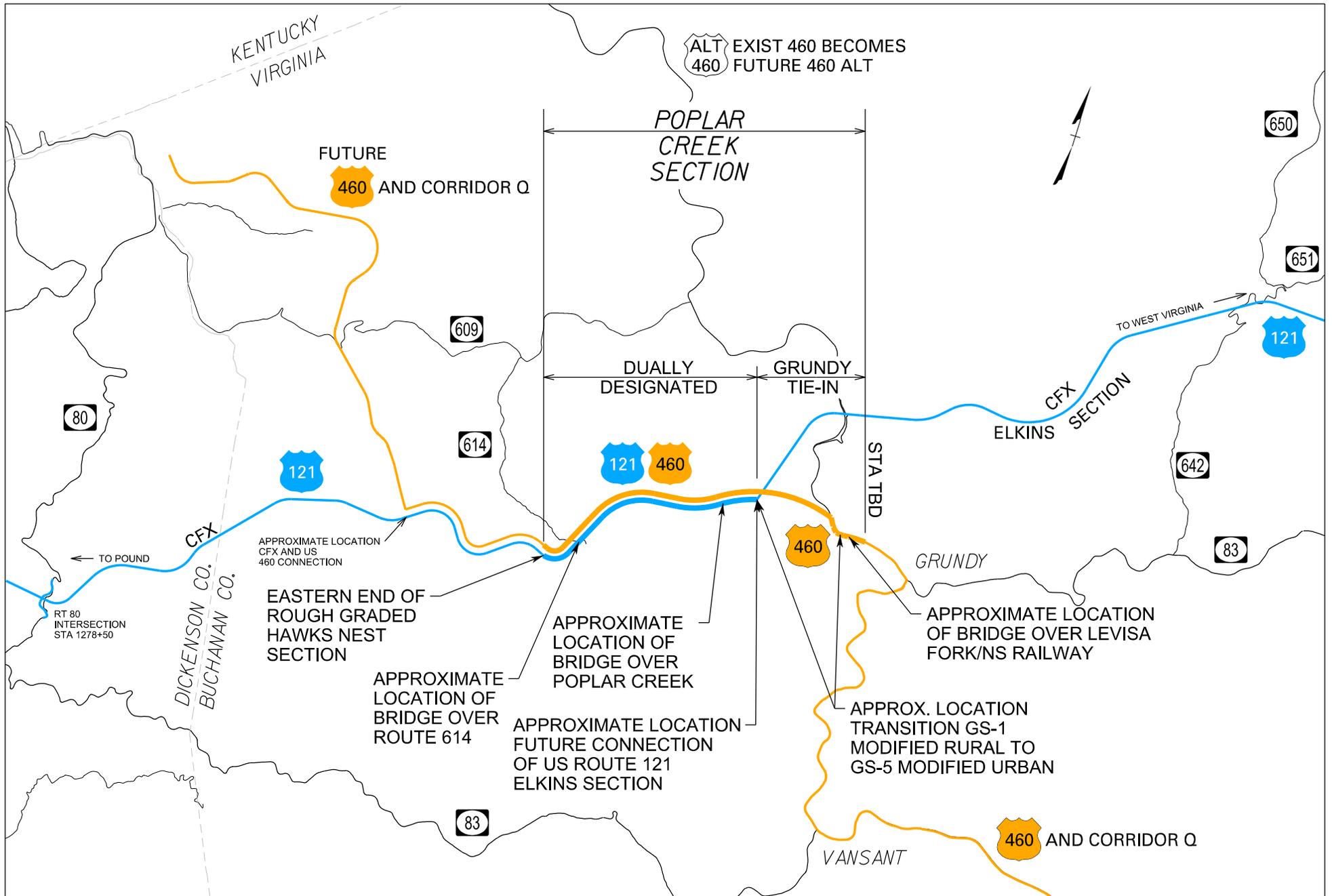
Work Product means all drawings, specifications, calculations, reports, and documentation, whether in paper copy or electronic format, produced by or through Bizzack in the performance of the Work that is to be furnished to the Department in accordance with this Amendment.

EXHIBIT B

SCOPE OF WORK

Bizzack shall design the Poplar Creek Section to finished grade within Project ROW limits on the alignment depicted on Attachment 1 to Exhibit B. The level of design shall be consistent with the level of design required in accordance with the Amendment. Design improvements shall include:

- (i) a connection from the Poplar Creek Section to Hawks Nest at the western terminus and existing U.S. Route 460 west of Grundy at the eastern terminus;
- (ii) finished-grade turn-lane tie-ins at all connections as approved by the Department;
- (iii) three bridge locations over Poplar Creek, Levisa Fork/Norfolk Southern Railway, and Route 614;
- (iv) future connection with the proposed Elkins Section; and
- (v) all necessary Surplus Materials Areas and Borrow Areas required for the Poplar Creek Section.



ATTACHMENT 1: GEOGRAPHIC DELINEATION MAP

NOT TO SCALE

EXHIBIT C

TECHNICAL REQUIREMENTS

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1.1 Baseline Schedule

1.1.1 General

- A. The Baseline Schedule shall be a CPM schedule that includes, among other things: the order in which Contractor proposes to carry out the Work (including each stage of design, and the times when submissions and approvals or consents by Department are required. The Baseline Schedule shall be resource-loaded and cost-loaded, broken down into Work Packages that are consistent with the Work Breakdown Structure (“WBS”) and in deliverables generally completed within 30 days, with the dollar value (price) of each deliverable being identified. Contractor shall prepare the Baseline Schedule for Department’s review and approval. Contractor shall resubmit a revised schedule to Department within seven days of its receipt of Department’s comments on such schedule. This process shall continue until such time as a schedule is so approved by Department.
- B. The Baseline Schedule, conforming to the Work Breakdown Structure (“WBS”) set forth below, shall be a CPM schedule that includes a narrative description of the proposed schedule for the Poplar Creek Section; logic relationships; durations; critical path based on the longest path, interim milestones; and timing of the WBS elements for design and design review by Department.
- C. The Baseline Schedule’s source document shall be in electronic format, e.g. .xer, .xls, etc., on a CD. The WBS shall be broken down into work packages, indicating and describing Contractor's work segments, phases for the Work, and major Deliverables. The WBS shall be consistent with Contractor's organization and approach to management, as well as to its approach to technical challenges for the Work. Activities within the WBS shall be broken down sufficiently to show design sequencing, field investigations, and significant interrelationships and dependencies.

1.1.2 Cost Loading

- A. Contractor shall cost load each activity in the Baseline Schedule for which Contractor expects to receive payment. The Baseline Schedule shall be reasonably cost loaded to allow for an accurate determination of progress of the activity based on earnings. The Baseline Schedule shall be cost loaded in accordance with the following:
 - 1. If the “Resource” feature is used to cost-load the Baseline Schedule, Contractor shall define and assign a project-specific resource to applicable activities. The Resource ID shall be unique.

2. Activities shall be cost-loaded to allow for summarization of the budgeted quantity and budgeted costs by “Cost Account ID.” Cost Account ID numbers shall be assigned to all applicable activities.
3. The aggregate sum of the budgeted costs for all activities shall equal the total contract value. Total contract value will be considered to mean the current contract value including the original amount of the contract and any authorized adjustments for authorized changes to the Work.

1.1.3 Baseline Schedule Narrative

- A. Baseline Schedule Narrative. A “Baseline Schedule Narrative” shall accompany the Baseline Schedule.
- B. A Baseline Schedule Narrative shall include the following written information:
 1. Contractor’s overall plan describing the proposed overall sequence of design;
 2. A description of the critical path;
 3. A description of the near critical path(s) (float paths with total float value within 20 days of the critical path total float);
 4. A listing of the Deliverable dates;
 5. A log identifying the schedule constraints used and explanation of the reasons why and the purpose for using each constraint; and
 6. A description of the proposed working calendar(s) to indicate the “Calendar ID”, number of work days per week.

1.1.4 Schedule Updates.

- A. As part of, and in conjunction with the monthly reports, Contractor shall provide Department with any proposed update of the Baseline Schedule for Department’s review and approval and a progress narrative that describes, at a minimum, the overall progress for the preceding month, a critical path analysis including a description of any deviations in the project critical path since the previous schedule submission, a discussion of problems encountered or anticipated since the previous schedule submission and proposed solutions thereof. The “Schedule Update” shall

be based on the most recently accepted Baseline Schedule. All activities that are completed prior to the current “Data Date” shall show actual start and finish dates. All on-going activities shall show an actual start date and remaining duration to indicate the amount of time required to complete the remaining Work as of the current Data Date. Activity percent complete for on-going activities shall be based on amount of Work completed as of the current Data Date relative to the total amount of Work planned. Activity relationships for the remaining activities shall be modified as necessary to correct out-of-sequence progress for on-going and remaining activities to reflect Contractor’s current plan for completing the remaining Work. The Schedule Update shall be calculated using the current Data Date. The monthly progress narrative shall also include a description of work planned for the next update period and actions to be taken by Department or other involved third parties.

- B. If Department believes that the Baseline Schedule or any Schedule Update needs a specific revision, either in logic, activity duration, manpower or cost, it will submit a written request to Contractor. Contractor shall respond in writing within seven days, either agreeing with Department’s proposed revision, and henceforth including it in the next Schedule Update, or providing justification why it should not be accomplished. If revisions cannot be agreed upon either through written correspondence or subsequent meetings, Department, and Contractor shall agree to attempt to resolve the issues through the Dispute Resolution procedures described in Section 16 of this Amendment.
- C. Contractor shall submit for the Baseline Schedule and Schedule Update submission the following submittal items. Each electronic file submittal shall have a unique file name, submission type, and order of submission (e.g. C00012345DB01-B1, C00012345DB01-U1, etc.). The submittals shall include:
 - 1. A transmittal letter to the Department’s project manager for the CFX Project, identifying the date of submittal of the Baseline Schedule or Schedule Update being submitted for review;
 - 2. Two sets of CDs containing the electronic working file of the applicable schedule in Primavera proprietary exchange format (“.XER”) file format. Each CD shall be labeled to indicate the Contract ID, type of submission, filename, and Data Date;
 - 3. Two sets of paper copies of the following schedule reports:
 - i. Schedule calculation log;

- ii. A legible time-scaled bar-chart plot of the applicable schedule to show for each activity information corresponding to the following (and under the following headings: the “Activity ID”, “Activity Name”, “Original Duration”, “Remaining Duration”, “Start and Finish Dates”, “Activity Percent Complete”, and “Total Float.” The bar-chart plot shall identify the project critical path (longest path). Contractor shall prepare the time-scaled bar-chart portion of the applicable schedule using scheduling software that is wholly compatible with Department’s scheduling software system;
- iii. A legible network logic diagram plot of the applicable schedule depicting the order, interdependence of activities, and sequence in which the Work will be accomplished. Contractor shall prepare the network logic diagram plot of the Baseline Schedule using scheduling software that is wholly compatible with Department’s scheduling software system; and;
- iv. A tabular Predecessor/Successor report sorted in ascending order by Activity ID to show the following:
 - a. Activity ID;
 - b. Activity Name
 - c. Original Duration;
 - d. Remaining Duration;
 - e. Early Start;
 - f. Early Finish;
 - g. Late Start;
 - h. Late Finish;
 - i. Total Float;
 - j. Critical (Yes or No);
 - k. Predecessor Activity ID, Activity Name, Early Start, Early Finish, Relationship Type, Lag,

Driving (Yes or No), Constraint, and Constraint Date; and

- l. Successor Activity ID, Activity Name, Early Start, Early Finish, Relationship Type, Lag, Driving (Yes or No), Constraint, and Constraint Date.
 - v. One (1) set of electronic file copies by email of the following:
 - a. A working file of the applicable schedule in .XER file format;
 - b. Electronic Portable Document Format (".PDF") copy of the monthly progress narrative;
 - c. Electronic .PDF copy of the Activity Cost-loading Report ("ACR"). The ACR shall provide a listing of the budgeted costs for each cost-loaded activity. The ACR shall show the budgeted cost by activity grouped by Cost Account ID and sorted by Activity ID. The ACR shall also show the aggregate sum of the budgeted costs for each "Cost Account" and an overall summary of the budgeted costs for the project. The ACR shall show for each activity the Activity ID, Activity Name, Price/Unit, Budgeted Unit (Quantity), and Budgeted Cost; and
 - d. Electronic .PDF copy of the "Earned Value Schedule S-Curve."
- D. This process shall continue until completion of the Work under this Amendment. The 16th day of the month ("Data Date") of each Schedule Update shall coincide with Contractor's Application for Payment in accordance with Section 5(b) of this Amendment. Contractor shall prepare and maintain the Baseline Schedule or Schedule Update using scheduling software that is capable of meeting all requirements of this provision. Contractor's scheduling software shall be wholly compatible with Department's scheduling software system and shall have the capability to import and export project data in .XER format. Department's scheduling software system is the latest version of Primavera's Project Management software (currently P6 version 6.2). "Compatible" shall mean that Contractor-provided electronic file versions of the applicable schedule can be imported into Department's scheduling software system with no modifications, preparation or adjustments. At Contractor's request, secured access via the internet may be granted to allow Contractor to

develop and maintain the Baseline Schedule in the Department's scheduling software system.

- E. Submission of data from another software system where data conversion techniques or software is used to import into Primavera's scheduling software is not acceptable and will be cause for rejection of the submitted schedule.
- F. The Baseline Schedule and Schedule Updates shall conform to the following software settings:
 - 1. Define Project ID as the Contract ID number.
 - 2. Define project "Must Finish By" date equal to the Contract Final Completion date.
 - 3. Define the baseline for "Earned Value" calculations as the "Project Baseline."
 - i. Define the critical activities as "Longest Path."
 - ii. Define schedule calculation option to compute total float as "Finish Float = Late Finish – Early Finish."

2.1 Standards, Specifications, and Reference Documents

2.1.1 General

- A. Contractor shall design the Poplar Creek Section pursuant to the standards, specifications, and reference documents set forth in Section 2.1. If during its performance of the Work Contractor determines that a particular design criteria or specification is required for the Work but is not identified in the Technical Requirements, Contractor shall identify the particular design criteria or specification and submit it to the Department for review and approval prior to applying the design criteria or specification to the Work.
- B. For the avoidance of doubt, Section 109 of the *VDOT Road and Bridge Specification (2007)* entitled "Measurement and Payment," and any related Special Provisions and Special Provision Copied Notes, shall not apply to the Work.

2.1.2 Standard Documents

- A. Contractor shall perform the Work in accordance with Law and the Department's standards, specifications, and reference documents

including, but not limited to, the documents listed in this Section 2.1 (the “Standard Documents”).

- B. Contractor must verify and use the latest version of the documents listed herein.
- C. If, during the course of the Work, Contractor determines that a specific standard, specification, or reference document is required but not identified in this Section 2.1, Contractor shall be responsible for identifying the pertinent standard, specification, or reference document and submitting it to the Department for review and approval prior using such standard, specification, or reference document.
- D. In the event of a discrepancy between the Standards, Specifications, Reference Manuals, and non-Department standards, specifications, and reference manuals identified in this Section 2.1, AAHSTO standards shall take precedence over other Standards, Specifications, and Reference Manuals; *provided, however*, that Section 4.1 of these Technical Requirements shall govern all matters with respect to Embankments. Special Provisions included in this Section 2.1 or other Special Provisions selected for use in the Work that have been approved by the Department will govern over the Department specifications, design standards, and manuals. Special Provision Copy Notes approved by the Department and requirements specified within the text of this Amendment will govern over both Special Provisions and Department specifications, design standards, and manuals.

Standards and Specifications and Reference Manuals

Standards and Specifications

VDOT 2002 Drainage Manual, Revised 2010 (including current Errata Sheet)

VDOT Hydraulic Design Advisories (all current)

VDOT CADD Manual (Version 2009) (including 2010 revisions)

VDOT Traffic Engineering Design Manual (2006)

VDOT Right-of-Way Manual of Instruction (January 2011)

<http://www.virginia-dot.org/business/row-default.asp>

VDOT Utilities Manual of Instruction (January 2011)

VDOT Policy Manual for Public Participation in Transportation Projects (updated November 26, 2012)

VDOT Instructional & Information Memoranda (“**I&IM**”), All Divisions

VDOT Stormwater Program Advisory SWPA 12-01 dated April 5, 2012

VDOT Road and Bridge Standards, Vol. 1 and Vol. 2 (2008) including all revisions through August 2010

VDOT Road and Bridge Specifications (2007), (all except Section 100 therein and otherwise as set forth in this Section 2.1.1), including all revisions

VDOT Guardrail Installation Training Manual (GRIT) (October 2010)

VDOT Road Design Manual, Vol. I, including all revisions

VDOT Survey Manual (2010 Edition) including 2011 revisions

VDOT Manual of Instructions for Material Division, including revisions through October 2009 (the “MOI”)

VDOT 2011 Virginia Work Area Protection Manual

VDOT Traffic Engineering Division Numbered Memoranda

VDOT Mobility Management Division Memoranda

VDOT Materials Division Approved List

VDOT’s Minimum Requirements for Quality Assurance & Quality Control on Design Build and Public-Private Transportation Act Projects (January 2012)

VDOT Materials Division Memorandum Number MD299-07 for Materials Acceptance (October 4, 2007)

AASHTO A Policy on Geometric Design of Highways and Streets (2011)

AASHTO Roadside Design Guide (2011)

VDOT Manual of Structure and Bridge Division – Volume V Series

AASHTO LRFD Bridge Design Specifications, 6th Edition (2012)

AASHTO Manual for Assessing Safety Hardware, First Edition

NCHRP Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features

Corps of Engineers EM-1110-2-1906, Laboratory Soils Testing (1986)

Engineering Properties of Clay Shales, Report 1 by W. Heley and B. N. McIver
ASTMD 4644-08 – Standard Test Method for Slake Durability of Shales and Similar Weak
Rocks

Manual on Uniform Traffic Control Devices (MUTCD) (2009)
Transportation Research Board Highway Capacity Manual (HCM 2010)

Virginia Supplement to MUTCD (2011)

VDOT Traffic Operations Analysis Tools Guidebook, ver 1.1 (August 2013)

Reference Manuals

DCR Virginia Stormwater Management Handbook, Vol. 1 and Vol. 2 (First Edition – 1999)

DCR Virginia Erosion and Sediment Control Handbook (Third Edition – 1992)

VA Statewide Fire Prevention Code (referenced in Special Provision for Section 107.11 - Use of
Explosives)

ISEE Blasters Handbook (Current Edition)

Virginia Test Methods Manual (June 2010)

Virginia Calibration Methods (October 2008)

gINT© Manual

DCR Virginia Stormwater Management Program Technical Bulletin 1 (see
http://www.dcr.virginia.gov/stormwater_management/documents/tecbtln1.PDF)

Duncan, J.M. (April 2000) Factors of Safety and Reliability in Geotechnical Engineering,
Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Discussions and Closure
(August 2001)

State of Virginia Administrative Code: 4 VAC 25-130 (see
<http://leg1.state.va.us/000/reg/TOC04025.HTM>)

DMME Legal Requirements and Governmental Approvals (see
<http://www.dmme.virginia.gov/DMME/LawsRegs.shtml>
<http://www.dmme.virginia.gov//DMME/permitting.shtml>)

National Institute of Standards and Technology Handbook No. 44 for Specifications, Tolerances and Requirements for Weighing and Measuring Devices (2005)

LD-436, VDOT Location & Design, Quality Control Checklist

LD-293, VDOT Location & Design, Hydrologic and Hydraulic Analysis Report

Special Provisions (copies of the following Special Provisions are included as Attachment 2.1)

Federal:

c100ai04-0114 General Project Requirements, Supplemental Specifications (SSs), Special Provisions (SPs) and Special Provision Copied Notes (SPCNs), September 5, 2013 (SPCN)

S100B00 Project Communication and Decision Making for Design-Build Projects, January 3, 2005c, Reissued August 2009

SS51202 Supplemental Section 512—Maintaining Traffic Design-Build Projects, June, 2009

Environmental:

S107E02-0910 Volatile Organic Compounds (“VOC”) Emissions Control Areas, August 12, 2010

S107G01-0309 Storm Water Pollution Prevention Plan (“SWPPP”) General Permit for the Discharge of Stormwater from Construction Activities Contractor and Subcontractor Certification Statement, February 19, 2009

S107F01-0309 Special Provision for Storm Water Pollution Prevention Plan (“SWPPP”), February 19, 2009

Geotechnical/Materials:

S302B00-1212 Restoring Existing Pavement, January 14, 2008c

Special Provision for Controlled Blasting, April 14, 2008

Special Provision for Design-Build Tracking (“DBT”) Numbers, December 8, 2009

Special Provision For Elastic Inclusion, June 24, 2003

SS40402-0211 Hydraulic Cement Concrete Operations, December 17, 2010

Special Provision for Low Permeability Concretes For Design-Build Projects, June 1, 2008

Special Provision for Section 315 – Asphalt Concrete Pavement, November 25, 2009

Special Provision for Section 315 – Rideability for Asphalt Concrete Pavement, November 23, 2009

Roadway/Drainage:

SPCN c302h00-0708 Precast Drainage Structures, January 14, 2008

Special Provision for Flowable Backfill, March 11, 2010

Special Provision for Right of Way Monumentation and Final Boundary Stakeout, December 2, 2009a

Structure & Bridge:

Special Provision for Corrosion Resistant Reinforcing Steel, January 24, 2012

SS41301-0609 Dismantling and Removing Existing Structures or Removing Portions of Existing Structures, August 5, 2008

Special Provision for Drilled Shafts, November 18, 2009

Special Provision for Dynamic Pile Testing for End Bearing Piles for LRFD, July, 2008

Special Provision for Dynamic Pile Testing for Friction Piles for LRFD, July, 2008

Special Provision for MSE Walls (Modular Cantilever Facing), December 10, 2009

Special Provision for Quality Assurance/Quality Control (“QA/QC”) for the Construction of Deep Foundation Systems, March 4, 2010

Special Provision for T-Wall Retaining Wall System, December 10, 2009

Special Provision for Wave Equation Analysis for LRFD, July, 2008

Traffic Engineering:

SPCN Uniformed Flaggers, September 29, 2008a

General Conditions:

Special Provision for Section 301 – Clearing and Grubbing, November 15, 2006

Special Provision for Work Zone Traffic Control Management for Design-Build,
revised November, 2009

3.1 Roadway Design Criteria

3.1.1 General Requirements

- A. The Roadway design criteria are summarized in the design criteria tables set forth in Attachment 3.1 to the Technical Requirements.
- B. The information contained herein and Attachment 3.1, including, but not limited to, the design criteria and other notes and data, contain the minimum Roadway geometric design requirements that Contractor shall meet in its development of the Poplar Creek Section.

3.1.2 Functional Classification

- A. The U.S. Route 121/U.S. Route 460 mainline of the Poplar Creek Section beginning at the eastern end of the rough graded Hawks Nest Section of U.S. Route 121/U.S. Route 460 to the future Connection with the Elkins Section is classified as a “Rural Principal Arterial” pursuant to the *VDOT Road Design Manual*. Contractor shall design the mainline Roadway in accordance with the Department’s geometric design standard GS-1 Modified as “Other Principal Arterial” in mountainous terrain with a minimum design speed of 60 miles-per-hour and a minimum radius of 1204 feet. The minimum continuous grade utilized throughout the Poplar Creek Section shall be 0.5%. Mainline Typical Sections for U.S. Route 121/U.S. Route 460 are set forth in Attachments 3.1A and 3.1B. The mainline typical section for the U.S. Route 121/U.S. Route 460 bridge over Poplar Creek is set forth in Attachment 3.1G, which contains shoulder widths based on AASHTO long bridge design.

The proposed Elkins Section of U.S. Route 121 is also classified as “Rural Principal Arterial,” pursuant to the *VDOT Road Design Manual*. Contractor shall design the mainline Roadway in accordance with the Department’s geometric design standard GS-1 Modified as “Other Principal Arterial” in mountainous terrain with a minimum design speed of 60 miles-per-hour and a minimum radius of 1,204 feet. The minimum continuous grade utilized throughout the Elkins Section shall be 0.5%. Contractor shall make design provisions in the Public Hearing plans for the future connection between the mainline of the Poplar Creek Section

and the Elkins Section by incorporating a minimum of three (3) connections for review and selection by the Department. The Department selected option shall be incorporated into the plans provided at the Design Public Hearing. Each proposed interchange option shall provide a Level of Service C or better on all approach, ramp, weave, and merge segments in accordance with the *Highway Capacity Manual (2010)*. Each proposed intersection option shall provide Level of Service C or better for all movements in accordance with the *Highway Capacity Manual (2010)*.

- B. The US Route 460 Grundy Tie-in of the Poplar Creek Section from the eastern side of the future connection with the Elkins Section to the eastern terminus of the CFX Project is classified as an “Urban Principal Arterial,” pursuant to the *VDOT Road Design Manual*. Contractor shall design the Grundy Tie-in Roadway based on the following locations and criteria:
- i. The portion of the Grundy Tie-In from the eastern side of the future connection with the Elkin Section to the western side of the Levisa Fork/NS Railway bridge consists of geometric design standard GS-5 as “Other Principal Arterial” with a minimum design speed of 50 miles-per-hour and a minimum radius of 1,204 feet and with a transition from geometric design standard GS-1 “Modified Rural” at the western end of the Grundy Tie-In. The Grundy Tie-In typical section for US Route 460 is set forth in Attachments 3.1D.
 - ii. The portion of the Grundy Tie-In from the western side of the Levisa Fork/NS Railway bridge to the eastern terminus of the CFX Project is geometric design standard GS-5 “Other Principal Arterial with Curb and Gutter” with a design speed of 50 miles-per-hour and a minimum radius of 929 feet. The Grundy Tie-In typical sections for U.S. Route 460 are set forth in Attachments 3.1E and 3.1F. The typical section for the U.S. Route 460 bridge over the Levisa Fork/NS Railway set forth in Attachment 3.1E contains shoulder widths based on AASHTO long bridge design.

The Contractor shall provide a design for multi-directional traffic movements between the Grundy Tie-in and to the future U.S. Route 460 Alternate.

- C. Route 614 is classified as a “Rural Local Road” pursuant to *VDOT Road Design Manual*. Contractor shall design the Roadway in accordance with the Department’s geometric design standard GS-4. The typical section for Route 614 under U.S. Route 121 is set forth in Attachment 3.1C.

4.1 Roadway Embankments

- A. In light of the Coal Synergy being used to help develop the CFX Project, Contractor shall design the Embankments in accordance with 4 VAC 25-130-816.71 (“Disposal of Excess Spoil; General Requirements”) and the specific requirements for various Embankment types as applicable, which shall supersede the Standard Documents.
- B. Disposal of Excess Spoil; Valley Fills/Head of Hollow Fills – Utilization of excavation or excess spoil for Embankments is governed by the general requirements set forth in 4 VAC 25-130-816.72.
- C. Disposal of Excess Spoil; Durable Rock Fills – Utilization of excavation or excess spoil for Embankments is governed by the general requirements set forth in 4 VAC 25-130-816.73. Durable rock shall be comprised of nonacid and nontoxic forming rock (sandstone or limestone) that does not slake in water and will not degrade to soil Material.
- D. Laboratory Testing – To determine the suitability of Material for durable rock fills, Contractor shall conduct laboratory testing on rock core samples consisting, at a minimum, of SDI and UCS for the development of design parameters. The SDI value shall be determined for 5 cycles. The number of each test shall be determined based on the number of rock units encountered in each cut. Contractor shall provide stratigraphic correlation and perform a minimum of five SDI tests for each stratum encountered in every cut section. The tests shall be distributed among the borings within the cut section.
- E. Disposal of Excess Spoil; Preexisting Benches – Utilization of excavation or excess spoil for Embankments is governed by 4 VAC 25-130-816.74.
- F. Topsoil and Subsoil – topsoil and subsoil for Embankments are governed by 4 VAC 25-130-816.22.
- G. For purposes of this Amendment, references to “division” in 4 VAC 25-130-816.71, 816.72, 816.73, 816.74, 816.22 shall mean the Department. The Department will not require groundwater monitoring.
- H. Contractor shall determine the location of off-Site Borrow Material sites, if necessary, and shall obtain and maintain all required rights of entry or acquisition to such off-Site Borrow Material sites. Contractor shall test any Materials obtained from Borrow sites in accordance with Law and the Technical requirements.

5.1 Environmental

A. Air Quality

- i. The CFX Project has been assessed for potential air quality impacts and conformity with Law and the Site lies in an area that is currently in attainment with all NAAQS.
- ii. Contractor shall perform the Work in compliance with all DEQ air pollution regulations.

B. Preliminary Investigation of Impacts to Jurisdictional Waters

- i. For use in determining potential impacts associated with the Poplar Creek Section, the Contractor will complete a wetland/stream assessment of the Site.
- ii. Activities associated with such assessment include but are not limited to the following:
 - a. checking maps, aerial photos, soil surveys, and other relevant sources of information about the Site;
 - b. walking the Site to identify potential wetlands and streams;
 - c. completing data sheets for plant communities in the area;
 - d. flagging the ordinary high water mark for streams and any wetlands;
 - e. field surveys of high water mark flags using GPS; and
 - f. preparing a report of the wetland/stream assessment.

6.1 Structures

6.1.1 Location of Structures

- A. There are two (2) bridge locations within the Site, as shown in Table 1 below, each of which carries the Poplar Creek Section or U.S. Route 460 over a significant stream, river, railroad, or road:

Table 1 – Bridge Locations

| Crossing | Length | Minimum Vertical Clearance |
|----------|--------|----------------------------|
|----------|--------|----------------------------|

| | | |
|---|------------------|---|
| U.S. Route 460/Poplar Creek Section over Poplar Creek and Route 604 | To be determined | Over roadways – 16.5 Feet |
| U.S. Route 460 over Levisa Fork/Norfolk Southern railroad | To be determined | Over roadways – 16.5 feet Over railroads – 23.0 feet |

- B. The design of the bridges shall comply with this Section 6.1.

6.1.2 Structure Design

- A. All Bridge design work will utilize the AASHTO LRFD Bridge Design Specifications, 6th Edition, 2012 including VDOT Modifications (Instructional and Informational Memorandum (“IIM”) - S&B-80) and other pertinent Department I&IMs. Bridge design will be in conformance with the *VDOT Road and Bridge Standards (2010)* and the *VDOT Road and Bridge Specifications (2007)*.
- B. All details and drawings shall be in accordance with Volume V Series of the *Manual of the Structure and Bridge Division*. The Contractor may propose deviations from the Department’s current standards, subject to the Department’s approval.
- C. Details and drawings not specifically included in the Volume V Series of the *Manual of the Structure and Bridge Division* may only be included in the structural plans and working drawings after review and approval by the Department. Should any such details not be acceptable, the Contractor shall make the necessary modifications or shall submit an alternate detail that is acceptable to the Department.
- D. The Department’s standard details, including the Department’s design aids, are available at: www.virginiadot.org/business/bridge-manuals.asp.
- E. Any special provisions not covered by the Department’s Road and Bridge Specifications, Special Provisions, and Copied Notes shall be prepared by the Contractor and reviewed and approved by the Department.
- F. The Contractor shall prepare bridge plan design submissions in accordance with Table 2 below. Preliminary plans (30% - Stage 1) shall be prepared for the minimum number of alternatives to be selected approved by the Department as shown in Table 2. Intermediate plans (60%) shall be prepared based on the Department selected and approved preliminary plan, as shown in Table 2.

Table 2 – Bridge Plans Design Submissions for Poplar Creek Section

| Preliminary Plans (30% - Stage 1) | | Intermediate Plans (60%) | |
|---|--------------------------------------|--------------------------------------|---|
| Poplar Creek | | Poplar Creek | Levisa Fork/NA Railway |
| Separate Bridges – Minimum Alternatives | Single Bridge – Minimum Alternatives | Single Bridge – Minimum Alternatives | Department Selected and Approved Preliminary Plan |
| 1) steel | 1) steel | 1) steel | Department Selected and Approved Preliminary Plan |
| 2) concrete | 2) concrete | 2) concrete | |
| | | 3) steel and concrete | |

1. Preliminary Plan (30% - Stage 1) Submission:

- i. The Contractor will submit Preliminary plans (30% - Stage 1) for each new permanent structure documenting how the structure geometrics were determined.
- ii. The Preliminary Plan (30% - Stage 1) will include:
 - a. a plan view, developed section along Bridge centerline/construction baseline and a transverse section, as further described in the Standard Documents;
 - b. completed Stage I Bridge Report Summary, using the form appended hereto as Attachment 6.1.2F (the preliminary geotechnical recommendation report is required with the Preliminary Plan (30% - Stage 1) submission); and
 - c. copies of design exceptions and waivers that influence the design of the structure or roadway approaches both over and under and will include a write up on how the design exceptions and design waivers affect the bridge (for details, see IIM-LD 227.8 – Design Exceptions/Waivers and IIM-S&B-70.5 – Design Exceptions/Waiver.
- iii. The Preliminary Plan (30% - Stage 1) submission must be submitted to and approved by the Department prior to commencement of the Intermediate Plan (60%) submission. The Department will not review any Intermediate Plan (60%) submission until the Preliminary Plan (30% - Stage 1) submission has been approved by the Department. The commencement of the Intermediate Plan (60%) submission prior to the approval of the Preliminary Plan (30% - Stage

1) submission by the Department will be done solely at the risk of the Contractor.

- iv. The Preliminary Plan (30% - Stage 1) will be subject to modifications based upon requirements identified in the detailed hydrologic and hydraulic study and scour analysis of the waterway crossing.

2. Intermediate Plan (60%) submission:

- i. 60% design shall be developed to the level of detail described in this subsection. Tasks that are not required to be completed (or in some cases, may not have been started) are checking, final quantities, elevations, and reinforcing steel schedule.
- ii. The front sheet of the submission must include all information shown in Volume V Series of the *Manual of the Structure and Bridge Division*.
- iii. Geotechnical/foundation information (if not previously reviewed and accepted by the Department) includes:
 - a. geotechnical boring logs
 - b. geotechnical recommendations;
 - c. the foundation/geotechnical report; and
 - d. slope stability.
- iv. The submission must include recommendations for bank erosion protection.
- v. Superstructure member sizes have been developed, including girder plate sizes and cut-offs or type/size of prestressed slab/beam which is reflected through the following documentation:
 - a. transverse section;
 - b. framing plan/erection diagram;
 - c. girder elevation sheet(s) or prestressed slab/beam details;

- d. cross frame sheets shall be included, including any anticipated modifications to standard drawings;
 - e. non-standard superstructure details;
 - f. deck placement sequence;
 - g. stage construction sheet including all staging information;
 - h. curved girder layout; and
 - i. curved girder bearing layout.
- vi. The following are applicable for concrete segmental box girder bridges:
- a. segment dimensions and reinforcement;
 - b. segment layouts;
 - c. post-tensioning layouts and details;
 - d. erection schematics;
 - e. permanent electrical interior lighting and outlets on 50-foot centers for bridge inspection personnel; and
 - f. vermin screening at all expansion joint areas.
- vii. Substructure elements have been sized, including footing sizes, stem thickness, pile/shaft loads (horizontal and vertical), locations for demonstration or trial shafts, pile estimated tip elevations, minimum shaft tip elevations, pier cap depth/width and column size and layout, which shall be reflected in the following:
- a. general plan and elevation;
 - b. substructure layout to include utilities and boring layout;
 - c. abutment plan, elevation, and sections, including footing elevations and dimension of major width, length, and depths or thicknesses;

- d. Pier or bent plan elevation and sections (dimension major width, length and depth or thickness, with schematics showing reinforcing and partial bar marks on major elements);
 - e. boring logs (geology sheets) completed (only if not shown in geotechnical report).
- viii. Constructability shall be investigated thoroughly as shown in the supplemental documentation listed below. Information shall be provided, which clearly identifies:
- a. shoring, where required, shall be shown to anticipated limits, including location of footings, tie backs, excavation, etc. (matches up to issues addressed at field inspection on LD-436, VDOT Location & Design, Quality Control Checklist);
 - b. all temporary clearances shall be shown (including coordination with MOT, when required, matches up to issues addressed at field inspection on LD-436, VDOT Location & Design, Quality Control Checklist);
 - c. discussion of conflicts which need to be addressed and if no conflicts are known to exist, a declaration should be provided that states “no known conflicts related to substructure construction and/or superstructure construction are anticipated or have been identified;”
 - d. final staging limits shall be shown, including coordination with MOT when required (matches up to issues addressed at field inspection on LD-436, VDOT Location & Design, Quality Control Checklist);
 - e. location of proposed easements (matches up to issues addressed at field inspection on LD-436, VDOT Location & Design, Quality Control Checklist);
 - f. permit sketches (matches up to issues addressed at field inspection on LD-436, VDOT Location & Design, Quality Control Checklist);

stiffeners, etc., which are anticipated to follow Volume V Series of the *Manual of the Structure and Bridge Division*), detailed elevations of substructure units (i.e., no rebar need be detailed, bars do not need to be shown or labeled, except as noted above for piers/bents).

G. All load modifiers shall have a default value of 1.05 for all limit states.

H. Design Loading:

Dead Loads:

| | |
|--|-----------------|
| Normal Weight Reinforced Concrete | 150 lbs/cu.ft. |
| Structural Steel | 490 lbs/cu.ft. |
| Future Wearing Surface | 20 lbs/cu.ft. |
| Construction Tolerances/Construction Methods | 20 lbs/cu.ft. |
| Concrete Parapets (Type F) | 425 lbs/lin.ft. |
| Bridge Supported Utilities | None |

Live Loads:

The design live load for the LRFD method is HL-93, and will be distributed using AASHTO LRFD Specifications

Wind Loads:

The design wind load shall be per AASHTO LRFD Specifications

Seismic Analysis:

A seismic analysis for the appropriate zone shall be conducted for all Bridges.

I. English (imperial) units of measure shall be used for the Bridge design and contract drawings.

6.1.3 Structure Types

A. Allowable Alternatives – Bridge type and layout shall be based on reducing long-term maintenance costs. The use of continuous span units and jointless bridge design technologies shall be used as outlined in the *Manual of the Structure and Bridge Division*, Volume V – Part 2 Chapter 17. Joints in bridges may be used only with specific written approval of the Department through a design waiver. Where it is necessary to accommodate a large amount of movement at abutments, the Virginia Alternate Abutment Detail shall be used.

- B. Cable stayed bridges, trusses, steel tied arch and fracture critical Bridges (including, but not limited to, transverse cross sections with less than four girders) are not acceptable. No timber bridge elements of any kind will be acceptable for use in the proposed structures. Prestressed concrete beam type Bridge is an acceptable structure over Levisa Fork/Norfolk Southern railroad.
- C. For the structural steel alternative, straight, horizontally curved, tapered (haunched) girders and steel box girders are acceptable. The alternative shall provide a deflection management system to control the magnitude of deflection in the longitudinal direction.
- D. For the concrete alternative, prestressed or post-tensioned Virginia Bulb-Tee type Bridges are acceptable. Alternate Bulb-Tee types will require the State Structure and Bridge Engineer's approval. AASHTO shapes will not be permitted. Externally post-tensioned segmental concrete box girders (unstayed) type Bridge is acceptable. An internally post-tensioned segmental type bridge is undesirable but acceptable. A cost comparison shall be provided between the externally and internally post-tensioned concrete segmental structures, when the internally post-tensioned structure is the recommended concrete alternate.

6.1.4 Concrete and Structural Steel

- A. The proposed structures shall utilize low permeability concrete in accordance with the current Special Provision for Low Permeability Concretes for Design-Build Projects. The structural beams/girders shall be either prestressed and/or post-tensioned concrete or structural steel in accordance with the AASHTO Specifications and Department modifications to AASHTO. Concrete strengths up to 10,000 psi concrete are allowed in prestressed element applications only. All other concretes shall not exceed 8,000 psi.
- B. If structural steel is proposed, the material shall be weathering steel if the conditions meet the requirements of the FHWA Technical Advisory T5140.22, "Uncoated Weathering Steel in Structures." Structural steel hybrid girders using HPS Grade 70W are acceptable. Grade 100 steel will not be allowed. Painting is not required for a jointless structure except as specified in Section 411.06(a) of the Department's *Road and Bridge Specifications (2007)*.

6.1.5 Reinforcing Steel

- A. Based on the functional road classification, Principal Rural Arterial, Class III (or Solid Stainless) for superstructure items and Class I (or Low

Carbon/Chromium) for substructure neat items require the use of Corrosion Resistant Reinforcing (CRR) Steel in accordance with Instructional and Informational Memorandum IIM-S&B-81.5.

- B. Plain reinforcement shall be used elsewhere. Plain reinforcement shall conform to the requirements of ASTM A615, Grade 60.
- C. Epoxy coated reinforcing steel will not be permitted for use on the Poplar Creek Section.

6.1.6 Prestressing Steel

- A. Prestressing strands shall be AASHTO M203, Grade 270, low-relaxation strands. Strands shall be 0.6 inches and have an apparent Modulus of Elasticity of 28,500 kip/in².

6.1.7 Hydraulic Design

- A. The proposed stream and river crossing structures shall be designed to meet all applicable hydraulic requirements, including current FEMA and Department guidelines as described in the latest edition of the *VDOT Drainage Manual*. Contractor shall deliver to the Department a preliminary hydrologic and hydraulic analysis and a final scour analysis for the proposed Bridges as described in Section 6.1.1. These analyses shall be submitted to the Department for review and approval with the Preliminary plans (30% - Stage 1) submission.

6.1.8 Pier Locations

- A. If possible, the piers for each Bridge crossing a river or stream shall be located far enough away from the stream so that no excavation shall interfere with the flow of the stream or require cofferdams.
- B. All piers located adjacent to vehicular traffic shall meet the crash load requirements of AASHTO 3.6.5 (“Vehicular Collision Forces” and the requirements in Chapter 15 – Piers in Vol. V – Part 2 in the *Manual of the Structure and Bridge Division* and standard details in Volume V – Part 3 of the *Manual of the Structure and Bridge Division*).

6.1.9 Durability

- A. All Bridge structures, including corrosion resistance and durability measures, shall be designed to ensure a minimum design life of 75 years. All structure alternatives should be designed to minimize maintenance over the design life.

- B. The proposed steel and concrete alternates shall minimize long term maintenance requirements. A life cycle cost analysis shall be performed for each alternative and the Contractor shall build the alternate that has the least present worth cost when evaluated over a 75 year life. The Contractor shall use a 1.75% interest rate when determining the present value for the alternatives under consideration.

6.1.10 Reserved

6.1.11 Structural Approach Slabs

- A. Structural approach slabs will be required at all Bridge locations. Approach slabs and sleeper slabs, if the latter is required, shall conform to the requirement of the *Manual of the Structure and Bridge Division* Vol. V – Parts 2 and 3. A sleeper pad is required when the bridge abutment is either integral or semi-integral.

6.1.12 Deck Drainage

- A. Provide adequate drainage for the Bridge structures; in particular, the designed system must be able to drain and control runoff that is on the bridge deck. Bridge deck drainage analysis and design shall be performed in accordance with the latest version of FHWA Publication HEC21-Design of Bridge Deck Drainage and the VDOT Drainage Manual. If scuppers and downspouts are required, then all hardware components for the deck drainage system shall conform to requirements of Section 226 of the Department's Road and Bridge Specifications, shall be galvanized steel, and shall be designed to minimize maintenance activity (minimum eight inch diameter pipe shall be used). Provisions shall be made to provide clean-outs in the pipe and downspout systems. Pipes and downspouts, if needed, shall be hidden to the maximum extent possible. Deck drains when utilized shall be positioned over water or to spill onto the slope protection or erosion control stone.

6.1.13 Bridge Parapets

- A. The bridge parapets for each bridge shall be cast-in-place concrete parapet (F-Shape with two inch diameter bridge conduit system) for each bridge parapet. Slip forming of parapets is not allowed.

6.1.14 Geotechnical Requirements for Bridges

- A. The minimum geotechnical requirements are for Geotechnical Engineering Reports are addressed in the VDOT Materials Division Manual of Instructions, Chapter III - Geotechnical Engineering.
- B. Bridges and approaches shall accommodate settlement as documented in Attachment 6.1.14A (the Additional Foundation Criteria).

6.1.15 Retaining Walls

- A. The maximum height of retaining walls on the Poplar Creek Section shall be limited to 50 feet as measured from the base of the leveling pad or footing to the top of the wall, including any height in front of the wall which may be backfilled.
- B. MSE walls that require traffic protection at the stop shall utilize barriers or railings on moment slabs.

6.1.16 Constructability Analysis and Life Cycle Cost Comparison

- A. The Contractor shall perform a constructability analysis as outlined in the AASHTO LRFD design specifications (Sections 2.5.3, 2.5.4, and 6.10.3).
- B. A constructability analysis and life cycle cost comparison shall be provided for each alternative proposed in the Preliminary Plan (30% - Stage 1) submission.

6.1.17 Bridge Construction Unit Cost Report

- A. Each Bridge alternate shall provide estimated quantities along with the associated unit costs for all standard and non-standard bridge items.
- B. The Contractor shall provide estimated quantities, along with associated unit costs, for all standard and non-standard Bridge items for each alternate (i.e., concrete and steel) in the Preliminary Plan (30% - Stage 1) submission. The Contractor shall provide updated pay items, quantities, and cost estimates (in the same format as the approved Preliminary Plan (30% - Stage 1) submission for the selected alternate) with the Intermediate Plan (60%) submittal.

6.1.18 Inspection Access Requirements

- A. Contractor shall comply with the following access requirements for inspection and maintenance of the bridge structure at Poplar Creek. All features noted below shall be designed to be in compliance with the *VDOT 2011 Virginia Work Area Protection Manual* and OSHA:
1. An interior stairway/ladder platform system shall be provided inside each hollow pier column for inspection purposes. The type and locations of interior platform system shall be approved by the Department.
 2. Inspection access doors shall be located at each hollow pier, approximately ten feet above ground level for security purposes and face the uphill side of the slope. The inspection access doors shall be lockable, using a keyed locking system (no padlocks) and an exterior platform with an open steel mesh floor shall be provided at each door. The access doors will be accessed by ladder brought by the inspection team at time of inspection. No permanent ladder shall be installed. An 8'x8' concrete leveling pad shall be provided underneath the steel mesh exterior platform to allow for placement of the inspection ladder and portable generator for inspection team. The concrete pad placement shall be located to provide easy access to the overhead platform.
 3. Hollow pier caps, if any, should have access either in the form of doors from the top of the interior pier stairwells, or from manholes located in the top of the pier caps.
 4. Interior lighting shall be provided for all hollow pier columns, caps and in superstructures constructed of segmental units. There shall be a minimum of one (1) lockable electrical access port at the top and bottom of each hollow pier and both ends of each segmental unit to allow the use of a portable generator. The electrical access port shall be located near the elevated inspection door. Lighting throughout the structure shall be connected so that all lights will operate when a single portable generator is connected to any port.
 5. The interior of each hollow pier shall be marked with elevations at a minimum of every ten feet for the entire height of column. The interior of segmental concrete and steel box units shall have distances marked in ten foot increments and pier

identification locations provided for each span. These markings will be used as a reference during bridge safety inspections.

6. Contractor shall conduct a ventilation study to determine if additional openings are required to provide adequate ventilation during inspection. Any openings required for ventilation shall be fitted with protective screening.
- B. For Bridges featuring hollow stem piers, permanent service roads shall be designed to provide access to piers for inspection and maintenance purposes. For Bridges featuring solid stem piers, the Department will determine if permanent service roads are required as part of the development of the applicable Preliminary Plans (30% - Stage 1). The access roads shall be designed as a GS-9 Standard Service Road Dead End, 10 mile-per-hour design speed, mountainous terrain. It shall be the responsibility of Contractor to locate and design the permanent pier access road system.
- C. Contractor shall comply with the following Structure Vulnerability Requirements for each of the Bridges.
1. The walls of each hollow pier shall be a minimum of three feet thick, extending from the top of the footing to ten feet above ground level.
 2. Permanent access roads to the bridge columns shall have lockable gates at the access road entrances to deter unauthorized entry.
 3. A minimum "standoff" distance of 25 feet shall be provided at the base of each pier. The standoff distance is defined as the minimum distance a vehicle can be parked away from the pier column. The standoff distance shall be obtained by placing permanent barriers at the end of each access road to prevent vehicles from approaching the face of the pier columns.

7.1 Survey

- A. Contractor shall perform all field survey and Utility data collection activities necessary to perform the Work, including:
1. horizontal control;

2. vertical control;
 3. notification to landowners;
 4. post photography control;
 5. photogrammetry;
 6. field data;
 7. topography;
 8. property data;
 9. Utilities;
 10. levels; and
 11. DTM.
- B. Pursuant to Virginia Code § 33.1-94, Contractor shall provide “Notice of Intent” letters under the Department’s letterhead to all landowners where access to private property for survey or other similar Work is necessary. Contractor shall deliver copies of all sent letters and address labels to the Department promptly following dispatch.
- C. Contractor shall obtain all required survey data, including all right of entry and land use Governmental Approvals, locating and/or designating underground Utilities, DTM, Utility test holes, and obtaining other related data necessary for the preliminary design and limited access revisions. Additionally, Contractor shall provide all updates (landowner changes, subdivisions, etc.) that may occur and needs to be reflected on the Plans in order to acquire Project ROW and complete the final design. Any additional survey changes shall be verified and certified and submitted in final documentation. Contractor shall bear all costs and expenses arising out of or relating to any change to the Work (excepting Change Directives) that require reauthorization of the CTB (including, but not limited to, changes to the limited access points).

8.1 Geotechnical Work

8.1.1 General

- A. Contractor shall perform a design-level geotechnical engineering investigation of the Site. The geotechnical engineering investigation performed shall meet or exceed the standards and specifications set forth in Chapter 3 of the MOI with the following exceptions: (i) spacing of borings along the centerline in cut sections is 300 feet or as proposed by Contractor and approved by the Department and (ii) the location and

frequency of borings or other exploratory methods in embankment sections shall be proposed by Contractor and approved by the Department. Contractor shall also prepare the Geotechnical Engineering Report per the MOI, which shall include subsurface investigations delineated in Section 8.1.2 of these Technical Requirements. Contractor acknowledges that Department is not providing, and will not provide, a geotechnical data report with respect to the CFX Project.

- B. Contractor shall collect appropriate data for geotechnical evaluation of Embankments, soil and rock cuts, SWM facilities and any other earth-supported or earth-retaining structures or elements of highway design and construction required for the CFX Project. Contractor shall collect appropriate data for a geotechnical evaluation of structures and Bridges. Contractor shall have obtained all necessary Governmental Approvals and Utility clearances prior to accessing public or private property for the purpose of conducting geotechnical field Work. Contractor shall complete laboratory tests in accordance with applicable ASTM or AASHTO standards, as prescribed in the MOI, and analyze the data to provide design and construction requirements. Soils, rock, aggregate, and other Materials tests shall be performed by a laboratory accredited through the AASHTO Accreditation Program (AMRL and CCRL, as applicable) for each test it conducts for the CFX Project.
- C. Contractor shall specify installation of two settlement monitoring monuments per embankment and one inclinometer (to a depth the shorter of (i) the vertical distance from the highest point of the deepest vertical fill and (ii) 300 feet, in either case, below the finished pavement subgrade) for the CFX Project and, in each case, at locations to be approved by Department to monitor settlement of Fill Slopes, benches and finished-grade Roadway. Contractor shall specify that the finished pavement subgrade be reestablished after settlement has occurred.
- D. Contractor shall provide Department with all records of subsurface explorations and describe the soils and rock encountered with their depth limits in accordance with the requirements outlined in Chapter 3 of the MOI. Contractor shall provide to Department electronic copies of all subsurface explorations in accordance with the boring log template in Chapter 3 of the MOI. The electronic files shall be provided by a certified professional geologist, or a suitably qualified PE registered in the State, in gINT© software format.
- E. Contractor shall provide lithological information of geological strata to include coal, clay, clay product, sandstone, shale and other Materials on

all profiles and cross-sections generated for design of the finished-grade Roadway. Underground Mine Works shall be shown in plan view, and shall show pillared and unpillared areas. Underground Mine Works shall be shown in the plans.

- F. Where applicable, Contractor shall incorporate reliability assessments in conjunction with standard analysis methods. Department will accept reliability assessments applying the method set forth in Duncan, J.M. (April 2000) *Factors of Safety and Reliability in Geotechnical Engineering*, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Discussions and Closure, August 2001. Contractor's design Work shall provide a probability of success equal to or greater than 99 percent. Contractor shall include the factors of safety for slope stability and settlement and bearing capacity of Embankments in its reliability assessment. Contractor may propose to identify specific, non-critical features, and alternative methods for evaluating variability of subsurface conditions, reliability and minimum factors of safety, prior to submission of its design calculations and drawings. Department may, in its sole discretion, accept or reject such proposed methods.
- G. Contractor shall submit to Department for its review all geotechnical design memoranda and/or reports that summarize subsurface investigations, tests, and geotechnical engineering evaluations and recommendations utilized in support of its design documents. The submittal of the final Geotechnical Engineering Report shall be made in accordance with Approved Baseline Schedule. The results of the geotechnical investigation and laboratory results shall support design efforts to meet the requirements outlined in this Section 8.1.
- H. Contractor shall review all available geologic information, including all published geologic information, in connection with its Work under this Section 8.1.
- I. Contractor shall compile profiles of coal seams associated with the Underground Mine Works and from coal seam information obtained from geologic borings, and Contractor shall include this information in the Geotechnical Engineering Report.

8.1.2 Geotechnical Requirements

- A. Contractor shall analyze methods to minimize differential settlement for new construction and provide construction recommendations to address

soil-structure interaction to accommodate the mining-related construction methods applied to the CFX Project.

- B. Contractor shall design stable Cut Slopes and Embankment slopes and evaluate stability for interim construction stages (including temporary construction conditions of the Work), for the final construction condition, and for design-life conditions.
- C. Design Cut Slopes in bedrock shall satisfy the following procedures and minimum requirements that Contractor shall:
 - 1. *Perform a Field Reconnaissance:* Contractor shall perform a Site reconnaissance that includes but is not limited to: (i) logging of rock exposures in and around the Project ROW, (ii) measurement of the orientation and condition of joints and other discontinuities in exposures and (iii) observation of the performance of existing Cut Slopes in the same rock units expected to be encountered in the CFX Project stratigraphy.
 - 2. *Perform the Subsurface Investigation:* Contractor shall develop a subsurface investigation program at intervals no greater than specified in Chapter 3 of the MOI with the exceptions noted in Section 8.1. In addition to procedures in the MOI, Contractor shall measure and report “Rock Quality Designation” (“RQD”) for each core run and for each *stratum* (“SRQD”) where the length of all the RQD rock within a stratum is divided by the thickness of the stratum.
 - 3. *Develop Geologic Profile(s):* Contractor shall develop geologic profile(s) for the Roadway alignment(s). This/these profile(s) shall include both previous and new borings and be used to define and thoroughly characterize the stratigraphy and lithology of each rock and coal unit in each cut.
 - 4. *Laboratory Testing:* Contractor shall conduct laboratory testing on rock core samples consisting, at a minimum, of SDI and UCS for the development of design parameters. The SDI value shall be determined for 5 cycles. The number of each test shall be determined based on the number of rock units encountered in each cut. Contractor shall provide stratigraphic correlation and perform a minimum of 5 SDI tests for each stratum encountered in every cut section. The tests shall be distributed among the borings within the cut section.
 - 5. *Rock Cut Minimum Slope Criteria:* Contractor shall refer to, and

use in its design, the following Table 3 to determine the configuration of the rock Cut Slopes:

Table 3: Minimum Slope Design Criteria for Rock Cut Slopes – Poplar Creek Section

(For rock with 5-cycle SDI > 50% and Type I or II Fragments)¹

| Bedrock Category | SRQD (%) | UCS (psi) | Slope^{1,4} Ratio (H:V) | Max Height Between Benches³ (ft) |
|-------------------------|-----------------|----------------------------------|--|--|
| A | >70 | > 5,000 3,000-5,000 <3,000 | ½H:1V ² ½ H:1V 1H:1V | 40 |
| B | 51-70 | >5,000 3,000-5,000 <3,000 | ½ H:1V ½ H:1V 1H:1V | 40 |
| C | 20-50 | >5,000 3,000-5,000 <3,000 | ½ H:1V 1H:1V 1H:1V | 40 |
| D | <20% | NA | 1.5H:1V | NA |

Notes:

¹ For rock units with a 5-cycle SDI <50% and/or Type III fragments, use 1.5H:1V unless proven history of past performance indicates steeper slope is acceptable and if approved by Department.

² May use ¼ H:1V for sandstone.

³ Within the same lithologic unit

⁴ Represents the minimum allowable slope ratio for all rock Cut Slopes. Contractor shall perform the required analysis based upon the criteria outlined herein to determine if a flatter slope is required to achieve adequate stability of the Cut Slope.

6. *Cut Slope Benches*: Contractor shall design Cut Slope benches at the following locations:

- i. Lithologic Bench – Both at the base of sandstone units, which are underlain by shale, claystone, clayshale or coal units and at the base of rock units which are underlain by

units having SDI values lower than 50%.

- ii. Soil/Rock Transitions Bench - At the soil/bedrock interface at the top of cut unless previously approved otherwise, in writing, by Department.
 - iii. Maximum Interval Bench - At maximum intervals indicated in Table 3.
7. *Lithologic and Maximum Interval Benches; Soil/Rock Transition Benches:* Contractor shall design lithologic and maximum interval benches with a minimum width of 15 feet and soil/rock transition benches with a minimum width of 10 feet. All benches shall be sloped toward the Roadway at a slope 15H:1V to 20H:1V.
 8. *Rockfall Containment Ditch:* Contractor shall design a rockfall containment ditch at road level. This ditch shall be designed using either the “Ritchie Ditch” (Ritchie, 1963) or the “Oregon Ditch” (Pierson et al, 2001) criteria. Contractor shall design the ditch to drain and prevent ponding of water. Rock fall fence barriers, draped fencing or other rockfall control methods of any kind shall not be allowed.
 9. *Develop Geologic Cross-Sections:* Contractor shall develop, as a submittal to Department, cross-sections showing the geologic and proposed cut configuration at a minimum of 100 foot intervals along the alignment. Changes and transitions in slope configurations and ratios based on design borings and field observations shall be smooth rather than abrupt and frequent where variations between borings are obtained.
 10. *Develop Cut Plan View:* Contractor shall develop a plan view of the proposed cut configuration to assess its effectiveness and impacts from drainage ways as indicated below.
 11. *Evaluation of Potential Rockfall:* Contractor shall use and refer to the Colorado Rockfall Simulation Program (“CRSP”), or an equivalent program as previously approved, in writing, by Department, to model the proposed rock Cut Slope configuration to evaluate the effectiveness of the containment ditch in preventing rockfalls from reaching the Roadway. Contractor shall include in its analyses a model representing the completed slope at the end of construction and a model representing long term slope conditions

with weathering impacts, such as (but not limited to) loss of bench width and/or talus build-up on benches. The proposed Cut Slope and containment ditch shall prevent rockfall from reaching the Roadway shoulder. Contractor shall provide results of these test(s) to Department, upon Department's request.

12. *Evaluation of Discontinuities:* Contractor shall measure and evaluate the condition and orientation of bedrock discontinuities in the proposed rock Cut Slopes. The discontinuity information shall be used to analyze the risk of block, wedge, or toppling failures in the proposed rock Cut Slope. Contractor shall use the results of the analyses and consider if slopes flatter than those in Table 1 are warranted to reduce the potential for failures.
 13. *Develop Underdrain System:* Contractor shall devise an underdrain system in development of the preliminary design of the finished-grade Roadway to properly disperse stormwater and accumulation of infiltrated subsurface water to prevent a failure of the Embankment. Contractor shall cap all durable stone base by an intermediate filtering course of smaller aggregate to prevent accumulation of sediment in the Subgrade for all fills that contain underdrains. Contractor shall comply with all requirements described in Section 4.1 of these Technical Requirements for all underdrains within Embankments. Contractor shall specify that after the foundation preparation, areas of groundwater flow shall be noted and documented in the critical construction fill certification to Department.
 14. *Drainage Gullies:* Contractor shall review proposed Cut Slope areas for existing drainage areas that will be intersected by the Cut causing water to be discharged over the face of the slope, increasing the potential for rockfalls and erosion of the slope. In these areas and where rock has an SDI of less than 90%, Contractor shall flatten, or otherwise protect, the permanent slopes to prevent erosion and undercutting.
 15. *Coordination by Geotechnical Engineer:* The Geotechnical Engineer shall present the status of CFX Project-related geotechnical matters at a minimum at monthly progress meetings with Department.
- D. Contractor shall design all soil Cut Slopes in accordance with Chapter 3 of the MOI.
- E. Contractor shall use factors of safety, in compliance with the MOI, with

limit-equilibrium methods of analysis to determine such factors of safety, for representative sections of all soil cut and soil Embankment Fill Slope areas greater than 10-feet in height and/or where slopes are supporting, or are supported by, retaining structures. Contractor shall seek Department approval of Site-specific investigation plans with reduced boring frequency, which may entail higher factors of safety as directed by Department.

F. Contractor shall address soil to rock transitions in cut sections in the plans to be approved by the Department.

G. Contractor shall design stormwater management (“SWM”) facilities based on finished grade impervious conditions. All SWM basins will be designed in accordance with the following requirements:

1. Design of stormwater management facilities shall meet criteria for stability of cut and Fill Slopes in Section 8.1 of these Technical Requirements.
2. Where ground conditions and grading indicate potential seepage into the foundation area of the dike, as from coal seams, Contractor shall design the SWM facilities to collect and divert seepage around the basin.
3. If the Contractor elects to install SWM facilities in upper hill fills to satisfy finished-grade Roadway requirements, Contractor shall specify that the facilities shall be lined with an impervious liner.

H. Contractor shall locate disposal sites of excess Material (the “Surplus Materials Area(s)”) on the Plans. Surplus Materials Area(s) do not include areas of embankments required for construction of the finished-grade Roadway. Contractor shall design these areas within the following minimum requirements and perform the stated obligations:

1. Review available information and obtain the number of supplemental borings prescribed in the approved Geotechnical Engineering Report to define subsurface conditions for the development design parameters.
2. Design the Surplus Materials Areas to provide a minimum factor of safety of 1.3 for soil and rock fills. Analysis shall be consistent with the Plan for Grading.
3. Provide a “Plan for Grading” of the Surplus Material Areas, which Plan for Grading shall include plans, sections and a stepwise

description detailing the sequence of earthwork operations (to include preparation of the existing ground, preparation of the locations where various Materials (suitable and unsuitable) shall be placed and compaction control for placement of Materials.

4. Incorporate provision for drainage and treatment of existing ground including Underground Mine Works in this area, to provide long term control of seepage and stability for the Surplus Materials Area(s).
 5. All applicable requirements included in the Department's Road and Bridge Specifications for off-Site disposal in Section 106.04.
- I. If Contractor encounters, via its geotechnical investigations, any Underground Mine Works, then, as part of the Work, Contractor shall submit a mitigation plan, and design the mitigation-related Work.
 - J. Contractor shall incorporate language into the plans for mitigation of mine openings encountered in Cut Slopes in the following manner:
 1. If encountered within the designed bench pattern, adjust bench elevations to the bottom of the coal seam or add a bench at such location, if possible and if approved by Department. Place 2 - 6-inch diameter solid wall SCH 80 PVC pipes into the opening at least 5 feet beyond the limits of the sandstone Backfill, described below, and at a maximum spacing along the face of the cut of 30 feet. Shape ground surface and set pipe to drain towards the cut face.
 2. Place a 6-inch diameter perforated SCH 80 PVC pipe along the face of the opening to collect water from the two 6-inch solid wall pipes inserted in the opening and any other seepage to beyond the limits of the mine opening. Extend the pipe as needed to discharge at a location that does not result in erosion of the slope. The pipe perforations shall be ½ -inch diameter, at 4-inch spacing along the circumference of the pipe, and at a longitudinal spacing of 6-inches along the pipe. Some excavation may be needed to provide uniform bedding for the pipes and to achieve drainage away from the area.
 3. Provide No. 57 stone bedding for the bottom of the perforated pipe.
 4. Backfill the entry with well-graded sandstone pieces having a 6 to

12-inch maximum dimension, for the full height of the opening and horizontally at least 10 feet into the entry or to the depth of the entry, if less than 10 feet, placing the Backfill material around pipes to provide adequate support.

5. Grout the outer 12-inches of sandstone Backfill with Hydraulic Cement Grout meeting the requirements of Section 218 of the Standard Specifications to lessen the potential for removal of the Backfill. Do not allow the grout to interrupt solid or perforated drainage pipes.
 6. Cover the perforated pipe with a minimum 18-inches of sandstone Backfill.
- K. If Contractor encounters any auger holes in Cut Slopes, then, as part of the Work, Contractor shall submit a mitigation plan to Department for approval, and design the mitigation-related Work in accordance with the approved plan.
- L. If Contractor anticipates encountering or encounters coal below pavement subgrade as shown on the typical sections during performance of the Work, then, in addition to all other obligations in respect of design of the CFX Project, Contractor's design shall include, at a minimum, undercut and removal of coal seams at least 6-inches in thickness and under clay, if present, when the top of the seam is within 6 feet below finished-grade Roadway. Contractor shall design a transition at least 25 feet long from the point of maximum undercut to pavement subgrade and install a 6-inch diameter perforated pipe to drain the undercut and Backfill to pavement subgrade with non-calcareous select granular Material.
- M. Contractor shall design all permanent access roads to meet requirements for Cut and Fill Slope design including the taking of adequate geotechnical borings and analyses in accordance with the Geotechnical Engineering Report to meet long term minimum safety factors set forth in the MOI. The investigation shall also be consistent with Chapter 3 of the MOI that shall apply to all road types to include access roads.

9.1 Minimum Pavement Structures

- A. Contractor will be responsible for the final design of the pavements for the Poplar Creek Section. Minimum pavement sections are provided. If Contractor confirms that the minimum pavement sections are inadequate for actual design/construction

conditions, acceptable changes are limited to increasing the thickness of the base or subbase layers. Any changes must be approved by the Department.

- B. The minimum mainline pavement structure for the Poplar Creek Section is shown in Attachment 3.1A and Attachment 3.1B.
- C. The minimum pavement structure for the proposed connector at Route 614 is shown in Attachments 3.1C.
- D. The minimum pavement structure for the proposed Grundy tie-in from the near eastern end of the Bridge over Poplar Creek to the eastern terminus is shown in Attachment 3.1D and Attachment 3.1F.

10.1 Hydraulics

10.1.1 General

- A. Contractor shall provide and/or perform all investigations, evaluations, analysis, coordination, documentation, and design required to meet all hydrologic and hydraulic, drainage, storm water management, erosion and sedimentation control, storm water pollution prevention, and Virginia storm water management program permitting requirements set out in the Standard Documents.
- B. Contractor shall design the conveyance system for the Poplar Creek Section (including but not limited to culverts, stream realignment, and outfall conveyance channels through the Project ROW) to meet all applicable hydraulic requirements, including current FEMA, FHWA, and Department guidelines as described in the VDOT Drainage Manual, Hydraulic Design Advisories and applicable I&IM.
- C. Contractor's hydraulic design shall minimize downstream impacts in accordance with Law.

10.1.2 Hydrologic and Hydraulic Analysis (H&HA)

- A. Contractor shall complete an H&HA, including scour analysis for all Bridges over waterways and major culvert crossings that have a total 100 year design discharge greater than 500 cfs. Contractor shall deliver to Department a final H&HA, including scour analysis for proposed major drainage structures. These analyses shall be submitted to the Department for review and approval prior to the approval of field inspection plans. The H&HA submitted to the Department shall consist of supporting documentation that has considered those variances that are typical

between the design plans and final construction. Contractor shall exercise its engineering judgment in determining a level of construction tolerance to be included in the H&HA.

- B. Contractor shall document the H&HA with completed Department LD-293 forms. Contractor shall provide to Department two paper and two electronic copies (.PDF format) of the final H&HA, HEC-RAS (or other Department approved analysis software) Files and LD-293. Contractor shall deliver the final H&HA submittal with a completed Department Form LD-450.

10.1.3 Drainage

- A. The drainage design Work shall include the design of culverts (as defined in Section 8.1 of the VDOT Drainage Manual), open channels, storm sewer systems (storm drain pipe and structures, as defined in Section 9.2.1 of the VDOT Drainage Manual) for finished-grade, underdrains, adequate outfall analysis (in accordance with Department of Conservation and Recreation (DCR) Minimum Standard 19), SWM facilities, and erosion and sediment control in compliance with the Standard Documents. Contractor shall design the drainage for the Poplar Creek Section in accordance with the Standard Documents.
- B. Contractor shall design the drainage Diversions in accordance with 4 VAC 25-130-817.43. Design of the Diversions shall be applicable to all embankments constructed in accordance with Section 4.1.
- C. Open channels, ditches or diversions constructed at a grade of greater than 16% shall be designed at a minimum to include the Department's standard PG-3, Type I Riprap Ditch Protection. Contractor shall specify the riprap ditches shall be constructed (brought up) as the embankment is constructed.
- D. Contractor shall provide to Department two paper and two electronic copies on CD of a final drainage report incorporating all drainage calculations including pre- and post-development discharges, capacities, and supporting data, including drainage areas (with maps) and ground cover calculations, in accordance with the documentation requirements as outlined in the VDOT Drainage Manual.

10.1.4 Storm water Management Plan and Erosion and Sediment Control Plan

- A. Contractor shall prepare an ESC, SWPPP, and a SWM Plan, each in compliance with the Standard Documents, Law, and otherwise consistent

with the Deliverables. Compliance with the water quality criteria applies to the total post development impervious area of the Site. The Poplar Creek Section is grandfathered under the Provisions of Section 4VAC50-60-48 of the VSMP Regulations adopted September 13, 2011, and utilizes the technical criteria of Part IIC (4VAC50-60-93.1 *et. seq.*) for determining its post development stormwater management design. Contractor shall appoint a qualified person within its team, other than the ESC and “SWM Plan designer,” who is authorized by DCR to perform plan reviews, independently review and certify that the ESC Plans and Narrative for the CFX Project are in accordance with Department’s Approved ESC and SWM Standards and Specifications. The ESC Narrative shall specifically include calculations (with supporting data) documenting and certifying that the design meets the adequate outfall requirements of Law promulgated through the Virginia Storm water Management Program for each location where storm water is discharged from the Poplar Creek Section.

- B. Contractor shall cause the ESC plan to be prepared under the direction of a qualified PE, registered in the State, with assistance from experts in related fields. Contractor shall design erosion and sediment control for the Poplar Creek Section using the best management practices to minimize additional contributions of sediment to stream flow to meet the more stringent of the applicable State or federal effluent limitations, to minimize erosion to the extent possible. Contractor’s design shall be based on either conversion to permanent storm water management facilities or removal after construction by returning the ground to approximate pre-construction conditions for all temporary sediment facilities no longer required for erosion and sediment control.

10.1.5 Storm water Management Facilities

- A. Contractor shall design the SWM facilities as required for the Poplar Creek Section in accordance with the Standard Documents and shall comply with the minimum geotechnical requirements contained therein. Contractor shall design proper ingress and egress to any SWM facility and any specific proprietary facilities shall have proper maintenance details included in the Plans.
- B. SWM facilities shall be designed in accordance with the Standard

Documents, while also satisfying the minimum geotechnical requirements for SWM facilities. SWM facilities design shall account for stabilization of access roads per Bristol District requirements. Contractor's design shall account for installation of impervious liners into permanent SWM facilities as required based on subsurface investigation by the Geotechnical Engineer and approved by Department. All permanent storm sewer system pipes and culverts designed by Contractor shall be reinforced concrete pipe.

11.1 Transportation Management Plan

11.1.1 General

- A. Department has determined that the Poplar Creek Section meets the criteria for a "Type B Category III project" in accordance with L&D Memorandum IIM-241.5 (dated September 19, 2011). Therefore, Contractor shall develop a TMP in accordance with the requirements of L&D Memorandum IIM-241.5 (dated September 19, 2011). Contractor shall coordinate all Work in accordance with the TMP using the most recent template from the Department's Bristol District available as of the Agreement Date.
- B. The TMP shall address at a minimum the following with respect to incident management at each of the Routes intersecting with the CFX Project:
 - 1. 24/7 point of contact for emergency notification of incident by a TOC;
 - 2. equipment to be utilized in the event a detour is necessary;
 - 3. pre-staged detour equipment and materials needs;
 - 4. signage of detour routes; and
 - 5. coordination with Virginia State Police and Buchanan County Sheriff's Department.

11.1.2 Maintenance of Traffic

- A. Contractor shall develop and deliver a Maintenance of Traffic Plan and a

TMP detailing a narrative plan for the Work, maintenance of traffic through work area and all construction accesses for approval by Department. This plan shall reflect the Scope of Work and all Standard Documents. This plan shall be developed and delivered to the Department in accordance L&D Memorandum IIM-241.5 and incorporate all strategies meeting the criteria for a “Type B Category III project” for temporary traffic control, public communication and outreach, and transportation operations.

- B. The Maintenance of Traffic Plan shall extend the prescribed distance beyond the construction tie-in locations to allow for the required length of shift per the current editions of the “Virginia Work Area Protection Manual (2011)” and the federal “Manual on Uniform Traffic Control Devices (2009).”
- C. Contractor’s TMP shall provide for coordination with the Buchanan County Sheriff’s Department if assistance with maintenance of traffic is required for the Poplar Creek Section. A minimum of 48 hours advance notice shall be required.

12.1 Public Involvement

- A. Contractor shall coordinate with Department on a Design Public Hearing to be prepared in accordance with the Standard Documents to be held after preliminary design plans are submitted and a field inspection is completed. Contractor shall coordinate with Department to schedule an appropriate time and location for the Design Public Hearing and shall be prepare and provide for any information, displays, and brochures as may be directed by Department.
- B. Contractor shall hold informal meetings with affected stakeholders when necessary and/or as directed by Department. These stakeholders shall include but not be limited to local institutions (hospitals, schools, etc.) and Buchanan County service providers (Police, Fire and EMS Departments, Utilities, etc.). All stakeholders, including all area medical agencies responsible for emergency transport of patients that use routes intersecting with the Poplar Creek Section, shall be informed of meetings. Any meetings held shall be in accordance with the Department Policy Manual for Public Participation in Transportation Projects, updated November 2010.
- C. Contractor shall coordinate with the Department on citizen information meetings to present information relating to crossroads, intersections, re-locations, and cul-

de-sacs to the public. Contractor shall coordinate with the Department to schedule an appropriate times and locations for citizen information meetings. Contractor shall provide any information, displays, and brochures needed for such citizen information meetings, as may be directed by the Department.

13.1 Utilities

- A. Contractor shall coordinate the Work with all Utilities that may be affected by the Work or location of the Project ROW on the Site. Contractor shall perform all Utility-related Work in accordance with the VDOT Utilities Manual of Instruction (January 2011) and all other applicable Standards, Specifications and Reference Documents. Contractor shall designate all Utilities on or near the Project ROW (and on or near the Poplar Creek Section, as may be necessary as part of the Work).
- B. Contractor shall perform, as part of the Work, all Utility-related activities for delivery of the Poplar Creek Section in accordance with this Amendment, including but not limited to: Utility location (test holes), conflict evaluations, cost responsibility determinations, Utility relocation designs and Utility coordination required for the Poplar Creek Section. Contractor shall use reasonable efforts to design the Poplar Creek Section to avoid conflicts with Utilities, and minimize impacts where conflicts cannot be avoided.
- C. Contractor shall review all relocation plans for compliance with the ROW Manual, the Department Utilities Manual of Instructions, Utility Relocation Policies and Procedures and Department's Land Use Permit Manual. Contractor shall also determine that there are no conflicts (a) between such manuals, policies and procedures with Contractor's planned Roadway improvements and (b) between Contractor's planned Roadway improvements and each of the Utility's relocation plans.
- D. Contractor shall submit to Department all conforming relocation plans. Contractor shall assemble the information included in the relocation plans into a final and complete form and in such a manner that Department may approve the submittals with minimal review.
- E. Known Utility owners and their respective contact numbers include the following:

Water

Buchanan County Public Service Authority
1023 Old Benns Branch Road
Vansant, Virginia 24656
Contact: Darrell Cantrell, Director
Telephone: (276) 935-5827

Sanitary Sewer

Buchanan County Public Service Authority
1023 Old Benns Branch Road
Vansant, Virginia 24656
Contact: Darrell Cantrell, Director
Telephone: (276) 935-5827

Telephone

Verizon
817 Fincastle Road
Lebanon, Virginia 24266
Contact: Wes Adams
Telephone: (276) 889-4654

Cable Television:

Cable Plus
P.O. Box 1030
Honaker, Virginia 24260
Contact: Jim Vermillion
Telephone: (276) 873-4828

Gas

Range Resources
406 West Main Street
Abingdon, Virginia 24212
Contact: Terry Mullins
Telephone: (276) 608-7658

CNX
2481 John Nash Boulevard
Bluefield, VA
Contact: Randy Albert
Telephone: (304) 323-6500

Electric

American Electric Power
1161 Elliott Street
Lebanon, Virginia 24266
Contact: John Vencill
Telephone: (276) 889-7030

Traffic Control:

VDOT
Salem Traffic Operations Center
1596 Deborah Lane
Salem, VA 24153
Telephone: (540) 375-0170; (888) 782-7982

14.1 Mining and Minerals

14.1.1 General

- A. Background data suggests that Underground Mine Works are present below the proposed road alignment. Contractor shall compile all background mining maps and develop mitigation strategies in those areas where Underground Mine Works are known to be present below the

proposed road alignment. Such mitigation strategies shall consider those mines within 25 feet of the existing ground surface in fill areas (measured to the roof of the Mine Works), within 25 feet of permanent SWM facilities or within 25 feet of the proposed road grade in cut areas (measured to the roof of the Mine Works). As more fully set forth in the Geotechnical Work section of these Technical Requirements, Contractor shall provide Department with available mapping showing the location of existing mines and Known Underground Mine Works. Contractor's Geotechnical Report shall specifically address future stability of the Roadway as it relates to Underground Mine Works so as to minimize future subsidence of the Roadway in accordance with this Amendment. Refer to Attachment 14.1A, Underground Mine Works Mitigation.

14.1.2 Underground Mine Works

- A. All Known Underground Mine Works within 25 feet of the existing ground surface in fill areas (measured to the roof of the Mine Works) or within 25 feet of the proposed road grade in cut areas (measured to the roof of the Mine Works), or within 25 vertical feet below the Work shall be identified by Contractor under this Amendment. In conjunction with Contractor's design activities, Contractor shall address such areas within the Plans and provide a mitigation method to prevent subsidence to be approved by Department.

14.1.3 Mineral Reserve Study

- A. The Contractor shall provide to the Department for its review and approval a mineral reserve study, signed and sealed by a PE licensed in the State (the "Mineral Reserve Study"). The Mineral Reserve Study shall delineate the coal to be extracted: (i) as a result of construction activities expected to be performed within the Project ROW; (ii) in permitted mining operations outside of the Project ROW expected to be performed in conjunction with construction of the Poplar Creek Section (if any); and (iii) 100 feet below all construction activities related to the Poplar Creek Section.

15.1 Design Quality Assurance / Quality Control ("QA/QC")

15.1.1 General

- A. Contractor shall submit its Design QA/QC Plan to Department within 15 days following the Agreement Date for Department's review and approval. Department shall have thirty (30) days after submission of the

QA/QC Plan to review and approve such Plan.

15.1.2 Design Management

- A. Contractor shall manage for design quality in accordance with Department's *Minimum Requirements for Quality Assurance and Quality Control on Design Build and Public-Private Transportation Act Projects* dated January 2012. Contractor, through its design manager, shall establish and oversee a conforming QA/QC program for all pertinent disciplines involved in the design of the Poplar Creek Section, including review of design, working plans, shop drawings, specifications, and constructability of the Poplar Creek Section. The design manager shall designate a Quality Assurance Manager ("QAM") to report directly to Contractor's Project Manager, and is responsible for all of the design, inclusive of QA and QC activities. Members of the Design QA and QC team shall review all design elements of the plans and specifications as they are developed for conformance with the requirements of this Amendment, including VDOT form LD-436. Design QA shall be performed by one or more member(s) of the lead design team that are independent of the Design QC. The Project Design QA/QC Plan (as part of the QA/QC Plan, if applicable) shall provide Department assurance that the design plans and submittals shall meet all requirements and other specifications set forth in this Amendment.
- B. Appendix 2 of the January 2012 QA/QC Guide provides minimum requirements that shall be met for development of the Design QA/QC Plan and the minimum qualifications for the QAM.

15.1.3 Geotechnical Coordination and QA/QC

- A. Contractor's Geotechnical Engineer shall be an integral member of the design team, and as such, the Geotechnical Engineer shall be experienced in the design and construction of projects similar to the Poplar Creek Section (i.e., similar types of terrain, geologic conditions), and shall be designated and involved in the review of drawings. Subsequent modification to Plans shall be reviewed by the Geotechnical Engineer to determine that such geotechnical recommendations have not been modified, or that new geotechnical recommendations are advised.

16.1 Plan Preparation

16.1.1 Geopak and MicroStation

- A. When Contractor is given the Notice to Proceed, Contractor shall be furnished with, or licensed, the following software and files which run in

Windows XP or Window s7 only: Geopak (current version used by the Department), MicroStation (current version used by the Department) and the Department Standard Resources Files, and all the design files used to develop the contractual Plans including updated survey files.

16.1.2 Software License Requirements

- A. The Department shall furnish license(s) for all the software products Department makes available to Contractor. The license(s) shall be supplied upon request by Contractor, based on the data provided on a completed Software License Form, LD-893, and subsequently reviewed and approved by the Department.
- B. All license(s) are provided for use on the Poplar Creek Section detailed on the request only for the duration specified for the Poplar Creek Section. Any adjustment made to the Baseline Schedule shall be taken into consideration in adjusting the time the license(s) are available. Justification for the number of license(s) requested shall include the estimated number of total computer hours for the task of design, detailing, relating project management and other computer based engineering functions requiring the software requested.
- C. Contractor shall be accountable to the Department and to the State for the appropriate use of all license(s) provided to Contractor, regardless of who on the team uses the license(s). Contractor shall track all license(s) provided to it or a team member and the prompt return of the license(s) and removal of the software from any system used solely for the project for which it was obtained.

16.1.3 Drafting Standards

- A. Contractor shall prepare all Plans in Imperial units and in accordance with the Standard Documents.

16.1.4 Electronic Files

- A. Contractor shall submit all plans in electronic format using the provided MicroStation CADD software. Files shall be submitted in both “.DGN” and .PDF formats, by way of the Department’s Falcon Consultant environment. Contractor shall complete Form LD-443, the Falcon System Access and Security Agreement and Form LD-894, the Falcon Access Request Form, for access to the Falcon Consultant environment.

Department will furnish electronic files of all applicable standard detail sheets upon request by Contractor. The files shall use standard Department cell libraries, level structures, line types, text fonts, and naming conventions as described in the most recent version of the Department's CADD Manual and Department's Manual of the Structure and Bridge Division, Vol. V - Part 2, Design Aids and Typical Details. Files furnished to Contractor in electronic format shall be returned to the Department and removed from Contractor and its designer's computer equipment upon completion of the Work.

16.1.5 Plan Deliverables

- A. Contractor shall prepare hard-copy paper plans and electronic plans (.DGN & .PDF) formats on CD or other approved media for each of the following deliverables in conjunction with the project development process as described in IIM-LD-226.4 and referenced in the VDOT Road Design Manual, where applicable:
1. PFI plans;
 2. PH plans;
 3. FI plans;
 4. Preliminary Bridge plans (30% design);
 5. Intermediate Bridge plans (60% design);
 6. design calculations; and
 7. supporting calculations and computations for drainage design, erosion and sediment control measures and storm water Management.

17.1 Monthly Progress Meetings

- A. Contractor shall participate in monthly progress meetings. During such meetings, Contractor and the Department shall review the progress of the Work during the prior month. Contractor shall collect information from any key Subcontractors responsible for Work completed during the specified duration and Work scheduled during the upcoming reporting duration. These meetings shall be attended by the Department Representative, the Contractor Project Manager,

design manager, and key personnel including but not limited to the structures manager and the Geotechnical Engineer. Contractor shall hold these meetings beginning the month after the issuance of the Notice to Proceed. Contractor shall prepare, maintain and distribute minutes of the meetings to all attendees for review, comment and/or approval. The meeting minutes shall be provided to the Department within seven days of the monthly progress meeting.

18.1 Coordination with Railroads

- A. Contractor, working through the Department, shall provide regular updates to Norfolk Southern Railway regarding the development of the Deliverables that relate to or affect the design of the Bridge over Norfolk Southern Railway's tracks. The intent of such updates is to familiarize Norfolk Southern Railway with the design and anticipated plan for construction of the Bridge in order to facilitate future development of a railway-highway construction agreement.

19.1 Data Management

- A. Contractor shall participate in the Department data management system to be used for the Poplar Creek Section (e.g., the Sharepoint data management system). Contractor shall submit promptly, and in an organized fashion, all required deliverables and correspondence in conjunction with the Department's preferred data management system.

Attachment 2.1

Special Provisions

(c100ai04-0114)

GENERAL PROJECT REQUIREMENTS, SUPPLEMENTAL SPECIFICATIONS (SSs), SPECIAL PROVISIONS (SPs) AND SPECIAL PROVISION COPIED NOTES (SPCNs)

This project shall be constructed in accordance with: the plans; the *Virginia Department of Transportation Road and Bridge Specifications*, dated 2007; the *Virginia Department of Transportation Road and Bridge Standards*, dated 2008; the 2011 edition of the *Virginia Work Area Protection Manual*; the 2009 edition of the *MUTCD with Revision Numbers 1 and 2 incorporated, dated May 2012* and the 2011 edition of the *Virginia Supplement to the MUTCD with Revision Number 1 dated September 30, 2013*; and the Supplemental Specifications, Special Provisions and Special Provision Copied Notes in this contract. **The status in the Contract of each of these documents shall be in accordance with Section 105.12 of the Specifications**

Special Provision Copied Notes in this contract are designated with "(SPCN)" after the date.

The information enclosed in parenthesis "(" at the left of each Special Provision Copied Note in this contract is file reference information for Department use only. The information in the upper left corner above the title of each Supplemental Specification and Special Provision in this contract is file reference information for Department use only.

The Department has identified the system of measurement to be used on this particular project as imperial. Any imperial unit of measure in this contract with an accompanying expression in a metric unit shall be referred to hereinafter as a "dual unit" measurement. Such a "dual unit" measurement is typically expressed first in the imperial unit followed immediately to the right by the metric unit in parenthesis "(" or brackets "[]" where parenthesis is used in the sentence to convey other information. Where a "dual unit" of measure appears in this project, only the imperial unit shall apply. The accompanying metric unit shown is not to be considered interchangeable and mathematically convertible to the imperial unit and shall not be used as an alternate or conflicting measurement.

9-5-13 (SPCN)

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
**PROJECT COMMUNICATION AND DECISION MAKING
FOR DESIGN-BUILD PROJECTS**

January 3, 2005c
Reissued August 2009

I. DESCRIPTION

The intent of this provision is to establish procedures, processes and guidelines for making decisions and managing communications regarding work under contract on construction and maintenance projects. The information contained herein is not meant to be all inclusive but to serve as a minimal general framework for promoting efficient and effective communication and decision making at both the project and, if needed, executive administrative level. It is also not meant to override the decision-making processes or timeframes of specific contract requirements.

II. DEFINITIONS

For the purposes of this provision the following terms will apply and be defined as follows:

Submittals – Documents required by the contract that the Design-Builder must submit for the Department's review, acceptance or approval. These may include plans, shop drawings, working drawings, material test reports, material certifications, project progress schedules, and schedule updates. The Design-Builder shall produce submittals as early as practicable when required by the contract so as not to delay review and determination of action.

Confirmation of verbal instructions (COVI) - Design-Builder requested written confirmation of agreements and instructions developed in negotiations with the Department concerning the Work under contract. Agreements must be able to be quantified using existing contract procedures and will, in the vast majority of cases, not impact contract time and cost. When time and/or cost are impacted, they must be clearly spelled out in the COVI.

Requests for information (RFI) – Requests generated by either the Design-Builder or the Department that the other party supplies information to better understand or clarify a certain aspect of the Work.

Requests for owner action (ROA) – Requests when the Design-Builder asks that the Department take certain action(s) the Design-Builder feels is required for proper completion of a portion of the Work or project completion.

Contract change requests (CCR) - Request where the Design-Builder asks the Department to make an equitable adjustment to the contract because of excusable and/or compensable events, instructions that have or have not been given or other work requiring time and/or cost beyond that specified or envisioned within the original contract.

Requests for Design-Builder action (RDBA) – Request generated by the Department where the Department asks the Design-Builder to take certain action that is in the best interests of the project and/or is required for proper completion of a portion of the Work or for project completion.

Contract change directives (CCD) – Directive by the Department which instructs the Design-Builder to perform work beyond that specified or envisioned in the original contract and which may specify instructions, time, and cost(s) to make an equitable adjustment to the original contract.

Responsible Person – The individual in the normal or escalated resolution process, for either the Design-Builder or the Department, having the direct authority, responsibility and accountability to formulate and respond to each category of information request.

III. PROCESS FOR DECISION MAKING

Project teams composed on responsible individuals directly involved in the administration, prosecution, and inspection of the Work from the Design-Builder and the Department shall define and agree upon the field decision-making process during the meeting held within seven (7) days after Date of Commencement (as set forth in Article 2.1.2 of the General Conditions). This information relative to the process should be written down and distributed to all parties of the process once it is established. Where there are responsibility, authority or personnel changes associated with this process such changes shall be distributed to all affected parties as quickly as practicable after they are effective so as not to delay or impede this process.

The process for making field decisions with respect to the Work detailed in the contract basically requires the following steps:

1. The Design-Builder and the Engineer agree on the decision-making process, the identity, authority and accountability of the individuals involved and on the cycle times for response for each category of decision.
2. The party requiring the information generates the appropriate request documents, and calls for a decision from the individual who is accountable for the particular facet of the Work under consideration within the agreed period.
3. The responding party has an internal decision-making process that supports the individual who is accountable and provides the information required within the agreed period for each category of request.
4. The party receiving the decision has an internal process for accepting the decision or referring it for further action within an agreed period of time.

The process also requires that clear and well-understood mechanisms be in place to log and track requests, document the age and status of outstanding requests and actions to be taken on requests that have not been answered within the agreed period.

Both the Department and the Design-Builder shall agree on the following:

- The documentation and perhaps format to be developed for each category of information requested,
- The name (as opposed to organizational position) of all individuals with the responsibility, authority and accountability to formulate and respond to each category of information requested. The District Administrator (DA) or Chief Executive Officer (CEO) of the Design-Builder may delegate the responsibility and authority for formulating and responding to requests, however, the accountability for meeting the established response time(s) remains with the District Administrator and CEO.
- The cycle times for each stage in the decision-making process,
- The performance measures to be used to manage the process,
- The action to be taken if cycle times are not achieved and information is not provided in a timely manner.

The following general guideline and timeframe matrix will apply to the various requests for action. Again, please note these guidelines are general in scope and may not apply to specific contract timeframes for response identified within the requirements of the Contract documents. In such cases, specific contract requirements for information shall apply.

PROCESS GUIDELINES FOR REQUESTS GENERATED BY THE DESIGN-BUILDER

| Process | Situation | Normal resolution process | | Escalated process | | Final resolution |
|---|--|--|--|------------------------------------|--------|---|
| | | By | Within (calendar days) | By | Within | |
| Submittal | Where the Design-Builder requests the Department's review, acceptance or approval of plans, shop drawings, materials data, test reports, project progress schedules, or other submittals required by standard Specifications or other contract language. | Department's Representative | <ul style="list-style-type: none"> • Acknowledge: 3 days¹ • Accept or Return: 14 days • Final Determination/Approve: 21 days or as outlined in contract documents. | Department's Senior Representative | 7 days | Submit ROA or CCR |
| Confirmation of Verbal Instruction (COVI) | Resolving routine field issues, within the framework of the Contract, in negotiation with Owner field personnel. | Department's Appropriate field personnel | <ul style="list-style-type: none"> • Confirmation: 1 day² | Submit RFI, ROA or CCR | 7 days | (See process for RFI, ROA, or CCR) |
| Request for Information (RFI) | Requests the Department to supply information to better understand or clarify a certain aspect of the work. | Department's Representative | <ul style="list-style-type: none"> • Action: 21 days (or appropriate Action Plan) | Department's Senior Representative | 7 days | Submit ROA or CCR |
| Request for Owner Action (ROA) | Requests that the Department take certain action the Design-Builder feels is required for proper completion of a portion of the Work or project completion. | Department's Representative | <ul style="list-style-type: none"> • Acknowledge: 3 days¹ • Action: 21 days (or appropriate Action Plan) | Department's Senior Representative | 7 days | Submit CCR |
| Contract Change Request (CCR) | Requests the Department to make an equitable adjustment to the contract because of excusable and/or compensable events, instructions that have or have not been given or other work requiring time and/or cost beyond that specified or envisioned within the original contract. | Department's Representative | <ul style="list-style-type: none"> • Acknowledge: 3 days¹ • Action: 21 days (45 days if federal oversight project) | Department's Senior Representative | 7 days | Established dispute resolution and claims process |

¹ Process initiated on the last business day of a week shall be acknowledged before 5 pm on the next VDOT business day.

² The absence of a written confirmation from the Department to a Design-Builder's written request for confirmation of a verbal instruction shall constitute confirmation of the verbal instruction.

PROCESS GUIDELINES FOR REQUESTS GENERATED BY THE OWNER

| Process | Situation | Normal resolution process | | Escalated process | | Final resolution |
|---------|--|---------------------------------------|---|------------------------------------|--------|--|
| | | By | Within (calendar days) | By | Within | |
| 1. RFI | Requests the Design-Builder to supply information to better understand or clarify a certain aspect of the work. (RFI) | Design-Builder's Construction Manager | <ul style="list-style-type: none"> Action: 21 days (or appropriate written Action Plan) | Design-Builder's Project Manager | 7 days | Submit RCA or CCD |
| 2. RCA | Requesting the Design-Builder take certain action(s) that is in the best interests of the project and/or is required for proper completion of a portion of the work or for project completion. (RCA) | Design-Builder's Construction Manager | <ul style="list-style-type: none"> Response or Action to safety and environmental issues: 1 day Otherwise acknowledge: 3 days¹ Action: 21 days (or appropriate Action Plan) | Design-Builder's Project Manager | 7 days | Submit CCD |
| 3. CCD | Instructs the Design-Builder to perform work beyond that specified or envisioned in the original contract and undertakes action(s) to make an equitable adjustment to the contract. (CCD) | Design-Builder's Construction Manager | <ul style="list-style-type: none"> Acknowledge: 3 days¹ Action: 21 days | Design-Builder's Project Manager** | 7 days | Established dispute resolution and termination process |

¹ Process initiated on the last business day of a week shall be acknowledged before 5 p m on next project business day.

VIRGINIA DEPARTMENT OF TRANSPORTATION
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

SUPPLEMENTAL SECTION 512—MAINTAINING TRAFFIC

SECTION 512—MAINTAINING TRAFFIC of the Specifications is amended as follows:

Section 512.03(a) Signs is amended to replace the last paragraph with the following:

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.

Section 512.03(b) Flagger Service and Pilot Vehicles is amended to replace the last paragraph with the following:

Portable traffic control signals conforming to the requirements of Section 512.03(h)2 of the Specifications may be used in lieu of flagger service when specified or approved by the Regional 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.

Section 512.03(e)b. Group 2 devices is amended to replace the first paragraph with the following:

- 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 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.

Section 512.03 Procedures is amended to add (r) **Work Zone Traffic Control** as the following:

- (r) **Work Zone Traffic Control:** The Contractor shall provide individuals trained in Work Zone Traffic Control in accordance with the requirements of Section 105.14 of the Specifications.

Section 512.04 Measurement and Payment is amended to add the following:

Basic Work Zone Traffic Control – Separate payment will not be made for providing a person to meet the requirements of Section 105.14 of the Specifications. The cost thereof shall be included in the price of other appropriate pay items.

Intermediate Work Zone Traffic Control - Separate payment will not be made for providing a person to meet the requirements of Section 105.14 of the Specifications. The cost thereof shall be included in the price of other appropriate pay items.

Section 512.04 Measurement and Payment is amended to replace the pay item and corresponding pay unit for "**Eradication of existing pavement markings**" with the following:

Eradication of existing pavement markings will be measured in linear feet of a 6-inch width or portion thereof as specified herein. Widths that exceed a 6-inch increment by more than 1/2 inch will be measured as the next 6-inch increment. Measurement and payment for eradication of existing pavement markings specified herein shall be limited to linear pavement line markings. Eradication of existing pavement markings will be paid for at the contract unit price per linear foot. This price shall include removing linear pavement line markings and disposing of residue.

Eradication of existing nonlinear pavement markings will be measured in square feet based on a theoretical box defined by the outermost limits of the nonlinear pavement marking. Nonlinear pavement markings shall include but not be limited to stop bars, arrows, images and messages. Eradication of existing nonlinear pavement markings will be paid for at the contract unit price per square foot. This price shall include removing nonlinear pavement markings and disposing of residue.

Payment will be made under:

| Pay Item | Pay Unit |
|--|-----------------|
| Eradication of existing pavement marking | Linear foot |
| Eradication of existing nonlinear pavement marking | Square foot |

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
VOLATILE ORGANIC COMPOUND (VOC) EMISSIONS CONTROL AREAS

August 12, 2010

VOC Emission Control Area - The Contractor is advised that this project may be located in a volatile organic compound (VOC) emissions control area identified in the State Air Control Board Regulations (9 VAC 5-20-206) and in Table 1 below. Therefore, the following limitations may apply:

- Open burning is prohibited during the months of May, June, July, August, and September in VOC Emissions Control areas
- Cutback asphalt is prohibited April through October except when use or application as a penetrating prime coat or tack is necessary in VOC Emissions Control areas

Table 1. Virginia Department of Environmental Quality Volatile Organic Compound (VOC) Emissions Control Areas*

| VOC Emissions Control Area | VDOT District | Jurisdiction |
|----------------------------|----------------|--|
| Northern Virginia | NOVA | Alexandria City Arlington County Fairfax County Fairfax City Falls Church City Loudoun County Manassas City Manassas Park City Prince William County |
| Northern Virginia | Fredericksburg | Stafford County |
| Fredericksburg | Fredericksburg | Spotsylvania County Fredericksburg City |
| Hampton Roads | Fredericksburg | Gloucester County |
| Hampton Roads | Hampton Roads | Chesapeake City Hampton City Isle of Wight County James City County Newport News City Norfolk City Poquoson City Portsmouth City Suffolk City Virginia Beach City Williamsburg City York County |

| | | |
|------------------|----------|--|
| Richmond | Richmond | Charles City County Chesterfield County Colonial Heights City Hanover County Henrico County Hopewell City Petersburg City Prince George County Richmond City |
| Western Virginia | Staunton | Frederick County Winchester City |
| Western Virginia | Salem | Roanoke County Botetourt County Roanoke City Salem City |

* Regulations for the Control and Abatement of Air Pollution (9 VAC 5-20-206)

See the Virginia Code 9 VAC 5-40, Article 39 (Emission Standards for Asphalt Paving Operations) and 9 VAC 5-130 (Regulation for Open Burning) for further clarification. In addition to the above requirements, the Contractor's attention is directed to the requirements of Section 107.16 of the Specifications, because other air pollution requirements may also apply.

VIRGINIA DEPARTMENT OF TRANSPORTATION

STORMWATER POLLUTION PREVENTION PLAN (SWPPP) GENERAL PERMIT FOR THE DISCHARGE OF STORMWATER FROM CONSTRUCTION ACTIVITIES CONTRACTOR AND SUBCONTRACTOR CERTIFICATION STATEMENT

Order No.: _____ Project Number: _____

Route: _____ Contract ID. #: _____

I certify under penalty of law that I understand the terms and conditions of the project contract, plans, permits, specifications and standards related to the erosion and sediment control, stormwater management and stormwater pollution prevention plan requirements for the affected activities associated with this project, the Virginia Stormwater Management Program (VSMP), and the General Permit for the Discharge of Stormwater from Construction Activities, if applicable to this project, issued by the Virginia Department of Conservation and Recreation. The VSMP Permit authorizes the storm water discharges associated with the construction activities from the project site identified and described in the bid documents and subsequent contract including any off-site support activities required for the complete fulfillment of the work therein.

Signature: _____

Name: _____

Title: _____

Contracting Firm: _____

Address: _____

Phone Number: _____

Address/Description of Site: _____
(Include off-site areas)

Certified on this date: _____

(Note: This form must be returned with performance and payment bonds)

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

February 19, 2009

SECTION 107—LEGAL RESPONSIBILITIES of the Specifications is amended as follows:

Section 107.16(e) Storm Water Pollution Prevention Plan is replaced as follows:

(e) Storm Water Pollution Prevention Plan and Virginia Stormwater Management Program General Permit for the Discharge of Stormwater from Construction Activities

A Stormwater Pollution Prevention Plan (SWPPP) identifies potential sources of pollutants which may reasonably be expected to affect the stormwater discharges from the construction site and any off site support areas and describes and ensures implementation of practices which will be used to reduce pollutants in such discharges.

The 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.

Land-disturbing activities that disturb one acre or greater, or 2,500 square feet or greater in an area designated as a Chesapeake Bay Preservation Area, require coverage under the Department of Conservation and Recreation's Virginia Stormwater Management Program (VSMP) General Permit for the Discharge of Stormwater from Construction Activities (hereafter referred to as the VSMP Construction Permit). Where applicable, the Department will apply for and retain coverage under the VSMP Construction Permit for those land disturbing activities for which it has contractual control.

The required contents of a SWPPP for those land disturbance activities requiring coverage under the VSMP Construction Permit are found in Section II D of the General Permit section of the VSMP Regulations (4VAC50-60-1170). While a SWPPP is an important component of the VSMP Construction Permit, it is only one of the many requirements that must be addressed in order to be in full compliance with the conditions of the permit.

The Contractor and all other persons that oversee or perform activities covered by the VSMP Construction Permit shall be responsible for reading, understanding, and complying with all of the terms, conditions and requirements of the permit and the project's SWPPP including, but not limited to, the following:

1. Project Implementation Responsibilities

The Contractor shall be responsible for the installation, maintenance, inspection, and, on a daily basis, ensuring the functionality of all erosion and sediment control measures and all other stormwater and pollutant runoff control measures identified within or referenced within the SWPPP, 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. SWPPP Requirements for Support Facilities

Where not included in the plans, 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 on-site or off-site support facilities including but not limited to, borrow and disposal areas, construction and waste material storage areas, equipment and vehicle storage and fueling areas, storage areas for fertilizers or chemicals, sanitary waste facilities and any other areas that may generate a stormwater or non-stormwater discharge directly related to the construction process. Such plans shall document the location and description of potential pollutant sources from these areas and 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 VSMP Construction Permit (where applicable) and shall be subject to all conditions and requirements of the VSMP Construction Permit (where applicable) and all other contract documents.

4. Reporting Procedures

a. Inspection Requirements

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.

(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 included in such reports.

5. Changes, Deficiencies and Revisions

a. 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.

b. Revisions to the SWPPP

Where site conditions, construction sequencing or scheduling necessitates revisions or modifications to the erosion and sediment control plan or 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 maintained on the project site or at a location convenient to the project site where no on site facilities are available and shall be available for review upon request during normal business working hours.

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
RESTORING EXISTING PAVEMENT

January 14, 2008cc

I. DESCRIPTION

This work shall consist of restoring existing pavement, removed for installation or repair of utilities such as, but not limited to pipe culverts, conduits, water and sanitary sewer items.

II. MATERIALS

Asphalt Concrete shall conform to the requirements of Section 211 of the Specifications.

Aggregate Subbase material shall conform to the requirements of Section 208 of the Specifications.

Asphalt Material shall conform to the requirements of Section 210 of the Specifications.

Fine Aggregate shall conform to the requirements of Section 202 of the Specifications.

Coarse Aggregate for surface treatment shall conform to the requirements of Section 203 of the Specifications.

Hydraulic Cement Concrete Class A3 shall conform to the requirements of Section 217 of the Specifications.

Steel Reinforcement shall conform to the requirements of Section 223 of the Specifications.

III. PROCEDURES

Pavement restoration shall be in accordance with this Provision and plan notes.

Backfill shall be in accordance with Section 302.03(a)2.g. of the Specifications.

Asphalt Concrete shall be placed and compacted in accordance with Section 315 of the Specifications.

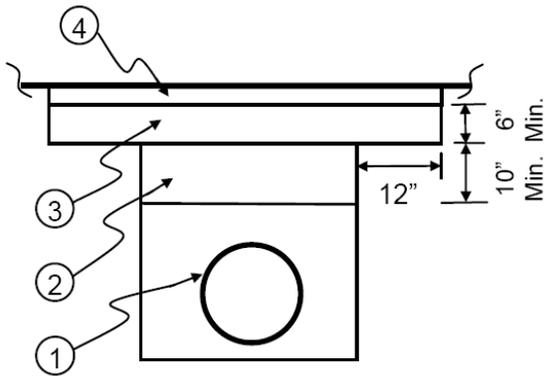
Surface Treatment shall be placed in accordance with the Asphalt Surface Treatment special provision and the attached drawing.

Concrete Pavement shall be placed in accordance with Section 509 of the Specifications and this special provision. Open trench in Hydraulic Cement Concrete Pavement should be located at existing transverse joints if at all possible. If concrete pavement is removed within two feet of an existing transverse joint, pavement removal shall be extended two feet beyond the joint. Reinforcing steel and dowels shall be installed in accordance with Road and Bridge Standard PR-2. Joint replacement shall be in accordance with Road and Bridge Standard PR-2.

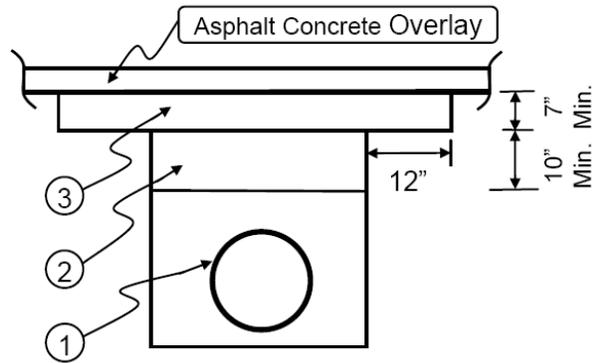
IV. MEASUREMENT AND PAYMENT

Restoring Existing Pavement unless otherwise specified will not be measured for separate payment, the cost thereof shall be included in the price bid for the utility to which it pertains in accordance with Section 302.04, Section 520.06 or Section 700.05 of the Specifications, as appropriate. However, widths and depths in excess of the attached drawing that are authorized

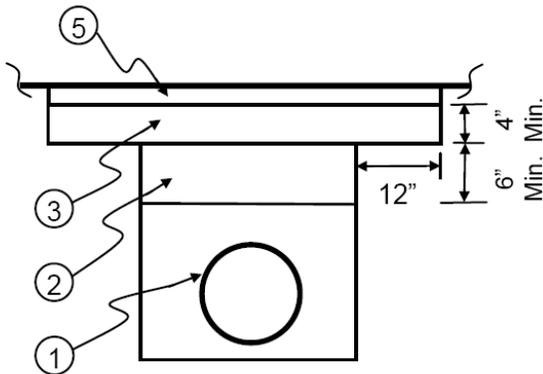
or directed by the Engineer will be paid for in accordance with Section 109.05 of the Specifications.



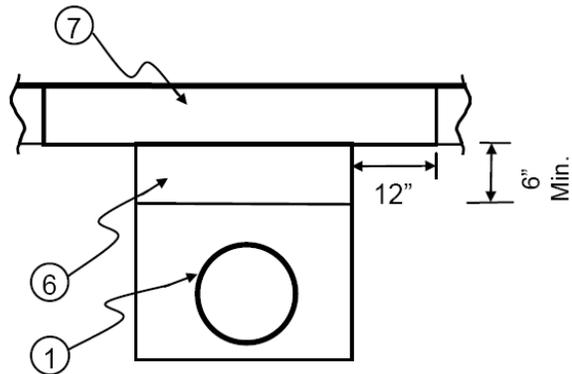
PAVEMENT STRUCTURE
Asphalt Conc. Base and Surface



PAVEMENT STRUCTURE
Scheduled for Asphalt Conc. Overlay



PAVEMENT STRUCTURE
Aggregate Base and Surface Treatment



PAVEMENT STRUCTURE
Hydraulic Cement Concrete

NOTES:

The following methods for restoring existing pavement shall be adhered to unless otherwise specified on the plans.

1. Pipe culverts, conduits and utility items shall be installed in accordance with the applicable Road and Bridge Standards and Specifications.
2. Subbase - Aggregate material Type 1, Size 21A or 21B.
3. Asphalt Concrete Type BM-25.0
4. Surface - Asphalt Concrete Type SM-9.5D @ 165 lbs. per sq. yd.
5. Surface - Blotted Seal Coat Type C: The initial seal and final seal shall be CRS-2, CMA-2 or CMS-2h liquid asphalt material @ 0.17 gal./sq. yd. with 15 lbs. of No. 8P stone/sq. yd. each. The blot seal shall be CRS-2, CMS-2 or CMS-2h liquid asphalt material @ 0.15 gal./sq. yd. with 10 lbs. of fine aggregate grade B sand per sq. yd.
6. Subbase - Aggregate material Type 1 Size 21B
7. Surface - Hydraulic Cement Concrete, high early strength, matching existing structure for depth and surface texture.

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
CONTROLLED BLASTING

April 14, 2008

I. DESCRIPTION

The Contractor is hereby advised of the close proximity of this project to private property, dwellings, water wells, springs, utilities, railroads and/or other structures. Therefore, to avoid property damages, the Contractor shall explore other means of loosening and/or reducing the size of the excavation without blasting, or if blasting becomes necessary, then controlled blasting techniques shall be employed during construction. 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 the excavation work. Blasting plan shall be submitted to the Engineer at least two (2) weeks prior to scheduled blasting.

II. BLASTING PROCEDURES

No blasting shall be performed within fifty (50) feet of existing or new bridge foundations, railroad right-of-way, residential or commercial buildings, wells or other structures without the written approval of the Engineer. In the vicinity of proposed concrete construction, blasting shall be scheduled so that blasting operations are fully complete prior to the placement of concrete.

All blasting shall be performed in accordance with the current edition of the Virginia Statewide Fire Prevention Code. The Contractor shall utilize the services of an experienced powder man at all times. The drill hole diameter, hole spacing, and size of charge per hole shall be such as to afford satisfactory breakage with a minimum of vibration. A Construction Blasting Quantity and Distance Table shall be utilized to control the maximum quantity of explosives per shot for instantaneous firing or per delay for delay firing in pounds. At no time shall the total size of any charge cause the particle velocity of the ground motion to exceed 0.50 inches per second when measured at the nearest structure to a blast.

The Contractor shall maintain a daily log of the type, grade and quantity of explosives, type of detonating cap, hole locations, depths and minimum distances from the blasts to private property, dwellings, water wells, springs, utilities, and other structures. A copy of this log shall be submitted to the Engineer at the end of each workday on which blasting activity has occurred.

III. SEISMIC MONITORING

The Contractor shall also submit to the Department a comprehensive blasting plan detailing the blasting techniques to be used near private property, dwellings, water wells, springs, utilities, and other structures. Seismic monitoring shall be performed by a qualified firm in advance of performing construction operations near private property, dwellings, water wells, springs, utilities, and other structures. Some of the initial blasts shall be monitored close to the blasting while others shall be monitored at private properties, dwellings, water wells, springs, utilities, and other structures, and the blasting plan shall be revised if it is anticipated that the maximum particle velocity at those locations will exceed 0.50 inches per second.

The seismograph used should have the ability to store data on a magnetic tape or floppy disk to be played back into a computer for digital processing, or onto a chart recorder for visual inspection interpretation. Further, the seismograph used shall be capable of accurately measuring frequency and amplitude in three planes: vertically, longitudinally, and transversely. These instruments must be dynamically calibrated and of such sensitivity that displacements as little as 0.0005 inches and frequencies of from 1 to 100 cycles per second

may be read. The instruments must also be capable of adjustment so that the peak of maximum amplitude of vibration can be recorded on the tape or disk.

The Contractor shall cooperate and coordinate blasting activities with the owners of private property, dwellings, water wells, springs, utilities, and structures.

The cost for explosives and blasting operations, alternative methods, monitoring, and the recording and submission of daily blasting logs will be considered incidental to the cost of regular excavation, and will not be measured for separate payment. Contractor's failure to maintain and submit daily blasting logs as stipulated herein will result in withholding payment for regular excavation until such time that daily logs are provided.

IV. Rock Slopes

For use in this Special Provision, slopes shall be considered rock slopes when any of the following criteria are met:

1. Height of final slope is fifteen (15) feet or greater.
2. Fifty (50) percent of the face of the final slope is rock, based on visual inspection.

All rock slopes with a slope of 1H:1V or steeper shall be pre-split by blasting, controlled blasting or non-explosive techniques, in accordance with Section 303.04a of the Road & Bridge Specifications and the preceding sections.

**SPECIAL PROVISION FOR
DESIGN-BUILD TRACKING (DBT) NUMBERS
DESIGN-BUILD PROJECTS**

December 08, 2009

In accordance with the Minimum Quality Control and Quality Assurance for Design- Build and Public Private Transportation Act (PPTA) Projects dated August 2008 and Materials Division Directive MD 299-07 the Successful Design-Builder is responsible for the compilation of a Materials Notebook (TL-142) in conjunction with the development of both Design-Build and PPTA projects administered by the Virginia Department of Transportation (the "Department").

Among the items that shall be included in the Materials Notebook are a Design-Build Tracking ("DBT") list and the required manufacturer/signatory data to be submitted in conjunction with the DBT list. This information includes all items captured in the CT Tracking Database for design-bid-build projects. The DBT Number assignment process was developed based on the Certification Number (CT Number) assignment process required for design-bid-build projects. The purpose of this process is to track and verify products that the Department does not test in-house.

The data shall be captured and maintained within a database such as Access, Oracle or other Department approved database software (the "Database") wherein each item that requires a DBT Number is assigned a unique identifier to assist with tracking processes for the Department. This will enable both the Design-Builder and Department to clearly identify and review those items that require a DBT Number to ensure they meet the requirements specified in the Contract Documents for particular project(s).

The Design-Builder shall be responsible for developing a unique DBT Number for those items in the following CT Number list. This identifier will be used to track any and all items delineated in the CT Number list. The tracking system shall be the current year followed by the UPC and DBT Number(s) in sequential order (i.e. 07-85914-01). The Design-Builder shall enter this information in a Database which will become a component of the Materials Notebook. A template Database has been developed by the Department which captures such information for design-bid-build projects. An example documentation file of a design-bid-build project has been provided. The Design-Builder shall provide sufficient and satisfactory documentation showing the QAM's approval of its DBT Number process prior to use of the database on the Project.

This template Database will be made available, but not required, for Successful Offeror's use. Alternately, the Design-Builder may develop its own database, subject to the Department's review and approval. The Design-Builder shall include reports as one of the core functions captured by its database delineating any and all key manufacturing related information and the QAM's signature.

**SPECIAL PROVISION FOR
DESIGN-BUILD TRACKING (DBT) NUMBERS
DESIGN-BUILD PROJECTS**

The Central Office Materials Division shall assist with audits during the project development process to ensure the proper paperwork is being captured and maintained in regard to the DBT Number process. The Design-Builder's QAM shall submit a copy of the paperwork involved with the first DBT Number to the Central Office Materials Division with a copy to the District Materials Engineer. Upon the initiation of any and all construction processes, the Design-Builder shall make available for Department review the Materials Notebook and accompanying DBT Number list. The QAM shall be responsible for signing off on the paperwork for any and all items requiring DBT Numbers.

CT 'ed item
 T-Base w/ Hinged Door
 5 Gauge Corrugated Liner Plate
 Air Release Valve
 Anchor Bolts for Str. Steel Plate Girder ASTM A709M
 Anchor Bolts, Nuts & Washers
 Bend, Branch, Plug or Cap, Reducer
 Blow-off Valve & Box
 Brick Pavers
 Bridge Aluminum Box Culvert
 Bridge Incidentals Fender System (Bolts)
 Cable Terminal Enclosure CTE-2 Ty. C
 CG-12 Detectable Warning Surface
 Closed Loop Controller
 Communication Equip. Auto Traffic Recorder (Stan Alone Site)
 Communication Equip. Handhole (Quazite Box)
 Communication Equipment Cabinet Electrical Service 3KVA
 Conductor Cable
 Conductor Cable Coaxial
 Conduit Bored
 Conduit Supports
 Control Center CCW-1
 Controller
 Corrugated Bridge Deck Forms
 Crossframes and Plates
 CSL Tubing for Drilled Shaft Pile
 Deflection/Expansion Fittings
 DI Sanitary Sewer Pipe
 DI Water Main
 Diaphragm Replacement
 Disconnect Switch Box
 Elastomeric Expansion Dam
 Electrical Service SE-3
 Emergency Preemption Type IV
 Expansion Plates
 F. R. P. Jacket
 Fire Hydrant
 Fixed Bollard, Hinged Bollard
 Gabions
 Galvanized Pyramid Trash Rack
 Galvanized Steel Channels
 Galvanized Swedge Bolt, Nut, Plate Washer
 Gas Main
 Gas Main Steel
 Gas Service Line
 Handrail
 HDG Steel Plate
 HDPE Pipe
 Hydro Control Feature
 Impact Attenuator
 Latex Modifier
 Lighting Junction Box JB-5C Modified
 Lighting Pole (Bases)
 Lighting Pole LP-1 Modified 37'-10' Dual Arms
 Lumi Trak System O/H 1
 Luminaire
 Magnetic Detector Amplifier
 Magnetic Detector Sensing Element TD-2
 Master Controller Type III
 Modify Exist. Columns (Misc. Metal)
 O/H Sign Structure Anchor Bolts
 Overlay Sign Panel
 Pedestal Pole
 Pedestrian Pushbutton
 Pedestrian Signal Head
 Prefabricated Steel: Anchor Rods, Nut and Washers
 PVC Pipe
 PVC San. Sewer Pipe
 Sheet Piles
 Railing, Aluminum
 Retaining Wall Gabion Wire
 Road Edge Delineator Post
 S.S. Rods with Nuts & Washers
 Safety Switch, Fuses
 Sanitary Service Lateral Connection
 Sanitary Service Lateral Connection
 Sanitary Sewer Force Main
 Scotchcast Splice Kits
 Scupper & Grate, Downspouts
 Sign Panel
 Sign Post Steel
 Signal Poles
 Silicone Joint Sealant
 Soil Nailed Wall
 Sole Plates
 Soundwall Steel Plates
 Spec. Design Hinged Bollard
 Split Mega-Lugs
 Spread Spectrum Radio
 Steel Beam Rehabilitation
 Steel Encasement Pipe
 Steel Piles
 Steel Pipe Pile
 Steel Sheet Piling
 Storm Water Management Drainage Str. SWM-1 (Orifice Plate)
 Structural Steel Paint
 Tapping Sleeve and Valve
 Toggle Bolts
 Tooth Expansion Joint
 Tooth Expansion Joint Threaded Rod
 Traffic Sign Bridge Mounted Sign Structure
 Traffic Sign Flashing School Zone
 Traffic Sign Illum. Street Name
 Traffic Sign Post USP
 Traffic Signalization Antenna Cable
 Traffic Signalization Antenna Mast
 Traffic Signalization Camera
 Traffic Signalization Emergency Preempt Detector Cable
 Traffic Signalization Video Detection Coaxial Cable
 Underbridge Lighting System
 Video Detection Equipment
 Wall/ H-Pile
 Water Service Line



COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION
1401 EAST BROAD STREET
RICHMOND, VIRGINIA 23219-2000

David S. Ekern, P.E.
COMMISSIONER

Date 08/23/2007
Route 5
Project 0005-018-111,C501 (116)
County Charles City & James City

MEMORANDUM

To: Mr. T.A. Hawthorne P.E.
Attn: Mr. C.A. Babish P.E.
From: W.L. King Jr.
Subject: Certification

We are transmitting herewith approved certification(s) issued by:
Dorey Electric Company

covering: Deflection/Expansion Fittings

supplied to the above project by: Tidewater Skanska, Inc.

Our review of these documents pertain only to the composition of the material. All other features must be reviewed and reported by the appropriate Design Division.

Certification No. 07-0424

Chickahominy Bridge

Project # - (NFO) 0005-018-111, C501, B604

Project # - (NFO) 0005-047-116, C501

FHWA # - STP-018-4(008)

FHWA # - BR-018-4(009)

FHWA # - BR-5403(990)

| <u>Spec</u> | <u>Item #</u> | <u>Description</u> | <u>Quantity</u> |
|-------------|---------------|-----------------------|-----------------|
| Plan | 67260 | Deflect/Expn Fittings | 6 + as needed |



DOREY ELECTRIC COMPANY
 894 Widgeon Road * P. O. Box 10158
 Norfolk, VA 23513
 Phone: 757.855.3381 Fax: 757.857.7835

FORWARD SUBMITTALS & MATERIAL TEST REPORTS & CERTIFICATION FOR APPROVAL TO:
 SKANSKA USA CIVIL SOUTHEAST INC
 16401 CHICKAHOMINY BLUFF ROAD
 WILLIAMSBURG, VA 23185
 ATTN: MR. GARY CLAYTON

**ROUTE 5 BRIDGE OVER THE CHICKAHOMINY RIVER
 CHARLES CITY & JAMES CITY, VA**

CONTRACT I.D. C00067953C01

DOREY ELECTRIC COMPANY'S JOB NUMBER 1010

SUBMITTAL DESCRIPTION: CONDUIT SYSTEM POWER TO NAVIGATION LIGHTS
NAVIGATION LIGHTS

SUBMITTAL NUMBER E-03 SPECIFICATION NUMBER: ATTD / PLAN

BID ITEM NUMBER: 67260 -1630, 67260 - 1640

RESUBMITTAL: YES NO DEVIATION: YES NO

Submittal data for the referenced Specification and Bid Item Number(s) have been reviewed.

DOREY ELECTRIC COMPANY

AUTHORIZED REVIEWER: B. Watkins DATE: Jul 26, 2007
 BEN WATKINS

ENCLOSURES:

CATALOG DATA - DEFLECTION/EXPANSION FITTINGS

Deflection/Expansion Fittings

For Rigid Metal Conduit & IMC

Type DX

Use:
To compensate for movement in any direction between two conduit ends which they connect. Type DX fittings will withstand occasional vibration transmitted to conduit by rotating equipment or vehicular traffic.

These fittings will provide for a movement of 1/2" from the normal in all directions. Where they are used for angular movement they will allow for a deflection of 30° from the normal in any direction.

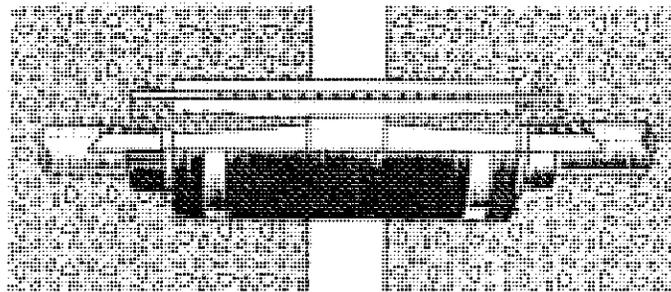
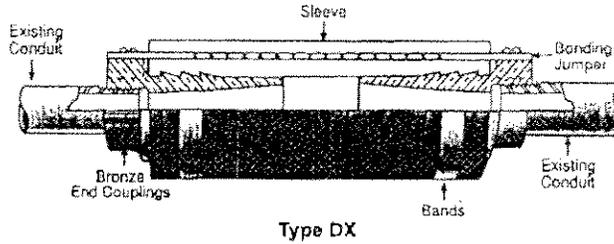
Fittings may be used with PVC conduit by using standard adapters in each end.

- Features:**
- Watertight (NEMA 4)
 - Raintight
 - Concretetight

- Material:**
- End Couplings - Bronze
 - Sleeve - Neoprene
 - Bands - Stainless Steel
 - Bonding Jumper - Tinned Copper Braid

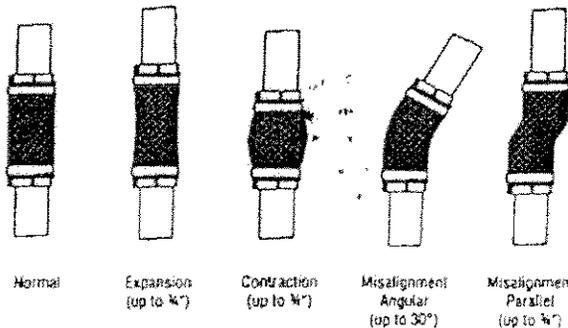
- Third Party Certification:**
- UL Listed: E-11853
 - CSA Certified: 11584

- Applicable Third Party Standards:**
- UL Standard: 514B
 - CSA Standard: C22.2 No. 18
 - Fed. Spec: WF-408E
 - NEMA: FB-1



| Trade Size (inches) | Catalog Number | Dimensions in Inches Max. Dia. Overall Length |
|---------------------|----------------|--|
| 1/2 | DX-50 | 2 1/4 6 1/2 |
| 3/4 | DX-75 | 2 3/4 6 3/4 |
| 1 | DX-100 | 3 7 |
| 1 1/4 | DX-125 | 3 3/4 7 1/2 |
| 1 1/2 | DX-150 | 3 3/4 7 1/2 |
| 2 | DX-200 | 3 3/4 8 1/2 |
| 2 1/2 | DX-250 | 4 3/4 8 3/4 |
| 3 | DX-300 | 5 8 1/2 |
| 3 1/2 | DX-350 | 5 1/2 9 1/2 |
| 4 | DX-400 | 6 3/4 9 3/4 |
| 5 | DX-500 | 7 3/4 9 3/4 |
| 6 | DX-600 | 8 3/4 9 3/4 |

VIRGINIA DEPARTMENT OF TRANSPORTATION
REVIEW OF WORKING DRAWINGS
 Working drawings have been reviewed in accordance with Section 102.02 of the Specifications with the following results:
 Review Completed
 Correct and resubmit
 Rejected See remarks
 Central Region Operations (Division or District)
 Reviewed by: M. D. Cassidy Date: 7/15/07



Effective November, 2005
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VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
ELASTIC INCLUSION

June 24, 2003a

I. DESCRIPTION

Elastic Inclusion work shall consist of installation of an elasticized Expanded Polystyrene (EPS) and geotextile separation fabric between the back of concrete surfaces and backfill material, in accordance with these specifications and in conformity with manufacturer's recommendations, the lines shown on the plans or as established by the Engineer.

II. MATERIALS

- (a) **Elasticized Expanded Polystyrene (EPS):** EPS shall have a size tolerance of 1/8 inch for each dimension and conform to the following:

| Physical Property | Test Method | Requirements |
|--------------------------|--------------------|------------------------------------|
| Compressive strength | D-1621 | 720 psf +/-60 psf @10% strain |
| Water absorption | C-272 | Max. 3% by volume |
| Insect Resistance | D-3345-74 | Resistance to ants, termites, etc. |

The EPS shall be elasticized, with a linear-elastic stress-strain behavior up to 10 percent strain and linear proportional stress-strain behavior up to 30 percent strain.

The EPS shall contain no chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs) or formaldehyde. It shall be chemically and biologically inert when in contact with acidic and alkaline soils. It shall be treated to prevent insect attack.

Materials shall withstand temperature variations from 0°F to 140°F without deforming and shall maintain their original dimensions and placement without chipping, spalling, or cracking. Material shall not deteriorate because of contact with sodium chloride, calcium chloride, mild alkalis and acids, or other ice control materials.

The EPS shall contain a flame retardant additive.

- (b) **Geotextile Separation Fabric:** A non-woven geotextile separation fabric shall be placed between the EPS and the backfill material. Fabric joints shall have a minimum overlap of twelve inches. Fabric shall extend a minimum of twelve inches beyond the EPS surface and overlap with adjacent concrete surface.

The separation fabric shall have the following properties:

| Physical Property | Test Method | Requirements |
|--------------------------|--------------------|----------------------------|
| Grab Strength | D-4632 | Min. 250 lb |
| Puncture Strength | D-4833 | Min. 112 lb |
| Tear Strength | D-4533 | Min. 90 lb |
| Permittivity | D-4491 | Min. 0.5 sec ⁻¹ |
| Apparent Opening Size | D-4751 | Max. No. 50 sieve |

Geotextile separation fabric shall be protected from mud, dirt, dust, sunlight, and debris during transport and storage. Material shall be inert to commonly encountered chemicals; resistant to mildew, rot, insects, and rodents; and biologically and thermally stable.

Geotextile separation fabric for subsurface installation shall not be exposed to direct sunlight for more than 24 hours during installation.

Tensile strength requirements are in the machine and cross-machine directions.

- (c) **Adhesive:** Adhesive shall be used to bond the EPS to concrete surfaces and the separation fabric to the EPS. It shall be applied in accordance with the EPS manufacturer's recommendations.
- (d) **Backfill Material:** Backfill material adjacent to the separation fabric shall be as specified in the contract documents.

III. PROCEDURES

- (a) **Preparation of Concrete Surface:** Before placement of EPS, concrete surfaces shall be abrasive blast cleaned with a positive contact sandblaster or adhesives manufacturer's recommendation and approved by the Engineer to remove all non-adherent laitance, oil, grease or other foreign or deleterious matter.

- (b) **Installation of Material:**

The EPS shall be attached to the back of the concrete surfaces with an adhesive compatible with the material.

The concrete surface must be thoroughly dry and clean for adhesive for the application of the EPS. Adhesive shall be applied in accordance with the adhesive manufacturer's recommendation or approval.

The separation fabric may be installed after the EPS has been installed or it may be pre-attached to the EPS. The separation fabric shall cover all exposed surfaces of the EPS.

EPS and separation fabric shall be installed in accordance with the manufacturer's recommendations.

IV. TESTING

Elasticized EPS shall be tested by an independent commercial laboratory, to verify the material requirements specified herein. The Contractor shall provide written documentation of all tests specified. Documentation shall include style, lot, roll numbers, and actual results of each test. In addition, the name, address, phone number of the testing laboratory, and date of testing shall be provided.

Geotextile separation fabric shall be tested by an independent commercial laboratory, to verify the material requirements specified herein. The Contractor shall provide written documentation of all tests specified. Documentation shall include style, lot, roll numbers, and actual results of each test. In addition, the name, address, phone number of the testing laboratory, and date of testing shall be provided.

After the EPS has been installed and before the work has been accepted, the Contractor and Inspector shall perform a visual inspection of EPS coverage and adhesion to the concrete surface. Any area deemed unacceptable and questionable as to remaining in position during the placement of the backfill material shall be replaced or repaired, as required.

REPAIR OF FAILED AREA OF EPS: Unacceptable portion of the EPS shall be removed and the concrete surface shall be prepared and the EPS installed in accordance with this special provision. New EPS in the repair areas shall be visually inspected after curing. The cost of all

additional work for repairing or replacing of the defective joint material shall be borne by the Contractor.

IV. MEASUREMENT AND PAYMENT

Elastic inclusion, when a pay item, will be measured in square yards along the back of backwall surface area, complete-in-place, and will be paid for at the contract unit price per square yard. Such price shall be full compensation for cleaning surface, for furnishing and installing the EPS material in accordance with these Specifications and the manufacturer's recommendations, separation fabric, testing, and for all material, labor, tools, equipment and incidentals necessary to complete the work. When not a pay item, the cost thereof shall be included in the price for other appropriate pay items.

Payment will be made under:

| Pay Item | Pay Unit |
|-------------------------------|-----------------|
| Elastic Inclusion (Thickness) | Square Yard |

GUIDELINES — PROJECTS REQUIRING HYRAULIC CEMENT CONCRETE OPERATIONS. Include SS21704 Hydraulic Cement Concrete.

SS40402-0211

December 17, 2010c

VIRGINIA DEPARTMENT OF TRANSPORTATION
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

SUPPLEMENTAL SECTION 404—HYDRAULIC CEMENT CONCRETE OPERATIONS

SECTION 404—HYDRAULIC CEMENT CONCRETE OPERATIONS of the Specifications is amended as follows:

Section 404.02(e) Prestressed concrete deck panels is deleted.

Section 404.03(a) Forms is amended to replace the first paragraph with the following:

- (a) **Forms:** On concrete 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 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 shall not be used to form overhangs or portions of slabs where a longitudinal joint occurs between beams or girders.

Section 404.03(a)2 Prestressed deck panel forms is deleted.

Section 404.03(j) Removing Formwork and Forming for and Placing Superimposed Elements is amended to replace "1. **Formwork**" with the following:

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 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** (for example: soffits of pile caps, bent caps and pier caps): 60 percent concrete strength (f'_c).

Section 404.08—Measurement and Payment is amended to replace the second paragraph with the following:

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.

Section 404.08—Measurement and Payment is amended to replace the fourth paragraph with the following:

*These SPECIFICATIONS REVISIONS are subject to change on short notice.

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.

DB-S217A0B-1103

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
LOW PERMEABILITY CONCRETES

~~December 2, 2002~~
June 1, 2008

SECTION 217 of the Specifications is amended as follows:

Section 217.02 (h) is replaced with the following:

- (h) Fly ash shall conform to the requirements of Section 241. Class F fly ash shall be between 20 percent and 25 percent by mass of the cementitious material. However, no more than 15 percent of the Portland cement of a standard mixture shall be replaced.

Section 217.02 (k) is amended to add the following:

- (k) Silica fume shall conform to the requirements of AASHTO M307 or ASTM C1240. Silica fume shall replace between 7 percent and 10 percent by mass of the cementitious material. Only silica fume at the rate of 3 percent to 7 percent may be added to all combinations to reduce the early permeability after the approval of the Engineer.

Section 217.08 is amended to add the following:

(c) Quality Assurance for Low Permeability Concrete (for Concrete in Bridges Only):

General:

At least two trial batches, using job materials, with permissible combination of cementitious materials shall be prepared, and test specimens shall be cast by the Contractor and tested by the Department for permeability and strength at least a month before the field application. The permeability samples shall be cylindrical specimens with a 4-inch diameter and at least 4-inches in length. They shall be moist-cured as the strength cylinders for acceptance except that the last 3 weeks of cure shall be at 100 degrees Fahrenheit \pm 10 degrees Fahrenheit. Cylinders shall be tested at 28 days in accordance with AASHTO T 277. The test value shall be the result of the average values of tests on two specimens from each batch. Permeability values obtained from trial batches shall be 500 coulombs below the maximum values specified in Table II-17.

Acceptance Tests:

A quality assurance and acceptance procedure that provides for periodic tests of the field concrete for permeability using AASHTO T 277 shall be established. This should include provisions for testing frequency; the range of coulomb values for which full or partial payments would be made; and the values that would require corrective measures to be taken, or rejection of the concrete, should be stated. The following are quality assurance procedures for field evaluations:

A lot shall be a day's production of concrete for the job and shall be used for statistical acceptance procedure for bridge concrete. For each set of cylinders made for compressive strength tests, two additional cylinders shall be made for the permeability test. The Contractor shall be responsible for making all test cylinders, and the Department shall be responsible for the testing of the specimens.

For all classes of concrete, initially one set of permeability cylinders shall be tested for each lot in accordance with AASHTO T 277. If the average coulomb value for this test is

less than the coulomb value shown in Table II-17, the lot will be accepted at the full bid price.

If the average test result exceeds the coulomb value in Table II-17, payment for the concrete in that element shall be reduced 0.005 percent for each coulomb above the coulomb value in Table II-17, however, the reduction in price will not exceed 5 percent of the bid price of the concrete. Concrete with a coulomb value that exceeds the maximum required in Table II-17 by 1000 coulomb will be rejected. However, bridge deck with the coulomb value exceeding the maximum required by over 1000 coulomb may be accepted by the Engineer at 95 percent of the bid price if it has the required strength and meets other specification requirements, and the Contractor applies, at his own expense, an approved epoxy concrete overlay to the top of the deck. In such case deck grooving will not be required. The adjustment to the roadway grade shall be made as required by the Engineer at the Contractor's expense.

Similarly, concrete in abutments and pier caps with coulomb value exceeding the maximum required in Table II-17, by more than 1000 coulomb may be accepted at 95 percent of the bid price if it has the required strength and meets other specification requirements, and the Contractor applies at his own expense, an approved epoxy, Type EP-3B and EP-3T in conformance with the requirements of Section 243.02, on top of the pier cap or abutment seat.

The reduction in the bid prices mentioned above shall be applied to the total volume of concrete in bridge members, eg. deck slab of a single span, deck slab of a group of continuous spans, pier or abutment, for which any portion of the concrete in the member did not meet the permeability test requirements.

SECTION 404 of the Specifications is amended as follows:

Section 404.03(k) 1. Curing Concrete is replaced with the following:

1. **Curing Bridge Deck and Overlay Concrete:** Bridge deck and overlay concrete, including latex modified concrete, shall be moist cured for a minimum of 7 days and until 70 percent of f_c is reached. Moist curing shall be maintained by wet burlap (keep wet) for the duration of the curing and covered with plastic sheeting. Immediately after screeding and until the application of wet burlap and white plastic sheeting (opaque and transparent sheeting may be used when the air temperature falls below 50°F), no surface of the freshly placed concrete shall be allowed to dry. During moist curing, the concrete temperature shall be maintained above 50°F at the outer most surfaces of the concrete mass. Immediately after removing the burlap and plastic sheeting (except for latex-modified concrete), white pigmented curing compound shall be applied while the surface is damp but has no free water standing on it. The application rate shall be 100 to 150 square feet per gallon.

Section 404.03(l) 1. Weather is amended to replace the 4th paragraph with the following:

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 wet burlap and white polyethylene sheeting, no surface of the freshly 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 pounds per square-foot per hour for normal concrete bridge deck placements or 0.05 pounds per square-foot per hour for concrete overlays over the exposed surface of the concrete. Other preventative measures described in ACI 308 can also be used in addition to fogging. Evaporation retardant films may be applied in a fine mist immediately after

Special Provision for Design-Build Projects

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. Placement of concrete shall be regulated at a rate such that the finishing operations can be completed and the wet burlap and polyethylene sheeting are placed prior to any drying of the concrete. If plastic shrinkage cracking occurs due to the Contractor's negligence or failure to follow 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.

Section 404.04 is amended to add after the fifth paragraph the following:

Consolidation: In deck placements, internal vibrators and screeds with vibrating element shall be used. The minimum frequency of the vibrating element shall be 3,000 vibrations per minute. Internal vibration shall be required along transverse and longitudinal edges and joints and areas where the thickness of concrete exceeds 3 inches.

SECTION 405 of the Specifications is amended as follows:

Section 405.05(c) is amended to replace the third paragraph with the following:

Both internal vibrators and external form vibrators shall be used for concrete with strength equal or exceeding 8000 pounds per square inch. The use of external vibration for other concrete will be at the option of the Contractor with approval of the Engineer. Improper placing and vibrating may be cause for rejection.

Section 405.05(f) 4. Is replaced by the following:

The temperature rise in the curing enclosure shall be uniform, with a rate rise of not more than 80 degrees Fahrenheit per hour. Concrete shall be cured at a steam temperature of not more than 180 degrees Fahrenheit, with the steam temperature uniform throughout the curing enclosure, and with a variation of not more than 20 degrees Fahrenheit. Maximum concrete temperature during the curing cycle shall be 190 degrees Fahrenheit. Approved recording thermometers shall be placed so that temperatures can be recorded at a minimum of two locations spaced at or near the third of the length in each curing enclosure and at least one sensor shall measure the temperature in the concrete.

TABLE II-17 Requirements for Hydraulic Cement Concrete of the Specifications is replaced by the following:

TABLE II-17
Requirements for Hydraulic Cement Concrete

| Class of Concrete | Design Min. Laboratory Compressive Strength at 28 Days (f'c) (psi) | Design Max. Laboratory Permeability at 28 Days (Coulombs) | Nominal Max. Aggregate Size (in) | Min. Cementitious Content (lb./cu yd) | Max. Water /Cementitious Mat. (lb. Water/lb. Cement) | Consistency (in of slump) | Air Content (percent) ¹ |
|---|--|---|----------------------------------|---------------------------------------|--|---------------------------|------------------------------------|
| A5 Prestressed and other special designs ² | 5,000 or as specified on the plans | 1,500 | 1 | 635 | 0.40 | 0-4 | 4 1/2 ± 1 1/2 |
| A4.5 | 4,500 | 2,500 | 1 | 635 | 0.45 | 2-4 | 6 1/2 ± 1 1/2 |
| A4 General | 4,000 | 2,500 | 1 | 635 | 0.45 | 2-4 | 6 1/2 ± 1 1/2 |
| A4 Post & rails ³ | 4,000 | 2,500 | 0.5 | 635 | 0.45 | 2-5 | 7 ± 2 |
| A3.5 General | 3,500 | 2,500 | 1 | 588 | 0.49 | 1-5 | 6 ± 2 |
| A3 General | 3,000 | 3,500 | 1 | 588 | 0.49 | 1-5 | 6 ± 2 |
| A3 Paving | 3,000 | 3,500 | 1 | 564 | 0.49 | 0-3 | 6 ± 2 |
| B2 Massive or lightly reinforced | 2,200 | N.A. | 1 | 494 | 0.58 | 0-4 | 4 ± 2 |
| C1 Massive Unreinforced | 1,500 | N.A. | 1 | 423 | 0.71 | 0-3 | 4 ± 2 |
| T3 Tremie seal | 3,000 | N.A. | 1 | 635 | 0.49 | 3-6 | 4 ± 2 |
| Latex hydraulic cement concrete overlay ⁴ | 3,500 | 1,500 | 0.5 | 658 | 0.40 | 4-6 | 5 ± 2 |
| Silica fume concrete overlay | 5,000 | 1,500 | 0.5 | 658 ⁵ | 0.40 | 4-7 | 6 ± 2 |

¹ When a high-range water reducer is used, the target air content shall be increased 1 percent and the slump shall not exceed 7 inches.

² When Class A5 concrete is used as the finishing bridge deck riding surface, or when it is to be covered with asphalt concrete with or without waterproofing, the air content shall be 5 1/2 ± 1 1/2 percent.

³ When necessary for ease in placement, aggregate No. 7 shall be used in concrete posts, rails, and other thin sections above the top of bridge deck slabs.

⁴ The latex modifier content shall be 3.5 gallons per bag of cement. Slump shall be measured approximately 4.5 minutes after discharge from the mixer.

⁵ Minimum 7 percent silica fume replacement by weight of the total cementitious material.

Note: Contractor may substitute a higher class of concrete for that specified at his expense.

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
**SECTION 315—ASPHALT CONCRETE PAVEMENT
DESIGN-BUILD PROJECTS**

November 25, 2009

SECTION 315—ASPHALT CONCRETE PAVEMENT of the Specifications is amended as follows:

Section 315.03—Equipment is amended by adding the following:

- (e) **Material Transfer Vehicle (MTV):** A MTV shall be a self-propelled storage unit capable of receiving material from trucks, storing the material and transferring the material from the unit to a paver hopper insert via a conveyor system. The required paver hopper insert and unit shall have a combined minimum storage capacity of 15 tons. Prior to placing the asphalt material on the roadway surface, the storage unit or paver hopper insert must be able to remix the material in order to produce a uniform, non-segregated mix, having a uniform temperature.

Section 315.05(b) Conditioning Existing Surface is replaced with the following:

- (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 VDOT. 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 shall be sealed by the application of an approved joint sealing compound.

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.

A tack or prime coat of asphalt will be required as specified below and shall conform to the applicable requirements of Section 310 and Section 311 of the Specifications. 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.

1. Priming and Tacking:

- a. **Priming aggregate base or subbase:** Unless otherwise specified in the contract documents, priming with asphalt material will not be required on aggregate subbase or base material prior to the placement of asphalt base, intermediate or surface layers.
- b. **Tacking:** Application of tack at joints, adjacent to curbs, gutters, or other appurtenances, shall be applied with a hand wand or with spray bar at the rate of 0.2 gallon per square yard. At joints, the tack applied by the hand wand or a spray bar 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.

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 VDOT.

Tack shall not be required atop asphalt stabilized open-graded material drainage layers.

Tack shall be applied between the existing asphalt surface and each asphalt course placed thereafter.

2. **Removing depressions and elevating curves:** Where irregularities in the existing surface will 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 Design-Builder 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.

Section 315.05(c) Placing and Finishing is amended to replace the second paragraph with the following:

A continuous line to mark the edge of pavement and provide proper control of pavement width and horizontal alignment will not be required for this contract.

And to add the following paragraphs:

Prior to application of tack coat and commencement of paving operations the Design-Builder shall clean the existing pavement surface of all accumulated dust, mud, or other debris that may affect the bond of the new overlay, as determined by VDOT. The Design-Builder shall ensure the surface remains clean until commencement and during paving operations. The cost for cleaning and surface preparation shall be included in the bid price for hot mix asphalt concrete.

When required in the Contract, a MTV shall be used during the placement of designated asphalt mixes on full lane width applications.

Section 315.05(d) Compacting is amended by replacing the fifth paragraph with the following:

Rolling shall begin at the sides and proceed longitudinally parallel with the center of the pavement, each trip overlapping at least 6 inches, gradually progressing to the crown of the pavement. When abutting a previously placed lane, rolling shall begin at the outside unconfined side and proceed toward the previously placed lane. On superelevated curves, rolling shall begin at the low side and proceed to the high side by overlapping of longitudinal trips parallel with the centerline.

Section 315.05(e) Density — Table III-3 Density Requirements and its footnote are replaced with the following:

**TABLE III-3
Density Requirements**

| Mixture Type | Min. Control Strip Density (%) |
|---------------------|---------------------------------------|
| SM-9.5A, 12.5A | 92.5 |
| SM-9.5D, 12.5D | 92.2 |
| SM-9.5E, 12.5E | 92.2 |
| IM-19.0A, IM-19.0D | 92.2 |
| BM-25.0A, BM-25.0D | 92.2 |

Note: 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 VDOT based on two or more production maximum theoretical density tests.

Section 315.05(e)2 Surface, Intermediate and Base Courses is replaced with the following:

- 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 Design-Builder 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.

For asphalt patching, the minimum density of 91.5 percent of the maximum theoretical density will be determined in accordance with the requirements of VTM-22. The Design-Builder shall be responsible for cutting cores or sawing plugs. One set of plugs/cores shall be obtained within the first 20 tons of patching material and every 500 tons thereafter for testing by the Design-Builder or the Department. Core/plug locations shall be randomly selected. If the density is less than the 91.5 percent, payment will be made on the tonnage within the 20 or 500 ton lot in accordance with the requirements of Table III-5.

TABLE III-5

Contract Price Adjustment or Corrective Action Required for Surface, Intermediate and Base Courses (Not sufficient quantity to perform nuclear density roller pattern and control)

| % Theoretical Maximum Density | Contract Adjustment or Corrective Action |
|--------------------------------------|--|
| Greater than or equal to 91.5 | No Contract Price Adjustment or Corrective Action Required |
| 88.3-91.4 | Contract Price Adjustment or Corrective Action Is Required |
| Less than 88.2 | Remove and Replace |

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.

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
**SECTION 315 RIDEABILITY FOR ASPHALT CONCRETE PAVEMENT
DESIGN-BUILD PROJECT**

November 23, 2009

SECTION 315—ASPHALT CONCRETE PAVEMENT of the Specifications is amended as follows:

For pavements designated for rideability testing Section 315.07(a) Surface Tolerances is replaced by the following:

Pavement smoothness will be determined by a profiler on designated lanes having a design speed of 45 miles per hour or higher as specified herein. A straightedge will be used to test intersections, urban areas, transition lanes, and pavement within 52 feet of bridge approach slabs.

For designated pavements, the surface course ride quality acceptance will be based on the lowest average International Roughness Index (IRI) for each 0.01-mile section produced by a minimum of two test runs, using a South Dakota style road profiling device and reported for each travel lane. The device shall measure both wheel paths with laser height sensing instruments. The Department will perform and complete Roughness testing within 30 calendar days of completion of the final surface course and pavement striping over the designated section, providing the Design-Builder can allow unimpeded access to the paved surface for constant highway speed test runs. Testing shall be conducted in accordance with the requirements of VTM-106.

Acceptance

An IRI number in inches per mile will be established for each 0.01-mile section for each travel lane of the surface course designated by the contract. The 0.01-mile section before and after a bridge, and the beginning and end 0.01-mile sections of the surface course will not be subject to a pay adjustment.

Areas excluded from testing by the profiler will be tested 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 not be more than 1/4 inch. Humps and depressions exceeding the specified tolerance shall be subject to correction as directed by the Engineer, at no additional cost to the Department.

The following table provides the acceptance quality rating scale of pavement based on the final rideability determination.

| IRI After Completion [Inches Per Mile] | Contract Price Adjustment or Corrective Action Required |
|---|--|
| 70.0 and Under | No Contract Price Adjustment or Corrective Action |
| 70.1-100.0 | Contract Price Adjustment or Corrective Action Required |
| Over 100.0 | Corrective Action Required |

If a contract price adjustment is required, VDOT and the Design-Builder will negotiate an appropriate adjustment in the Contract Lump Sum price or other specific requirements or adjustments that are appropriate. Any contract price adjustment will apply to the price for the total theoretical tonnage representing the total thickness of the asphalt pavement structure of the 0.01-mi section for the lane width.

When corrections to the pavement surface are required, VDOT shall approve the Design-Builder's method of correction. In order to produce a uniform cross section, VDOT may require correction to the adjoining traffic lanes or shoulders. Corrections to the pavement surface and/or the adjoining traffic lanes and shoulders will be at no cost to the Department. Methods of correction shall be limited to diamond grinding, remove and replace, and AC overlay.

Rideability will not be waived as a result of AC layer thickness and the thin hot mix asphalt concrete overlay will not be considered a "scratch course."

(c302h00-0708) **SECTION 302.03(b) PRECAST DRAINAGE STRUCTURES** of the Specifications is amended to include the following:

Precast units, excluding concrete pipe, prestressed concrete items and soundwalls, conforming to the requirements herein will only be accepted under a Quality Control/Quality Acceptance Program (QC/QA). The Contractor shall have the producer perform quality control functions in accordance with a Department approved QC/QA plan. Each piece, manufactured under the QC/QA program, in addition to the date and other required markings, shall be stamped with the letters (QC), as evidence that the required QC/QA procedures have been performed. Each shipping document shall be affixed with the following:

We certify that these materials have been tested and conform to VDOT Precast Concrete Products Quality Assurance Program

Signature and Title

1-14-08 (SPCN)

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
FLOWABLE BACKFILL

March 11, 2010

I. DESCRIPTION

This work shall consist of furnishing and placing flowable backfill for use as backfill material in pipe installations or in other uses at locations as designated on the plans, and as backfill material for plugging designated abandoned pipes and culverts.

II. MATERIALS

Hydraulic Cement shall conform to the requirements of Section 214 of the Specifications.

Fly Ash shall conform to the requirements of Section 241.02(a) of the Specifications.

Water shall conform to the requirements of Section 216 of the Specifications with the exception that wash water as described in Section 216.02 may comprise the total mix water.

Aggregates shall conform to the requirements of Sections 202 and 203 of the Specifications with a combined gradation as determined by the Contractor.

Admixtures shall conform to the requirements of Section 215 of the Specifications.

Granulated Iron Blast Furnace Slag shall conform to the requirements of Section 215 of the Specifications.

III. MIX DESIGN

Mix design for flowable backfill shall be provided by the Contractor. When used as backfill material in pipe installations or in other uses at locations as designated on the plans flowable backfill shall have a design compressive strength of 30 to 200 pounds per square inch. When used as backfill material for plugging designated abandoned pipes and culverts flowable backfill shall have a design compressive strength of 30 to 1200 pounds per square inch. The design compressive strength requirement shall be at 28 days when tested in accordance with ASTM D 4832. Mix design shall result in a fluid product having no less than an 8-inch slump at time of placement. The Contractor shall submit a mix design for approval supported by laboratory test data verifying compliance with 28 day compressive strength requirements. Mix design shall be approved by the Engineer prior to placement.

IV. PROCEDURES

Mixing and transporting shall be in accordance with Section 217 of the Specifications or by other methods approved by the Engineer.

Temperature of flowable backfill shall be at least 50 degrees F at time of placement. Material shall be protected from freezing for 24 hours after placement.

When used as backfill for pipe installation and floatation or misalignment occurs, correct alignment of the pipe shall be assured by means of straps, soil anchors or other approved means of restraint.

When used to fill the voids in abandoned pipes and culverts, they shall be plugged and backfilled in accordance with the plan details or as directed by the Engineer. The plugs shall be in accordance with the plan details. The backfill material shall be flowable backfill placed into the abandoned pipe or culvert without voids. When deemed necessary by the Engineer, the Contractor shall submit a plan of operations for acceptance showing how the flowable backfill will be placed without voids. The opening for culvert backfill installation shall be sealed with masonry or Class A-3 concrete at completion of backfilling.

V. MEASUREMENT AND PAYMENT

Flowable Backfill will be measured and paid for in cubic yards complete-in-place. When used as backfill material in pipe installations or in other uses at locations as designated on the plans this price shall be full compensation for furnishing and placing flowable backfill, securing the pipe alignment, and for all materials, labor, tools, equipment and incidentals necessary to complete the work. When used as backfill material for plugging designated abandoned pipes and culverts the price bid shall include furnishing and placing of backfill material and furnishing and installing plugs.

Payment will be made under:

| Pay Item | Pay Unit |
|-------------------|-----------------|
| Flowable Backfill | Cubic yard |

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
RIGHT-OF-WAY MONUMENTATION AND FINAL BOUNDARY STAKEOUT

December 2, 2009a

The number of **right-of-way monuments** to be set for this contract are **fill-in**.

The Contractor shall furnish right-of-way monuments and ensure the setting of such monuments and final boundary stakeout is performed by or under the direct responsibility, control and personal supervision of a Land Surveyor currently licensed and able to practice in the Commonwealth of Virginia.

SECTION 503 is added to the Specifications as a complete section as follows:

SECTION 503—RIGHT-OF-WAY MONUMENTS

503.01—Description

This work shall consist of furnishing and setting right-of-way monuments at locations shown on the plans or as designated by the Engineer in accordance with the requirements of the Standard Drawings and the Department's Survey Manual.

503.02—Materials

Right-of-way monuments shall conform to the requirements of Section 219 of the Specifications.

503.03—Procedures

Monuments shall be placed at locations designated on the plans, by the Engineer or as required by the Department's Survey Manual

Excavation shall be kept to the minimal for installation so as minimize the disturbance of in-situ material and compaction and backfill efforts. Backfill shall be thoroughly compacted in a manner that will not displace the monument.

503.04—Measurement and Payment

Right-of-way monuments 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, installing, excavating, backfilling and compaction.

Payment will be made under:

| Pay Item | Pay Unit |
|----------------------------------|-----------------|
| Right-of-way monument (Standard) | Each |

SECTION 517—CONTRACTOR CONSTRUCTION SURVEYING of the Specifications is amended as follows:

Section 517.02—General Requirements is amended to add the following:

- (e) location, final boundary stakeout, and final right of way monumentation

Section 517.04(i) Right of way and boundary stakeout affecting property ownership is amended to replace the last sentence with the following:

Final boundary stakeout shall be performed in accordance with the Department's Survey Manual by or under the direct responsibility, control and personal supervision of a Land Surveyor currently licensed and able to practice in the Commonwealth of Virginia.

Section 517.04(j) Locating and setting right-of-way monuments is replaced with the following:

- (j) **Locating and setting right-of-way monuments:** Final right of way monumentation shall be performed in accordance with the Department's Survey Manual and Section 503 herein by or under the direct responsibility, control and personal supervision of a Land Surveyor currently licensed and able to practice in the Commonwealth of Virginia.

Hub and tack points for RM-1 right-of-way monuments shall be set in accordance with the Road and Bridge Standards. The Contractor shall furnish RM-2 right-of-way monuments and locator posts. The Department will furnish the required caps for installation by the Contractor. Surveying work and drawings shall be in accordance with the requirements of *Sample Figure 4 in Chapter 8—Construction Surveys* of the Survey Manual. Where required by the Department's Survey Manual all drawings, layouts, field notes, documentation, etc shall be signed and sealed by the licensed Land Surveyor. The Certified record drawings, field notes, and computations shall be submitted to the Engineer.

Upon completion of the project, the Contractor shall provide the Engineer with all original surveying drawings, field notes, layouts, computations, sketches and drawings in the format approved by the Engineer. All electronic copies submitted shall be in a format fully compatible with the Department's existing computer hardware and software.

Section 517.05(h) Right of way and boundary stakeout affecting property ownership is amended to replace the last sentence with the following:

Final boundary stakeout shall be performed in accordance with the Department's Survey Manual by or under the direct responsibility, control and personal supervision of a Land Surveyor currently licensed and able to practice in the Commonwealth of Virginia.

Section 517.05(i) Setting right-of-way monuments is replaced with the following:

- (i) **Setting right-of-way monuments:** Final right of way monumentation shall be performed in accordance with the Department's Survey Manual and Section 503 herein by or under the direct responsibility, control and personal supervision of a Land Surveyor currently licensed and able to practice in the Commonwealth of Virginia.

Hub and tack points for RM-1 right-of-way monuments shall be set in accordance with the Road and Bridge Standards. The Contractor shall furnish RM-2 right-of-way monuments and locator posts. The Department will furnish the required caps for installation by the Contractor. Surveying work and drawings shall be in accordance with the requirements of *Sample Figure 4 in Chapter 8—Construction Surveys* of the Survey Manual. Where required by the Department's Survey Manual all drawings, layouts, field notes,

documentation, etc shall be signed and sealed by the licensed Land Surveyor. Certified record drawings, field notes, and computations shall be submitted to the Engineer.

Upon completion of the project, the Contractor shall provide the Engineer with all original surveying drawings, field notes, layouts, computations, sketches and drawings in the format approved by the Engineer. All electronic copies submitted shall be in a format fully compatible with the Department's existing computer hardware and software.

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
CORROSION RESISTANT REINFORCING STEEL

January 24, 2012

SECTION 223—STEEL REINFORCEMENT of the Specifications is revised as follows:

223.02—Detail Requirements is amended to add the following

- (e) **Corrosion Resistant Reinforcing Steel, Class I:** Steel shall conform to the requirements of ASTM A1035/A1035M – Standard Specification for Deformed and Plain, Low-carbon, Chromium, Steel Bars for Concrete Reinforcement; or shall conform to the requirements of ASTM A955/A955M – Standard Specification for Deformed and Plain, Solid Stainless Steel Bars for Concrete Reinforcement, UNS* Designation(s): S32101.
- (f) **Corrosion Resistant Reinforcing Steel, Class II:** Steel shall conform to the requirements of AASHTO Designation: MP 13M/MP 13-04, Standard Specification for Stainless Steel Clad Deformed and Plain Round Steel Bars for Concrete Reinforcement; or shall conform to the requirements of ASTM A955/A955M - Standard and Specification for Deformed and Plain Solid Stainless Steel Bars for Concrete Reinforcement. UNS* Designations: S24100. Stainless steel clad bars may only be provided if they are domestically produced except for projects designated as experimental in the plans.
- (g) **Corrosion Resistant Reinforcing Steel, Class III:** Steel shall conform to the requirements of ASTM A955/A955M - Standard Specification for Deformed and Plain Solid Stainless Steel Bars for Concrete Reinforcement. UNS* Designations: S24000, S30400, S31603, S31653, S31803, S32304.

* Unified Numbering System for Metals and Alloys

VIRGINIA DEPARTMENT OF TRANSPORTATION
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

**SUPPLEMENTAL SECTION 413—DISMANTLING AND REMOVING EXISTING STRUCTURES OR
REMOVING PORTIONS OF EXISTING STRUCTURES**

**SECTION 413—DISMANTLING AND REMOVING EXISTING STRUCTURES OR REMOVING
PORTIONS OF EXISTING STRUCTURES** of the Specifications is amended as follows:

Section 413.02(b) Removing Portion of Existing Structure is replaced with the following:

- (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, the weight of the hammer alone shall be not more than a nominal 90 pounds for widening work or a nominal 35 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 a nominal 35 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 nominal 35-pound pneumatic hammers within 2 inches of the deck and not more than nominal 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.

**VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
DRILLED SHAFTS
for Design-Build and PPTA Contracts**

November 18, 2009

I. DESCRIPTION:

This work shall consist of all labor, materials, equipment and services necessary to perform all operations to complete the drilled shaft installation in accordance with the specifications, this special provision and with the details and dimensions shown on the plans. Drilled shafts are reinforced concrete, deep foundation elements, cast-in-place against insitu material through augered holes. Unless otherwise shown on the plans, drilled shafts are straight and vertical. In this Special Provision, the terms "Design-Build team" and "Contractor" are generic terms that refer to the party under contract with VDOT to design and construct the project.

II. SITE INFORMATION

If Engineering Geology Sheets are included in the Contract Documents, the data on subsurface conditions are not intended as representations or warranties of continuity of such conditions. The data are made available for the convenience of the Design-Build team, and it is expressly understood that the Department will not be responsible for interpretations or conclusions drawn there from.

The Design-Build team may obtain right-of-entry and complete whatever investigations, research, tests, or analyses required for design and construction purposes.

If a geotechnical report was prepared for this project, this report is not a warranty of subsurface conditions. The opinions and engineering analyses expressed in the report are those of the authors, and they represent their interpretation of subsurface conditions, and field and laboratory test data. Therefore, the information in the Geotechnical Report is not intended as a substitute for the Design-Build team's personal investigation, interpretation, and good judgment.

III. QUALIFICATIONS OF DRILLED SHAFT CONTRACTOR:

The Contractor performing the work described in this specification shall have experience consisting of successful installation of at least 10 drilled shaft projects installed within the past 5 years, 2 of which shall be similar or greater size and in similar geologic conditions. The Contractor shall provide documentation of his superintendent's qualifications, record of experience, and prior project references demonstrating that he can handle unusual site conditions and equipment breakdowns. The drilled shaft work shall be performed under the supervision of the Contractor's superintendent, who shall have at least 5 years of experience installing drilled shafts within the last 8 years and shall be fully knowledgeable and experienced in construction of drilled shaft foundations of similar size and geologic conditions as those shown on the plans.

The mentioned documentation shall reference, for each project, the names and phone numbers of owner's representatives who can verify the Contractors' participation on those projects, detail the size and number of the shafts, methods used during installation, methods used for wall stabilization, local soil conditions, actual construction time, and contract time.

VDOT may accept or reject the Drilled Shaft Subcontractor based on his qualifications and previous field performance.

IV. SUBMITTALS:

A. Installation Plan

No later than one month prior to constructing drilled shafts, the Contractor shall submit an installation plan for review by VDOT. This plan shall provide information of the following:

- (a) A list of the 10 projects performed in the last 5 years by the Contractor performing the work specified as required experience in Section III. QUALIFICATIONS OF DRILLED SHAFT CONTRACTOR. The documentation shall reference, for each project the names and phone numbers of owner's representatives who can verify the Contractors' participation on those projects, detail the size and number of the shafts, methods used during installation, methods used for hole stabilization, local soil conditions, actual construction time, and contract time. The Contractor shall provide documentation of his superintendent's qualifications, record of experience, and prior project references demonstrating that he can handle unusual site conditions and equipment breakdowns. The mentioned documentation shall reference, for each project, the names and phone numbers of owner's representatives who can verify the Contractors' participation on those projects, detail the size and number of the shafts, methods used during installation, methods used for hole stabilization, local soil conditions, actual construction time, and contract time.
- (b) List of proposed equipment to be used, including cranes, drills, augers, bailing buckets, final cleaning equipment, desanding equipment, slurry pumps, core sampling equipment, tremies or concrete pumps, etc.
- (c) Details of overall construction operation sequence and the sequence of shaft construction in bents or groups including the time for driving casing, sealing casing, excavation and/or drilling time, drilled shaft cleaning, rock coring, drilled shaft inspection and concrete placement.
- (d) Details of shaft excavation methods. Methods for monitoring verticality of the drilled shaft walls during excavation and details of proposed corrective measures to be implemented for shafts out of tolerance.
- (e) When the use of slurry is anticipated, details of the mix design and its suitability for the subsurface conditions at the construction site, mixing and storage methods, maintenance methods, and disposal procedures.
- (f) Details of methods to clean the excavated shaft.
- (g) Details of Steel Reinforcement Placement during Construction. Include methods to ensure cage centering and cover; cage integrity while lifted during placement (number of cranes, lift points, and spreader bars); number and location of bottom and side spacers; cage support; and tie downs during concrete placement.
- (h) Details of concrete placement, including proposed operational procedures for free fall, tremie or pumping methods.
- (i) Details of casing installation and removal methods.
- (j) Plan to Protect Existing Structures. The Contractor shall outline the steps he will take during drilled shaft installation to protect adjacent or nearby structures.
- (k) Details of Environmental Control Procedures. Indicate plan to prevent loss of soil, slurry or concrete into waterways, project areas, or protected areas and to comply with all State and Federal environmental regulations.
- (l) Method to install and secure the Crosshole Sonic Logging (CSL) tubes to the reinforcing cage.
- (m) Concrete Mix Design. Include the details of the concrete mix design to be used. Mix design shall include a Slump Loss Graph. The Slump Loss Graph for a proposed drilled shaft mix design shall illustrate the slump reducing slowly and still exceeding 4 inches slump 4 hours after batching.
- (n) Concrete Placement Plan. The proposed Concrete Placement Plan shall ensure that sufficient concrete is at the job site or in transit to the job site so that the entire pour can be done without delay. Include location of the concrete plant, number of trucks, estimated delivery times, estimated time between trucks, and number of trucks at the site before placement begins. Indicate the use of tremie or concrete pump, deair lines, details of the seal to be used at the bottom end of the tremie or concrete pump line. Breakdowns of concrete plants, trucks, or traffic problems shall be considered under this Concrete Placement Plan. Include an estimate of the concrete placement and overpouring time per drilled shaft.
- (o) Methods of Disposal of Spoil Excavation, Waste Slurry, Waste Concrete, and Drilled Shaft Cutoffs. Sufficient details shall be presented to VDOT to evaluate the adequacy and compliance of the Contractor's methods of disposal with the VDOT specifications, including all related environmental permits and local regulations.

VDOT will evaluate the drilled shaft installation plan for conformance with the plans, specifications and special provisions. Within 14 days after receipt of the installation plan, VDOT will notify the Contractor of any additional information required and/or changes necessary to meet the contract requirements. All procedural approvals given by VDOT shall be subject to trial in the field and shall not relieve the Contractor of the responsibility to satisfactorily complete the work as detailed in the plans and specifications.

B. Preconstruction Conference

A shaft preconstruction conference will be held with the Contractor and Sub-Contractor (if applicable) prior to the start of shaft construction to discuss construction and inspection procedures. This conference will be scheduled by VDOT after the Contractor's submittals are approved by VDOT.

V. FIELD DEMONSTRATION OF THE TRIAL SHAFT:

When required on the plans, after the Drilled Shaft Installation Plan has been approved, a trial (non-production) drilled shaft(s) will be constructed to the dimension(s) and at the location(s) indicated in the plans or as directed by VDOT. The trial drilled shaft must be constructed in identical manner as that proposed for the production shafts, including the method of installation, CSL tube installation and testing, steel reinforcement, and concreting. The diameter and depth of the trial drilled shaft shall be the maximum diameter and maximum depth of any the production drilled shafts shown on the plans unless otherwise directed by VDOT. During the construction of the trial drilled shaft, the Contractor must demonstrate the adequacy of his Drilled Shaft Installation Plan.

Construction of the trial drilled shaft(s) will be used to determine if the Contractor's methods, equipment, and proposed procedures are effective in producing a drilled shaft excavation and concreting that meet the requirements of the plans and specifications.

Failure by the Contractor to demonstrate to VDOT the adequacy of methods and equipment shall be reason for VDOT to require alterations in equipment and/or method by the Contractor to eliminate unsatisfactory results. Any additional trial shafts required to demonstrate the adequacy of altered methods or construction equipment shall be at the expense of the Design-Bid team. Once approval has been given to construct production shafts, no changes will be permitted in the methods or equipment used to construct the satisfactory trial shaft without written approval of VDOT.

The concreted trial shafts shall be cut off 2 feet below finished grade and left in place. The disturbed areas at the sites of the trial shafts shall be restored as nearly as practical to their original condition.

VI. MATERIALS:

A. Hydraulic Cement Concrete for Drilled Shafts

1. Hydraulic cement concrete shall conform to the requirements of Section 217 of the Road and Bridge specifications, except as noted herein.
2. Specifications for Concrete Mixture

(a) Requirements for Hydraulic Cement Concrete

| Class of Concrete | Design Min. Laboratory Compressive Strength at 28 Days (f'c) (psi) | Design Max. Laboratory Permeability at 28 Days (Coulombs) | Aggregate Size No. | Min. Cementitious Content (lb /cu yd) | Max. Water /Cementitious <u>lb. water</u> /lb. cement | Consistency (in of slump) | Air Content (percent) |
|------------------------|--|---|--------------------|---------------------------------------|---|---------------------------|-----------------------|
| Drilled Shaft Concrete | 5,000 or as specified on the plans | 2500 | 8 | 635 | 0.40 | See Section VI.A 2 (c) | 4 ½ ± 1 ½ |

(b) Requirements for Low Permeability

1. Fly ash shall conform to the requirements of Section 241. Class F fly ash shall be between 20 percent and 25 percent by mass of the cementitious material. However, no more than 15 percent of the Portland cement of a standard mixture shall be replaced. Silica fume shall conform to the requirements of AASHTO M307 or ASTM C1240. Silica fume shall replace between 7 percent and 10 percent by mass of the cementitious material. Only silica fume at the rate of 3 percent to 7 percent may be added to all combinations to reduce the early permeability after the approval of VDOT.
2. Quality Assurance for Low Permeability Concrete in Drilled Shafts

When required on the plans, testing for permeability shall be conducted and submitted as part of the concrete mix design required in IV.A (m) Installation Plan. At least two trial batches, using job materials, with permissible combination of cementitious materials shall be prepared, and test specimens shall be cast by the Contractor and tested by the Department for permeability and strength at least a month before the field application. The permeability samples shall be cylindrical specimens with a 4-inch diameter and at least 4-inches in length. They shall be moist-cured as the strength cylinders for acceptance except that the last 3 weeks of cure shall be at 100 degrees Fahrenheit \pm 10 degrees Fahrenheit. Cylinders shall be tested at 28 days in accordance with VTM 112. The test value shall be the result of the average values of tests on two specimens from each batch. Permeability values obtained from trial batches shall be 500 coulombs below the maximum values specified.

(c) Consistency of Concrete

Ensure that drilled shaft concrete has a slump between 7 inches and 9 inches when placement is to be under a drilling fluid and between 6 inches and 8 inches for all other placement techniques.

Ensure that drilled shaft concrete maintains a slump of 4 inches or more throughout the drilled shaft concrete elapsed time. Ensure that the slump loss is gradual as evidenced by slump loss tests described below. The concrete elapsed time is the sum of the mixing and transit time, the placement time and the time required for removal of any temporary casing that could cause the concrete to flow into the space previously occupied by the temporary casing.

Provide slump loss tests before drilled shaft concrete operations begin, demonstrating that the drilled shaft concrete maintains a slump of at least 4 inches throughout the concrete elapsed time. Perform slump loss testing of the drilled shaft mix using a laboratory acceptable to VDOT.

(d) Slump Loss Test

Conduct the slump loss test as follows:

- 1) Batch the actual mix design at 8 inches (9 inches if wet placement) initial slump and at the highest concrete temperature expected on the job, but no less than 60°F.
- 2) Batch at least 4 cu. yd. in a mixer truck. Begin timing the test when the mixing water is introduced into the mix.
- 3) After initial mixing, measure and record the slump, ambient and, concrete temperature and percent air. Ensure all concrete properties are within specifications.
- 4) Mix the concrete intermittently at agitation speed for 30 seconds every 15 minutes.
- 5) Measure and record the slump, ambient and concrete temperatures, and percent air after every second 15 minute interval until the slump is 3 ½ inches.

Make certain the concrete maintains a minimum slump of 4 inches at least 4 hours after batching.

(e) At least three concrete test cylinders shall be taken per load.

B. Reinforcing Steel

Deformed reinforcing bars shall comply with the size, spacing, dimension, and details shown on the plans and shall conform to ASTM A 615, Grade 60, and all the pertinent requirements of Section 223 and 406 of the VDOT Road and Bridge Specifications.

C. Casing

Casing shall be steel, rigid, smooth, clean, watertight, and of ample strength to withstand both handling and driving stresses and to withstand pressure from both concrete and the surrounding earth materials. The outside diameter of casing shall not be less than the specified size of the drilled shaft. The thickness of steel casings shall not be less than (a) diameter less than 48 inches, minimum thickness $\frac{3}{8}$ inch; (b) diameter 48 to 78 inches, minimum thickness $\frac{1}{2}$ inch; (c) diameter greater than 78 inches minimum thickness $\frac{3}{4}$ inch. The dimensions are subjected to American Pipe Institute tolerances applicable to regular steel pipe. When approved by VDOT, the Contractor may elect to provide a casing larger in diameter than shown in the plans. All casing diameters shown on the plans refer to O.D. (outside diameters).

Casing pipe shall conform to ASTM A 252, Grade 2, for temporary and permanent applications. All casing, except permanent casing, shall be removed from drilled shaft excavations. Splices for permanent casing shall be welded in accordance with Section 407.04 of the VDOT Road and Bridge Specifications with no interior splice plates, producing a true and straight casing. All welding shall be in accordance with ANSI/AWS D1.1.

D. Crosshole Sonic Logging Tubes

Drilled shafts shall be equipped with access tubes for Crosshole Sonic Logging (CSL) tests at the locations shown in the plans and according to Section XV, of these Specifications. Access tubes for CSL testing shall be 2 inches I.D. schedule 40 steel pipe conforming to ASTM A 53, Grade A or B, Type E, F, or S. Pipes shall have a round, regular internal diameter, free of defects or obstructions; including any defect at the pipe joints, so as to permit the free unobstructed passage of source and receiver probes. CSL probes should be 1.35 inches diameter or smaller and 6 to 10 inches long. Each tube or steel pipe shall be fitted with a watertight shoe onto the bottom and a removable cap at the top. Both, shoe and cap shall be watertight and free from corrosion, and the internal and external faces of the tubes clean to ensure passage of the probes and good bond with the concrete.

VII. CONSTRUCTION METHODS AND EQUIPMENT:

A. Protection of Existing Structures

All reasonable precautions shall be taken to prevent damage to existing structures and utilities as indicated in Sections 107.12 and 401.03 (g) of the VDOT Road and Bridge Specifications. These measures shall include but are not limited to vibration monitoring, or subsidence control during driving of casings, sheets, or drilling.

B. Construction Sequence

Excavation to bottom of footing elevation shall be completed before shaft construction begins unless otherwise noted in the contract documents or approved by VDOT. Any disturbance to the footing area caused by shaft installation shall be repaired by the Contractor prior to the footing pour.

When drilled shafts are to be installed in conjunction with embankment placement, the Contractor shall construct drilled shafts after the placement of fill unless shown otherwise in the contract documents or approved by VDOT.

Drilled shafts, constructed prior to the completion of the fill, shall not be capped until the fill has been placed as near to final grade as possible, leaving only the necessary work room for construction of the caps.

C. General Methods and Equipment

1. General

The method used for drilled shaft installation shall be suitable for the intended purpose and materials encountered. The dry method, wet method, temporary casing method, or permanent casing method can be used as necessary to produce a sound and durable foundation free of defects. When a particular installation method is required in the Contract Documents, only that method of construction shall be used. If no particular method is specified for use, the Contractor shall select and use one of the methods of construction cited above as determined by the site conditions and needed to properly accomplish the work. The permanent casing method shall be used only when required in the Contract Documents or authorized by VDOT. The Contractor shall submit to VDOT for approval his selected method of construction in the Drilled Shaft Installation Plan described in Section IV of these Specifications.

Where soil and groundwater conditions vary along the site, a single method of construction may be not appropriate for the entire job site, a combination of methods may be used. The Contractor may propose in his Drilled Shaft Installation Plan alternative methods of drilled shaft installation as appropriate, or recommendations in preparation for contingencies, or a contingency plan to change installation method when the new conditions are encountered.

2. Dry Construction Method

The dry construction method shall be used only at sites where the groundwater level and soil and rock conditions are suitable to permit construction of the shaft in a relatively dry excavation, and where the sides and bottom of the shaft may be visually inspected by VDOT prior to placing the concrete. The dry method consists of drilling the shaft excavation, removing accumulated water and loose material from the excavation, placing the reinforcing cage, and concreting the shaft in a relatively dry excavation.

The dry construction method shall only be approved by VDOT when the trial shaft excavation demonstrates that: less 12 inches of water accumulates above the base over a one hour period when no pumping is permitted; the sides and bottom of the hole remain stable without detrimental caving, sloughing or swelling over a four-hour period immediately following completion of excavation; and all loose material and water can be satisfactorily removed prior to inspection and prior to concrete placement. The Contractor shall use the wet construction method or the casing construction method for shafts that do not meet the above requirements for the dry construction method.

3. Wet Construction Method

The wet construction method may be used at sites where a dry excavation cannot be maintained for placement of the shaft concrete. This method consists of using water or slurry (mineral or polymer) to maintain stability of the borehole perimeter while advancing the excavation to final depth, placing the reinforcing cage, and concreting the shaft. Where drilled shafts are located in open water areas, exterior casings shall be extended from above the water elevation into the ground to protect the shaft concrete from water action during placement and curing of the concrete. The exterior casing shall be installed in a manner that will produce a positive seal at the bottom of the casing so that no piping of water or other materials occurs into or from the shaft excavation.

The wet construction method may be used in combination with the dry method and temporary or permanent casing methods. The wet method may involve desanding and cleaning the slurry (for mineral slurries); final cleaning of the excavation by means of a bailing bucket, air lift, submersible pump or other approved devices; and placing the shaft concrete with a tremie or concrete pump beginning at the shaft bottom. Temporary surface casings should be provided to aid shaft alignment and position, and to prevent sloughing of the top of the shaft excavation, unless the Contractor demonstrates to the satisfaction of VDOT that the surface casing is not required. When using the wet method all drilled shaft operations shall be accomplished while maintaining at least 5 feet of positive head of fluid above the water table.

4. Temporary Casing Construction Method

The temporary casing method shall be used when the dry or wet construction methods are inadequate to prevent hole caving or excessive deformation of the hole. In this method the casing may be either placed in a predrilled hole or advanced through the ground by twisting, driving or vibration before being cleaned out.

When the casing is placed within a predrilled borehole and the temporary stability of the hole is needed, drilling slurry shall be used. The slurry that is trapped in the annular space behind the casing must be forced out of that space by the rising column of fluid concrete as the casing is being pulled. The slurry used to stabilize a borehole temporarily prior to the placement of casing must satisfy all of the criteria of drilling slurry for the wet method of construction.

5. Permanent Casing Construction Method

The permanent casing method shall be used only when required in the plans or approved by VDOT, to construct drilled shafts through weak caving soils that do not contribute significantly to the drilled shaft shear capacity. In this method, before beginning the excavation, a permanent casing is installed to the projected depth by advancing it through the caving material by twisting, driving, or vibration. Unless specifically allowed by the plans, placement of permanent casing in an oversized hole or temporary casing outside the permanent casing beneath the ground surface will not be allowed. If full penetration of the permanent casing cannot be attained to the projected depth, excavate a selected depth inside the permanent casing, resume casing advancing, and

repeat the process as necessary until the casing reaches the projected depth. Once the required elevation is reached, clean the excavation as indicated in XII of these specifications, lower the reinforcing cage, and concrete to completion.

VIII. EXCAVATION AND DRILLING EQUIPMENT:

The excavation and drilling equipment shall have adequate capacity, including power, torque and downthrust to excavate a hole of both the maximum diameter and to a depth of 20 percent beyond the depths shown on the plans or 15 feet whichever is greater.

The excavation and overreaming tools shall be of adequate design, size and strength to perform the work shown in the plans or described herein. When the material encountered cannot be drilled using conventional earth or rock augers and/or underreaming tools, the Contractor shall provide special drilling equipment, including but not limited to: rock core barrels, rock tools, air tools, and other equipment as necessary to construct the shaft excavation to the size and depth required. Blasting is not permitted to advance the excavation unless shown on the plans and specifications. Blasting for core removal is permitted when approved by VDOT.

The Contractor shall stabilize all drilled shaft excavations with steel casing and/or fluid except, as approved by VDOT, above the portions of the excavations in rock. Stabilize excavations at all times from the beginning of drilling through concrete placement. Provide casing or slurry in rock if unstable material is anticipated or encountered during drilling. When slurry is not used, do not leave a partially excavated shaft open overnight unless the excavation is cased to rock.

For the purposes of this special provision, "Rock" is defined as a continuous intact natural material in which the penetration rate with a rock auger is less than 2 inches per 5 minutes of drilling using a drill rig capable of applying at minimum of 35,000 pounds of down pressure (Crowd) while turning the auger for diameters equal to or less than 48 inches in diameter and at least 50,000 pounds of down pressure (Crowd) for augers greater than 48 inches in diameter. Rock augers shall be equipped with carbide teeth in good condition while performing this test. This definition excludes discontinuous loose natural materials such as boulders and man-made materials such as concrete, steel, timber, etc.

When slurry is used the Contractor shall adjust the excavation operations so that the maximum time the slurry is in contact with the sidewalls of the uncased portions of the drilled shaft excavation (from time of drilling to completing concrete placement) does not exceed 24 hours. The slurry shall be agitated in the drilled shaft excavations a minimum of every 4 hours. If the 24 hour time limit is exceeded, overream the drilled shaft excavation a minimum of 1 inch and a maximum of 3 inches, or as required by VDOT, prior to performing other operations in the excavation. Overream with a grooving tool, overreaming bucket or other approved equipment at a minimum spacing of 12 inches. The Contractor bears all costs associated with both overreaming and additional shaft concrete placement at no additional cost to the Department. If concrete placement is not completed within three days of beginning drilling, enlarge the design drilled shaft diameter by a minimum of 6 inches, or as required by VDOT, the entire length of the shaft at no additional cost to the Department. Enlarging the drilled shaft includes replacing the steel casing with steel casing the same size to which the drilled shaft is enlarged at no additional cost to the Department.

IX. EXCAVATIONS:

A. General

Shaft excavations shall be made at locations, shaft geometry and dimensions shown in the contract documents. The Contractor shall extend drilled shaft tip (base) elevations when VDOT determines that the material encountered during excavation is unsuitable and/or differs from that anticipated in the design of the drilled shaft.

The Contractor shall maintain a construction method log during shaft excavation. The information recorded shall be as indicated in the "VDOT Excavation Form" provided by VDOT. For each drilled shaft installed, record on the VDOT Excavation Form the location, dimensions, verticality, slurry test data, description of the materials encountered at all elevations, drilling time, elevation of the water table during excavation and seepage, description of any change in excavated material, elevation of top and bottom of the finished shaft, depth to the rock bearing stratum, condition of the bottom of the excavation or rock bearing surface, deviation from plan location, concrete data, a description of the tools and drill rigs used and any changes necessitated by changing ground conditions and other pertinent data to the drilled shaft operations. Submit a draft of this form for each

completed drilled shaft within 24 hours of shaft completion. Report any unusual observation to VDOT as soon as possible.

The Contractor shall provide areas for the disposal of unsuitable materials and excess materials removed from drilled shaft excavations and shall dispose them in accordance with applicable requirements of Section 106.04 of the VDOT Road and Bridge Specifications.

The Contractor shall not permit any worker to enter the drilled shaft excavation for any reason unless: a suitable casing has been installed, the water level has been lowered and stabilized below the level to be occupied, and an adequate safety equipment and procedures have been provided to the personnel entering the excavation which includes OSHA certification for confined space entry.

B. Classified Excavation:

When designated in the contract documents, the Contractor shall perform classified excavation under standard and special excavation items. Obstruction removal shall be defined separately.

1. Standard Excavation

Standard excavation is excavation accomplished with conventional tools such as augers fitted with either soil or rock teeth, drilling buckets, and overreaming buckets attached to drilling equipment of the size, power, torque, and down thrust (crowd) approved for use by VDOT after successful construction of a trial drilled shaft.

2. Special Excavation

Special excavation is an excavation that requires special tools and/or procedures to accomplish hole advancement. Special excavation is defined as excavation, except obstructions, below the depth where conventional tools and the approved drilling equipment, operating at maximum power, torque and down thrust, cannot advance the hole more than 2 inches in 5 minutes and coring, air tools, etc. are required to advance the excavation.

3. Probe Holes

When required on the plans, at the completion of the drilled shaft excavation, drill a minimum 2-inch probe hole one and one-half shaft diameters below the base of the excavation for examination with a feeler probe.

C. Obstructions

Surface and subsurface obstructions at drilled shaft locations shall be removed by the Contractor. Such obstructions may include man-made materials such as old concrete foundations and natural materials such as boulders. Special procedures and/or tools shall be employed by the Contractor after the hole cannot be advanced using conventional augers, drilling buckets and/or underreaming tools. Such special procedures/tools may include but are not limited to chisels, boulder breakers, core barrels, air tools, hand excavation, temporary casing, and increasing the hole diameter. Blasting shall not be permitted unless specifically approved by VDOT.

D. Lost Tools

Drilling tools that are lost in the excavation shall not be considered obstructions and shall be promptly removed by the Contractor.

X. CASINGS

Casings shall be steel, smooth, clean, watertight, and of ample strength to withstand both handling and driving stresses and the pressure of both concrete and the surrounding earth materials. The outside diameter of casing shall not be less than the specified diameter of shaft, and the outside diameter of any excavation made below the casing shall not be less than the specified diameter of the shaft. All casings, except permanent casings, shall be removed from shaft excavations. Any length of permanent casing installed below the shaft cutoff elevation, shall remain in place.

When the shaft extends above ground or through a body of water, the portion exposed above ground or through a body of water may be formed with removable casing except when the permanent casing is specified. Removable casing shall be stripped from the shaft in a manner that will not damage the concrete. Casings can

be removed when the concrete has attained sufficient strength provided: curing of the concrete is continued for a 72-hour period; the shaft concrete is not exposed to salt water or moving water for 7 days; and the concrete reaches a compressive strength of at least 2500 psi, as determined from concrete cylinder breaks.

A. Temporary Casing

All subsurface casing shall be considered temporary unless specifically shown as permanent casing in the contract documents. The Contractor shall be required to remove temporary casing before completion of concreting the drilled shaft. Telescoping, predrilling with slurry, and/or overreaming beyond the outside diameter of the casing may be required to install casing.

If the Contractor elects to remove a casing and substitute a longer or larger-diameter casing through caving soils, the excavation shall be either stabilized with slurry or backfilled before the new casing is installed. Other methods, as approved by VDOT, may be used to control the stability of the excavation and protect the integrity of the foundation materials.

Before the casing is withdrawn, the level of fresh concrete in the casing shall be a minimum of 10 feet above either the hydrostatic water level in the formation or the level of drilling fluid in the annular space behind the casing, whichever is higher. As the casing is withdrawn, care shall be exercised to maintain an adequate level of concrete within the casing so that fluid trapped behind the casing is displaced upward and discharged at the ground surface without contaminating or displacing the shaft concrete.

Temporary casings which become bound or fouled during shaft construction and cannot be practically removed shall constitute a defect in the drilled shaft. The Contractor shall be responsible to improve defective shafts to the satisfaction of VDOT. Such improvement may consist of, but is not limited to, removing the shaft concrete and extending the shaft deeper to compensate for loss of frictional capacity in the cased zone, providing straddle shafts to compensate for capacity loss, or providing a replacement shaft. All corrective measures including redesign of footings caused by defective shafts shall be done to the satisfaction of VDOT without an extension of the completion date of the project.

B. Permanent Casing

Permanent casing shall be used when shown in the contract documents. The casing shall be continuous between top and bottom elevations prescribed in the plans. After installation is complete, the permanent casing shall be cut off at the prescribed elevation and the shaft completed by installing necessary reinforcing steel and concrete in the casing.

In cases where special temporary casings are shown on the plans or authorized in writing by VDOT to be used in conjunction with permanent casing, the Contractor shall maintain both alignment of the temporary casing with the permanent casing and a positive, watertight seal between the two casings during excavation and concreting operations.

XI. SLURRY:

Mineral or polymer slurries shall be employed when slurry is used in the drilling process unless other drilling fluids are approved by VDOT. Mineral slurry shall have both a mineral grain size that will remain in suspension and sufficient viscosity and gel characteristics to transport excavated material to a suitable screening system. The percentage and specific gravity of the material used to make the mineral suspension shall be sufficient to maintain the stability of the excavation and to allow proper concrete placement.

In locations with hard water or acidic groundwater, the slurry manufacturer shall measure the hardness, acidity, chloride and organic content of the mix water and groundwater and furnish for review and approval recommendations for modifications to the slurry that will ensure successful results in the conditions at the project site.

In locations or areas where saline or chemically contaminated ground water occurs, the use of attapulgite or sepiolite and/or additives instead of bentonite maybe needed. Furnish for review and approved recommendations for the type and modification to the proposed mineral slurry that will ensure successful results in the conditions at the project site.

During construction, the level of the slurry shall be maintained at a height sufficient to prevent caving of the hole. In the event of a sudden significant loss of slurry to the hole, the construction of that foundation shall be stopped until either a method to stop slurry loss or an alternate construction procedure has been approved by VDOT.

The level of mineral slurry in the shaft excavation shall be maintained at a level not less than 5 feet above the highest expected piezometric pressure head along the depth of the shaft, and the level of polymer slurry shall be maintained at a level not less than 6 feet above the highest expected piezometric pressure head along the shaft. It is anticipated that the highest piezometric pressure head is the static water elevation or the ground water elevation; however, the Contractor is responsible for determining the highest piezometric pressure head. If at any time the slurry construction method fails, in the opinion of VDOT, to produce the desired final results, then the Contractor shall both discontinue this method and propose an alternate method for approval by VDOT.

A. Mineral Slurry

Mineral slurry shall be premixed thoroughly with clean fresh water and adequate time (as prescribed by the mineral manufacturer) allotted for hydration prior to introduction into the shaft excavation. Slurry tanks of adequate capacity will be required for slurry circulation, storage, and treatment. No excavated slurry pits will be allowed in lieu of slurry tanks without the written permission of VDOT. Desanding equipment shall be provided by the Contractor as necessary to control slurry sand content to less than 4 percent by volume at any point in the borehole at the time the slurry is introduced, including situations in which temporary casing will be used. The Contractor shall take all steps necessary to prevent the slurry from "setting up" in the shaft. Such methods may include but are not limited to agitation, circulation and/or adjusting the properties of the slurry. Disposal of all slurry shall be done off site in suitable areas by the Contractor.

It is the responsibility of the Contractor to maintain a stable suspension at all times and keep the stability of the excavation. The Contractor shall adjust the slurry properties as necessary to bring the slurry to specifications.

| Property at 70°F (Units) | At the Time of Slurry Introduction in the Drilled Shaft | During Drilling and Before Concrete Placement in the Drilled Shaft | Test Method |
|---|---|--|--|
| Density in Fresh Water ^a (lb/ft ³) | 63 to 69 | 64 to 75 | Mud density balance API-13B-1, Section 1 |
| Viscosity (sec per quart) | 28 to 45 | 28 to 45 | Marsh Cone Method API-13B-1, Section 22 |
| pH | 8 to 11 | 8 to 11 | Electric pH meter or pH indicator paper strips |
| Sand Content ^b (%) | 4% maximum | 4% maximum | API-13B-1 |

- (a) Density values shall be increased by two pounds per cubic foot (lb/ft³) in salt water.
- (b) At time of concreting, sand content at any point in the drilled shaft excavation shall not exceed 4% (by volume); test for sand content as determined by the American Petroleum Institute.
- (c) Minimum mixing time shall be 10 minutes.
- (d) Storage time to allow for hydration shall be a minimum of 6 hours.

B. Polymer Slurry

If the Contractor proposes to use polymer slurry, either natural or synthetic, it must be a product approved for use by the Department. Mixing of polymer slurry in the borehole will not be permitted. Slurry properties at the time of mixing and at the time of concreting must be in conformance with the written recommendations of the manufacturer. However, whatever product is used, the sand content at the base of the drilled shaft excavation shall not exceed 1 percent when measured by Method API 13B-1, Section 5, immediately prior to concreting. The Contractor's slurry management plan shall include detailed provisions for controlling the quality of the slurry, including tests to be performed, the frequency of those tests, the test methods, and the maximum and/or minimum property requirements that must be met to ensure that the slurry meets its intended functions in the subsurface conditions at the construction site and with the construction methods that are to be used. The slurry management plan shall include a set of the slurry manufacturer's written recommendations.

Polymer slurry shall have the following properties:

| Property at 70°F (Units) | At the Time of Slurry Introduction in the | During Drilling and Before Concrete | Test Method |
|--------------------------|---|-------------------------------------|-------------|
|--------------------------|---|-------------------------------------|-------------|

| | Drilled Shaft | Placement in the Drilled Shaft | |
|---|---------------|--------------------------------|--|
| Density in Fresh Water ^a (lb/ft ³) | 63 to 65 | 65 to 67 | Mud density balance API-13B-1, Section 1 |
| Viscosity (sec per quart) | 50 maximum | 50 maximum | Marsh Cone Method API-13B-1, Section 2.2 |
| pH | 8 to 10 | 8 to 10 | Electric pH meter or pH indicator paper strips |
| Sand Content ^b (%) | 0.3% maximum | 1% maximum | API-13B-1 |

- (a) Density values shall be increased by two pounds per cubic foot (lb/ft³) in salt water.
- (b) At time of concreting, sand content at any point in the drilled shaft excavation shall not exceed 1% (by volume); test for sand content as determined by the American Petroleum Institute.
- (c) Minimum mixing time shall be 15 minutes.
- (d) Storage time to allow for hydration shall be a minimum of 4 hours.

C. Water As Drill Fluid

If approved by VDOT, the Contractor may use only water as a drilling fluid. All of the provisions in the table shown in this section for mineral slurries shall be met, except that the maximum density shall not exceed 70 pcf.

D. Slurry Testing

Slurry testing shall include the following tests, as a minimum: Density test (API 13B-1, Section 1), viscosity test (Marsh funnel and cup, API-13B-1, Section 2.2 or approved viscometer), pH test (pH meter, litmus paper), and sand content test (API sand content kit, API 13B-1, Section 5).

Tests shall be performed when the slurry temperature is above 40 degrees Fahrenheit.

Tests to determine density, viscosity and pH value shall be performed during the shaft excavation to establish a consistent working pattern. A minimum of four sets of tests shall be made during the first 8 hours of slurry use. When the results show consistent behavior the testing frequency may be decreased to one set every four hours of slurry use.

The Contractor shall ensure that a heavily contaminated slurry suspension, which could impair the free flow of concrete, has not accumulated in the bottom of the shaft. Prior to placing concrete in any shaft excavation, the Contractor shall take slurry samples using a sampling tool approved by VDOT. Slurry samples shall be extracted from the base of the shaft and at intervals not exceeding 10 feet up the slurry column in the shaft, until two consecutive samples produce acceptable values for density, viscosity, and pH.

If any slurry sample is found to be unacceptable, the Contractor shall take whatever action is necessary to bring the slurry within specifications requirements. Concrete shall not be poured until the slurry in the hole is re-sampled and tests results produce acceptable values.

Reports of all tests required above signed by an authorized representative of the Contractor, shall be furnished to VDOT on completion of each drilled shaft.

XII. EXCAVATION INSPECTION:

The Contractor shall provide equipment for checking the dimensions and alignment of each shaft excavation. The dimensions and alignment shall be determined by the Contractor. Final shaft depths shall be measured with a suitable weighted tape or other approved methods after final cleaning. Unless otherwise stated in the plans, a minimum of 50 percent of the base of each shaft will have less than 1/2 inch of sediment at the time of placement of the concrete. The maximum depth of sediment or any debris at any place on the base of the shaft shall not exceed 1-1/2 inches. Shaft cleanliness will be determined by visual inspection for dry shafts or other methods deemed appropriate by VDOT for wet shafts.

For dry excavations, the maximum depth of water shall not exceed 3 inches prior to concrete pour.

For dry shafts, the sidewalls shall be visually free of cuttings that may have been smeared on the walls during the removal and insertion of drilling tools.

XIII. CONSTRUCTION TOLERANCES:

The following construction tolerances apply to drilled shafts unless otherwise stated in the contract documents:

- (a) The center of the drilled shaft shall be within 3 inches of plan position in the horizontal plane at the plan elevation for the top of the shaft.
- (b) The vertical alignment of a vertical shaft excavation shall not vary from the plan alignment by more than 1 1/2% of the total length of the shaft.
- (c) After the concrete is placed, the top of the reinforcing steel cage shall be no more than 6 inches above and no more than 3 inches below plan position.
- (d) All casing diameters shown on the plans refer to O.D. (outside diameter) dimensions. The dimensions of casings are subject to American Pipe Institute tolerances applicable to regular steel pipe.
- (e) The top elevation of the shaft shall have a tolerance of plus 1 inch or minus 3 inches from the plan top-of-shaft elevation.
- (f) Excavation equipment and methods shall be designed so that the completed shaft excavation will have a planar bottom. The cutting edges of excavation equipment shall be normal to the vertical axis of the equipment within a tolerance of $\pm 3/8$ inch per foot of diameter.

Drilled shaft excavations and completed shafts not constructed within the required tolerances are unacceptable. The Contractor shall be responsible for correcting all unacceptable shaft excavations and completed shafts to the satisfaction of VDOT. Materials and work necessary, including engineering analysis and redesign, to complete corrections for out-of-tolerance drilled shaft excavations shall be furnished to the Department. No extension of the completion date of the project will be provided.

XIV. REINFORCING STEEL CAGE CONSTRUCTION AND PLACEMENT:

The reinforcing steel cage, consisting of longitudinal bars, ties, cage stiffener bars, spacers, centralizers, and other necessary appurtenances, shall be completely assembled and placed as a unit immediately after the shaft excavation is inspected and accepted, and prior to concrete placement. Internal stiffeners shall be removed as the cage is placed in the shaft so as not to interfere with the placement of concrete.

The reinforcing steel in the shaft shall be tied and supported so that the reinforcing steel will remain within allowable tolerances given in Section XIII of this specification. Plastic spacing devices shall be used at sufficient intervals [near the bottom and at intervals not exceeding 10 feet up the shaft] to ensure concentric spacing for the entire cage length. Use a minimum of one spacer per 30 inches of circumference of the casing with a minimum of three at each layer. The spacers shall be of adequate dimension to ensure a minimum 3 inch annular space between the outside of the reinforcing cage and the side of the excavated hole. Approved cylindrical feet (bottom supports) shall be provided to ensure that the bottom of the cage is maintained the proper distance above the base.

Hooks at the top of the reinforced steel cage shall not be bent outward if a temporary casing is to be used. Interior hooks must be designed to permit adequate clearance for the concrete tremie pipe (i.e. 10 inches minimum space). Hooks may be placed on dowels that may be rotated after concrete placement or casing removal and repositioned after the tremie is removed. The concrete must be fluid during dowel repositioning.

The elevation of the top of the steel cage shall be checked before and after the concrete is placed. If the upward displacement of the rebar cage exceeds 6 inches or if the downward displacement exceeds 3 inches, the drilled shaft will be considered defective. Corrections shall be made by the Contractor to the satisfaction of VDOT. No additional shafts shall be constructed until the Contractor has modified his rebar cage support in a manner satisfactory to VDOT.

If the bottom of the constructed shaft elevation is lower than the bottom of the shaft elevation in the plans, a minimum of one half of the longitudinal bars required in the upper portion of the shaft shall be extended the additional length by adding longitudinal reinforcing bars at the bottom of the cage. Tie or spiral bars shall be continued for the extra depth and the stiffener bars shall be extended to the final depth. All longitudinal and

transverse bars must be lap spliced or spliced with mechanical splices. Welding to the reinforcing steel will not be permitted unless specifically shown in either the plans or special provisions.

When concrete placement does not follow immediately after cage placement, remove the steel from the excavation. If the cage is removed, recheck excavation cleanliness in accordance with this special provision prior to reinstallation of the cage.

XV. INSTALLATION REQUIREMENTS FOR CSL INTEGRITY TESTS:

Crosshole Sonic Logging (CSL), a nondestructive testing (NDT) method, measures the time for an ultrasonic pulse to travel from a signal source in one access tube to a receiver in another access tube. Drilled shafts must be fitted with CSL test tubes to evaluate their integrity as indicated in the plans, Contract Documents, or as designated by VDOT. Install the access tubes or pipes as nearly parallel and far as possible from the longitudinal bars. The number of tubes to be installed per each drilled shaft diameter is as indicated in the table below:

| <u>Drilled Shaft Diameter</u> | <u>Number of CSL Tubes</u> | <u>Tube Spacing^a</u> |
|-------------------------------|----------------------------|---------------------------------|
| 3 ft to 5 ft | 4 minimum | 90 degrees |
| 5.5 ft. to 7 ft | 6 minimum | 60 degrees |
| 7.5 ft to 9 ft | 8 minimum | 45 degrees |
| Greater than 10 feet | 10 minimum | 36 degrees |

(a) Spacing based on a central angle in degrees

The tubes shall be securely attached to the interior of the reinforcement cage with a minimum concrete cover of 3 inches, and they shall be wire-tied to the reinforcing cage every five feet to secure the tubes in position during placement of the reinforcing steel cage. In all cases the tubes shall be as near to vertical and parallel as possible. The Contractor shall install the tubes in the drilled shafts in a regular and symmetric pattern such that each tube is spaced a maximum distance possible from its adjacent tube and distributed around the drilled shaft perimeter as indicated by the central angle in the table above.

The tubes shall extend from the bottom of the drilled shaft to at least 3 feet above the top of the drilled shaft, or 2 feet above the ground surface for shafts with cut-offs below the ground surface. The tubes must be capped to prevent concrete or debris from entering during manipulation of the cage and concreting. Care must be taken during lifting and lowering the steel reinforcement so as not to damage the tubes. The CSL tubes shall be filled with clean water no later than 4 hours after concrete placement. Do not break the bond between the tube and the concrete by applying excessive torque, hammering, or other sort of stress while removing the caps or plugs from the pipes. For production shafts and upon completion of the CSL tests, remove all the water from the access tubes or drilled holes and fill them up with an approved grout. CSL testing procedures are found in Section XVII of these Specifications.

XVI. CONCRETE PLACEMENT:

A. General

Concrete placement shall be performed in accordance with the applicable portions of the general specifications on concrete materials in Section V IA of this Special Provision and with the requirements herein.

Concrete shall be placed as soon as possible after reinforcing steel placement. Concrete placement shall be continuous from the bottom to the top elevation of the shaft. Concrete placement shall continue after the shaft excavation is filled until good quality concrete is evident at the top of shaft. Concrete shall be placed either by free fall or through a tremie or concrete pump. The free fall placement shall only be permitted in dry holes. Concrete placed by free fall shall fall directly to the base without contacting either the rebar cage or hole sidewall. Drop chutes may be used to direct concrete to the base during free fall placement.

The elapsed time from the beginning of concrete placement in the shaft to the completion of the placement shall not exceed 2-hours. Admixtures such as water reducers, plasticizers, and retarders shall not be used in the concrete mix unless permitted in the Contract Documents. All admixtures, when approved for use, shall be

adjusted for the conditions encountered on the job. The Contractor may request a longer placement time provided he supplies a concrete mix that will maintain a slump of 4 inches or greater over the longer placement time as demonstrated by trial mix and slump loss tests.

Subject to performance satisfactory to VDOT in the construction of the trial shafts, concrete to be placed in dry shafts less than 5 feet in diameter may be placed by allowing the concrete to free fall up to 60 feet into the excavation; for shafts at least 5 feet in diameter the free fall distance may be increased to 100 feet.

During concrete placement the Contractor is required to plot the theoretical and actual concrete volume curves on the "DRILLED SHAFT CONCRETE VOLUMES FORM."

Within the first 16 hours after a drilled shaft has achieved its initial concrete set (as determined by VDOT), do not drill adjacent shafts or allow any equipment wheel loads or excessive vibrations to occur at any point within a 20 foot radius of the drilled shaft unless the concrete has reached a strength of at least 1500 psi.

B. Tremies

Tremies may be used for concrete placement in either wet or dry holes. Tremies used to place concrete shall consist of a tube of sufficient length, weight, and diameter to discharge concrete at the shaft base elevation. The tremie shall not contain aluminum parts that will have contact with the concrete. The tremie inside diameter shall be at least 6 times the maximum size of aggregate used in the concrete mix but shall not be less than 10 inches. The inside and outside surfaces of the tremie shall be clean and smooth to permit both flow of concrete and unimpeded withdrawal during concreting. The wall thickness of the tremie shall be adequate to prevent crimping or sharp bends, which restrict concrete placement.

The tremie used for wet excavation concrete placement shall be watertight. Underwater or under-slurry placement shall not begin until the tremie is placed to the shaft base elevation, and the concrete shall be kept completely separated from the water or slurry prior to the time it is discharged. Valves, bottom plates or plugs may be used for this purpose only if concrete discharge can begin within one tremie diameter of the base of the drilled shaft. Plugs shall either be removed from the excavation or be of a material, approved by VDOT, which will not cause a defect in the shaft if not removed. The discharge end of the tremie shall be constructed to permit the free radial flow of concrete during placement operations. The tremie discharge end shall be immersed at least 7 feet in concrete at all times after starting the flow of concrete. The flow of the concrete shall be continuous. The level of the concrete in the tremie shall be maintained above the level of slurry or water in the borehole at all times to prevent water or slurry intrusion into the shaft concrete.

If at any time during the concrete pour, the tremie line orifice is removed from the fluid concrete column and discharges concrete above the rising concrete level, the shaft shall be considered defective. In such case, the Contractor shall remove the reinforcing cage and concrete, complete any necessary sidewall removal and repour the shaft.

C. Pumped Concrete

Concrete pumps and lines may be used for concrete placement in either wet or dry excavations. All pump lines shall have a minimum 4 inch diameter and be constructed with watertight joints. Concrete placement shall not begin until the pump line discharge orifice is at the shaft base elevation.

For wet excavations, a plug or similar device shall be used to separate the concrete from the fluid in the hole until pumping begins. The plug shall either be removed from the excavation or be of a material, approved by VDOT, that will not cause a defect in the shaft if not removed.

The discharge orifice shall remain at least 7 feet below the surface of the fluid concrete. When lifting the pump line during concreting, the Contractor shall temporarily reduce the line pressure until the orifice has been repositioned at a higher level in the excavation.

If at any time during the concrete pour the pump line orifice is removed from the fluid concrete column and discharges concrete above the rising concrete level, the shaft shall be considered defective. In such case, the Contractor shall remove the reinforcing cage and concrete, complete any necessary sidewall removal and repour the shaft.

D. Drop Chutes

Drop chutes may be used to direct placement of free-fall concrete in excavations where the maximum depth of water does not exceed 3 inches. Free fall placement is not permitted in wet excavations. Drop chutes shall consist of a smooth tube of either one piece construction or sections that can be added and removed. A drop chute can also be a hopper with a short tube to direct the flow of concrete. Concrete may be placed through either the hopper at the top of the tube or side openings as the drop chute is retrieved during concrete placement. If concrete placement causes the shaft excavation to cave or slough, or if the concrete strikes the rebar cage or sidewall, the Contractor shall reduce the height of free fall and/or reduce the rate of concrete flow into the excavation. If caving or sloughing of the shaft walls occurs during free-fall placement of concrete, the shaft shall be considered defective. In such case, the Contractor shall remove the reinforcing cage and concrete, complete any necessary sidewall removal and repour the shaft. If concrete placement cannot be satisfactorily accomplished by free fall, the Contractor shall use either tremie or pumping techniques to accomplish the pour.

XVII. NONDESTRUCTIVE EVALUATION:

A. General

When called for in the contract documents, specific completed drilled shafts, the number and/or location of which are specified in the Contract Documents, shall be subjected to nondestructive tests to evaluate their structural integrity. The Contractor shall be responsible for performing and submitting reports of such tests to VDOT in a timely manner. All testing shall be conducted after the concrete has cured for at least 48 hours. The Contractor shall employ a registered Professional Engineer registered in the Commonwealth of Virginia who has been qualified to perform, evaluate and report the tests. The report on the tests on any given shaft must be submitted to VDOT within 3 working days of the performance of the tests on that shaft. VDOT will evaluate the results and provide to the Contractor a response regarding the acceptability of the shaft that was tested within 3 working days of receipt of the test report.

The Contractor may continue to construct drilled shafts before the receipt of notice of acceptance of the tested shaft or shafts by VDOT; however, if VDOT finds the tested shaft(s) to be unacceptable, the Contractor shall be required to repair the unacceptable shaft to the satisfaction of VDOT and, (a) prove to the satisfaction of VDOT that the acceptability of all shafts constructed since the unacceptable shaft was constructed and the acceptability of the procedure to be used in constructing future shafts, or (b) cease all drilled shaft construction until a new construction procedure acceptable to VDOT has been proposed by the Contractor and accepted by VDOT. In the latter case, those drilled shafts constructed after the unacceptable shaft was constructed shall be repaired or tested to determine if they are of sound quantity. If any repair procedures or revisions to the Contractor's installation procedure are proposed by the Contractor, the Contractor shall submit a written plan to VDOT to repair defects and revise construction procedures. If these plans involve changes to the structural design of the shafts or shaft caps, or to the geometry of the shafts, any redesign proposed in the Contractor's plan to VDOT shall be performed by a Professional Engineer registered in the Commonwealth of Virginia.

B. Crosshole Sonic Logging CSL Test

1. General

Crosshole Sonic Logging, CSL, is a nondestructive testing, NDT, method that measures the time for an ultrasonic pulse to travel from a signal source inside an access tube to a receiver inside another access tube and evaluates the integrity of drilled shafts. In uniform, good quality concrete, the travel time between these equidistant tubes will be relatively constant from the bottom to the top of the drilled shafts and corresponds to a reasonable concrete pulse velocity. In uniform, good quality concrete, the CSL test will also produce records with good signal amplitude and energy. Longer travel times and lower amplitude/energy signals indicate the presence of irregularities such as poor quality concrete, voids, honeycombs, or soil intrusions. The signal will be completely lost by the receiver and system recorder for more severe defects such as voids and soil intrusions.

The Contractor must install access tubes intended for Crosshole Sonic Logging CSL testing and perform the test(s) as indicated in the plans, and in Sections IV.B.(i), VI-D, and XV of this Special Provision. When the Contractor is required to perform CSL tests in the Contract Documents, he must only employ experienced personnel and engage the services of approved independent testing firm with previous experience in this sort of testing. The Contractor shall submit to VDOT for his approval the list of personnel and testing firms he intends to use during the CSL testing program along with their competence and field experience to perform evaluate, and report the results of CSL tests. The Contractor shall perform the CSL tests in the number and locations specified in the Contract Documents, and he shall execute the test after at least 48 hours of concrete curing. VDOT may specify a longer curing time when retarders are used in the mix design, or other factors that may result in a

slower rate of concrete setting. All CSL testing must be completed within forty five calendar days of concrete placement.

Prior to beginning the CSL test, the Contractor shall assure that the test probes can pass through and down the tubes to the bottom of every installed tube. If a tube is obstructed, the Contractor must core a hole within the drilled shaft and near the obstructed tube to the depth indicated in the plans for that CSL tube, and the core shall be large enough to accommodate the probe through its full length. Core equipment, procedure, and location of the hole shall be approved by VDOT prior to beginning coring. Logged results of the core drilling shall be submitted to VDOT along with the cores. The CSL test can commence after the core hole is inspected and the probes can pass through.

The Contractor is responsible for submission of the CSL test report to VDOT within 3 working days of its performance for a specific drilled shaft. VDOT will evaluate and analyze the CSL test results within 3 working days of their receipt and provide the Contractor with a response regarding the acceptability of the drilled shaft tested.

2. Equipment for the Crosshole Sonic Logging, CSL, Test

The CSL test equipment consists of the following components:

- a. A microprocessor-based CSL system or analyzer for display of individual CSL records, analog-digital conversion and recording of CSL data, analysis of receiver responses, and printing of CSL logs.
- b. Ultrasonic emitter and receiver probes for 2 inches I.D. pipe.
- c. An ultrasonic voltage pulse to excite the source with a synchronized triggering system to start the recording system.
- d. Winch and tripod and connecting cables.
- e. A depth measurement device to determine recorded depths.
- f. Appropriate filter/amplification and cable systems for CSL testing.

3. Logging Procedures for Crosshole Sonic Logging, CSL, Test

The test should proceed from the bottom to the top of the test tubes and in depth increments of about 3 inches to include the full depth of both tubes. Any slack shall be removed from the cables prior to pulling the probes providing accurate depth measurement records. Test a pair of perimeter and/or diagonal tubes, and include evaluation of the condition of the drilled shaft bottom. The source and receiver should be lifted simultaneously at a speed less than 1 ft per second, and a set of readings carefully taken at their corresponding depths. The CSL tests shall be carried out with the source and receiver probes in the same horizontal plane unless test results indicate potential anomalies/defects, in which case the questionable zone may be further evaluated with fan shape or angled tests (source and receiver are vertically offset inside the tubes). Equipment, procedure, and evaluation shall be adjusted to detect, locate, and assess the extent of any irregularity or void that appears in the path of the sonic pulse. Any anomalies/defects indicated by longer pulse arrival times and significantly lower amplitude/energy signals should be reported to VDOT on site and any further tests should be carried out as necessary to evaluate the extent of such anomalies/defects.

Additional testing may be conducted in the event anomalies should be detected or suspected during the test. Information of the drilled shaft bottom and top elevations, length, along with construction dates shall be provided to the testing organization before or at the time of the CSL tests. Levels will be taken on top of each tube, and actual tube plumbness and length be recorded. CSL tests shall be conducted between pairs of tubes, and the determination of which pairs to be tested made by the independent testing agency.

4. Reporting Results of the Crosshole Sonic Logging, CSL, Test

Results of CSL test shall be presented in a report including:

- a. A brief explanation of how the test was performed, the CSL logs, the analyses, and the test results of each drilled shaft.
- b. Record the arrangement of the tubes and their dimensions per drilled shaft tested.
- c. Present a Plan View of the CSL test locations in relation to the bridge foundation.
- d. Arrival time of acoustic pulse versus depth in each pair of tubes for every drilled shaft tested.
- e. Pulse energy/amplitude versus depth in each pair of tubes for every drilled shaft tested.

- f. A CSL log shall be presented for each pair of tube tested, and when applies with any anomaly/defect zones properly discussed. Any zone with long arrival times and low power relative to other zones should be considered anomalous.

XVIII. ACCEPTANCE OF DRILLED SHAFTS:

A. Based on Specifications

Acceptance of drilled shafts shall be based on meeting the requirements as set forth in the Contract Documents. Drilled shafts will not be acceptable if:

1. Drilled shafts constructed disregarding any requirements of the Specifications or this Special Provision for Drilled Shaft.
2. Drilled shaft excavations constructed out of tolerance. The Contractor shall correct completed drilled shaft to acceptable tolerances before proceeding with new drilled shaft construction and submit correction for VDOT's approval.
3. When applicable, slurry out of tolerance, especially late introduction into the drilled shaft and before concreting.
4. Cave-in of the drilled shaft walls due to improper use of casing or slurry; or failure to use weighting agents in the slurry in running groundwater.
5. Temporary casing that cannot be removed.
6. Horizontal separations or severe neck in the drilled shaft walls when pulling temporary casing with concrete adhering to it.
7. Failure to agitate slurry or to place concrete in a timely manner causing excessive build-up of mud cake on the wall of the excavation.
8. Horizontal sand lens in concrete produced by tremie or pump line pulled out of concrete when concreting under slurry or water.
9. Quarter-moon-shaped soil intrusion on the side of the drilled shaft created by interruption in flow of concrete being pumped or tremied into slurry-filled hole or use of telescoping casing where concrete from inner casing spills into the over break zone behind outer casing.
10. Soft or loose drilled shaft bottom caused by incomplete bottom cleaning, side sloughing, or sedimentation of cuttings from slurry column where base bearing is required.
11. Voids outside of cage when low slump concrete is introduced into the drilled shaft.
12. Honeycombing, washout of fines, or water channels in the concrete if concrete is placed directly into water.
13. Folded-in debris from insufficient cleaning of the drilled shaft excavation or excessive sand in the slurry.
14. Drilled shafts for which the mix design has been altered or extra water has been added without the approval of VDOT.
15. Drilled shaft constructed in such a manner that the drilled shaft cannot be completed within the required tolerances. The Contractor shall submit correction methods for VDOT's approval.

Final acceptance decision on whether repairs can or should be made or if the drilled shaft is rejected and must be replaced will be made by VDOT as necessary applying criteria set forth herein and sound engineering judgment on a drilled shaft by drilled shaft basis.

B. Based on the Cross Hole Sonic Logging (CSL) Tests

Rejection of a drilled shaft based on the drilled shaft crosshole sonic logging testing shall be conclusive evidence that a defect exists in the drilled shaft that will result in inadequate or unsafe performance of the drilled shaft. The acceptance of each drilled shaft shall be the decision of VDOT based on the results of the drilled shaft integrity testing report(s) and other information on the drilled shaft placement. If the CSL records are inconclusive, VDOT may require coring or excavation of the drilled shaft to verify drilled shaft conditions.

In the event testing discloses voids or discontinuities in the concrete which indicate that the drilled shaft is not structurally adequate, the drilled shaft shall be rejected, and construction of additional drilled shafts shall be suspended until the Contractor repairs, replaces or supplements the defective work, and VDOT approves the

remedial work. The Contractor shall suspend drilled shaft construction until VDOT approves proposed changes to the methods of drilled shaft construction submitted in writing by the Contractor.

In the case that any drilled shaft is determined to be unacceptable, the Contractor shall submit a plan for remedial action to VDOT for approval. Any modifications to the foundation drilled shafts and load transfer mechanisms caused by the remedial action will require calculations and working drawings prepared by and stamped by a Professional Engineer, hired by the Contractor and registered in the Commonwealth of Virginia, for all foundation elements affected. The Contractor shall provide all labor and materials required to design and repair or remediate drilled shafts with no extension of the contract time.

The Contractor may continue to construct drilled shafts at his own risk before the receipt of notice of acceptance by VDOT of the previously tested drilled shafts or drilled shafts constructed by a modified means and method of construction; however, if VDOT finds the tested drilled shaft or drilled shafts to be unacceptable, the Contractor shall repair to the satisfaction of VDOT the unacceptable drilled shafts and (a) prove to the satisfaction of VDOT the acceptability of all drilled shafts constructed since the unacceptable drilled shaft was built and the acceptability of the procedure to be used in construction of future drilled shafts, or (b) cease all drilled shaft construction until a new construction procedure has been proposed by the Contractor and accepted by VDOT. In the latter case, drilled shafts built after the unacceptable drilled shaft shall be repaired to the satisfaction of VDOT.

All payment to the relevant work package is part of the lump sum contract price established prior to construction. No separate payment for any of this work will be made. If an item does not satisfy the criteria stated herein, and in the event the Department accepts this item, the Quality Assurance Manager (QAM), as defined in the Special Provision for Quality Assurance/Quality Control (QA/QC) for the Construction of Deep Foundations for Design-Build and PPTA Contracts, will document the basis of acceptance. The Contractor and the Department will negotiate an appropriate adjustment in the contract price, warranty, or other specific requirements or adjustments that are appropriate.

ROCK SOCKETS where specified and detailed on the plans, the Contractor shall provide a minimum penetration into rock as shown or as field adjusted by VDOT.

Rock Sockets, complete in place, will be measured in linear feet for each diameter of rock socket listed in the estimated quantities. The final length will be determined as the difference between the top of the rock socket elevation shown on the plans or as determined by VDOT and the final bottom of the surface of the rock socket excavation elevation, as determined and authorized, complete, and accepted by VDOT.

All payment for the Rock Sockets is part of the lump sum contract price established prior to construction. No separate payment for any of this work will be made. If an item does not satisfy the criteria stated herein, and in the event the Department accepts this item, the QAM will document the basis of acceptance. The Contractor and the Department will negotiate an appropriate adjustment in the contract price, warranty, or other specific requirements or adjustments that are appropriate.

Measured Obstructions: Where specified and detailed on the plans, the Contractor shall remove all obstructions so that satisfactory completion of the drilled shaft can be accomplished.

All payment for the Obstruction Removal is part of the lump sum contract price established prior to construction. No separate payment for any of this work will be made. If an item does not satisfy the criteria stated herein, and in the event the Department accepts this item, the QAM will document the basis of acceptance. The Contractor and the Department will negotiate an appropriate adjustment in the contract price, warranty, or other specific requirements or adjustments that are appropriate.

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
DYNAMIC PILE TESTING FOR END BEARING PILES

May 25, 1999c
Reissued July 2008

I. DESCRIPTION

This work shall consist of dynamic testing of driving test piles by the use of electronic monitoring equipment, reprocessing the data and furnishing a written report of the results.

II. EQUIPMENT

The Contractor shall furnish a Pile Driving Analyzer and all required associated equipment including transducers and accelerometers.

III. TESTING

The Contractor shall employ a firm experienced in the use of the pile driving analyzer and related equipment to install or supervise the installation of the necessary equipment and to perform the dynamic monitoring. Names of previously approved firms are on a Department approved list and will be made available upon request. If the Contractor wants to use a firm that is not on the approved list, documentation of such experience shall be submitted to the Engineer for approval prior to beginning work.

Dynamic testing shall be conducted in the presence of the Engineer and during the entire time piles are initially driven or redriven.

Where possible, splices shall be made prior to the start of driving so that dynamic testing can be performed without interruption.

The Contractor shall fasten a pair of transducers and a pair of accelerometers in place prior to testing. Piles shall be driven until the pile driving analyzer indicates that the soil resistance measured is 225 percent of the pile design capacity and the required minimum tip elevation and penetration has been obtained or as directed by the Engineer. The Contractor shall remove the transducers and accelerometers after the dynamic testing is completed.

The Contractor shall notify the Engineer of the date and time for dynamic testing at least 48 hours prior to testing. Such notice shall be given during the normal work hours of the Department. If additional dynamic testing is ordered by the Engineer, the Contractor shall schedule the additional tests in cooperation with the Engineer.

The results of the dynamic testing shall be printed by the pile driving analyzer and shall include for each blow selected by the Engineer, a combination of the following quantities:

- Soil resistance from the Case Goble Method,
- Input and reflection values of force and velocity,
- Maximum transferred energy,
- Maximum compression force,
- Velocity and displacement,
- Blows per minute,
- Value of upward and downward traveling force wave,
- Ram stroke and corresponding blow sequence
- Maximum tensile and compressive stresses in the pile

A preliminary report with this information shall be provided to the Engineer within 24 hours of the testing if so requested by the Engineer.

All signals shall be recorded and made available upon the request of the Engineer.

Accompanying the production pile order list, the Contractor shall furnish the Engineer a Pile Loading (if applicable) and Dynamic Testing Report that shall include the following information for each pile tested:

- Location of test,
- Date of test,
- Driving log, all data obtained during the test,
- Any unusual or otherwise noteworthy behavior observed during or after driving or testing,
- A resistance distribution plot and related information by the CAPWAP program,
- Plot of applied load versus average butt settlement with determination of safe bearing capacity, as required by the specifications,
- A summary of soil resistance from both Loading and Dynamic Testing, including an evaluation of the correlation between the two approaches and discussion of any discrepancies,
- Recommendations for a refined wave equation analysis based on the above findings and recommended driving criteria for production piles

IV. MEASUREMENT AND PAYMENT

Dynamic pile testing (End Bearing) will be measured and paid for at the contract unit price per each, which price shall be full compensation for furnishing, installing, and removing the dynamic testing equipment, tools, labor, and incidental work necessary to monitor the dynamic testing, to provide the data and written report specified, and drilling holes to mount transducers and accelerometers.

Payment will be made under:

| Pay Item | Pay Unit |
|---------------------------------------|-----------------|
| Dynamic Pile Test (End bearing Piles) | Each |

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
DYNAMIC PILE TESTING FOR FRICTION PILES

May 25, 1999cc
Reissued July 2008c

I. DESCRIPTION

This work shall consist of dynamic testing of driving test piles by the use of electronic monitoring equipment, reprocessing the data and furnishing a written report of the results.

II. EQUIPMENT

The Contractor shall furnish a Pile Driving Analyzer and all required associated equipment including transducers and accelerometers.

III. TESTING

The Contractor shall employ a firm experienced in the use of the pile driving analyzer and related equipment to install or supervise the installation of the necessary equipment and to perform the dynamic monitoring. Names of previously approved firms are on a Department approved list and will be made available upon request. If the Contractor wants to use a firm that is not on the approved list, documentation of such experience shall be submitted to the Engineer for approval prior to beginning the work.

Dynamic testing shall be conducted in the presence of the Engineer and during the entire time piles are initially driven or redriven and during pile restrike testing.

Where possible, splices shall be made prior to the start of driving so that dynamic testing can be performed without interruption.

The Contractor shall fasten a pair of transducers and a pair of accelerometers in place prior to testing. Piles shall be driven until the pile driving analyzer indicates that the soil resistance measured is 175 percent of the pile design capacity and the required minimum tip elevation and penetration have been obtained or as directed by the Engineer. The Contractor shall remove the transducers and accelerometers after the dynamic testing is completed.

Pile restrike testing shall be conducted no sooner than 120 hours after the pile, or any pile within a 25-foot radius has been driven. Restrike testing shall include dynamic testing of the pile when it is redriven. The pile shall be redriven with the same pile hammer used for initial driving. A cold hammer shall not be used for restrike. The amount of penetration required during restrike testing shall be 6 inches or a total number of 100 hammer blows, whichever occurs first, unless the analyzer indicates the soil resistance measured on restrike is less than 225 percent of the design capacity. If the soil resistance measured on restrike is less than required, the Engineer may direct the Contractor to drive all or a portion of the remaining test pile length and repeat the restrike testing. The Contractor will be notified of the necessity to perform a second restrike test within 3 days of receipt of the CAPWAP results from the initial restrike.

The Contractor shall notify the Engineer of the date and time for dynamic testing at least 48 hours prior to testing. Such notice shall be given during the normal work hours of the Department. If additional dynamic testing is ordered by the Engineer, the Contractor shall schedule the tests in cooperation with the Engineer.

The results of the dynamic testing shall be printed by the pile driving analyzer and shall include for each blow selected by the Engineer, a combination of the following quantities:

- Soil resistance from the Case Goble Method,
- Input and reflection values of force and velocity,
- Maximum transferred energy,
- Maximum compression force,
- Velocity and displacement,
- Blows per minute,
- Value of upward and downward traveling force wave,
- Ram stroke and corresponding blow sequence
- Maximum tensile and compressive stresses in the pile

A preliminary report with this information shall be provided to the Engineer within 24 hours after completion of the testing if so requested by the Engineer.

All signals shall be recorded and made available upon the request of the Engineer.

Accompanying the production pile order list, the Contractor shall furnish the Engineer a Pile Loading (if applicable) and Dynamic Testing Report that shall include the following information for each pile tested:

- Location of test,
- Date of test,
- Driving log, all data obtained during the test,
- Any unusual or otherwise noteworthy behavior observed during or after driving or testing,
- A resistance distribution plot and related information by the CAPWAP program for the end of initial drive conditions and the beginning of restrrike conditions,
- Plot of applied load versus average butt settlement with determination of safe bearing capacity, as required by the specifications,
- A summary of soil resistance from both Loading and Dynamic Testing, including an evaluation of the correlation between the two approaches and discussion of any discrepancies,
- Recommendations for a refined wave equation analysis based on the above findings and recommended driving criteria for production piles

IV. MEASUREMENT AND PAYMENT

Dynamic pile testing (Friction Piles) will be measured and paid for at the contract unit price per each, which price shall be full compensation for furnishing, installing, and removing dynamic testing equipment, tools, labor, and incidental work necessary to monitor the dynamic testing, to provide the data and written report specified, drilling holes to mount transducers and accelerometers, all work and equipment necessary to drive the pile during restrrike testing, and any additional driving required should the required soil resistance not be obtained. A second restrrike test will be paid for at 2/3 of the contract unit price of a dynamic pile test.

Payment will be made under:

| Pay Item | Pay Unit |
|------------------------------------|-----------------|
| Dynamic Pile Test (Friction Piles) | Each |

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
**MECHANICALLY STABILIZED EARTH WALLS
(MODULAR CANTILEVER FACING)**
for Design-Build and PPTA Contracts

December 10, 2009

1.0 DESCRIPTION

This work shall consist of furnishing and constructing Mechanically Stabilized Earth (MSE) Walls with modular cantilever facing in accordance with these specifications and in reasonably close conformity with the lines, grades, dimensions, and design shown on the plans. This specification is intended to cover MSE wall systems utilizing modular cantilever facing approved by VDOT Structure and Bridge Division.

2.0 SUBMITTALS

The Contractor shall submit working drawings, shop plans, and design calculations, signed and sealed by a Virginia Registered Professional Engineer, to the Contractor's Geotechnical Engineer. The Contractor shall allow 30 days from the day the submittals are received for review and approval. The Contractor's Geotechnical Engineer will provide written review comments to the Contractor and to the Construction Quality Assurance Manager (QAM). Fabrication or any wall construction shall not begin prior to the approval of the design, working drawings and shop plans. Approval of the Contractor's working drawings and shop plans shall not relieve the Contractor of any of his responsibility under the contract for the successful completion of the work.

2.1 Working Drawings and Shop Plans

The working drawings and shop plans shall reflect all information needed to fabricate and erect the walls including:

- a. Elevations at the top of wall at all the horizontal and vertical break points and at interval not exceeding 50 feet along the wall;
- b. Elevations at the top of leveling pad step breaks;
- c. Elevation of the finished grade in front of the wall;
- d. The number, size, type, length, and details of the soil reinforcing elements in each design section;
- e. The locations and sizes of all pipes and utilities that will be penetrating the wall face or within the soil reinforced mass;
- f. Typical cross-section or cross-sections showing the elevation relationship between ground conditions and proposed grades;
- g. Details for construction of wall around obstructions (i.e. drainage facilities, utilities, overhead sign footing, piles, drilled shafts) within the reinforced backfill;
- h. Details pertaining to coping, parapets, railing, fencing as required by the contract plans;
- i. Shape, dimension, color, and designation of modular cantilever units and alignment and connection devices.

2.2 Design Calculations

The proposed design shall satisfy the design parameters and requirements in the plans and in the special provisions. Complete design calculations shall include the most critical geometry and loading combination for each design section that exist during construction and at the end of construction.

3.0 MATERIALS

The Contractor shall make arrangements to purchase or manufacture the facing elements, soil reinforcement, connection devices, cap block adhesive, and all other necessary components. Material not conforming to this section of the specifications shall not be.

3.1 Modular Cantilever Units

Modular cantilever units (field-assembled facing panels and counterforts) shall be made of hydraulic cement concrete having a minimum 28-day compressive strength of 5500 psi with synthetic fibers at 1-3% by volume. Maximum water absorption limit shall be 5%. Reinforcing steel for counterforts shall meet the requirements of Section 223 of the Specifications. Connecting loop steel for facing panels shall be type 304 stainless steel wire meeting the requirements of ASTM A1022.

When modular cantilever freeze-thaw test is required on the plans, modular cantilever units shall be tested in accordance with ASTM C1262 to demonstrate durability. The modular cantilever unit shall meet the requirements of ASTM C1372, except that acceptance regarding durability under this testing method shall be achieved if the weight loss of each of four of the five specimens at the conclusion of 150 cycles does not exceed 1% of its initial weight when tested in water. Units shall also meet the additional requirements of ASTM C 140.

3.1.1. Inspection, Sampling and Testing

The Contractor or his supplier shall furnish facilities and shall perform all necessary sampling and testing in an expeditious and satisfactory manner. Acceptance of the modular cantilever unit with respect to compressive strength will be determined on a lot basis. The maximum number of units in each lot shall be 1,500. The lot will be randomly sampled in accordance with ASTM C-140. Compressive strength tests shall be performed by the supplier and approved by the Contractor's Geotechnical Engineer. Compressive strength test specimens shall be cored or shall conform to the saw-cut coupon provisions of Section 5.2.4 of ASTM C-140. Units represented by three test coupons shall have an average compressive strength of 5500 psi and all individual coupons shall have compressive strength of 5000 psi.

3.1.2. Casting

Modular cantilever units shall be cast in a manner that will assure the production of uniform modular cantilever units. The concrete in each unit shall be placed without interruption and shall be consolidated by the use of an approved method.

3.1.3. Finish and Appearance

Unless otherwise shown on the plans, concrete surfacing for the front face of the unit shall be natural gray cut stone face finish. All units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or permanence of the construction.

3.1.4. Tolerances - All modular cantilever units shall be manufactured within the following tolerances:

- The length and width of each individual unit shall be within $\pm 1/8$ inch of the specified dimension.
- The height of each individual unit shall be within $\pm 1/16$ inch of the specified dimension.
- Squareness, as determined by the difference between the two diagonals, shall not exceed $1/4$ inch.

3.1.5. Rejection

Modular cantilever units will be subject to rejection because of failure to meet any of the requirements specified above. In addition, any of the following defects will be sufficient cause for rejection:

- Defects that indicate imperfect molding.
- Cracked greater than 0.02 inch in width and longer than 25% of the height of the unit.
- Severely chipped or broken units.
- Defects indicating honeycombed or open texture concrete.
- Color variations on front face of unit due to excess form oil or other reason.

3.1.6. Marking

The date of manufacture, production lot number, and type of unit in accordance with the approved design drawings shall be clearly marked on each lot.

3.1.7. Handling, Storage and Shipping

Modular cantilever units shall be handled, stored and shipped in such manner as to eliminate the dangers of chipping, cracks, fractures and discoloration.

3.2 Geogrid Reinforcement

Geogrids shall be a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil or rock. Structure of geogrid reinforcement shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation. Geogrid design requirements shall be as shown in the plans and specified in the design drawings.

3.2.1 Delivery, Storage, and Handling

The Contractor shall check the geogrid reinforcement upon delivery to assure that the proper grade and type of material has been received. Rolled geogrid shall be stored in accordance with the manufacture's recommendations. During all period of shipment and storage, geogrid reinforcement shall prevent wet cement, epoxy and like materials which may affix themselves, from coming in contact with the geogrids.

3.3 Select Backfill Material

Select backfill material used in the reinforced zone shall be reasonably free from organic material, shale or other poor durability particles and otherwise deleterious materials. The backfill shall conform to the following grading as determined by AASHTO T-27:

| Sieve Size | Percent Passing |
|--------------------|-----------------|
| 4 in. ⁺ | 100 |
| No. 40 | 0 - 60 |
| No. 200 | 0 - 15 |

⁺ The maximum soil particle size for polymeric geogrid reinforcement shall be 3/4 inch unless full scale installation damage tests are conducted in accordance with ASTM D5818, or if epoxy coatings are used for steel reinforcements.

The Plasticity Index (P.I.) of the backfill material as determined by AASHTO T-90 shall not exceed 6.

Backfill material shall exhibit an angle of internal friction of not less than 34 degrees, as determined by the standard Direct Shear Test, AASHTO T236, on the portion finer than the #10 sieve, using a sample of the material compacted to 95 percent of AASHTO T99, Methods C or D, with oversized correction as outlined in Note 7, at optimum moisture content. No testing is required for material where 80 percent of sizes are greater than 3/4 inch.

Backfill material shall have a magnesium sulfate soundness loss of less than 30 percent after four cycles.

Additionally, the backfill material shall have a pH range between 4.5 and 9.0 as measured by AASHTO test method T289.

The Contractor shall perform analysis tests for each source of material and shall perform such additional tests to assure conformance whenever the character of the select backfill material changes.

The Contractor shall furnish the QAM with a Certificate of Compliance certifying the furnished select backfill materials comply with the aforementioned requirements. Test results performed by the Contractor necessary to assure contract compliance shall also be furnished to the QAM.

3.4 Modular Fill

Well graded crushed stone or crushed gravel placed in the modular fill zone, extending from the facing panel to the counterfort tail, shall meet conform to the gradation limits for AASHTO #57 stone.

Additionally, the backfill material shall conform to the following electrochemical requirements when steel soil reinforcement is used:

| Requirements | AASHTO Test Methods |
|--|---------------------|
| a) pH range between 5.0 and 10.0 | T289 |
| b) Resistivity greater than 3,000 ohm-cm | T288 |
| c) Chlorides less than 100 ppm | T291 |
| d) Sulfates less than 200 ppm | T290 |
| e) Organic Content less than 1% | T267 |

If resistivity is greater or equal to 5000 ohm-cm, the chlorides and sulfates requirements may be waived.

The Contractor shall perform analysis tests for each source of material and shall perform such additional tests to assure conformance whenever the character of the select backfill material changes.

The Contractor shall furnish the QAM with a Certificate of Compliance certifying the furnished select backfill materials comply with the aforementioned requirements. Test results performed by the Contractor necessary to assure contract compliance shall also be furnished the Engineer.

3.5 Geotextile Filter Fabric

If required, separate the select backfill and modular fill with a geotextile meeting the requirements for drainage fabric as specified in Section 246. The minimum lap shall be 12 inches.

3.6 Cast-In-Place Concrete

If required, concrete for leveling pads shall be Class A3 conforming to the requirements of Section 217 of the Specifications.

3.7 Cap Stone Adhesive

Cap stone shall be attached to the top modular cantilever units in strict accordance with the manufacturer's requirements and the adhesive manufacturer's recommended procedures. Contractor shall provide a written 10 year warranty, that the integrity of the materials used to attach the cap stones will preclude separation and displacement of the cap stones for the warranty period.

4.0 CONSTRUCTION REQUIREMENTS

4.1 Wall Excavation

Wall excavation shall be unclassified in accordance with the requirements of Sections 506 and 401 of the Specifications and shall be performed in reasonably close conformity to the limits and construction stages shown on the plans.

4.2 Foundation Preparation

The foundation for the structure shall be graded level for a width equal to or exceeding the length of reinforcement or as shown on the Plans. Prior to wall construction, the foundation shall be compacted in accordance with the embankment requirements of Section 303.04 (h) of the Specifications and graded to a relatively smooth and uniform surface. Any foundation soils found to be unsuitable shall be removed and replaced with select backfill as per Materials of these specifications.

At each wall foundation level, an unreinforced concrete leveling pad shall be provided as shown on the plans. Leveling pads shall be level within 1/8 inch per pad or per 100 feet, whichever is greater. Concrete shall be cured a minimum of 24 hours before placement of modular cantilever units.

4.3 Modular Cantilever Units Installation

First course of modular cantilever units shall be placed on leveling pad and leveled side-by-side and front-to-rear with adjacent units. Prior to placing the next course of units, modular fill shall be placed in and around the counterforts, and all lifts of reinforced fill, including any geogrid reinforcement that is required, shall be placed to the top of the facing panel. Modular fill and reinforced backfill shall be placed and compacted as shown on the plans. Units shall be installed in a running bond pattern and the method of aligning blocks shall follow block manufacturer's recommendations.

Successive courses shall be placed in the sequence and alignment shown on the plans as backfill proceeds. Wall facing vertical tolerances and horizontal alignment tolerances shall not exceed 0.75 inch when measured with a 10 feet straight edge. The overall vertical tolerance of wall (plumbness from top to bottom) shall not exceed 0.5 inch per 10 feet of wall height.

4.4 Soil Reinforcement Placement

Soil reinforcement shall be placed in accordance with the manufacturer's recommendations and these specifications. Soil reinforcement shall be placed within the layers of the compacted backfill material at the locations shown on the plans. Soil reinforcement shall be placed with the strongest direction of soil reinforcement perpendicular to the wall face, unless shown otherwise in the wall plan. Soil reinforcement shall be placed within the modular fill in accordance with the unit supplier's recommendations. The soil reinforcement shall then be laid flat and uniformly tensioned to remove any slack in the connection and soil reinforcement material.

4.5 Select Backfill Placement

The placement of the select backfill material shall closely follow the erection of each course of units. At each reinforcing element level, backfill shall be roughly leveled to an elevation approximately 1 inch above the level units before placing and attaching reinforcement to the blocks. Unless otherwise shown on the plans, reinforcement shall be placed normal to the face of the wall. The maximum lift thickness shall not exceed 8 inches loose and shall closely follow block installation. The Contractor shall decrease this lift thickness if necessary to obtain the specified density.

Backfill shall be compacted to 95% of the maximum density as determined by AASHTO T-99, Method C or D with oversize correction as outlined in Note 7. For backfills containing more than 80 percent material retained on the 3/4 inch sieve, a method of compaction consisting of at least four passes with a heavy roller shall be used. For applications where spread footings are used to support bridge or other structural loads, the top 5 feet below the footing elevation shall be compacted to 100 percent AASHTO T-99. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Backfill material shall have a placement moisture content equal to the optimum moisture content. Moisture content may be up to 2 percentage points less than optimum moisture content.

At the end of each day's operations, the Contractor shall shape the last level of backfill as to permit runoff of rainwater away from the wall face. Backfill compaction shall be accomplished without disturbance or distortion of reinforcing elements and blocks. Compaction of modular fill shall be achieved using 1-ton vibrating plate compactor.

4.6 Cast-In-Place Concrete

Concrete work for leveling pads and wall top coping shall be performed in accordance with the requirements of Section 404 of the Specifications.

5.0 MEASUREMENT AND PAYMENT

The quantity of Mechanically Stabilized Earth Walls (Modular Cantilever Facing) will be the plan quantity, in units of square feet of retaining structure, as shown on the contract drawings and will include all excavation; temporary shoring when not specified on the wall plans or in the proposal as a separate pay item; concrete leveling pads; modular cantilever units; soil reinforcement; masonry; reinforcing steel; select backfill material; modular fill, backfilling; compaction; geotextile filter fabric; riprap to fill temporary excavation, including all work necessary outside the retainage area shown on the plans; disposal offsite or onsite, where permitted by the contract, of unsuitable or surplus material; and all materials, labor, tools, equipment, and incidentals necessary to complete the work. This work is integral to the relevant work package that is part of the lump sum contract price. There is no separate payment for this work. If an item does not satisfy the criteria stated herein, and in the event the Department accepts this item, this item should document the basis of acceptance. The Contractor and the Department will negotiate an appropriate adjustment in the contract price, warranty, or other specific requirements or adjustments that are appropriate.

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
Quality Assurance/Quality Control (QA/QC)
for the Construction of
Deep Foundation Systems
for Design-Build and PPTA Contracts
in Staunton, Salem and Bristol Districts

March 4, 2010

I. DESCRIPTION

This work shall consist of all material, equipment, labor, and services necessary to perform all operations of the QA/QC for the construction of deep foundation systems in accordance with these Special Provisions, the details and dimensions shown on the Plans, and the Contract Documents. Deep foundation systems referenced herein are defined exclusively as either drilled shafts or driven piles. Other methods of deep foundation construction (including, but not limited to, auger-cast piles and micropiles) may be used subject to Department approval; however, the QA/QC requirements for methods other than drilled shafts or driven piles are beyond the scope of this document.

Note regarding the frequency of testing: For dual structures (parallel bridges situated in close proximity to each other), while these bridges are considered to be two individual structures, for the purposes of the paragraphs herein, they can be considered to be a "single" bridge.

II. SUPPORTING DOCUMENTS

Implementation of this Special Provision requires a complete understanding of the following documents:

1. "Special Provision for Drilled Shafts"
2. "Special Provision for Wave Equation Analysis"
3. "Special Provision for Dynamic Pile Testing for Friction Piles"
4. "Special Provision for Dynamic Pile Testing for End Bearing Piles"
5. Section 403 of the VDOT Road and Bridge Specifications

III. CONSTRUCTION QUALITY CONTROL

The Contractor shall integrate the design and construction team to ensure coordination and implementation of its geotechnical engineer's foundation design requirements in the constructed product. The Contractor shall employ a full-time, Construction Quality Assurance Manager (QAM) in accordance with the project requirements. The Contractor's geotechnical engineer shall be a Professional Engineer registered in the Commonwealth of Virginia and qualified by education and experience with geotechnical engineering aspects of projects of similar scope and complexity. Qualified representatives of the Contractor's geotechnical engineer shall observe and document all work described in this Special Provision, and shall submit such documentation to the QAM. All work not performed in the presence of the representative of the Contractor's geotechnical engineer shall be considered unacceptable, and reparations shall be performed by the Contractor to the satisfaction of the Department. All remedial work required due to the Contractor performing work not supervised by a representative of the Contractor's geotechnical engineer shall be completed with no additional compensation made to the Contractor.

The Contractor's geotechnical engineer shall review all reports, tests and documentation required herein for conformance to contract requirements and its foundation design recommendations, and shall sign and seal all such reports, tests and documentation. All representatives of the QAM and the Contractor's geotechnical engineer shall keep a diary of the

activities that he/she observes. The Contractor's geotechnical engineer shall prepare weekly reports summarizing the contractor's work.

The Contractor's geotechnical engineer shall certify whether the work was subjected to the required QA/QC, whether its representatives were qualified by education, experience and training to conduct the referenced activities, shall note any non-compliance issues, and shall certify whether the work is deemed acceptable or unacceptable. The Contractor's geotechnical engineer shall promptly notify the QAM of the results of its review, and the QAM shall report the contractors plan and progress for correcting non-compliant work.

The QAM shall submit summary reports of all work corresponding to requests for payment. The QAM's summary reports shall include the Contractor's geotechnical engineer's certifications of completed work.

IV. DRILLED SHAFTS

A. Demonstration Shafts (also known as "Test Shafts" or "Technique Shafts")

Demonstration shafts are often used to determine if the Contractor's means and methods will produce drilled shafts that meet the requirements of the project. Additionally, load tests can be performed on demonstration shafts without concern of damage occurring to production shafts. However, since this site may be underlain by karst features (sinkholes, caves, soil seams within the bedrock, and pinnacled bedrock) or other irregularities in the bedrock surface, subsurface conditions at a demonstration shaft location may be significantly different than conditions at production shaft locations. Therefore, the requirement for a demonstration shaft shall be waived. Additional testing during construction of production shafts, as defined in Section IV.E of this Special Provision, shall be performed in lieu of construction of a demonstration shaft.

B. Concreting Curves

Frequency:

During concrete placement of all production shafts, the Contractor's Geotechnical Engineer shall plot the theoretical and actual concrete volume curves. This information shall be submitted to the QAM no later than 48 hours after the concrete placement of each shaft has been completed. If unexpected occurrences are observed during concrete placement (such as the actual volume deviating from the theoretical volume by more than 10%, for example), the Contractor shall conduct CSL testing and shall determine whether the shaft is acceptable.

Acceptance:

No acceptance/rejection of the concreting curves will be made. This information will be used as an indicator as to the quality of the concrete in the shaft.

C. Crosshole Sonic Logging (CSL)

CSL is a nondestructive testing method performed on completed drilled shafts. It provides a method for evaluating the integrity of the drilled shaft concrete. All production shafts shall be equipped with CSL tubes as described the Special Provision for Drilled Shafts.

Frequency:

All non-redundant shafts shall be CSL tested. (A typical example of a non-redundant shaft is the case in which a single drilled shaft supports a single pier column. The failure of a non-redundant shaft, by definition, will likely result in the failure of the entire substructure unit and the structure itself.)

On projects that utilize redundant shafts (several shafts arranged in a group), the first four (4) production shafts (of each size) constructed for each bridge shall be CSL tested. Furthermore, a minimum of 20% of the total number of production shafts shall be CSL tested for each structure. The CSL testing shall be equally spaced (in time and location) across the structure. The Contractor shall be prepared to perform additional CSL testing as deemed necessary by the Contractor's Geotechnical Engineer and/or the QAM. Additional CSL testing will be required if field observations seem to indicate that concrete contamination has occurred.

Acceptance:

Acceptable CSL tests will be defined as those for which there is essentially no signal distortion throughout the entire length of the shaft, and the signal velocity is reduced by no more than 10% of that of sound concrete. If the CSL test results indicate that the aforementioned criteria have not been met, the Contractor and the Contractor's geotechnical engineer shall propose remedial procedures to the QAM. If the Contractor and the Contractor's geotechnical engineer feel that, in spite of marginal or poor CSL results, the drilled shaft is adequate, the Contractor shall propose alternative integrity testing to the QAM in an attempt to demonstrate that the shaft is acceptable. Some of these alternatives may include the use of other appropriate methods of non-destructive testing, coring the entire length of the shaft, or some other method acceptable to the QAM.

D. Load Testing

Load testing in this case shall be assumed to refer to the axial, compressive static load test as defined in Section 403 of the Road and Bridge Specifications. If a project requires either lateral or tensile load testing, the Contractor shall follow the procedures outlined in the latest versions of ASTM D3966 and ASTM D3689, respectively.

In lieu of traditional static load testing, the Contractor may perform Osterberg load tests or Statnamic load tests, provided the required test load can be applied to the shaft using the alternative test method. If the Contractor is considering either the Osterberg or Statnamic methods, a detailed submittal of the proposed procedure shall be provided to the QAM for review and approval.

Frequency:

A minimum of one (1) load test shall be performed for each shaft size for each bridge on the project. For bridges having more than 30 shafts, two (2) load tests shall be performed for each shaft size. If multiple load tests will be performed, they should be located, generally, at opposite ends of the structure. The load tests shall be performed on production shafts.

Acceptance:

A load test will be considered acceptable if it satisfies the required deflection and load carrying requirements cited in the Special Provisions, the Plans and the Specifications, as determined by the Contractor's Geotechnical Engineer. If, for a specific project, modifications to these deflection criteria are deemed necessary, the Contractor shall submit these modifications to the QAM for approval.

E. Construction Testing of Shafts

At each production shaft location, prior to shaft excavation, two (2) air-track probe holes or hollow-stem auger borings shall be taken to the top of the rock. After the drilled shaft has been excavated to the proposed bearing elevation, one (1) probe hole shall be cored in the bottom of the shaft excavation to a depth of 20 feet below the base of the shaft. A feeler rod shall be used to determine the frequency and size of the discontinuities in the bedrock.

Frequency:

As indicated above.

Acceptance:

Prior to performing this work, the Contractor's Geotechnical Engineer shall describe to the Department the criteria that constitutes minimally acceptable bedrock conditions. Specifically, the acceptable size and frequency of the discontinuities shall be presented. The minimally acceptable bedrock conditions shall be supported with calculations that demonstrate the performance of the drilled shafts with respect to vertical bearing capacity, lateral capacity, and settlement/displacement). The Department may accept or reject the suggested criteria in its reasonable discretion. Additionally, the probes/borings and probe holes will be considered acceptable if the bedrock is free from significant discontinuities (voids, soil seams, caverns or caves). "Significant," as used in the previous sentence, shall be defined as a discontinuity or void larger than 6 inches.

V. DRIVEN PILES

A. Wave Equation Submittals

Frequency:

The Contractor shall submit Wave Equation models to the QAM in accordance with the requirements set forth in the "Special Provision for Wave Equation Analysis." One (1) model for each pile size and loading condition for each structure shall be submitted. Additionally, all proposed hammers and all distinctly differing subsurface conditions shall be modeled with individual wave equation models. It is preferable to submit drivability models, which evaluate the pile capacity, driving resistance and driving stresses throughout the entire depth of penetration.

Acceptance:

No driving tests shall be performed until the Contractor's Geotechnical Engineer and the QAM have reviewed and approved the Wave Equation models. Acceptance will be based on the requirements stated in the "Special Provision for Wave Equation Analysis."

B. Driving Tests

Frequency:

When prestressed concrete piles are used for foundation support, the Contractor shall perform all driving tests prior to ordering production piles. A minimum of one (1) driving test per substructure unit shall be performed. If a substructure unit is greater than 100 ft. in width, two (2) driving tests per substructure unit shall be performed. When two driving tests are used within the same substructure unit, they shall be spaced as far apart as practical. Note that, when parallel structures are proposed, as was noted in *Section III. A.* (See above), they can effectively be defined as a single structure for purposes of this Special Provision.

Driving test piles shall be cast at least 10 ft. longer than the production piles they are supposed to represent, in order to provide some contingency length.

It is permissible for the Contractor to drive test piles in production pile locations and, provided they are successfully installed, these piles can be used as production piles. However, if the test pile is not successfully installed (or if the pile is broken or damaged during installation), the Contractor shall remove the test pile from the production pile location.

When steel piles are used and it is anticipated that the pile tips will be driven to competent rock, driving tests generally need not be performed. However, if the pile tips are expected to bear on/within weathered rock or if steel piles will be used predominantly as friction piles, driving tests are required. In all cases in which dynamic pile tests are utilized, driving test piles (one for each dynamic pile test) shall be used.

The following table summarizes the minimum driving test quantities when steel piles are used for structural support:

| Condition | Required Quantity of Driving Tests |
|---|--|
| 1. Pile tips driven to competent rock (overburden contains no boulders or buried obstructions, and typical pile loads are used) | No driving tests required, unless Dynamic Testing is performed. |
| 2. Pile tips driven to competent rock (overburden likely contains boulders or buried obstructions) | One (1) driving test per substructure unit. |
| 3. Pile tips driven to/into weathered rock (particularly where the soil overburden gradually transitions to weathered rock) | One (1) driving test placed at alternating substructure units (e.g., Abutment A, Bent 2, Bent 4, etc.) |
| 4. Steel piles used as friction piles | One (1) driving test per substructure unit. |

Acceptance:

The results of the driving test work will be used to help determine production pile lengths, anticipated driving resistances, and potential driving problems. No acceptance/rejection of the driving tests will be made.

B. Dynamic Pile Tests

Frequency:

When prestressed concrete piles are used, dynamic pile tests shall be performed on at least 50% of the driving test piles, with a minimum of one (1) dynamic test per each pile size used for each structure. When multiple dynamic tests are performed, they shall be spaced equally across the site of the structure. Copies of the dynamic test reports shall be submitted to the QAM within five (5) days of completion of the fieldwork.

With respect to steel piles, referring to the table above, if conditions #2, #3 or #4 are applicable, at least 50% of the driving test piles shall be dynamically tested.

If Condition #1 is applicable, no dynamic pile testing is required. However, if the piles are required to carry a higher load than is typically used, dynamic testing shall be utilized to estimate pile capacity and driving stresses. For Condition #1 where a higher than typical load will be used, a minimum of 5% of the production piles shall be designated as “driving test” piles and shall be dynamically tested.

Acceptance:

A dynamic pile test will be deemed acceptable if the required pile capacity is achieved per the requirements of the “Special Provision for Dynamic Pile Testing for Friction Piles” or the “Special Provision for Dynamic Pile Testing for End Bearing Piles.” Also, an acceptable dynamic pile test is one in which the allowable stresses are not exceeded during the initial driving and restrike operations.

C. Load Testing

Load testing in this case shall be assumed to refer to the axial, compressive static load test as defined in Section 403 of the Road and Bridge Specifications. Load tests need not be performed for driven piles, provided an appropriate level of dynamic pile testing is performed. Exceptions to this rule, if required, will be clearly indicated in the contract.

In lieu of the traditional static load testing, the Contractor may perform Osterberg load tests or Statnamic load tests, provided the required test load can be applied to the shaft using the alternative test method. If the Contractor is considering either the Osterberg or Statnamic methods, a detailed submittal of the proposed procedure shall be subject to the prior review and approval of the Contractor's Geotechnical Engineer and the QAM.

If a project requires either lateral or tensile load testing, the Contractor shall follow the procedures outlined in the latest versions of ASTM D3966 and ASTM D3689, respectively.

VI. MEASUREMENT AND PAYMENT

All QA/QC is integral to the relevant work package that is part of the lump sum contract price. There is no separate payment for QA/QC. All items that do not satisfy the criteria stated herein shall be submitted to the Department for acceptance. In the event the Department accepts an item, the QAM will document the basis of acceptance. The Contractor and the Department will negotiate an appropriate adjustment in the contract price, warranty, or other specific requirements or adjustments that are appropriate.

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
T-WALL RETAINING WALL SYSTEM
for Design-Build and PPTA Contracts

December 10, 2009

1.0 DESCRIPTION

This work shall consist of furnishing and constructing T-WALL Retaining Walls in accordance with these specifications and in reasonably close conformity with the lines, grades, dimensions and design shown on the plans.

2.0 MATERIALS

2.1 Concrete T-WALL Unit

Concrete for T-WALL units shall be Class A4 conforming to the requirements of Section 217 of the Specifications except that the maximum water/cement ratio shall be 0.47.

Reinforcing steel shall be set in place to the dimensions and tolerances shown on the plans prior to casting.

2.1.1. Testing and Inspection

The Contractor or his supplier shall furnish facilities and shall perform all necessary sampling and testing. Units will be considered acceptable for placement in the wall when control cylinder tests exceed 85% of 28 day design strength requirements.

2.1.2. Casting

Concrete in each unit shall be placed without interruption and shall be consolidated by the use of an approved vibrator, supplemented by such hand-tamping as may be necessary to force the concrete into the corners of the forms and prevent the formation of stone pockets or cleavage plans. Clear form oil of the same manufacture shall be used throughout the casting operation.

2.1.3. Curing

Panel units shall be cured in accordance with the requirements of Section 404.03 (k) of the Specifications. Any unit concrete placement which does not reach specified design strength within 28 days will be rejected as determined by concrete control cylinders.

2.1.4. Removal of Forms

The forms shall remain in place for at least 20 hours or when control cylinder tests indicate that the concrete has attained at least 20% of the 28 day design requirement in accordance with the requirements of Section 404.03 (j) of the Specifications.

2.1.5. Concrete Finish and Tolerances

Concrete surface for the front face shall be a Class I finish conforming to the requirements of Section 404 of the Specifications or as detailed on the plans and a uniform surface finish on the rear face and stem. The top edge of the unit shall be screeded to eliminate open pockets or aggregate and surface distortions in excess of 1/4 inch.

2.1.6. Tolerances

All units shall be manufactured within the following tolerances:

- All dimensions within 3/16 inch.
- Squareness, as determined by the difference between the two diagonals, shall not exceed 1/2 inch.
- Surface irregularities on formed surfaces measured on a length of 10 feet shall not exceed 1/4 inch.

2.1.7. Rejection

Panels shall be subject to rejection because of failure to meet any of the requirements specified above. In addition, any or all of the following defects shall be sufficient cause for rejection:

- Defects that indicate imperfect molding.
- Defects that indicate honeycombed or open texture concrete.
- Defects in the physical characteristics of the concrete, such as broken or chipped concrete.
- Stained front face, due to excessive form oil or other contaminations.
- Signs of aggregate segregation.
- Broken or cracked corners.
- Exposed reinforcing steel.

2.1.8. Marking

The date of manufacture, lot number and type of unit shall be scribed or marked with waterproof paint on the rear face of each unit.

2.1.9. Handling, Storage and Shipping

All units shall be handled, stored and shipped in such manner as to eliminate the danger of chipping, cracks, fractures and excessive bending stresses. Units shall be removed from casting beds by an approved pick-up method. Units in storage shall be supported on firm blocking.

2.2 Joints

2.2.1. Horizontal Joint Material

Fiber expansion joint material shall conform to AASHTO M-213 for horizontal joints.

2.2.2. Joint Cover

Joints between panels shall be covered on the back side of the wall with either a woven or non-woven plastic filter cloth as per the manufacturer's recommendations. Installation shall be in accordance with the plan details and shall have minimum 12" widths and laps no less than 4".

2.3 Select Backfill Material

Select backfill material used in the structure volume shall be reasonably free from organic material, shale or other poor durability particles and otherwise deleterious materials. The backfill shall conform to the following grading as determined by AASHTO T-27:

| Sieve Size | Percent Passing |
|------------|-----------------|
| 3" | 100 |
| #200 | 0 - 15 |

The material shall exhibit an angle of internal friction of not less than 34 degrees as determined by the standard Direct Shear Test, AASHTO T236, on the portion finer than the No. 10 sieve, utilizing a sample of the material compacted to 95 percent of AASHTO T99, Methods C or D (with oversized corrected as outlined in Note 7) at optimum moisture content. No testing is required for backfills where 80 percent of sizes are greater than 3/4 inch.

2.4 Cast-in-Place Concrete

Concrete for leveling pads and wall top coping shall be Class A3 conforming to the requirements of Section 217 of the Specifications.

3.0 CONSTRUCTION REQUIREMENTS

3.1 Structure Excavation

Structure excavation shall be unclassified in accordance with the requirements of Sections 506 and 401 of the Specifications and shall be performed in reasonably close conformity to the limits and construction stages shown on the plans.

3.2 Foundation Preparation

The foundation for the structure shall be graded level for a width equal to or exceeding the length of the bottom unit stems or as shown on the plans. Prior to wall construction, the foundation shall be compacted in accordance with the embankment requirements of Section 303.04 (h) of the Specifications and graded to a relatively smooth and uniform surface. Any foundation soils found to be unsuitable shall be removed and replaced.

At each panel foundation level, an unreinforced concrete leveling pad shall be provided as shown on the plans. Leveling pads shall be level within 1/8 inch per pad or per 100 feet, whichever length is greater. The pad shall be cured at least 24 hours before placement of wall panels.

3.3 Wall Erection

Erection of the units typically shall begin at the lowest elevation and proceed laterally along the wall length. Where a wall meets a fixed structure or a critical location such as a bend point, erection shall begin at that point, provided the site configuration is suitable.

In the case of vertical walls, T-WALL units shall be set such that the front face is vertical. In the case of battered walls, T-WALL units shall be set at the batter rate of the structure.

Units shall be set such that the front faces are on line with the plan layout of the structure. The front faces of each unit shall be continuous from one unit to the next. Vertical joint width shall be gauged to assure the desired joint width. For curved structures the joint opening shall be measured either at the front face or the rear face of the unit whichever is narrower.

Tolerance and alignment shall be as follows:

- Horizontal joint openings between panels shall be 1/2 inch (+/- 3/8 inch).
- Vertical joint openings between panels shall be 3/8 inch (+/- 3/8 inch).
- Vertical tolerance (plumbness) and horizontal alignment tolerance as the wall is constructed shall not exceed 3/4 inch when measured with a 10-foot straight edge.
- The overall vertical tolerance of the wall (plumbness from top to bottom) shall not exceed 1/2 inch per 10 feet of wall height (for vertical walls).

Repairs at the jobsite, when approved by the QAM shall be made by experienced personnel utilizing methods and materials recommended by the manufacturer. Patching shall only be done when conditions exist which assure that the repaired area conforms to the remainder of the work with respect to appearance, strength and durability and are subject to the approval of the QAM.

3.4 Select Backfill Placement

Backfill placement shall closely follow the erection of each lift of T-WALL units. Backfill shall be placed in approximate equal amounts on each side of the stems. Backfill may be carefully discharged directly on top of the stems to facilitate this requirement. The backfill lift shall be uniform in thickness and compacted within the limits shown on the plans. The backfill shall be sloped so that surface drainage is away from the panel portion of the unit. Placement of backfill shall be in uniform layers not exceeding 8 inches in thickness unless otherwise proposed by the Contractor and approved by the QAM. Lift thickness shall be decreased as needed to obtain the specified density. Backfill shall be compacted to at least 95% of maximum laboratory dry density in accordance with ASTM D-698. Placement and compaction of the backfill shall be accomplished without displacement of the T-WALL units. Compaction shall proceed from the back of the panel portion of the T-WALL unit toward the end of the stem. Whenever a compaction test fails, no additional backfill shall be placed over the area until the lift is recompacted and a passing compaction test is achieved.

Where the T-WALL units are open faced and tiered in construction and plant growth is planned, topsoil may be placed at the outer front edge of each tier to a depth of 6 inches maximum.

3.5 Cast-in-Place Concrete

Concrete for leveling pads and wall top coping shall be performed in accordance with the requirements of Section 404 of the Specifications.

4.0 MEASUREMENT AND PAYMENT

T-WALL will be measured in units of square feet of retaining structure and will include all excavation; temporary shoring when not specified on the wall plans or in the proposal as a separate item; concrete footing; leveling pads; T-WALL units; copings and moment slabs; masonry; reinforcing steel; select backfill material; backfilling; compaction; riprap to fill temporary excavation, including all work necessary outside the retainage area shown on the plans; disposal offsite or onsite, where permitted by the contract, of unsuitable or surplus material; and all materials, labor, tools, equipment, and incidentals necessary to complete the work. This work is integral to the relevant work package that is part of the lump sum contract price. There is no separate payment for this work. If an item does not satisfy the criteria stated herein, and in the event the Department accepts this item, the QAM shall document the basis of acceptance. The Contractor and the Department will negotiate an appropriate adjustment in the contract price, warranty, or other specific requirements or adjustments that are appropriate.

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
WAVE EQUATION ANALYSIS

May 25, 1999cc
Reissued July 2008

SECTION 403.06(d) 1. and 2. of the Specifications is replaced by the following:

Pile driving equipment furnishing by the Contractor shall be subject to the approval of the Engineer.

Prior to driving test piles, the Contractor shall furnish the Engineer the following information pertaining to the proposed pile driving equipment:

1. Completed Pile and Driving Equipment Data Form for each proposed pile hammer and pile type combination (Attachment 1).
2. At each driving test location, where different subsurface conditions exist, the Contractor shall furnish a Wave Equation Analysis of pile driveability performed by a Professional Engineer experienced in such work, demonstrating that the piles can be driven with reasonable effort to the ordered lengths without damage. This analysis shall include the following:

Copies of computer input and output sheets and graphs showing soil resistance versus blow count as well as maximum tensile and compressive stresses versus blow count. Analyses shall be run at the estimated tip elevation as well as other required elevations to define maximum stress levels in the pile during driving.

The Contractor shall use the optimum type and size of hammer for the indicated pile and subsurface conditions at the structure site. Unless documentation supporting other values can be provided, the following hammer efficiencies shall be used in a wave equation analysis:

| <u>Hammer Type</u> | <u>Efficiency in Percent</u> |
|-------------------------|------------------------------|
| Single acting air/steam | 67 |
| Double acting air/steam | 50 |
| Diesel | 80 |
| Hydraulic | 90 |

The criterion that the Engineer will use to evaluate the driving equipment consists of both the required number of hammer blows per inch and the pile stresses at the required ultimate pile capacity. The required number of hammer blows indicated by calculations at the required bearing capacity shall be a maximum of 6 per inch for the driving equipment to be acceptable and shall be on the rising (or linear) portion of the resistance versus blow count curve.

Should the Wave Equation Analysis indicate the possibility of excessive driving stresses, the Contractor shall submit to the Engineer proposed corrective measures (modification of hammer stroke or other appropriate action) for approval.

The following criteria will be used in evaluating calculated results to determine acceptability of the Contractor's proposed driving system.

The calculated ultimate soil resistance as determined from wave equation analysis alone shall be no less than 275 percent of the required design capacity for the driven pile. When the calculated ultimate soil resistance determined from wave equation analysis has been calibrated to the results of a dynamic pile test, the ultimate soil resistance shall be no less than 225 percent of the required design bearing capacity for the driven pile.

Soil setup (pile freeze effect) may be considered when establishing initial driving criteria. If soil setup is considered, two additional wave equation analyses, one modeling the end of initial drive conditions and the second modeling the beginning of restrike conditions shall be performed. In lieu of performing the two additional wave equation analyses, a pile driveability analysis may be performed when considering soil setup. However, hammers requiring the consideration of soil setup for approval may require restrikes of the driving test piles, at the Contractor's expense, for verification purposes.

Contractor notification of acceptance or rejection of pile driving equipment will be made within 20 days of receipt of the data form and Wave Equation Analysis.

When initial parameters selected are judged to be inappropriate, the Contractor shall submit a refined wave equation analysis along with the pile order list. The refined analysis shall include any modifications or changes deemed appropriate from the results of the Driving Test (Loading Test and/or Dynamic Pile Testing) Program(s).

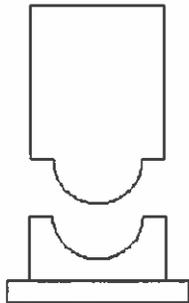
The Engineer will determine driving resistance, tip elevations and safe bearing capacity criteria to be used for production piles from the above information.

During production pile driving operations, the Contractor shall use the approved system. Any change in the driving system will only be considered after the Contractor has submitted revised pile driving equipment data and calculations.

Approval of pile driving equipment shall not relieve the Contractor of the responsibility to drive piles, free of damage, to the bearing and tip elevation shown on the plans, specified in the special provisions, or mandated by the Engineer. In addition, approval of pile driving equipment relative to driving stress damage shall not relieve the Contractor of responsibility for piles damaged because of misalignment of the leads, failure of capblock or cushion material, failure of splices, malfunctioning of the pile hammer, or other improper construction methods or practices.

VIRGINIA DEPARTMENT OF TRANSPORTATION
PILE AND DRIVING EQUIPMENT DATA FORM

Project: _____
 Pile Driving Contractor Or Subcontractor (Driven by): _____



HAMMER Manufacture: _____ Model: _____
 Type: _____
 Rated Energy: _____ @ _____ Length of Stroke
 Modifications: _____



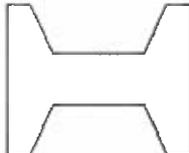
RAM Ram Weight: _____



ANVIL OR BASE Weight: _____



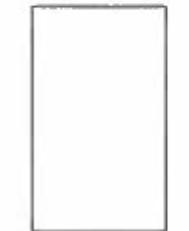
STRIKER PLATE Material: _____
 Thickness: _____ Area: _____
 Modulus of Elasticity - E: _____ (p.s.i.)
 Coefficient of Restitution: _____



CAP BLOCK Material: _____
 Thickness: _____ Area: _____
 Modulus of Elasticity - E: _____ (p.s.i.)
 Coefficient of Restitution: _____



PILE CAP Helmet Weight: _____
 Bonnet Materials: _____
 Anvil Block _____
 Remarks: _____
 Drive head _____
 Accessories _____



CUSHION Cushion Material: _____
 Thickness: _____ Area: _____
 Modulus of Elasticity - E: _____ (p.s.i.)
 Coefficient of Restitution: _____

PILE Type: _____
 Pile Size: _____ Length: _____ Diameter: _____
 Cross Sectional Area: _____
 Material: _____ Weight/Ft.: _____
 Design Pile Capacity: _____ (tons)
 Description of Splice: _____

Tip Treatment Description: _____

Remarks: _____

Submitted By: _____ Date: _____
 Company: _____ Phone: _____

Cc: District Bridge Engineer
 State Bridge Engineer
 Construction Manager

UNIFORMED FLAGGERS - The Contractor shall utilize off-duty uniformed police officers for control of traffic through signalized intersections during periods when the control equipment is non-operational. It is expressly understood that the work under this pay item exceeds the requirements and duties typically associated with flagger service. Off duty police officers will not be required to have VDOT flagger certification to perform this work. Police assisted flagger service will be measured and paid for in hours of in duty service. This price will be full compensation for furnishing uniform officers and all associated costs.

Payment will be made under:

| Pay Item | Pay Unit |
|--------------------|-----------------|
| Uniformed Flaggers | Hours |

9-29-08a (SPCN)

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
SECTION 301 – CLEARING AND GRUBBING

November 15, 2006

SECTION 301 – CLEARING AND GRUBBING of the Specifications is amended as follows:

Section 301.02 is amended by replacing the third paragraph with the following:

Stumps, roots, topsoil, other perishable material and nonperishable objects that will be less than 5 feet below subgrade within the area directly beneath the pavement and 2 feet beyond the outside edge of shoulders shall be removed. Stumps, roots, perishable and non-perishable objects shall be disposed off-site at no additional cost to the Department. Suitable topsoil may be used for establishing on-site vegetative cover provided the thickness of topsoil does not exceed 12 inches. However, such material and objects that will be more than 5 feet below subgrade within the area directly beneath pavement and 2 feet beyond the outside edge of 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, to prevent detrimental settlement or to ensure stability of embankment slopes or structures founded thereon. The top of stumps left in place shall be not more than 6 inches above the existing ground surface or low water level.

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
**WORK ZONE TRAFFIC CONTROL MANAGEMENT
DESIGN-BUILD PROJECTS**

January 14, 2008
Revised November 2009

I. GENERAL DESCRIPTION

This work shall consist of providing work zone traffic control management in strict compliance with the contract, plans, specifications, the Virginia Work Area Protection Manual and the Manual on Uniform Traffic Control Devices (MUTCD), including supervision of personnel and the installation, inspection, and maintenance of all traffic control devices on the project.

II. REQUIREMENTS

The Design-Builder shall assign a traffic control supervisor (TCS) to provide work zone traffic control management for the project. If the Design-Builder assigns more than one TCS to provide work zone traffic control management, a weekly schedule identifying who will be in charge of providing work zone traffic control management on a daily basis shall be submitted to the VDOT VDOT Project Manager by the Design-Builder.

The TCS shall have a set of traffic control plans and a copy of the edition of the Virginia Work Area Protection Manual specified on the plan sheet or in the contract readily available at all times.

A. Certification

Prior to commencing work requiring work zone traffic control management, the Design-Builder shall submit to the VDOT Project Manager a valid copy of the Traffic Control Supervisor certificate (wallet size card) issued by the American Traffic Safety Services Association (ATSSA), or another similarly accredited agency or firm approved by the Department.

The Department will accept the certification by ATSSA or any approved agency or firm only if all of the following minimum requirements are met:

1. Successful completion of an Intermediate or Advanced work zone traffic control training course approved by the Department.
2. Passing a written examination given by the agency or firm on the approved work zone traffic control training course.
3. A minimum of two years full-time field experience in work zone traffic control. The experience may be verified by the Department at its discretion.

The TCS certification shall be renewed every four years by the TCS taking and passing a recertification test. The recertification test shall be taken through ATSSA or an agency or firm approved by the Department. Recertification shall be done in the fourth year prior to the expiration date.

B. Duties

The TCS's main responsibility shall be work zone traffic control management. The TCS may have other assigned duties on the project as approved in writing by the VDOT Project Manager. The following is a listing of the TCS's primary duties:

1. The TCS(s) shall personally provide work zone traffic control management and supervision services at the project site.
2. The TCS(s) shall coordinate the training of flagging and signing personnel.
3. The TCS(s) shall supervise the flagging and signing personnel.
4. The TCS(s) shall coordinate all work zone traffic control operations for the duration of the contract, including those of subcontractors, utility companies, and suppliers, to ensure that all work zone traffic control is in place and fully operational prior to the commencement of any work.

The Department recognizes that the Design-Builder does not have direct control over the work zone traffic control operations of the utility companies. The coordination provided by the TCS when dealing with utility companies is for the purpose of coordinating concurrent utility work zone traffic control with any other construction/maintenance work zone traffic control to avoid conflicts.

5. The TCS(s) shall perform daily reviews of work zone traffic control when work activities are underway and document in the work zone traffic control daily diary activities taking place and any deviation from the traffic control plan, length and timing and mitigation of excessive traffic queues, and instances or conflicts or problems with the work zone traffic control and corrective actions taken. In addition, the TCS(s) shall perform weekly reviews of the work zone traffic control and document in detail using Forms TE-97001 and 97002. Every other detailed weekly review shall be performed during nighttime hours or as directed by the VDOT Project Manager.

The TCS shall inspect traffic control devices in use for compliance with the ATSSA Quality Standards for Work Zone Traffic Control Devices, the Road and Bridge Specifications, and the Virginia Work Area Protection Manual. The TCS shall provide for the immediate repair, cleaning, or replacement of traffic control devices not functioning as required to ensure the safety of the motorists and construction personnel.

The traffic control devices shall be inspected by the TCS during working and nonworking hours on a schedule approved in writing by the VDOT Project Manager, but as a minimum at the beginning and end of each work day or night and once during non-working weekends and holidays, and daily on restricted days due to inclement weather or during any work shutdown.

Traffic control devices in use longer than fourteen (14) days shall be inspected by the TCS at least once every other week during nighttime periods.

6. The TCS(s) shall prepare and submit statements concerning road closures, delays, and other project activities to the District Public Affairs office as required.
7. The TCS(s) shall be responsible for notifying the VDOT project Maintenance of Traffic (MOT) Coordinator or designee, of all accidents related to the project traffic control. The time and date of notification shall be documented in the daily diary.
8. The TCS(s) assigned to the project shall attend the preconstruction conference and any other meeting which involves traffic control.
9. The TCS(s) shall be responsible for the maintenance, cleanliness, and replacement of traffic control devices of the existing traffic control plan during working and non-working hours.

C. Documentation - Traffic Control Diary

The TCS shall maintain a project work zone traffic control diary in a bound book. The Design-Builder shall provide a sufficient number of diaries for his or her use.

The TCS shall keep the work zone traffic control diary current on a daily basis, and shall sign each daily entry. Entries shall be made in ink in a format approved by the VDOT Project Manager, and there shall be no erasures or white-outs. Incorrect entries shall be struck out and then replaced with the correct entry. Photographs may be used to supplement the written text.

The work zone traffic control diary shall, at all times, be available for inspection by the VDOT Maintenance of Traffic Coordinator and a copy of the diary shall be submitted to the MOT Coordinator on a weekly basis.

The work zone traffic control diary(s) shall become the property of the Department at the completion of the project. Failure to submit the diary shall result in the withholding of final payment until the diary(s) is submitted.

D. Availability of TCS

Traffic control management shall be provided under the supervision and direction of the TCS on a 24-hour-per-day basis throughout the duration of the project.

The TCS shall be available on every working day—on call at all times—and available upon the VDOT Project Manager's request during normal working hours and during other than normal working hours in the case of emergency. The provisions for availability of the TCS shall also be met during times of partial or full project suspension. Contact telephone numbers for the TCS(s) shall be provided to Department project personnel, the VDOT Project Manager, the Residency Administrator, and the region Smart Traffic Center prior to the Design-Builder commencing work requiring work zone traffic control management.

E. Failure to Comply

The VDOT Project Manager may suspend all or part of the Design-Builder's operation(s) for failure to comply with the approved "Traffic Control Plan" or failure to correct unsafe traffic conditions within 24 hours for critical items and 72 hours for non-critical items after such notification is given to the Design-Builder in writing.

In the event that the Design-Builder does not take appropriate action to bring the deficient work zone traffic control into compliance with the approved traffic control plan or fails to correct the unsafe traffic conditions, the Department may proceed with the corrective action using its own forces, equipment, and material to maintain the project and such costs, plus 25 percent for supervisory and administrative personnel, will be deducted from the money owed to the Design-Builder for the project.

The Design-Builder shall not be relieved of the responsibility to provide work zone traffic control safety to the traveling public when a project is under full or partial suspension. When a project is under suspension due to the Design-Builder's failure to comply with this section, or when the contract is under liquidated damages, the Design-Builder shall continue to provide work zone traffic control management and no additional measurement or payment will be made.

If suspensions or partial suspensions are requested by the Design-Builder, the additional work zone traffic control management costs will be at the Design-Builder's expense.

ATTACHMENT 3.1

MINIMUM DESIGN CRITERIA

Dually Designated US Route 121/US Route 460, Poplar Creek Section
Four-Lane Finished-Grade Roadway
(GS-1 Modified– Rural Principal Arterial, Other Principal Arterials, Mountainous)

| | |
|------------------------------------|--|
| Design Speed: | 60 mph |
| Min. Radius: | 1204 feet |
| Max. Grade: | 6.0% |
| Min. Stopping Sight Distance: | 570 feet; for grades $\geq 3\%$, see Table 3-2 of the AASHTO A Policy on Geometric Design of Highways and Streets (2011) |
| Max. e: | 8% |
| Cut Slope: | |
| Soil Cut: | In accordance with Project Specifications |
| Rock Cut: | In accordance with Project Specifications |
| Fill Slopes: | Approximate 2:3H:1V For Preliminary Design (allows for benches) |
| Min. Width of Right of Way Limits: | 150 feet |
| Ascending/Descending Grades | On ascending grades, which exceed the critical design length, a climbing lane analysis shall be performed and climbing lanes added where appropriate. Likewise, on extended lengths of maximum or near maximum descending grades, emergency escape ramps shall be added where an analysis indicates they are required. |
| GS-1 Modified | GS-1 Modified is equal to GS-1 in the VDOT Road Design Manual with the exception that under “Other Principal Arterial”, Mountainous, a row has been added for 60 MPH. The minimum radius and minimum stopping sight distance are as stated above. See GS-1 Modified on sheets 2 and 3. |

GS-1 Modified Design Criteria for Poplar Creek

GEOMETRIC DESIGN STANDARDS FOR RURAL PRINCIPAL ARTERIAL SYSTEM (GS-1)

| | TERRAIN | DESIGN SPEED (MPH) | MIN. RADIUS | (6) MINIMUM STOPPING SIGHT DISTANCE | MIN. WIDTH OF LANE | (1) MIN. WIDTH OF TOTAL SHOULDERS (GRADED & PAVED) | | (2) PAVED SHOULDER WIDTH | | (3) MINIMUM WIDTH OF DITCH FRONT SLOPE | (4) SLOPE | NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES | |
|---------------------------|----------------|--------------------|-------------|-------------------------------------|--------------------|--|-----|--------------------------|-----|--|----------------|---|-------|
| | | | | | | FILL | CUT | LT. | RT. | | | | |
| FREEWAYS | LEVEL | 75 | 2215' | 820' | 12' | 17' | 14' | 4' | 12' | 12' | CS-4B | See Footnote (5) | |
| | | 70 | 1821' | 730' | | | | | | | | | |
| | ROLLING | 60 | 1204' | 570' | | | | | | | | | |
| | MOUNTAINOUS | 50 | 760' | 425' | | | | | | | | | CS-4E |
| OTHER PRINCIPAL ARTERIALS | LEVEL | 70 | 1821' | 730' | 12' | 13' | 10' | 4' | 8' | 10' | CS-4/ CS-4B | | |
| | | 60 | 1204' | 570' | | | | | | | CS-4/ CS-4E | | |
| | ROLLING | 60 | 1204' | 570' | | | | | | | 6' | | |
| | | 50 | 760' | 425' | | | | | | | | | |
| | MOUNTAINOUS(7) | 60 | 1204' | 570' | | | | | | | | | |
| | | 50 | 760' | 425' | | | | | | CS-3/ CS-3B | | | |
| | | 45 | 589' | 360' | | | | | | | | | |
| | | 40 | 446' | 305' | | | | | | | | | |

GENERAL NOTES

Freeways - A design speed of 75 mph should be used for Rural Freeways. Where terrain is mountainous a design speed of 60 mph or 50 mph, which is consistent with driver expectancy, may be used. All new and major reconstructed Interstate facilities will have a 75 mph design speed unless a lower design speed is approved by the Location and Design Engineer and FHWA.

Other Principal Arterials - A design speed of 40 to 70 mph should be used depending on terrain, driver expectancy and whether the design is constructed on new location or reconstruction of an existing facility. An important safety consideration in the selection of one of the lower design speeds in each range is to have a properly posted speed limit which is enforced during off peak hours.

Incorporated towns or other built-up areas, Urban Standard GS-5 may be used for design. "Built-up" is where there is sufficient development along the roadway that justifies a need to channelize traffic into and out of properties utilizing curb and gutter.

Standard TC-5.11R superelevation based on 8% maximum is to be used for all Rural Principal Arterials.

Clear Zone and Recoverable Area information can be found in Appendix A, Section A-2 of the *Road Design Manual*.

If medians are included, see Section 2E-3 of Chapter 2E of the *Road Design Manual*.

For additional information on roadway widths and maximum grades relative to terrain and design speed, see AASHTO Green Book, Chapter 7, Section 7.2.2, page 7-4, Tables 7-2 and Section 7.2.3, page 7-5, Table 7-3; for Freeways, see Chapter 8, Section 8.2.7, page 8-4, Table 8-1.

FOOTNOTES

- (1) Graded Shoulders (including the paved portion); Shoulder widths shown are for right shoulders and independently graded median shoulders. No additional width is necessary for guardrail situations.
For 4-lane non-Interstate (2 lanes in each direction) with independently graded median shoulders, an 8' graded median shoulder will be provided. For 6 or more lanes, the graded median shoulder shall be the same as right graded shoulder. For Freeways with truck < 250 DDHV, the graded shoulder width shall be a minimum of 15' for fills and 12' for cuts.
- (2) Paved Shoulders: When the mainline is 6 or more lanes, the left paved shoulder width should be the same as the right paved shoulder. On Freeways, if truck traffic is < 250 DDHV, the right paved shoulder width shall be a minimum of 10'.
- (3) Ditch slopes to be 6:1 - 10' and 12' widths and 4:1 - 6' width. A hydraulic analysis is necessary to determine actual depth requirement.
- (4) Additional or modified slope criteria to apply where shown on typical sections.
- (5) See [*Manual of the Structure and Bridge Division – Volume V – Part 2 Design Aids – Chapter 6 Geometrics*](#).
- (6) For additional information on sight distance requirements on grades of 3 percent or greater, see Section 3.2.2, page 3-5, Tables 3-2 of the AASHTO Green Book.
- (7) Additional criteria for 60 MPH in mountainous terrain, “Other Principal Arterial”.

Connector Road: Route 614
(GS-4 – Rural Local Road, Mountainous with Average Daily Traffic 400-1500)

| | |
|--------------------------------------|--|
| Design Speed: | 30 mph |
| Min. Lane Width | 12 feet |
| Min. Radius: | 215 feet |
| Max. Grade: | 14.0% |
| Min. Stopping Sight Distance: | 200 feet; for grades $\geq 3\%$, see Table 3-2 of the AASHTO A Policy on Geometric Design of Highways and Streets (2011) |
| Max. e: | 8% |
| Cut Slope: | |
| Soil Cut: | In accordance with Project Specifications |
| Rock Cut: | In accordance with Project Specifications |
| Fill Slopes: | Approximate 2:3H:1V For Preliminary Design (allows for benches) |
| Min Width of Right of Way Limits: | 60 feet |
| GS-4 | GS-4 is per the VDOT Road Design Manual, see GS-4 on sheets 5 and 6. |

GEOMETRIC DESIGN STANDARDS FOR RURAL LOCAL ROAD SYSTEM (GS-4)

| TRAFFIC VOLUME | TERRAIN | DESIGN SPEED (MPH) | MIN. RADIUS | (9) MINIMUM STOPPING SIGHT DISTANCE | (2) MINIMUM WIDTH OF SURFACING OR PAVEMENT | (3) (4) (5) MINIMUM WIDTH OF GRADED SHOULDERS | | (6) MINIMUM WIDTH OF DITCH FRONT SLOPE | (7) SLOPE | NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES |
|--------------------------------|-------------|--------------------|-------------|--|---|--|------------|---|---------------|---|
| | | | | | | FILL W/G R | CUT & FILL | | | |
| (1) ADT OVER 2000 | LEVEL | 50 | 760' | 425' | 24' | 11' (10) | 8' | 6' | CS-4, 4A / 4C | See Footnote (8) |
| | ROLLING | 45 | 589' | 360' | | | | | | |
| | | 40 | 446' | 305' | | | | | | |
| | MOUNTAINOUS | 35 | 316' | 250' | | | | | | |
| 30 | | 215' | 200' | | | | | | | |
| (1) ADT 1500 TO 2000 | LEVEL | 50 | 760' | 425' | 22' | 9' (10) | 6' | 6' | CS-4, 4A / 4C | |
| | ROLLING | 45 | 589' | 360' | | | | | | |
| | | 40 | 446' | 305' | | | | | | |
| | MOUNTAINOUS | 35 | 316' | 250' | | | | | | |
| 30 | | 215' | 200' | | | | | | | |
| (1) ADT 400 TO 1500 | LEVEL | 50 | 760' | 425' | 22' | 8' (10) | 5' | 6' | CS-1 | |
| | ROLLING | 45 | 589' | 360' | | | | | | |
| | | 40 | 446' | 305' | | | | | | |
| | MOUNTAINOUS | 35 | 316' | 250' | 20' | | | | | |
| 30 | | 215' | 200' | | | | | | | |
| CURRENT ADT UNDER 400 | LEVEL | 45 | 589' | 360' | 18' | 7' (10) | 2' | 4' | CS-1 | |
| | | 40 | 446' | 305' | | | | | | |
| | ROLLING | 35 | 316' | 250' | | | | | | |
| | | 30 | 215' | 200' | | | | | | |
| | MOUNTAINOUS | 25 | 135' | 155' | | | | | | |
| | | 20 | 77' | 125' | | | | | | |

GENERAL NOTES

Low design speeds are generally applicable to roads with winding alignment in rolling or mountainous terrain where environmental conditions dictate.

High design speeds are generally applicable to roads in level terrain or where other environmental conditions are favorable.

Intermediate design speeds would be appropriate where terrain and other environmental conditions are a combination of those described for low and high speed.

For minimum design speeds for 250 ADT and under, see AASHTO Green Book, Chapter 5, Section 5.2.1, page 5-2, Table 5-1.

Standard TC-5.11R superelevation based on 8% maximum is to be used.

In incorporated towns or other built-up areas, Urban Standard GS-8 may be used. "Built-up" is where there is sufficient development along the roadway that justifies a need to channelize traffic into and out of properties utilizing curb and gutter.

For Passing Sight Distance Criteria See AASHTO Green Book, Chapter 3, Section 3.2.4, page 3-8.

For maximum grades relative to terrain and design speed, see AASHTO Green Book, Chapter 5, Section 5.2.1, page 5-3, Table 5-2.

FOOTNOTES

- (1) Use Design Year ADT for new construction and reconstruction projects (not applicable to R.R.R. projects or roads with ADT < 400) in accordance with *Road Design Manual*, Chapter 2A, "REQUEST FOR TRAFFIC DATA" and Form LD-104.
- (2) Lane width to be 12' at all interchange locations.
- (3) In mountainous terrain or sections with heavy earthwork, the graded width of shoulder in cuts may be decreased by 2', but in no case shall the shoulder width be less than 2'.
- (4) Minimum shoulder slope shall be 8% on low side and same slope as pavement on high side (See St'd. GS-12).
- (5) Provide 4' wide paved shoulders when design year ADT exceeds 2000 VPD, with 5% or more truck and bus usage. All shoulders not being paved will have the mainline pavement structure extended 1' on the same slope into the shoulder to eliminate raveling at the pavement edge. For additional guidance on shoulder widths, see AASHTO Green Book, Chapter 5, Section 5.2.2, page 5-5.
- (6) Ditch slopes to be 4:1 - 6' width, 3:1 - 4' width. A hydraulic analysis is necessary to determine actual depth requirement.
- (7) Additional or modified slope criteria to be applied where shown on typical sections.
- (8) See [*Manual of the Structure and Bridge Division – Volume V – Part 2 Design Aids – Chapter 6 Geometrics*](#).
- (9) For additional information on sight distance requirements on grades of 3 percent or greater, see AASHTO Green Book, Chapter 3, Section 3.2.2, page 3-3, Table 3-2.
- (10) See [*Road and Bridge Standards, Section 500*](#), GR-INS for Guardrail Installation.

Route 460, Grundy Tie-in
Four-Lane Finished-Grade Roadway
(GS-5 - Urban Principal Arterial, Other Principal Arterial with Curb and Gutter)

| | |
|-----------------------------------|--|
| Design Speed: | 50 mph |
| Min. Radius: | 929 feet |
| Max. Grade: | 8.0% |
| Min. Stopping Sight Distance: | 425 feet; for grades $\geq 3\%$, see Table 3-2 of the AASHTO A Policy on Geometric Design of Highways and Streets (2011) |
| Max. e: | 4% |
| Cut Slope: | |
| Soil Cut: | In accordance with Project Specifications |
| Rock Cut: | In accordance with Project Specifications |
| Fill Slopes: | Approximate 2:3H:1V For Preliminary Design (allows for benches) |
| Min Width of Right of Way Limits: | 120 feet |
| Ascending/Descending Grades | On ascending grades, which exceed the critical design length, a climbing lane analysis shall be performed and climbing lanes added where appropriate. Likewise, on extended lengths of maximum or near maximum descending grades, emergency escape ramps shall be added where an analysis indicates they are required. |
| GS-5 | GS-5 is per the VDOT Road Design Manual, on the following sheet. |

GEOMETRIC DESIGN STANDARDS FOR URBAN PRINCIPAL ARTERIAL SYSTEM (GS-5)

| | DESIGN SPEED (MPH) | MINIMUM RADIUS | | (13) MINIMUM STOPPING SIGHT DISTANCE | MIN. WIDTH OF LANE | MINIMUM WIDTH OF TOTAL SHOULDERS | | | (2) PAVED SHOULDER WIDTH | | (3) MINIMUM WIDTH OF DITCH FRONT SLOPE | (4) SLOPE | NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES | |
|---|--------------------|----------------|------|--------------------------------------|------------------------|----------------------------------|------|---------|--------------------------|----------------------------|--|------------|---|------------|
| | | U | ULS | | | FILL W/GR | FILL | CUT | LT. | RT. | | | | |
| FREEWAYS | 70 | # | - | 730' | 12' | (1) 17' | 14' | (1) 14' | 4' | 12' | 12' | CS-4 OR 4B | See Footnote (7) | |
| | 60 | # | - | 570' | | | | | | | | | | CS-4 OR 4E |
| | 50 | # | - | 425' | | | | | | | | | | |
| OTHER PRINCIPAL ARTERIAL WITH SHOULDER DESIGN | 60 | # | - | 570' | (12) | 13' | 10' | 10' | 4' | 8' | 10' | CS-4 OR 4E | | |
| | 50 | 929' | - | 425' | 12' | | | | | | 6' | | | |
| | 45 | 713' | 795' | 360' | (5) (6) (12) 11' | | | | | | | CS-3 OR 3B | | |
| | 40 | 536' | 593' | 305' | | | | | | | | | | |
| | 35 | 373' | 408' | 250' | | | | | | | | | | |
| | 30 | 251' | 273' | 200' | | | | | | | | | | |
| | 30 | MINIMUM RADIUS | | MINIMUM STOPPING SIGHT DISTANCE | 200' | (8) STANDARD CURB & GUTTER | | | BUFFER STRIP WIDTH | (9) MINIMUM SIDEWALK WIDTH | (10) SLOPE | | | |
| OTHER PRINCIPAL ARTERIAL WITH CURB & GUTTER | 60 | # | - | 570' | (12) | (8) STANDARD CURB & GUTTER | | | BUFFER STRIP WIDTH | | (9) MINIMUM SIDEWALK WIDTH | (10) SLOPE | | |
| | 50 | 929' | - | 425' | 12' | | | | | | | | CG-7 | |
| | 45 | 713' | 795' | 360' | (5) (6) (12) 11' | | | | | | | | | |
| | 40 | 536' | 593' | 305' | | | | | | | | | | |
| | 35 | 373' | 408' | 250' | | | | | | | | | | |
| | 30 | 251' | 273' | 200' | | | | | | | | | | |

GENERAL NOTES*

Freeways - Urban Freeways should accommodate desired safe operating speeds during non-peak hours, but should not be so high as to exceed the limits of prudent construction, right of way and socioeconomic costs due to the large proportion of vehicles which are accommodated during periods of peak flow when lower speeds are necessary. The design speeds for Freeways should never be less than 50 mph.

On many Urban Freeways, particularly in suburban areas, a design speed of 60 mph or higher can be provided with little additional cost above that required for 50 mph design speed. The corridor of the mainline may be relatively straight and the character and location of interchanges may permit high speed design. Under these conditions, a design speed of 70 mph is most desirable because the higher design speeds are closely related to the overall quality and safety of the facility.

Other Principal Arterials - Design speeds for Urban Arterials generally range from 40 to 60 mph, and occasionally may be as low as 30 mph. The lower (40 mph and below) speeds apply in the central business district and intermediate areas. The higher speeds are more applicable to the outlying business and developing areas.

Standard TC-5.11R (Rural) superelevation based on 8% maximum is to be used for all Freeways and is to be used for all other Principal Arterials with a design speed of 60 mph. # For minimum radius, See GS-1.

Standard TC-5.11U (Urban) superelevation based on 4% maximum is to be used on Other Principal Arterials with a design speed less than 60 mph.

Standard TC-5.11ULS (Urban Low Speed) 1 superelevation based on 2% maximum is to be used on Other Principal Arterials with a design speed less than or equal to 45 mph.

Clear Zone and Recoverable Area information can be found in Appendix A, Section A-2 of the [Road Design Manual](#).

If medians are included, see [Section 2E-3 of Chapter 2E](#) of the [Road Design Manual](#).

For minimum widths for roadway and right of way used within incorporated cities or towns to qualify for maintenance funds see [Code of Virginia Section 33.1-41.1](#).

For guidelines on Interchange Ramps, see Standard GS-R.

For maximum grades relative to terrain and design speed, see AASHTO Green Book, Chapter 7, Section 7.3.3, page 7-29, Table 7-4, for Freeways, see Chapter 8, Section 8.2.1, page 8-4, Table 8-1.

FOOTNOTES

- (1) Shoulder widths shown are for right shoulders and independently graded median shoulders. An 8' graded median shoulder will be provided when the mainline is 4 lanes (2 lanes in each direction). For 6 or more lanes, the median shoulder provided will be the same as that shown for independent grading. On Freeways, if truck traffic is less than 250 DDHV, the minimum width of graded shoulder shall be 15' for fills and 12' for cuts.
- (2) When the mainline is 6 or more lanes, the left paved shoulder width should be the same as the right paved shoulder. On Freeways, if truck traffic is less than 250 DDHV, the minimum right paved shoulder width shall be 10'.
- (3) Ditch slopes to be 6:1 - 10' and 12' widths and 4:1 - 6' width. A hydraulic analysis is necessary to determine actual depth requirement.
- (4) Additional or modified slope criteria apply where shown on typical sections. (5) Minimum lane widths to be 12' at all interchange locations.
- (5) Minimum lane widths to be 12' at all interchange locations.
- (6) If heavy truck traffic is anticipated, an additional 1 foot width is desirable.
- (7) See [Manual of the Structure and Bridge Division – Volume V – Part 2 Design Aids – Chapter 6 Geometrics](#).
- (8) Or equivalent City or Town design.
- (9) Width of 8' or more may be needed in commercial areas.
- (10) 3:1 and flatter slopes shall be used when the right of way is behind the sidewalk (or sidewalk space) in residential or other areas where slopes will be maintained by the property owner.
- (11) For buffer strip widths see Appendix A, Section A-5 Bicycle & Pedestrian Facility Guidelines.
- (12) Situations having restrictions on trucks may allow the use of lanes 1 foot less in width.
- (13) For additional information on sight distance requirements on grades of 3 percent or greater, see AASHTO Green Book, Section 3.2.2, page 3-3, Table 3-2.
- (14) Intersection sight distance requirements see [Append. F, Table 2-7](#).

Route 460, Grundy Tie-in
Four-Lane Finished-Grade Roadway
(GS-5 Modified - Urban Principal Arterial, Other Principal Arterial with Shoulder Design)

| | |
|-----------------------------------|--|
| Design Speed: | 50 mph Min. |
| Radius: | 1204 feet |
| Max. Grade: | 8.0% |
| Min. Stopping Sight Distance: | 425 feet; for grades $\geq 3\%$, see Table 3-2 of the AASHTO A Policy on Geometric Design of Highways and Streets (2011) |
| Max. e: | 4% |
| Cut Slope: | |
| Soil Cut: | In accordance with Project Specifications |
| Rock Cut: | In accordance with Project Specifications |
| Fill Slopes: | Approximate 2:3H:1V For Preliminary Design (allows for benches) |
| Min Width of Right of Way Limits: | 120 feet |
| Ascending/Descending Grades | On ascending grades, which exceed the critical design length, a climbing lane analysis shall be performed and climbing lanes added where appropriate. Likewise, on extended lengths of maximum or near maximum descending grades, emergency escape ramps shall be added where an analysis indicates they are required. |

GS-5 Modified GS-5 Modified is equal to GS-5 in the VDOT Road Design Manual with the exception that under “Other Principal Arterial with shoulder design” a row has been added for 50 MPH with a radius of 1204 feet and minimum stopping sight distance of 425 feet. See GS-5 Modified on the following sheets.

GS-5 Modified Design Criteria for Poplar Creek (Grundy Tie-In)

GEOMETRIC DESIGN STANDARDS FOR URBAN PRINCIPAL ARTERIAL SYSTEM (GS-5)

| | DESIGN SPEED (MPH) | MINIMUM RADIUS | | (13) MINIMUM STOPPING SIGHT DISTANCE | MIN. WIDTH OF LANE | MINIMUM WIDTH OF TOTAL SHOULDERS | | | (2) PAVED SHOULDER WIDTH | | (3) MINIMUM WIDTH OF DITCH FRONT SLOPE | (4) SLOPE | NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES |
|--|--------------------|----------------|------|--------------------------------------|--------------------|----------------------------------|------|---------|--------------------------|----------------------------|--|------------|---|
| | | U | ULS | | | FILL W/GR | FILL | CUT | LT. | RT. | | | |
| FREEWAYS | 70 | # | - | 730' | 12' | (1) 17' | 14' | (1) 14' | 4' | 12' | 12' | CS-4 OR 4B | See Footnote (7) |
| | 60 | # | - | 570' | | | | | | | | | |
| | 50 | # | - | 425' | | | | | | | | | |
| OTHER PRINCIPAL ARTERIAL WITH SHOULDER DESIGN (15) | 60 | # | - | 570' | (12) 12' | 13' | 10' | 10' | 4' | 8' | 10' | CS-4 OR 4E | |
| | 50 | 1204' | - | 425' | | | | | | | 6' | | |
| | 50 | 929' | - | 425' | | | | | | | | | |
| | 45 | 713' | 795' | 360' | (5) (6) (12) 11' | | | | | | | CS-3 OR 3B | |
| | 40 | 536' | 593' | 305' | | | | | | | | | |
| | 35 | 373' | 408' | 250' | | | | | | | | | |
| | 30 | 251' | | 273' | 200' | (8) STANDARD CURB & GUTTER | | | BUFFER STRIP WIDTH | (9) MINIMUM SIDEWALK WIDTH | (10) SLOPE | | |
| OTHER PRINCIPAL ARTERIAL WITH CURB & GUTTER | 60 | U | U | 570' | (12) 12' | CG-7 | | | (11) | 5' | 2:1 | | |
| | 60 | # | - | 570' | | | | | | | | | |
| | 50 | 929' | - | 425' | | | | | | | | | |
| | 45 | 713' | 795' | 360' | (5) (6) (12) 11' | CG-6 | | | | | | | |
| | 40 | 536' | 593' | 305' | | | | | | | | | |
| | 35 | 373' | 408' | 250' | | | | | | | | | |
| | 30 | 251' | 273' | 200' | | | | | | | | | |

GENERAL NOTES*

Freeways - Urban Freeways should accommodate desired safe operating speeds during non-peak hours, but should not be so high as to exceed the limits of prudent construction, right of way and socioeconomic costs due to the large proportion of vehicles which are accommodated during periods of peak flow when lower speeds are necessary. The design speeds for Freeways should never be less than 50 mph.

On many Urban Freeways, particularly in suburban areas, a design speed of 60 mph or higher can be provided with little additional cost above that required for 50 mph design speed. The corridor of the mainline may be relatively straight and the character and location of interchanges may permit high speed design. Under these conditions, a design speed of 70 mph is most desirable because the higher design speeds are closely related to the overall quality and safety of the facility.

Other Principal Arterials - Design speeds for Urban Arterials generally range from 40 to 60 mph, and occasionally may be as low as 30 mph. The lower (40 mph and below) speeds apply in the central business district and intermediate areas. The higher speeds are more applicable to the outlying business and developing areas.

Standard TC-5.11R (Rural) superelevation based on 8% maximum is to be used for all Freeways and is to be used for all other Principal Arterials with a design speed of 60 mph. # For minimum radius, See GS-1.

Standard TC-5.11U (Urban) superelevation based on 4% maximum is to be used on Other Principal Arterials with a design speed less than 60 mph.

Standard TC-5.11ULS (Urban Low Speed) 1 superelevation based on 2% maximum is to be used on Other Principal Arterials with a design speed less than or equal to 45 mph.

Clear Zone and Recoverable Area information can be found in Appendix A, Section A-2 of the *Road Design Manual*.

If medians are included, see Section 2E-3 of Chapter 2E of the *Road Design Manual*.

For minimum widths for roadway and right of way used within incorporated cities or towns to qualify for maintenance funds see Code of Virginia Section 33.1-41.1.

For guidelines on Interchange Ramps, see Standard GS-R.

For maximum grades relative to terrain and design speed, see AASHTO Green Book, Chapter 7, Section 7.3.3, page 7-29, Table 7-4, for Freeways, see Chapter 8, Section 8.2.1, page 8-4, Table 8-1.

FOOTNOTES

- (1) Shoulder widths shown are for right shoulders and independently graded median shoulders. An 8' graded median shoulder will be provided when the mainline is 4 lanes (2 lanes in each direction). For 6 or more lanes, the median shoulder provided will be the same as that shown for independent grading. On Freeways, if truck traffic is less than 250 DDHV, the minimum width of graded shoulder shall be 15' for fills and 12' for cuts.
- (2) When the mainline is 6 or more lanes, the left paved shoulder width should be the same as the right paved shoulder. On Freeways, if truck traffic is less than 250 DDHV, the minimum right paved shoulder width shall be 10'.
- (3) Ditch slopes to be 6:1 - 10' and 12' widths and 4:1 - 6' width. A hydraulic analysis is necessary to determine actual depth requirement.
- (4) Additional or modified slope criteria apply where shown on typical sections. (5) Minimum lane widths to be 12' at all interchange locations.
- (5) Minimum lane widths to be 12' at all interchange locations.
- (6) If heavy truck traffic is anticipated, an additional 1 foot width is desirable.
- (7) See [Manual of the Structure and Bridge Division – Volume V – Part 2 Design Aids – Chapter 6 Geometrics](#).
- (8) Or equivalent City or Town design.
- (9) Width of 8' or more may be needed in commercial areas.
- (10) 3:1 and flatter slopes shall be used when the right of way is behind the sidewalk (or sidewalk space) in residential or other areas where slopes will be maintained by the property owner.
- (11) For buffer strip widths see Appendix A, Section A-5 Bicycle & Pedestrian Facility Guidelines.
- (12) Situations having restrictions on trucks may allow the use of lanes 1 foot less in width.
- (13) For additional information on sight distance requirements on grades of 3 percent or greater, see AASHTO Green Book, Section 3.2.2, page 3-3, Table 3-2.
- (14) Intersection sight distance requirements see [Append. F, Table 2-7](#).
- (15) [Additional criteria for 50 MPH with shoulder design](#).

PROJECT MANAGER _____
 SURVEYED BY _____
 DESIGN SUPERVISED BY _____
 DESIGNED BY _____

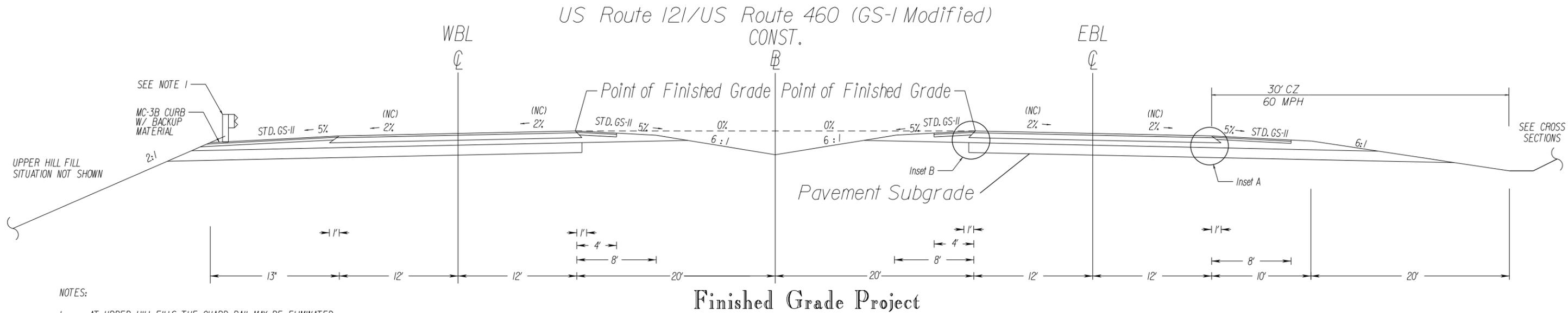
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| REVISED | STATE | | | SHEET NO. |
|---------|-------|-------|---------|-----------|
| | STATE | ROUTE | PROJECT | |
| | VA. | | | PC |

US ROUTE 121/US ROUTE 460

FROM: THE EASTERN END OF ROUGH GRADED HAWKS NEST SECTION TO: THE FUTURE CONNECTION OF US ROUTE 121 ELKINS SECTION

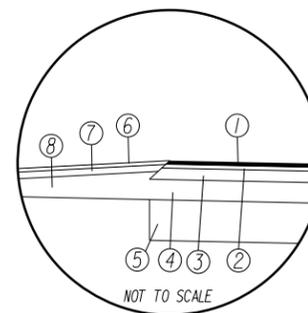
TYPICAL NORMAL CROWN SECTION



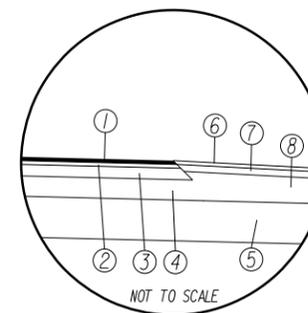
NOTES:

1. AT UPPER HILL FILLS THE GUARD RAIL MAY BE ELIMINATED, SUBJECT TO THE LENGTH OF NEED.

INSET B



INSET A



PAVEMENT LEGEND

- ① 1.5" ASPHALT CONCRETE TYPE SM-12.5D @ 165 LBS/SY
- ② SM-9.5 AS A SURFACE LEVELING COURSE @ 84 LBS/SY
- ③ 6" ASPHALT CONCRETE TYPE BM-25.0
- ④ 6" AGGREGATE BASE MATERIAL, TYPE I, NO. 21B
- ⑤ 12" AGGREGATE MATERIAL NO. 1 (DAYLIGHT AS SHOWN)
- ⑥ ASPHALT CONCRETE TYPE IM-19.0A @ 165 LBS/SY
- ⑦ 3" ASPHALT CONCRETE TYPE BM-25.0
- ⑧ VARIABLE DEPTH AGGREGATE BASE MATERIAL, TYPE I, NO. 21B (DAYLIGHT AS SHOWN)

ATTACHMENT 3.1A

Not To Scale

| | | |
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| | PROJECT | SHEET NO. |
|--|---------|-----------|

PROJECT MANAGER _____
 SURVEYED BY _____
 DESIGN SUPERVISED BY _____
 DESIGNED BY _____

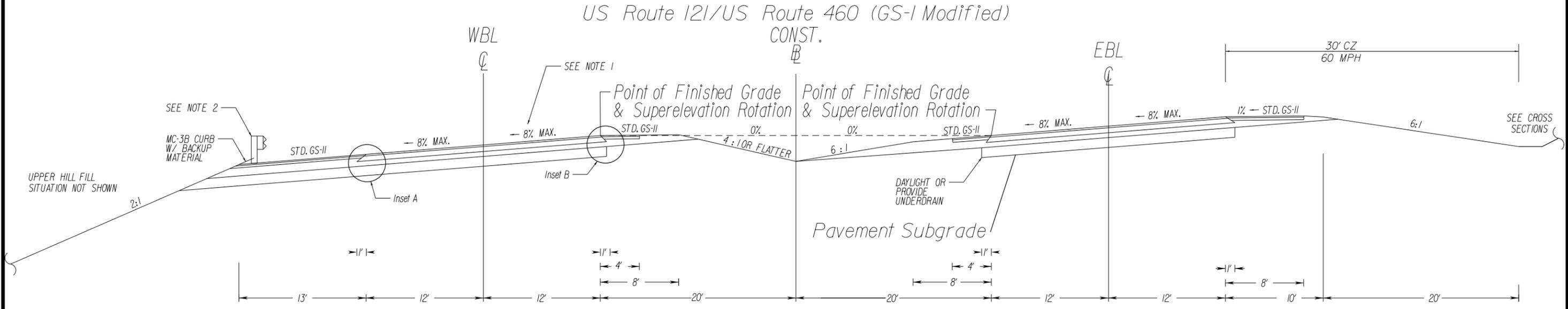
DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

| REVISED | STATE | ROUTE | STATE PROJECT | SHEET NO. |
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| | VA. | | | |

US ROUTE 121/US ROUTE 460

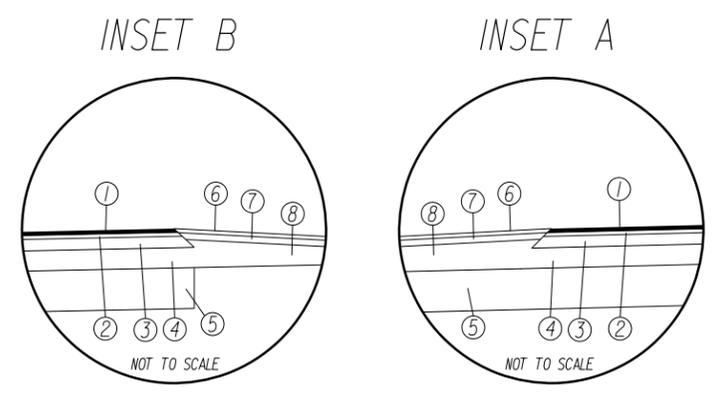
FROM: THE EASTERN END OF ROUGH GRADED HAWKS NEST SECTION TO: THE FUTURE CONNECTION OF US ROUTE 121 ELKINS SECTION

TYPICAL SUPERELEVATED SECTION



- NOTES:
1. SUPERELEVATION VARIES, SHOWN AT MAXIMUM 8%.
 2. AT UPPER HILL FILLS THE GUARD RAIL MAY BE ELIMINATED, SUBJECT TO THE LENGTH OF NEED.

Finished Grade Project



- #### PAVEMENT LEGEND
- ① 1.5" ASPHALT CONCRETE TYPE SM-12.5D @ 165 LBS/SY
 - ② SM-9.5 AS A SURFACE LEVELING COURSE @ 84 LBS/SY
 - ③ 6" ASPHALT CONCRETE TYPE BM-25.0
 - ④ 6" AGGREGATE BASE MATERIAL, TYPE I, NO. 21B
 - ⑤ 12" AGGREGATE MATERIAL NO. 1 (DAYLIGHT)
 - ⑥ ASPHALT CONCRETE TYPE 1M-19.0A @ 165 LBS/SY
 - ⑦ 3" ASPHALT CONCRETE TYPE BM-25.0
 - ⑧ VARIABLE DEPTH AGGREGATE BASE MATERIAL, TYPE I, NO. 21B (DAYLIGHT THROUGH THE SHOULDER)

| | | |
|--|---------|-----------|
| | PROJECT | SHEET NO. |
|--|---------|-----------|

PROJECT MANAGER _____
 SURVEYED BY _____
 DESIGN SUPERVISED BY _____
 DESIGNED BY _____

ROUTE 614 NORMAL CROWN TYPICAL SECTION

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

| REVISED | STATE | | | SHEET NO. |
|---------|-------|-------|---------|-----------|
| | STATE | ROUTE | PROJECT | |
| | VA. | | | |

PAVEMENT LEGEND

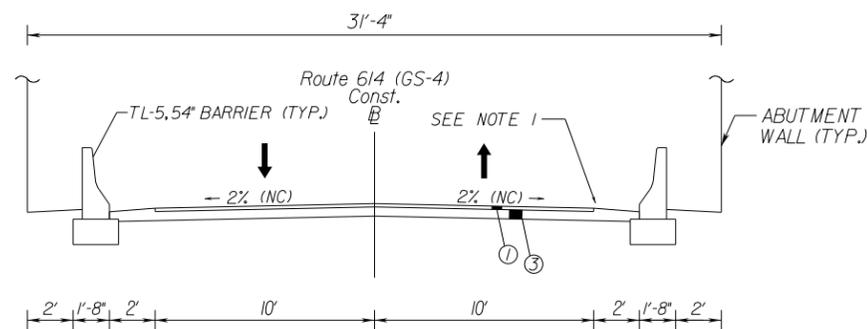
- ① 220 LBS/SY ASPHALT CONCRETE SURFACE COURSE, TYPE SM-12.5A
- ③ 6" AGGREGATE BASE MATERIAL, TYPE 1, NO. 21B

GS-4

| ROUTE | APPROX. STATION |
|-------|-----------------|
| 614 | 259+00 |

NOTES:

1. PROVIDE 1' OF ADDITIONAL PAVING FOR RAVELING, TYPICAL, BOTH SIDES IF NO SHOULDER PAVING IS REQUIRED.
2. PER VDOT STANDARDS PAVEMENT WIDENING IN CURVES MAY REQUIRE WIDENING TO A LANE WIDTH GREATER THAN 10'.
3. THE MINIMUM VERTICAL CLEARANCE IS 16'-6".
4. TL-5 AND 2' OFFSET TO ABUTMENT WALL PER LRFD.



ROUTE 614 UNDERPASS TYPICAL SECTION
 UNDER U.S. ROUTE 121 BRIDGE

| | | |
|--|---------|-----------|
| | PROJECT | SHEET NO. |
|--|---------|-----------|

PROJECT MANAGER _____
 SURVEYED BY _____
 DESIGN SUPERVISED BY _____
 DESIGNED BY _____

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

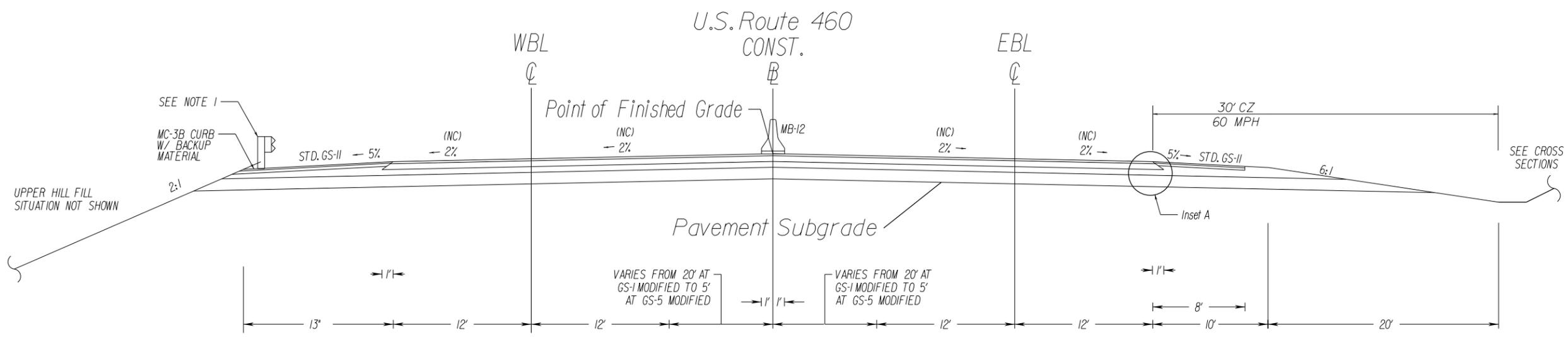
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| | STATE | ROUTE | PROJECT | |
| | VA. | | | PC |

U.S. ROUTE 460 GRUNDY TIE-IN

TRANSITION GS-1 MODIFIED RURAL TO GS-5 MODIFIED URBAN

FROM: THE FUTURE CONNECTION OF US ROUTE 121 ELKINS SECTION TO: THE WESTERN END OF THE BRIDGE OVER LEVISA FORK / NS RAILWAY

TYPICAL NORMAL CROWN SECTION

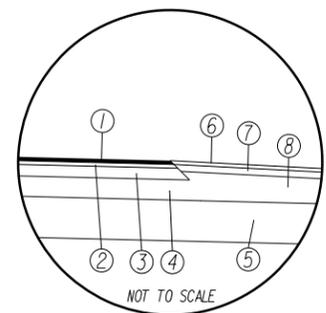


NOTES:

1. AT UPPER HILL FILLS THE GUARD RAIL MAY BE ELIMINATED, SUBJECT TO THE LENGTH OF NEED.

Finished Grade Project

INSET A



PAVEMENT LEGEND

- ① 1.5" ASPHALT CONCRETE TYPE SM-12.5D @ 165 LBS/SY
- ② SM-9.5 AS A SURFACE LEVELING COURSE @ 84 LBS/SY
- ③ 6" ASPHALT CONCRETE TYPE BM-25.0
- ④ 6" AGGREGATE BASE MATERIAL, TYPE I, NO. 21B
- ⑤ 12" AGGREGATE MATERIAL NO. 1 (DAYLIGHT AS SHOWN)
- ⑥ ASPHALT CONCRETE TYPE 1M-19.0A @ 165 LBS/SY
- ⑦ 3" ASPHALT CONCRETE TYPE BM-25.0
- ⑧ VARIABLE DEPTH AGGREGATE BASE MATERIAL, TYPE I, NO. 21B (DAYLIGHT AS SHOWN)

ATTACHMENT 3.ID

Not To Scale

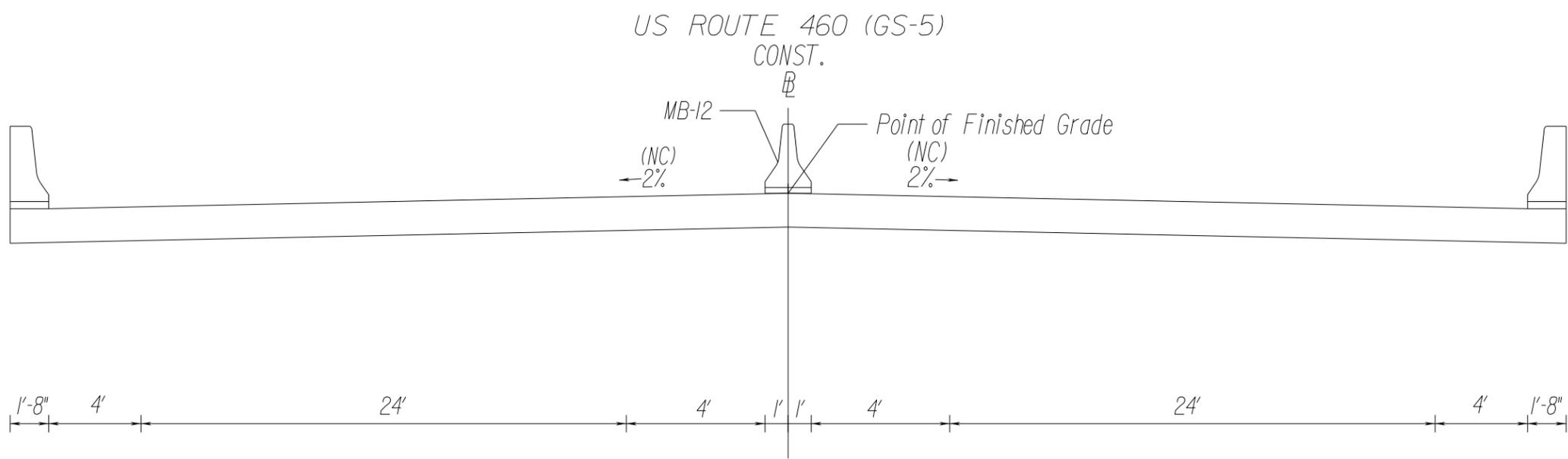
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| | PROJECT | SHEET NO. |
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PROJECT MANAGER _____
 SURVEYED BY _____
 DESIGN SUPERVISED BY _____
 DESIGNED BY _____

US ROUTE 460 GRUNDY TIE-IN BRIDGE OVER LEVISA FORK/NS RAILWAY NORMAL CROWN TYPICAL SECTION

DESIGN FEATURES RELATING TO CONSTRUCTION
 OR TO REGULATION AND CONTROL OF TRAFFIC
 MAY BE SUBJECT TO CHANGE AS DEEMED
 NECESSARY BY THE DEPARTMENT

| REVISED | STATE | STATE | | SHEET NO. |
|---------|-------|---------|--|-----------|
| | ROUTE | PROJECT | | |
| | VA. | | | |



Bridge over Levisa Fork/Norfolk Southern Railway

NOTE: 4' SHOULDERS ARE BASED ON
 AASHTO SHOULDER WIDTHS FOR
 LONG BRIDGES.

| | | |
|--|---------|-----------|
| | PROJECT | SHEET NO. |
|--|---------|-----------|

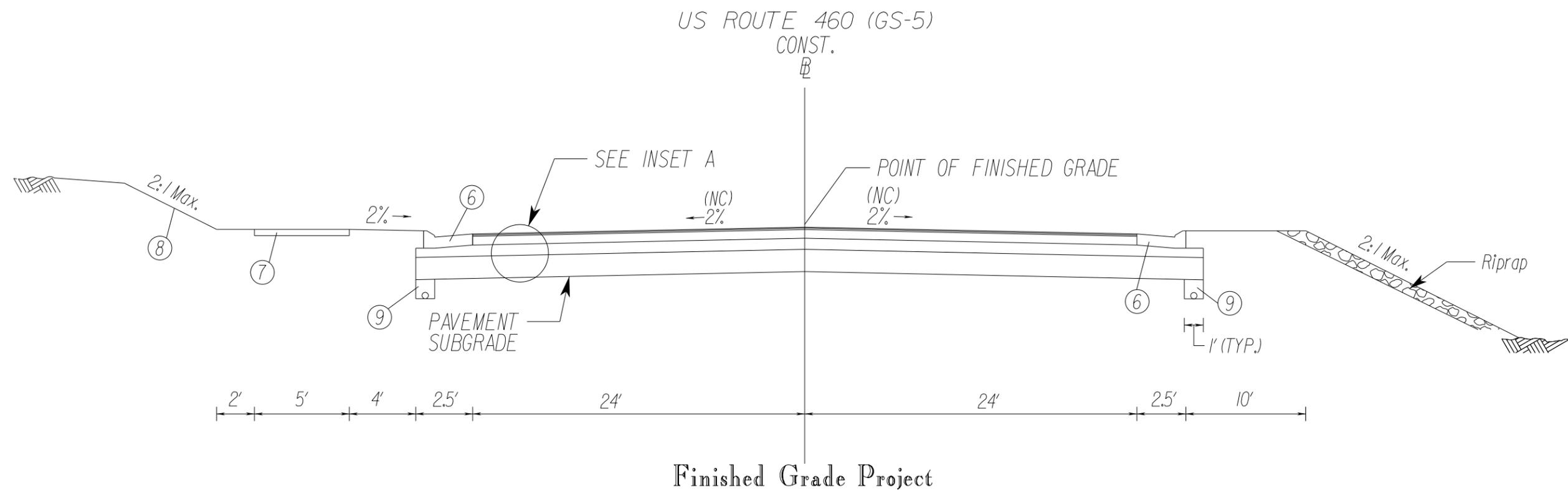
PROJECT MANAGER _____
 SURVEYED BY _____
 DESIGN SUPERVISED BY _____
 DESIGNED BY _____

DESIGN FEATURES RELATING TO CONSTRUCTION
 OR TO REGULATION AND CONTROL OF TRAFFIC
 MAY BE SUBJECT TO CHANGE AS DEEMED
 NECESSARY BY THE DEPARTMENT

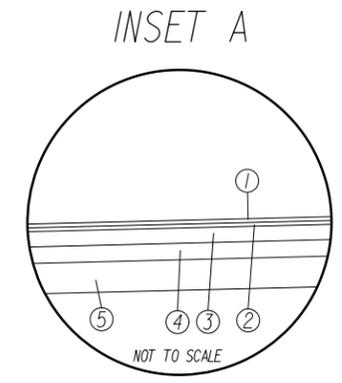
| REVISED | STATE | STATE | | SHEET NO. |
|---------|-------|---------|--|-----------|
| | ROUTE | PROJECT | | |
| | VA. | | | |

US ROUTE 460 GRUNDY TIE-IN

FROM: EASTERN END OF BRIDGE OVER LEVISA FORK/NS RAILWAY
 TO: EASTERN TERMINUS OF THE PROJECT
 NORMAL CROWN TYPICAL SECTION



- PAVEMENT LEGEND
- ① 1.5" ASPHALT CONCRETE TYPE SM12.5A @ 165 LBS/SY
 - ② SM-9.5 AS A SURFACE LEVELING COURSE @ 84 LBS/SY
 - ③ 6" ASPHALT CONCRETE TYPE BM25.0
 - ④ 6" AGGREGATE BASE MATERIAL TYPE 1, NO. 21B
 - ⑤ 12" AGGREGATE MATERIAL NO. 1
 - ⑥ ST'D. CG-7
 - ⑦ CONCRETE SIDEWALK 4" DEPTH
 - ⑧ ST'D. CS-2 OR AS SHOWN ON CROSS SECTIONS
 - ⑨ ST'D PAVEMENT EDGEDRAIN UD-4



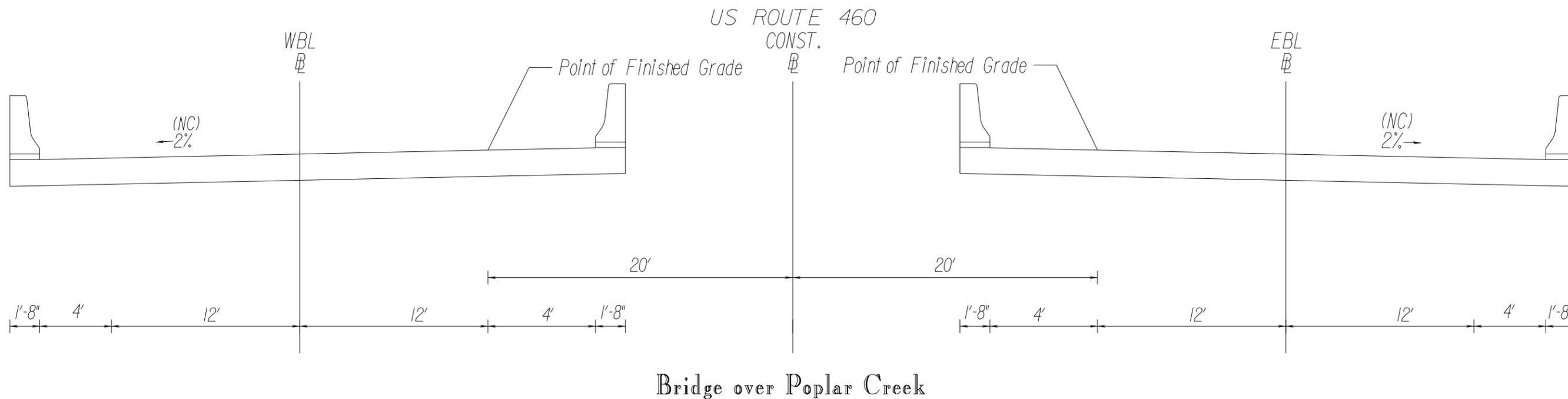
| | | |
|--|---------|-----------|
| | PROJECT | SHEET NO. |
|--|---------|-----------|

PROJECT MANAGER _____
SURVEYED BY _____
DESIGN SUPERVISED BY _____
DESIGNED BY _____

US ROUTE 460 BRIDGE OVER POPLAR CREEK NORMAL CROWN TYPICAL SECTION

DESIGN FEATURES RELATING TO CONSTRUCTION
OR TO REGULATION AND CONTROL OF TRAFFIC
MAY BE SUBJECT TO CHANGE AS DEEMED
NECESSARY BY THE DEPARTMENT

| REVISED | STATE | | SHEET NO. |
|---------|-------|---------|-----------|
| | ROUTE | PROJECT | |
| | VA. | | PC |



NOTE: 4' SHOULDERS ARE BASED ON
AASHTO SHOULDER WIDTHS FOR
LONG BRIDGES.

ATTACHMENT 3.IG

NOT TO SCALE

| PROJECT | SHEET NO. |
|---------|-----------|
| | |

ATTACHMENT 6.1.14B

Additional Foundation Criteria (June 8, 2012)

The following additional VDOT Modifications to the AASHTO LRFD Bridge Design Specifications, 6th Edition; and VDOT Modifications (IIM-S&B-80) are made as an intermediate measure to provide general guidance.

Settlements:

Plans shall incorporate one of the following **General Notes**.

The foundations for this structure have been designed to limit Total Settlement to ½". The total settlement (S_{TOT}) is defined as the arithmetic sum; $S_{TOT} = \text{Elastic Settlement} + \text{Consolidation Settlement} + \text{Secondary Settlement}$. The superstructure and substructure elements above the footings has not been specifically analyzed or designed to accommodate total nor differential settlement.

OR

This structure has been analyzed and designed to accommodate settlement as noted below:

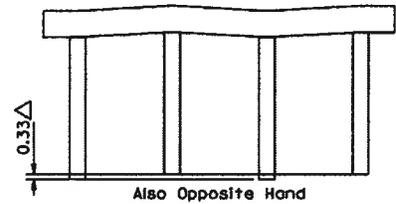
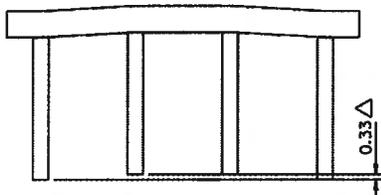
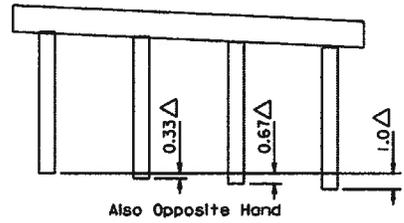
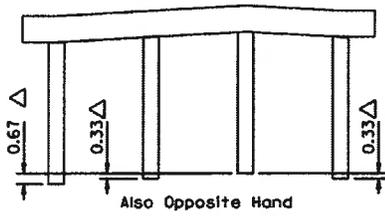
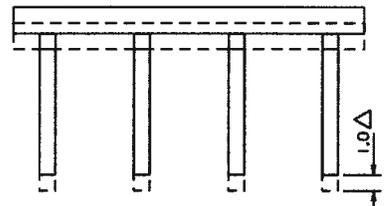
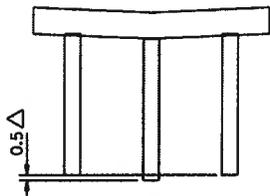
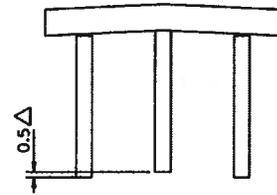
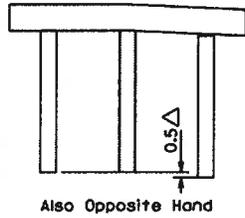
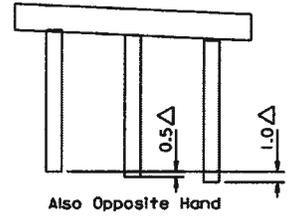
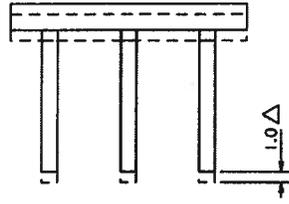
Total Settlement of ()" has been accommodated. The total settlement (S_{TOT}) is defined as the arithmetic sum; $S_{TOT} ()" = \text{Elastic Settlement} ()" + \text{Consolidation Settlement} ()" + \text{Secondary Settlement} ()"$. In addition, Differential Settlement of ()" between adjacent substructure units and ()" within a single unit has been accommodated.

In order to facilitate the selection of the specific values for the General Note, the following Notes to Designer are provided:

The following restrictions are placed on Settlements:

1. For beam and slab bridges conforming to superstructure types a, e, f, g, k, i as defined in AASHTO Table 4.6.2.2.1-1: when total settlement and differential settlement are limited to ½" no additional analysis is required.
2. During construction and after all settlements have occurred the bridge structure (consisting of the superstructure, substructure and associated elements in the load path) must meet all structural capacity requirements for all loading combinations requiring such analysis. In addition, the structure must meet all structural capacity requirements for all load combinations for the listed differential settlement.
3. The bearings and substructure shall be designed and detailed to accommodate increases or decreases in loads due to total or differential settlement shown on the plans. (Ref AASHTO 3.4.1; 3.12.6). The superstructure shall be designed and detailed to accommodate changes in loads, locations of inflections points or fatigue stress ranges.
4. Creep and/or shrinkage may only be used to offset settlement effects when it occurs **CONCURRENTLY** with settlement, and the designer is responsible for determining

- time rate of settlement and creep. [For instance, if all settlement is elastic (instantaneous), creep cannot be used to offset loads imposed]
5. Joint rotations and Bearing rotations due to settlement shall be considered in addition to all tolerances for rotations due to Live Load (LL) effects or for constructability.
 6. In no case shall anticipated settlements (or rotations due to settlement) as noted in the general note cause the structure to encroach on horizontal, vertical or navigation clearance envelopes. (e.g. if 2" of settlement is anticipated then the designer should add 2" to the planned minimum vertical clearance)
 7. In no case shall anticipated settlements (or rotations due to settlement) as noted in the general note cause the structure to encroach on horizontal, vertical or navigation clearance envelopes. (e.g. if 2" of settlement is anticipated then the designer should add 2" to the planned minimum vertical clearance)
 8. Settlements which change profile grade shall not:
 - a. Increase spread of drainage beyond limits specified in AASHTO.
 - b. Change performance or maintainability of utilities.
 - c. Introduce a low spot on the bridge.
 - d. Negatively impact rideability except as limited by the special provision for rideability. [When applicable]
 9. Coordinate predicted/expected settlement of the approach embankments and bridge structure to comply with contract rideability requirements.
 10. The structure must be capable of carrying an additional future wearing surface equal to the magnitude of the total anticipated settlement placed uniformly from curb to curb and abutment to abutment. All parapets and railings shall accommodate the additional layer of surfacing with no modification or reduction in crash test level after construction.
 11. Jacking and shimming shall not be allowed to correct differential settlement except as noted in the original design plans.
 12. Settlements shall be treated as a load condition with $\gamma_{SE} = 1.0$ for all AASHTO indicated groups. (Clarify AASHTO 3.4.1)
 13. When differential settlement at a single substructure unit is anticipated, both the superstructure and substructure shall be analyzed and detailed to account for the changes resulting from differential deflection. For continuous footings, settlement may be considered to be linear along the long axis of the footing. For isolated footings, in addition to the linear distribution of settlement, adjacent footings shall be analyzed for a linear proportion of the differential settlement at each footing (for a 3 column pier with 2 equal spaces, 50%, for a 4 column pier with 3 equal spaces, 33% of the total pier differential shall be used at each column. (including but not limited to the settlement conditions shown on the following page)
 14. Under no condition shall settlement be used to justify use of simple span configurations instead of continuous span configurations.



Examples of Possible Settlement patterns to clarify differential settlement proportioning as it is intended to be considered as part of settlement analysis (Patterns are selected for illustrative purposes, the pattern selection is not all inclusive, designer is responsible for determining Critical Pattern)



Structure and Bridge

Stage I Bridge Report Summary Form

Project Name: _____ Date: **11/15/2013**

| | | | | | |
|------------------------|--|------------------------|--|------|--|
| Fed Structure ID (New) | | Fed Str. ID (Existing) | | UPC: | |
|------------------------|--|------------------------|--|------|--|

State Project Number: _____

County of: _____ District: _____

Facility Carried: _____ Over _____

This project is programmed for Federal Aid. Funding Source: _____

Federal Project Number: _____ Federal Oversight _____

Prepared for the

**Virginia Department of Transportation
Structure and Bridge Division**

[XXXXXX], XXXXXXX Dist. Structure and Bridge Engineer, (XXX)-XXX-XXXX

XXXXXXXX, Project Manager, (XXX)-XXX-XXXX

Submitted by

XXXXXXXXXX, XXXXXXXXXXXXXXXXXXXX (XXX)-XXX-XXXX

VDOT will provide an electronic file of this attachment
for use of drop-down values

Recommended Bridge Structural Summary:

Superstructure: Type:
Units:
Span Layout:
Skew Angle:
Material - **Steel**
Superstructure width has been selected using:
P= ft. Left Shoulder= ft. Right shoulder= ft. Median= ft
There is lane in each direction.. Through lane width is **12'**.
Total **Pavement +Shoulder** Width – face-to-face of **rails** with a 12'-0 SUP
separated from traffic by a BR-27 series, 54" high rail and a pedestrian
fence/concrete rail along the exterior.
Parapet or Rail Type - **BR 27 series, 42"** high, Test Level **TL-4**
Bridge Deck Width (Bridge Surface Width): Out-to-Out of Deck width
Pedestrian and Bicycle facilities **NA** requirements shown in Volume 5 Part 2
Chapter 20
A Design Waiver is not required
Joint Type(s) - **Structure will be Jointless** Structure **does not meet** requirements
for a jointless structure shown in Volume 5 Part 2 Chapter 20.
A Design Waiver is required

Substructure: Proposed Abutment A Type - **Deck Extensions**
Proposed Abutment B Type - **Deck Extensions**
Proposed Pier Type(s) - **N/A- Simple Span**
Piers **will not** be designed for collision. Pier protection **is not** required.
Proposed Foundation: **Piles**

Clearances: Minimum Vertical Clearance: -
Minimum Horizontal Clearance: -
 Bridge **crosses Railroad track(s)**. Geometry allows for **2 track(s)**

Preliminary Hydraulic Analysis:

Freeboard above design flood () –
If 100 year storm floods bridge include:
Return Period of roadway flood event: years

Scour at this location **has not been computed**. Scour is **NA** to effect foundation
design.
A Design Waiver is not required

Recommended Bridge Cost Summary:

Estimated Costs: Estimated Cost of recommended layout - \$
Ratio of recommended layout to lowest cost alternative considered:
Cost/SF this layout: \$
Estimate NA based on Transport.
The detailed cost estimate **NA** included with the supplemental data.

This recommendation **NA** the lowest cost bridge solution. Justification for a cost differential **NA**
presented in the narrative appendix.

(Estimated Cost NA include Preliminary =or Construction Engineering nor does it include
Contingency.)

*For estimated cost of alternative layout(s) see Bridge Alternative forms

Bridge Alternatives Developed:

- Bridge Alternative forms are attached
- Bridge Alternatives are presented in a Narrative Appendix

Special construction Considerations:

Aesthetics -

Stage Construction -

Roadway Coordination Data Summary

Data not shown is provided on roadway plans provided as supplementary data

Recommended structure will not be functionally obsolete.

Based on Preliminary Roadway Plans dated:

On Bridge

Current ADT (year): _____ () Design ADT (year): _____ ()

% Trucks: _____ Design Speed: _____ *mph* Posted Speed: _____ *mph*

Reduced Design Speed (if applicable) _____ Is the road carried on the NHS? No

Functional Classification: Rural Collector Road Min. Design Standard: _____

Existing Dimensions _____ Proposed Dimensions _____

Max Grade _____ Profile type Straight Grade

Under Bridge (if applicable)

Current ADT(year): _____ () Design ADT(year): _____ ()

% Trucks: _____ Design Speed: _____ *mph* Posted Speed: _____ *mph*

Reduced Design Speed (if applicable) _____ Is the road under on the NHS? No

Functional Classification: _____ Min. Design Standard: _____

Existing Dimensions _____ Proposed Dimensions _____

Max Grade _____ Profile type _____

The geometrics of the road approaching the structure include the position and alignment of the approach guardrail, if applicable. When bridge is an overpass then lateral clearances beneath the structure constitute part of the control geometrics and must be shown.

If an existing structure at this site is to remain in place, its primary geometrics and its dimensional relationship to the proposed structure are included in the data.

Recommended Bridge Geometrics Summary:

Geometrics:

This project must meet

- Low Volume Road Standards
 - RRR Stds
 - VDOT Road Design Manual and AASHTO Green Book
 - AASHTO Green Book only (First Cities)
- PM 100 attached Scoping Report Attached Current Road Plans Attached

Roadway width conforms to Volume 5 Part 2 Chapter 6 File No. 06-02-04 which controls the design.

A Design Waiver is not required.

- Roadway includes following provisions for bicycles,
 - Roadway is a shared roadway no modification to geometrics is required
 - Roadway is a signed shared roadway
 - Bicycle Lane is designated by striping, signing and pavement markings.

Parapets and lane widths conform to the requirements of Volume 5 Part 2 Chapter 6.

A Design Waiver is not required.

- Pedestrian facilities are included:

Sidewalk(s) meet requirements of Volume 5 Part 2 Chapter 6 are met; a 54" crash tested railing has been provided.

A Design Waiver is not required.

- Bridge is on horizontal curve or within 200ft of PC/PT:

Stopping sight distances meet requirements of Volume 5 Part 2 Chapter 6.

A Design Exception is not required.

Data Sources:

Data from the following sources was considered in the development of this report

| | | | | | | | |
|--|---|--------------------------|----|--------------------------|-----|--------------------------|-------|
| Environmental Sources | | | | | | | |
| <input type="checkbox"/> | CE | <input type="checkbox"/> | EA | <input type="checkbox"/> | EIS | <input type="checkbox"/> | other |
| L&D Sources | | | | | | | |
| <input type="checkbox"/> | Preliminary Roadway Design Plans | | | | | | |
| <input type="checkbox"/> | Traffic Engineering Reports | | | | | | |
| Surveys | | | | | | | |
| <input type="checkbox"/> | Bridge Situation Plan | | | | | | |
| <input type="checkbox"/> | Topographic survey and bathymetric/hydraulic datum references | | | | | | |
| <input type="checkbox"/> | Other survey information (scour, utility, etc.) | | | | | | |
| <input type="checkbox"/> | Hydraulics/Hydrology | | | | | | |
| Bridge Sources | | | | | | | |
| <input type="checkbox"/> | Existing Bridge Plans | | | | | | |
| <input type="checkbox"/> | Existing Bridge Inspection Report(s) | | | | | | |
| <input type="checkbox"/> | Other | | | | | | |
| Geotechnical sources | | | | | | | |
| <input type="checkbox"/> | Existing Geotechnical Information (From project site, nearby bridges, roadway borings, geologic maps, etc.) | | | | | | |
| <input type="checkbox"/> | Project Specific Geotechnical | | | | | | |
| Meeting(s) (Localities, District, Residency, etc.) (dates on for these are critical) | | | | | | | |
| <input type="checkbox"/> | Localities | | | | | | |
| <input type="checkbox"/> | District | | | | | | |
| <input type="checkbox"/> | Residency | | | | | | |
| <input type="checkbox"/> | Other | | | | | | |
| Other Sources | | | | | | | |
| <input type="checkbox"/> | FHWA Recommendation (Rehabilitation vs. Replacement) | | | | | | |
| <input type="checkbox"/> | Site Visit | | | | | | |
| <input type="checkbox"/> | Other | | | | | | |
| <input type="checkbox"/> | | | | | | | |

Approval of Recommended Bridge:

Project Name _____ **Date:** 11/15/2013

Fed Structure ID XXXXX UPC: _____ Federal Oversight NFO

State Project Number: _____ Federal Project Number: _____

County of: _____ District: _____ Funding Source: _____

Facility Carried: _____ Over Buckingham Branch RR

Recommended for Approval By:

Date:

Remarks:

Recommended for Approval By:

Date:

Remarks:

Approved:

Date:

Remarks:

Approved:

Date:

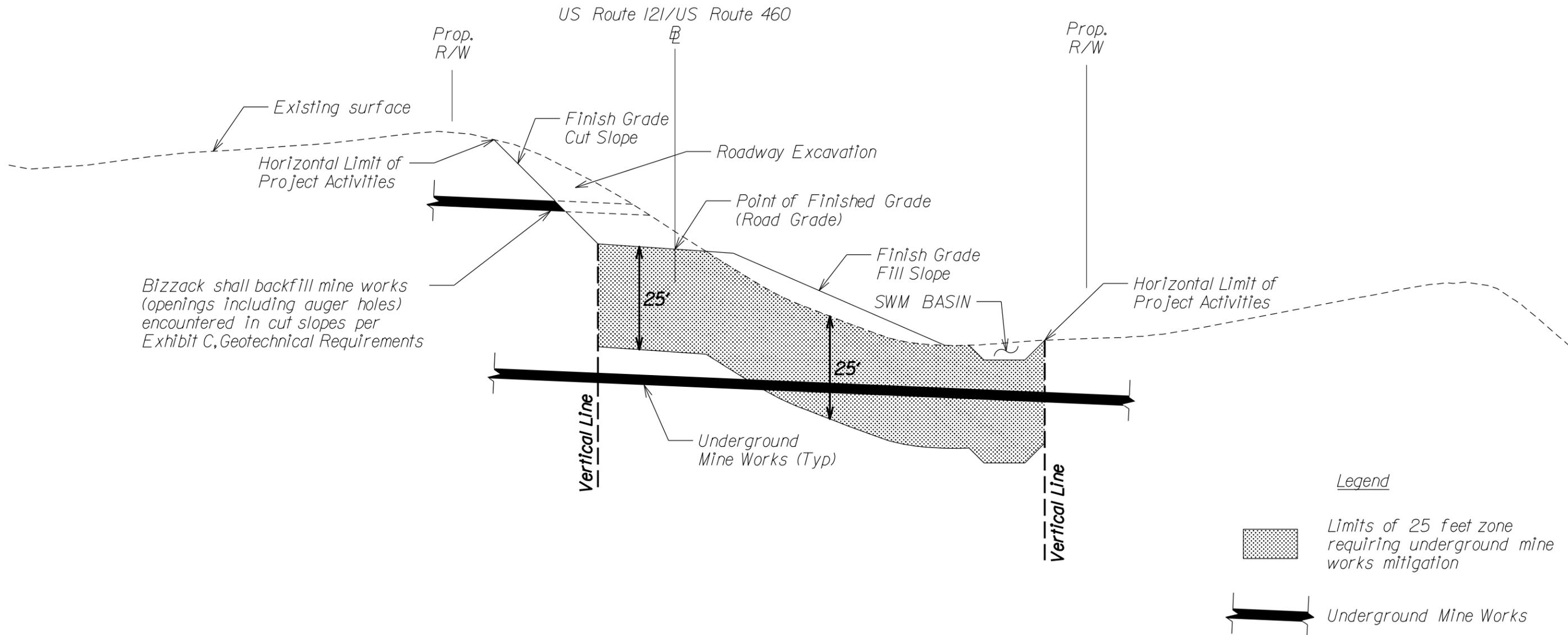
FHWA Virginia Division Bridge Engineer

Remarks:

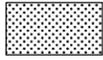
PROJECT MANAGER _____
SURVEYED BY _____
DESIGN SUPERVISED BY _____
DESIGNED BY _____

DESIGN FEATURES RELATING TO CONSTRUCTION
OR TO REGULATION AND CONTROL OF TRAFFIC
MAY BE SUBJECT TO CHANGE AS DEEMED
NECESSARY BY THE DEPARTMENT

| REVISED | STATE | ROUTE | STATE | PROJECT | SHEET NO. |
|---------|-------|-------|-------|---------|-----------|
| | | VA. | | | |



Legend

-  Limits of 25 feet zone requiring underground mine works mitigation
-  Underground Mine Works

UNDERGROUND MINE WORKS MITIGATION
NOT TO SCALE

ATTACHMENT 14.1A

| PROJECT | SHEET NO. |
|---------|-----------|
| | |

EXHIBIT D

INITIAL BASELINE SCHEDULE

[see attached]

| Activity ID | Activity Name | Original Duration | Remaining Duration | Start | Finish | Total Float |
|--|--|-------------------|--------------------|-----------|-----------|-------------|
| Total | | 350 | 350 | 28-Mar-14 | 30-Jul-15 | 0 |
| Poplar Creek - Initial Schedule | | 350 | 350 | 28-Mar-14 | 30-Jul-15 | 0 |
| Milestones | | 350 | 350 | 28-Mar-14 | 30-Jul-15 | 0 |
| MS-0100 | Amendment Date | 0 | 0 | 28-Mar-14 | | 0 |
| MS-0115 | Notice-to-Proceed for Design | 0 | 0 | 28-Mar-14 | | 0 |
| MS-0110 | Baseline Schedule for Design | 0 | 0 | | 18-Apr-14 | 12 |
| MS-0120 | VDOT Select Poplar Creek Bridge Type | 0 | 0 | | 02-Sep-14 | 4 |
| MS-0125 | VDOT Select Levisa Fork Bridge Type | 0 | 0 | | 02-Sep-14 | 6 |
| MS-0105 | Design Public Hearing | 0 | 0 | | 24-Feb-15 | 112 |
| MS-0130 | Project Completion | 0 | 0 | | 30-Jul-15 | 0 |
| Project Management and Coordination | | 336 | 336 | 28-Mar-14 | 12-Jul-15 | 14 |
| Administration | | 296 | 296 | 28-Mar-14 | 15-May-15 | 16 |
| ADM-0100 | Property Access Notice | 15 | 15 | 28-Mar-14 | 11-Apr-14 | 16 |
| ADM-0105 | Develop and Submit QA/QC Plan for Design | 10 | 10 | 28-Mar-14 | 10-Apr-14 | 56 |
| ADM-0115 | Develop Baseline Schedule for Design | 1 | 1 | 28-Mar-14 | 28-Mar-14 | 18 |
| ADM-0120 | VDOT Review and Approve Baseline Schedule for Design | 21 | 21 | 29-Mar-14 | 18-Apr-14 | 18 |
| ADM-0110 | VDOT Review and Approve QA/QC Plan for Design | 21 | 21 | 11-Apr-14 | 01-May-14 | 80 |
| ADM-0125 | Develop Hydrologic and Hydraulic Analysis (H&HA) | 22 | 22 | 02-Feb-15 | 04-Mar-15 | 53 |
| ADM-0135 | VDOT Review Hydrologic and Hydraulic Analysis (H&HA) | 21 | 21 | 05-Mar-15 | 25-Mar-15 | 75 |
| ADM-0130 | Develop Final Drainage Report | 22 | 22 | 25-Mar-15 | 24-Apr-15 | 16 |
| ADM-0140 | VDOT Review - Final Drainage Report | 21 | 21 | 25-Apr-15 | 15-May-15 | 24 |
| Contract Management | | 465 | 465 | 04-Apr-14 | 12-Jul-15 | 18 |
| CM-0100 | Contract Management (20%) | 15 | 15 | 04-Apr-14 | 18-Apr-14 | 18 |
| CM-0103 | Contract Management (25%) | 30 | 30 | 19-Apr-14 | 18-May-14 | 18 |
| CM-0105 | Contract Management (30%) | 30 | 30 | 19-May-14 | 17-Jun-14 | 18 |
| CM-0110 | Contract Management (35%) | 30 | 30 | 18-Jun-14 | 17-Jul-14 | 18 |
| CM-0115 | Contract Management (40%) | 30 | 30 | 18-Jul-14 | 16-Aug-14 | 18 |
| CM-0120 | Contract Management (45%) | 30 | 30 | 17-Aug-14 | 15-Sep-14 | 18 |
| CM-0125 | Contract Management (50%) | 30 | 30 | 16-Sep-14 | 15-Oct-14 | 18 |
| CM-0130 | Contract Management (55%) | 30 | 30 | 16-Oct-14 | 14-Nov-14 | 18 |
| CM-0135 | Contract Management (60%) | 30 | 30 | 15-Nov-14 | 14-Dec-14 | 18 |
| CM-0140 | Contract Management (65%) | 30 | 30 | 15-Dec-14 | 13-Jan-15 | 18 |
| CM-0145 | Contract Management (70%) | 30 | 30 | 14-Jan-15 | 12-Feb-15 | 18 |
| CM-0150 | Contract Management (75%) | 30 | 30 | 13-Feb-15 | 14-Mar-15 | 18 |

| Activity ID | Activity Name | Original Duration | Remaining Duration | Start | Finish | Total Float |
|-------------------------------------|---|-------------------|--------------------|------------------|------------------|-------------|
| CM-0155 | Contract Management (80%) | 30 | 30 | 15-Mar-15 | 13-Apr-15 | 18 |
| CM-0160 | Contract Management (85%) | 30 | 30 | 14-Apr-15 | 13-May-15 | 18 |
| CM-0165 | Contract Management (90%) | 30 | 30 | 14-May-15 | 12-Jun-15 | 18 |
| CM-0170 | Contract Management (100%) | 30 | 30 | 13-Jun-15 | 12-Jul-15 | 18 |
| Design Management | | 465 | 465 | 28-Mar-14 | 05-Jul-15 | 25 |
| DM-0100 | Design Management (20%) | 15 | 15 | 28-Mar-14 | 11-Apr-14 | 25 |
| DM-0103 | Design Management (25%) | 30 | 30 | 12-Apr-14 | 11-May-14 | 25 |
| DM-0105 | Design Management (30%) | 30 | 30 | 12-May-14 | 10-Jun-14 | 25 |
| DM-0110 | Design Management (35%) | 30 | 30 | 11-Jun-14 | 10-Jul-14 | 25 |
| DM-0115 | Design Management (40%) | 30 | 30 | 11-Jul-14 | 09-Aug-14 | 25 |
| DM-0120 | Design Management (45%) | 30 | 30 | 10-Aug-14 | 08-Sep-14 | 25 |
| DM-0125 | Design Management (50%) | 30 | 30 | 09-Sep-14 | 08-Oct-14 | 25 |
| DM-0130 | Design Management (55%) | 30 | 30 | 09-Oct-14 | 07-Nov-14 | 25 |
| DM-0135 | Design Management (60%) | 30 | 30 | 08-Nov-14 | 07-Dec-14 | 25 |
| DM-0140 | Design Management (65%) | 30 | 30 | 08-Dec-14 | 06-Jan-15 | 25 |
| DM-0145 | Design Management (70%) | 30 | 30 | 07-Jan-15 | 05-Feb-15 | 25 |
| DM-0150 | Design Management (75%) | 30 | 30 | 06-Feb-15 | 07-Mar-15 | 25 |
| DM-0155 | Design Management (80%) | 30 | 30 | 08-Mar-15 | 06-Apr-15 | 25 |
| DM-0160 | Design Management (85%) | 30 | 30 | 07-Apr-15 | 06-May-15 | 25 |
| DM-0165 | Design Management (90%) | 30 | 30 | 07-May-15 | 05-Jun-15 | 25 |
| DM-0170 | Design Management (100%) | 30 | 30 | 06-Jun-15 | 05-Jul-15 | 25 |
| Property Research and Survey | | 156 | 156 | 28-Mar-14 | 31-Oct-14 | 59 |
| ROW Survey | | 44 | 44 | 28-Mar-14 | 28-May-14 | 61 |
| RS-0100 | Survey Deed Research (50%) | 22 | 22 | 28-Mar-14 | 28-Apr-14 | 61 |
| RS-0105 | Survey Deed Research (100%) | 22 | 22 | 29-Apr-14 | 28-May-14 | 61 |
| Geotechnical Survey | | 111 | 111 | 21-Apr-14 | 23-Sep-14 | 45 |
| GS-0100 | Survey Geotech Boreholes (Preliminary Bridge Borings) | 3 | 3 | 21-Apr-14 | 24-Apr-14 | 12 |
| GS-0115 | Survey Geotech Boreholes (Roadway) | 22 | 22 | 08-May-14 | 09-Jun-14 | 31 |
| GS-0130 | Survey Geotech Boreholes (Disposal Area) | 15 | 15 | 23-Jun-14 | 14-Jul-14 | 71 |
| GS-0125 | Survey Geotech Boreholes (Mineral Reserve) | 15 | 15 | 28-Jul-14 | 18-Aug-14 | 71 |
| GS-0110 | Survey Geotech Boreholes (Levisa Fork Bridge) | 5 | 5 | 16-Sep-14 | 23-Sep-14 | 28 |
| GS-0120 | Survey Geotech Boreholes (Poplar Creek Bridges) | 5 | 5 | 16-Sep-14 | 23-Sep-14 | 28 |
| Roadway/Bridge Survey | | 88 | 88 | 09-Jun-14 | 09-Oct-14 | 31 |
| RBS-0100 | Field Survey (25%) | 22 | 22 | 09-Jun-14 | 09-Jul-14 | 31 |
| RBS-0105 | Field Survey (50%) | 22 | 22 | 09-Jul-14 | 08-Aug-14 | 31 |

| Activity ID | Activity Name | Original Duration | Remaining Duration | Start | Finish | Total Float |
|---|---|-------------------|--------------------|------------------|------------------|-------------|
| RBS-0110 | Field Survey (75%) | 22 | 22 | 08-Aug-14 | 09-Sep-14 | 31 |
| RBS-0115 | Field Survey (100%) | 22 | 22 | 09-Sep-14 | 09-Oct-14 | 31 |
| Utility Survey | | 60 | 60 | 08-Aug-14 | 31-Oct-14 | 59 |
| US-0100 | Locate Existing Utilities (50%) | 30 | 30 | 08-Aug-14 | 19-Sep-14 | 59 |
| US-0105 | Locate Existing Utilities (100%) | 30 | 30 | 19-Sep-14 | 31-Oct-14 | 59 |
| Roadway Design | | 350 | 350 | 28-Mar-14 | 30-Jul-15 | 0 |
| Roadway Preliminary Field Inspection Plans | | 121 | 121 | 28-Mar-14 | 12-Sep-14 | 6 |
| RD-PFI-0100 | PFI Plans - Roadway Design (20%) | 11 | 11 | 28-Mar-14 | 11-Apr-14 | 0 |
| RD-PFI-0105 | PFI Plans - Drainage Design (20%) | 11 | 11 | 28-Mar-14 | 11-Apr-14 | 0 |
| RD-PFI-0110 | PFI Plans - Erosion & Sediment Control Plan Design (20%) | 11 | 11 | 28-Mar-14 | 11-Apr-14 | 0 |
| RD-PFI-0115 | PFI Plans - Stormwater Management Plan Design (20%) | 11 | 11 | 28-Mar-14 | 11-Apr-14 | 0 |
| RD-PFI-0120 | PFI Plans - Traffic Management Plan Design (20%) | 11 | 11 | 28-Mar-14 | 11-Apr-14 | 0 |
| RD-PFI-0130 | PFI Plans - Roadway Design (40%) | 22 | 22 | 14-Apr-14 | 13-May-14 | 0 |
| RD-PFI-0135 | PFI Plans - Drainage Design (40%) | 22 | 22 | 14-Apr-14 | 13-May-14 | 0 |
| RD-PFI-0140 | PFI Plans - Erosion & Sediment Control Plan Design (40%) | 22 | 22 | 14-Apr-14 | 13-May-14 | 0 |
| RD-PFI-0145 | PFI Plans - Stormwater Management Plan Design (40%) | 22 | 22 | 14-Apr-14 | 13-May-14 | 0 |
| RD-PFI-0150 | PFI Plans - Traffic Management Plan Design (40%) | 22 | 22 | 14-Apr-14 | 13-May-14 | 0 |
| RD-PFI-0160 | PFI Plans - Roadway Design (60%) | 22 | 22 | 14-May-14 | 12-Jun-14 | 0 |
| RD-PFI-0165 | PFI Plans - Drainage Design (60%) | 22 | 22 | 14-May-14 | 12-Jun-14 | 0 |
| RD-PFI-0170 | PFI Plans - Erosion & Sediment Control Plan Design (60%) | 22 | 22 | 14-May-14 | 12-Jun-14 | 0 |
| RD-PFI-0175 | PFI Plans - Stormwater Management Plan Design (60%) | 22 | 22 | 14-May-14 | 12-Jun-14 | 0 |
| RD-PFI-0180 | PFI Plans - Traffic Management Plan Design (60%) | 22 | 22 | 14-May-14 | 12-Jun-14 | 0 |
| RD-PFI-0190 | PFI Plans - Roadway Design (80%) | 22 | 22 | 13-Jun-14 | 14-Jul-14 | 0 |
| RD-PFI-0195 | PFI Plans - Drainage Design (80%) | 22 | 22 | 13-Jun-14 | 14-Jul-14 | 0 |
| RD-PFI-0200 | PFI Plans - Erosion & Sediment Control Plan Design (80%) | 22 | 22 | 13-Jun-14 | 14-Jul-14 | 0 |
| RD-PFI-0205 | PFI Plans - Stormwater Management Plan Design (80%) | 22 | 22 | 13-Jun-14 | 14-Jul-14 | 0 |
| RD-PFI-0210 | PFI Plans - Traffic Management Plan Design (80%) | 22 | 22 | 13-Jun-14 | 14-Jul-14 | 0 |
| RD-PFI-0220 | PFI Plans - Roadway Design (100%) | 22 | 22 | 15-Jul-14 | 13-Aug-14 | 0 |
| RD-PFI-0225 | PFI Plans - Drainage Design (100%) | 22 | 22 | 15-Jul-14 | 13-Aug-14 | 0 |
| RD-PFI-0230 | PFI Plans - Erosion & Sediment Control Plan Design (100%) | 22 | 22 | 15-Jul-14 | 13-Aug-14 | 0 |
| RD-PFI-0235 | PFI Plans - Stormwater Management Plan Design (100%) | 22 | 22 | 15-Jul-14 | 13-Aug-14 | 0 |
| RD-PFI-0240 | PFI Plans - Traffic Management Plan Design (100%) | 22 | 22 | 15-Jul-14 | 13-Aug-14 | 0 |
| RD-PFI-0335 | PFI Plans - Constructability Review (100%) | 1 | 1 | 21-Aug-14 | 21-Aug-14 | 0 |
| RD-PFI-0340 | PFI Plans - Submit 100% Preliminary Field Inspection | 1 | 1 | 22-Aug-14 | 22-Aug-14 | 0 |

| Activity ID | Activity Name | Original Duration | Remaining Duration | Start | Finish | Total Float |
|---------------------------------------|---|-------------------|--------------------|------------------|------------------|-------------|
| RD-PFI-035 | PFI Plans - VDOT Review 100% Preliminary Field Inspection | 21 | 21 | 23-Aug-14 | 12-Sep-14 | 10 |
| Roadway Public Hearing Plans | | 133 | 133 | 22-Aug-14 | 24-Feb-15 | 112 |
| RD-PH-0100 | PH Plans - Roadway Design (25%) | 22 | 22 | 22-Aug-14 | 22-Sep-14 | 0 |
| RD-PH-0105 | PH Plans - Drainage Design (25%) | 22 | 22 | 22-Aug-14 | 22-Sep-14 | 0 |
| RD-PH-0110 | PH Plans - Erosion & Sediment Control Plan Design (25%) | 22 | 22 | 22-Aug-14 | 22-Sep-14 | 0 |
| RD-PH-0115 | PH Plans - Stormwater Management Plan Design (25%) | 22 | 22 | 22-Aug-14 | 22-Sep-14 | 0 |
| RD-PH-0120 | PH Plans - Traffic Management Plan Design (25%) | 22 | 22 | 22-Aug-14 | 22-Sep-14 | 0 |
| RD-PH-0160 | PH Plans - Roadway Design (50%) | 22 | 22 | 23-Sep-14 | 22-Oct-14 | 0 |
| RD-PH-0165 | PH Plans - Drainage Design (50%) | 22 | 22 | 23-Sep-14 | 22-Oct-14 | 0 |
| RD-PH-0170 | PH Plans - Erosion & Sediment Control Plan Design (50%) | 22 | 22 | 23-Sep-14 | 22-Oct-14 | 0 |
| RD-PH-0175 | PH Plans - Stormwater Management Plan Design (50%) | 22 | 22 | 23-Sep-14 | 22-Oct-14 | 0 |
| RD-PH-0180 | PH Plans - Traffic Management Plan Design (50%) | 22 | 22 | 23-Sep-14 | 22-Oct-14 | 0 |
| RD-PH-0190 | PH Plans - Roadway Design (75%) | 22 | 22 | 23-Oct-14 | 21-Nov-14 | 0 |
| RD-PH-0195 | PH Plans - Drainage Design (75%) | 22 | 22 | 23-Oct-14 | 21-Nov-14 | 0 |
| RD-PH-0200 | PH Plans - Erosion & Sediment Control Plan Design (75%) | 22 | 22 | 23-Oct-14 | 21-Nov-14 | 0 |
| RD-PH-0205 | PH Plans - Stormwater Management Plan Design (75%) | 22 | 22 | 23-Oct-14 | 21-Nov-14 | 0 |
| RD-PH-0210 | PH Plans - Traffic Management Plan Design (75%) | 22 | 22 | 23-Oct-14 | 21-Nov-14 | 0 |
| RD-PH-0220 | PH Plans - Roadway Design (100%) | 22 | 22 | 24-Nov-14 | 23-Dec-14 | 0 |
| RD-PH-0225 | PH Plans - Drainage Design (100%) | 22 | 22 | 24-Nov-14 | 23-Dec-14 | 0 |
| RD-PH-0230 | PH Plans - Erosion & Sediment Control Plan Design (100%) | 22 | 22 | 24-Nov-14 | 23-Dec-14 | 0 |
| RD-PH-0235 | PH Plans - Stormwater Management Plan Design (100%) | 22 | 22 | 24-Nov-14 | 23-Dec-14 | 0 |
| RD-PH-0240 | PH Plans - Traffic Management Plan Design (100%) | 22 | 22 | 24-Nov-14 | 23-Dec-14 | 0 |
| RD-PH-0315 | PH Plans - Constructability Review (100%) | 1 | 1 | 31-Dec-14 | 31-Dec-14 | 0 |
| RD-PH-0320 | PH Plans - Submit 100% Public Hearing Plans | 1 | 1 | 01-Jan-15 | 01-Jan-15 | 0 |
| RD-PH-0325 | PH Plans - VDOT Review 100% Public Hearing Plans | 21 | 21 | 02-Jan-15 | 22-Jan-15 | 0 |
| RD-PH-0360 | Resolve Comments 100% Public Hearing Plans | 22 | 22 | 22-Jan-15 | 23-Feb-15 | 0 |
| RD-PH-0370 | Submit Final Public Hearing Plans | 1 | 1 | 23-Feb-15 | 24-Feb-15 | 112 |
| Roadway Field Inspection Plans | | 150 | 150 | 01-Jan-15 | 30-Jul-15 | 0 |
| RD-FI-0100 | FI Plans - Roadway Design (25%) | 22 | 22 | 01-Jan-15 | 02-Feb-15 | 15 |
| RD-FI-0105 | FI Plans - Drainage Design (25%) | 22 | 22 | 01-Jan-15 | 02-Feb-15 | 15 |
| RD-FI-0110 | FI Plans - Erosion & Sediment Control Plan Design (25%) | 22 | 22 | 01-Jan-15 | 02-Feb-15 | 15 |
| RD-FI-0115 | FI Plans - Stormwater Management Plan Design (25%) | 22 | 22 | 01-Jan-15 | 02-Feb-15 | 15 |
| RD-FI-0120 | FI Plans - Traffic Management Plan Design (25%) | 22 | 22 | 01-Jan-15 | 02-Feb-15 | 15 |
| RD-FI-0125 | FI Plans - Roadway Design (50%) | 22 | 22 | 23-Feb-15 | 25-Mar-15 | 0 |

| Activity ID | Activity Name | Original Duration | Remaining Duration | Start | Finish | Total Float |
|--|--|-------------------|--------------------|------------------|------------------|-------------|
| RD-FI-0130 | FI Plans - Drainage Design (50%) | 22 | 22 | 23-Feb-15 | 25-Mar-15 | 0 |
| RD-FI-0135 | FI Plans - Erosion & Sediment Control Plan Design (50%) | 22 | 22 | 23-Feb-15 | 25-Mar-15 | 0 |
| RD-FI-0140 | FI Plans - Stormwater Management Plan Design (50%) | 22 | 22 | 23-Feb-15 | 25-Mar-15 | 0 |
| RD-FI-0145 | FI Plans - Traffic Management Plan Design (50%) | 22 | 22 | 23-Feb-15 | 25-Mar-15 | 0 |
| RD-FI-0150 | FI Plans - Roadway Design (75%) | 22 | 22 | 25-Mar-15 | 24-Apr-15 | 0 |
| RD-FI-0155 | FI Plans - Drainage Design (75%) | 22 | 22 | 25-Mar-15 | 24-Apr-15 | 0 |
| RD-FI-0160 | FI Plans - Erosion & Sediment Control Plan Design (75%) | 22 | 22 | 25-Mar-15 | 24-Apr-15 | 0 |
| RD-FI-0165 | FI Plans - Stormwater Management Plan Design (75%) | 22 | 22 | 25-Mar-15 | 24-Apr-15 | 0 |
| RD-FI-0170 | FI Plans - Traffic Management Plan Design (75%) | 22 | 22 | 25-Mar-15 | 24-Apr-15 | 0 |
| RD-FI-0175 | FI Plans - Roadway Design (100%) | 22 | 22 | 24-Apr-15 | 26-May-15 | 0 |
| RD-FI-0180 | FI Plans - Drainage Design (100%) | 22 | 22 | 24-Apr-15 | 26-May-15 | 0 |
| RD-FI-0185 | FI Plans - Erosion & Sediment Control Plan Design (100%) | 22 | 22 | 24-Apr-15 | 26-May-15 | 0 |
| RD-FI-0190 | FI Plans - Stormwater Management Plan Design (100%) | 22 | 22 | 24-Apr-15 | 26-May-15 | 0 |
| RD-FI-0195 | FI Plans - Traffic Management Plan Design (100%) | 22 | 22 | 24-Apr-15 | 26-May-15 | 0 |
| RD-FI-0275 | FI Plans - Constructability Review (100%) | 3 | 3 | 02-Jun-15 | 05-Jun-15 | 0 |
| RD-FI-0280 | FI Plans - Submit 100% Field Inspection Plans | 3 | 3 | 06-Jun-15 | 08-Jun-15 | 0 |
| RD-FI-0285 | FI Plans - VDOT Review 100% Field Inspection Plans | 21 | 21 | 09-Jun-15 | 29-Jun-15 | 0 |
| RD-FI-0295 | FI Plans - Resolve VDOT Comments 100% Field Inspection Plans | 22 | 22 | 29-Jun-15 | 29-Jul-15 | 0 |
| RD-FI-0200 | FI Plans - Submit Final Field Inspection Plans | 1 | 1 | 29-Jul-15 | 30-Jul-15 | 0 |
| Disposal Site Design | | 203 | 203 | 22-Aug-14 | 03-Jun-15 | 2 |
| DSD-0100 | Disposal Site Review and Selection (20%) | 22 | 22 | 22-Aug-14 | 23-Sep-14 | 2 |
| DSD-0105 | Disposal Site Review and Selection (40%) | 22 | 22 | 23-Sep-14 | 23-Oct-14 | 2 |
| DSD-0110 | Disposal Site Review and Selection (60%) | 22 | 22 | 23-Oct-14 | 24-Nov-14 | 51 |
| DSD-0125 | Disposal Site Design (20%) | 22 | 22 | 23-Oct-14 | 24-Nov-14 | 2 |
| DSD-0130 | Disposal Site Design (40%) | 22 | 22 | 23-Oct-14 | 24-Nov-14 | 2 |
| DSD-0115 | Disposal Site Review and Selection (80%) | 22 | 22 | 24-Nov-14 | 24-Dec-14 | 51 |
| DSD-0135 | Disposal Site Design (60%) | 22 | 22 | 24-Nov-14 | 24-Dec-14 | 73 |
| DSD-0120 | Disposal Site Review and Selection (100%) | 22 | 22 | 24-Dec-14 | 23-Jan-15 | 51 |
| DSD-0140 | Disposal Site Design (80%) | 22 | 22 | 23-Jan-15 | 24-Feb-15 | 51 |
| DSD-0145 | Disposal Site Design (100%) | 22 | 22 | 04-May-15 | 03-Jun-15 | 2 |
| Utility Design and Coordination | | 321 | 321 | 28-Mar-14 | 19-Jun-15 | 29 |
| UDC-0100 | Utilities Coordination (5%) | 13 | 13 | 28-Mar-14 | 15-Apr-14 | 29 |
| UDC-0105 | Utilities Coordination (10%) | 22 | 22 | 16-Apr-14 | 15-May-14 | 29 |
| UDC-0110 | Utilities Coordination (15%) | 22 | 22 | 16-May-14 | 16-Jun-14 | 29 |

| Activity ID | Activity Name | Original Duration | Remaining Duration | Start | Finish | Total Float |
|-----------------------------|--|-------------------|--------------------|------------------|------------------|-------------|
| UDC-0115 | Utilities Coordination (20%) | 22 | 22 | 17-Jun-14 | 16-Jul-14 | 29 |
| UDC-0120 | Utilities Coordination (25%) | 22 | 22 | 17-Jul-14 | 15-Aug-14 | 29 |
| UDC-0125 | Utilities Coordination (30%) | 22 | 22 | 18-Aug-14 | 16-Sep-14 | 29 |
| UDC-0130 | Utilities Coordination (35%) | 22 | 22 | 17-Sep-14 | 16-Oct-14 | 29 |
| UDC-0135 | Utilities Coordination (40%) | 22 | 22 | 17-Oct-14 | 17-Nov-14 | 29 |
| UDC-0180 | Utilities - Waterline Design (33%) | 22 | 22 | 31-Oct-14 | 02-Dec-14 | 59 |
| UDC-0140 | Utilities Coordination (45%) | 22 | 22 | 18-Nov-14 | 17-Dec-14 | 29 |
| UDC-0185 | Utilities - Waterline Design (67%) | 22 | 22 | 02-Dec-14 | 01-Jan-15 | 59 |
| UDC-0145 | Utilities Coordination (50%) | 22 | 22 | 18-Dec-14 | 16-Jan-15 | 29 |
| UDC-0190 | Utilities - Waterline Design (100%) | 22 | 22 | 01-Jan-15 | 02-Feb-15 | 59 |
| UDC-0150 | Utilities Coordination (60%) | 22 | 22 | 19-Jan-15 | 17-Feb-15 | 29 |
| UDC-0175 | Utilities - UFI Meeting | 22 | 22 | 19-Jan-15 | 17-Feb-15 | 117 |
| UDC-0155 | Utilities Coordination (70%) | 22 | 22 | 18-Feb-15 | 19-Mar-15 | 29 |
| UDC-0160 | Utilities Coordination (80%) | 22 | 22 | 20-Mar-15 | 20-Apr-15 | 29 |
| UDC-0165 | Utilities Coordination (90%) | 22 | 22 | 21-Apr-15 | 20-May-15 | 29 |
| UDC-0170 | Utilities Coordination (100%) | 22 | 22 | 21-May-15 | 19-Jun-15 | 29 |
| Roadway Design QA/QC | | 283 | 283 | 01-May-14 | 02-Jun-15 | 0 |
| RD-QA-0100 | PFI Plans - Quality Assurance / Quality Control (20%) | 3 | 3 | 01-May-14 | 06-May-14 | 63 |
| RD-QA-0105 | PFI Plans - Quality Assurance / Quality Control (40%) | 3 | 3 | 14-May-14 | 16-May-14 | 58 |
| RD-QA-0110 | PFI Plans - Quality Assurance / Quality Control (60%) | 3 | 3 | 13-Jun-14 | 17-Jun-14 | 39 |
| RD-QA-0115 | PFI Plans - Quality Assurance / Quality Control (80%) | 2 | 2 | 15-Jul-14 | 16-Jul-14 | 20 |
| RD-QA-0120 | PFI Plans - Quality Assurance / Quality Control (100%) | 5 | 5 | 14-Aug-14 | 20-Aug-14 | 0 |
| RD-QA-0125 | PH Plans - Quality Assurance / Quality Control (25%) | 5 | 5 | 23-Sep-14 | 29-Sep-14 | 0 |
| RD-QA-0131 | PH Plans - Quality Assurance / Quality Control (50%) | 5 | 5 | 23-Oct-14 | 29-Oct-14 | 34 |
| RD-QA-0132 | PH Plans - Quality Assurance / Quality Control (75%) | 5 | 5 | 24-Nov-14 | 28-Nov-14 | 17 |
| RD-QA-0133 | PH Plans - Quality Assurance / Quality Control (100%) | 5 | 5 | 24-Dec-14 | 30-Dec-14 | 0 |
| RD-QA-0135 | FI Plans - Quality Assurance / Quality Control (25%) | 5 | 5 | 02-Feb-15 | 09-Feb-15 | 15 |
| RD-QA-0140 | FI Plans - Quality Assurance / Quality Control (50%) | 5 | 5 | 25-Mar-15 | 01-Apr-15 | 0 |
| RD-QA-0145 | FI Plans - Quality Assurance / Quality Control (75%) | 5 | 5 | 24-Apr-15 | 01-May-15 | 0 |
| RD-QA-0155 | FI Plans - Quality Assurance / Quality Control (100%) | 5 | 5 | 26-May-15 | 02-Jun-15 | 0 |
| Structural Design | | 346 | 346 | 28-Mar-14 | 24-Jul-15 | 4 |
| Levisa Fork Bridge | | 344 | 344 | 28-Mar-14 | 22-Jul-15 | 6 |
| LFB-DE-0100 | Levisa Fork Bridge - Stage I Report Development (25%) | 11 | 11 | 28-Mar-14 | 11-Apr-14 | 6 |
| LFB-DE-0105 | Levisa Fork Bridge - Stage I Report Development (50%) | 22 | 22 | 14-Apr-14 | 13-May-14 | 6 |

| Activity ID | Activity Name | Original Duration | Remaining Duration | Start | Finish | Total Float |
|---|--|-------------------|--------------------|------------------|------------------|-------------|
| LFB-DE-0110 | Levisa Fork Bridge - Stage I Report Development (75%) | 22 | 22 | 14-May-14 | 12-Jun-14 | 6 |
| LFB-DE-0115 | Levisa Fork Bridge - Stage I Report Development (100%) | 22 | 22 | 13-Jun-14 | 14-Jul-14 | 6 |
| LFB-DE-0120 | Levisa Fork Bridge - Stage I Report - Constructability Review | 15 | 15 | 22-Jul-14 | 11-Aug-14 | 6 |
| LFB-DE-0125 | Levisa Fork Bridge - Stage I Report - Submit Stage I Report to VDOT | 1 | 1 | 12-Aug-14 | 12-Aug-14 | 6 |
| LFB-DE-0130 | Levisa Fork Bridge - VDOT Review Stage I Report | 21 | 21 | 13-Aug-14 | 02-Sep-14 | 8 |
| LFB-DE-0135 | Levisa Fork Bridge - Intermediate Bridge Design (10%) | 22 | 22 | 02-Sep-14 | 02-Oct-14 | 6 |
| LFB-DE-0140 | Levisa Fork Bridge - Intermediate Bridge Design (25%) | 22 | 22 | 07-Oct-14 | 06-Nov-14 | 6 |
| LFB-DE-0145 | Levisa Fork Bridge - Intermediate Bridge Design (40%) | 22 | 22 | 11-Nov-14 | 11-Dec-14 | 6 |
| LFB-DE-0150 | Levisa Fork Bridge - Intermediate Bridge Design (55%) | 22 | 22 | 16-Dec-14 | 15-Jan-15 | 6 |
| LFB-DE-0155 | Levisa Fork Bridge - Intermediate Bridge Design (70%) | 22 | 22 | 20-Jan-15 | 19-Feb-15 | 6 |
| LFB-DE-0160 | Levisa Fork Bridge - Intermediate Bridge Design - Constructability Review (70%) | 5 | 5 | 24-Feb-15 | 03-Mar-15 | 6 |
| LFB-DE-0165 | Levisa Fork Bridge - Intermediate Bridge Design (85%) | 22 | 22 | 03-Mar-15 | 02-Apr-15 | 6 |
| LFB-DE-0170 | Levisa Fork Bridge - Intermediate Bridge Design (100%) | 22 | 22 | 07-Apr-15 | 07-May-15 | 6 |
| LFB-DE-0175 | Levisa Fork Bridge - Intermediate Bridge Design - Constructability Review (100%) | 5 | 5 | 21-May-15 | 28-May-15 | 6 |
| LFB-DE-0180 | Levisa Fork Bridge - Intermediate Bridge Design - Submit to VDOT (100%) | 1 | 1 | 28-May-15 | 29-May-15 | 6 |
| LFB-DE-0185 | Levisa Fork Bridge - VDOT Review Intermediate Bridge Design (100%) | 21 | 21 | 30-May-15 | 19-Jun-15 | 10 |
| LFB-DE-0195 | Levisa Fork Bridge - Resolve VDOT Comments Intermediate Bridge Design (100%) | 22 | 22 | 19-Jun-15 | 21-Jul-15 | 6 |
| LFB-DE-0205 | Levisa Fork Bridge - Submit Final Intermediate Bridge Design to VDOT | 1 | 1 | 21-Jul-15 | 22-Jul-15 | 6 |
| Levisa Fork Bridge Quality Assurance/Quality Control | | 223 | 223 | 15-Jul-14 | 21-May-15 | 6 |
| LFB-QA-0100 | Levisa Fork Bridge - Stage I Report - Quality Assurance / Quality Control | 5 | 5 | 15-Jul-14 | 21-Jul-14 | 6 |
| LFB-QA-0105 | Levisa Fork Bridge - Intermediate Bridge Design - Quality Assurance / Quality Control (10%) | 3 | 3 | 02-Oct-14 | 07-Oct-14 | 6 |
| LFB-QA-0110 | Levisa Fork Bridge - Intermediate Bridge Design - Quality Assurance / Quality Control (25%) | 3 | 3 | 06-Nov-14 | 11-Nov-14 | 6 |
| LFB-QA-0115 | Levisa Fork Bridge - Intermediate Bridge Design - Quality Assurance / Quality Control (40%) | 3 | 3 | 11-Dec-14 | 16-Dec-14 | 6 |
| LFB-QA-0120 | Levisa Fork Bridge - Intermediate Bridge Design - Quality Assurance / Quality Control (55%) | 3 | 3 | 15-Jan-15 | 20-Jan-15 | 6 |
| LFB-QA-0125 | Levisa Fork Bridge - Intermediate Bridge Design - Quality Assurance / Quality Control (70%) | 3 | 3 | 19-Feb-15 | 24-Feb-15 | 6 |
| LFB-QA-0130 | Levisa Fork Bridge - Intermediate Bridge Design - Quality Assurance / Quality Control (85%) | 3 | 3 | 02-Apr-15 | 07-Apr-15 | 6 |
| LFB-QA-0135 | Levisa Fork Bridge - Intermediate Bridge Design - Quality Assurance / Quality Control (100%) | 10 | 10 | 07-May-15 | 21-May-15 | 6 |
| Poplar Creek Bridge (Twin) | | 346 | 346 | 28-Mar-14 | 24-Jul-15 | 4 |
| PCB-DE-0100 | Poplar Creek Bridges - Stage I Report Development (25%) | 11 | 11 | 28-Mar-14 | 11-Apr-14 | 4 |
| PCB-DE-0105 | Poplar Creek Bridges - Stage I Report Development (50%) | 22 | 22 | 14-Apr-14 | 13-May-14 | 4 |
| PCB-DE-0110 | Poplar Creek Bridges - Stage I Report Development (75%) | 22 | 22 | 14-May-14 | 12-Jun-14 | 4 |
| PCB-DE-0115 | Poplar Creek Bridges - Stage I Report Development (100%) | 22 | 22 | 13-Jun-14 | 14-Jul-14 | 4 |
| PCB-DE-0120 | Poplar Creek Bridges - Stage I Report - Constructability Review | 15 | 15 | 22-Jul-14 | 11-Aug-14 | 4 |
| PCB-DE-0125 | Poplar Creek Bridges - Stage I Report - Submit Stage I Report to VDOT | 1 | 1 | 12-Aug-14 | 12-Aug-14 | 4 |

| Activity ID | Activity Name | Original Duration | Remaining Duration | Start | Finish | Total Float |
|---|---|-------------------|--------------------|------------------|------------------|-------------|
| PCB-DE-0130 | Poplar Creek Bridges - VDOT Review Stage I Report | 21 | 21 | 13-Aug-14 | 02-Sep-14 | 6 |
| PCB-DE-0135 | Poplar Creek Bridges - Intermediate Bridge Design (25%) | 22 | 22 | 02-Sep-14 | 02-Oct-14 | 4 |
| PCB-DE-0145 | Poplar Creek Bridges - Intermediate Bridge Design (40%) | 22 | 22 | 09-Oct-14 | 10-Nov-14 | 4 |
| PCB-DE-0150 | Poplar Creek Bridges - Intermediate Bridge Design (60%) | 22 | 22 | 17-Nov-14 | 17-Dec-14 | 4 |
| PCB-DE-0155 | Poplar Creek Bridges - Intermediate Bridge Design (80%) | 22 | 22 | 24-Dec-14 | 23-Jan-15 | 4 |
| PCB-DE-0160 | Poplar Creek Bridges - Intermediate Bridge Design - Constructability Review (80%) | 10 | 10 | 30-Jan-15 | 13-Feb-15 | 4 |
| PCB-DE-0165 | Poplar Creek Bridges - Intermediate Bridge Design (90%) | 22 | 22 | 13-Feb-15 | 17-Mar-15 | 4 |
| PCB-DE-0170 | Poplar Creek Bridges - Intermediate Bridge Design (100%) | 22 | 22 | 24-Mar-15 | 23-Apr-15 | 4 |
| PCB-DE-0175 | Poplar Creek Bridges - Intermediate Bridge Design - Constructability Review (100%) | 22 | 22 | 30-Apr-15 | 01-Jun-15 | 4 |
| PCB-DE-0180 | Poplar Creek Bridges - Intermediate Bridge Design - Submit to VDOT (100%) | 1 | 1 | 01-Jun-15 | 02-Jun-15 | 4 |
| PCB-DE-0185 | Poplar Creek Bridges - VDOT Review Intermediate Bridge Design (100%) | 21 | 21 | 03-Jun-15 | 23-Jun-15 | 6 |
| PCB-DE-0195 | Poplar Creek Bridges - Resolve VDOT Comments Intermediate Bridge Design (100%) | 22 | 22 | 23-Jun-15 | 23-Jul-15 | 4 |
| PCB-DE-0205 | Poplar Creek Bridges - Submit Final Intermediate Bridge Design to VDOT | 1 | 1 | 23-Jul-15 | 24-Jul-15 | 4 |
| Poplar Creek Bridge Quality Assurance/Quality Control | | 208 | 208 | 15-Jul-14 | 30-Apr-15 | 4 |
| PCB-QA-0100 | Poplar Creek Bridges - Stage I Report - Quality Assurance / Quality Control | 5 | 5 | 15-Jul-14 | 21-Jul-14 | 4 |
| PCB-QA-0105 | Poplar Creek Bridges - Intermediate Bridge Design - Quality Assurance / Quality Control (2) | 5 | 5 | 02-Oct-14 | 09-Oct-14 | 4 |
| PCB-QA-0115 | Poplar Creek Bridges - Intermediate Bridge Design - Quality Assurance / Quality Control (4) | 5 | 5 | 10-Nov-14 | 17-Nov-14 | 4 |
| PCB-QA-0120 | Poplar Creek Bridges - Intermediate Bridge Design - Quality Assurance / Quality Control (6) | 5 | 5 | 17-Dec-14 | 24-Dec-14 | 4 |
| PCB-QA-0125 | Poplar Creek Bridges - Intermediate Bridge Design - Quality Assurance / Quality Control (8) | 5 | 5 | 23-Jan-15 | 30-Jan-15 | 4 |
| PCB-QA-0130 | Poplar Creek Bridges - Intermediate Bridge Design - Quality Assurance / Quality Control (9) | 5 | 5 | 17-Mar-15 | 24-Mar-15 | 4 |
| PCB-QA-0135 | Poplar Creek Bridges - Intermediate Bridge Design - Quality Assurance / Quality Control (1) | 5 | 5 | 23-Apr-15 | 30-Apr-15 | 4 |
| Geotechnical Engineering | | 310 | 310 | 28-Mar-14 | 04-Jun-15 | 40 |
| Initial Geotechnical Submittals | | 16 | 16 | 28-Mar-14 | 18-Apr-14 | 16 |
| GEO-0100 | Geotech - Submit E&S and SWPPP for Geotechnical Drilling Activities | 1 | 1 | 28-Mar-14 | 28-Mar-14 | 16 |
| GEO-0105 | Geotech - VDOT Review E&S and SWPPP for Drilling Activities | 21 | 21 | 29-Mar-14 | 18-Apr-14 | 24 |
| Preliminary Bridge Report Geotechnical Borings/Testing | | 20 | 20 | 24-Apr-14 | 22-May-14 | 12 |
| PBR-GEO-0105 | Geotech - Preliminary Bridge Borings | 5 | 5 | 24-Apr-14 | 01-May-14 | 12 |
| PBR-GEO-0110 | Geotech - Laboratory Testing (Preliminary Bridge Borings) | 15 | 15 | 01-May-14 | 22-May-14 | 12 |
| Intermediate Bridge Geotechnical Borings/Testing | | 66 | 66 | 16-Sep-14 | 17-Dec-14 | 28 |
| IB-GEO-0100 | Geotech - Bridge Borings (50%) | 22 | 22 | 16-Sep-14 | 16-Oct-14 | 28 |
| IB-GEO-0105 | Geotech - Bridge Laboratory Testing (50%) | 22 | 22 | 16-Oct-14 | 17-Nov-14 | 28 |
| IB-GEO-0110 | Geotech - Bridge Borings (100%) | 22 | 22 | 16-Oct-14 | 17-Nov-14 | 28 |
| IB-GEO-0115 | Geotech - Bridge Laboratory Testing (100%) | 22 | 22 | 17-Nov-14 | 17-Dec-14 | 28 |
| Roadway Geotechnical Borings/Testing | | 110 | 110 | 08-May-14 | 09-Oct-14 | 102 |
| RD-GEO-0100 | Geotech - Roadway Borings (25%) | 22 | 22 | 08-May-14 | 09-Jun-14 | 40 |

| Activity ID | Activity Name | Original Duration | Remaining Duration | Start | Finish | Total Float |
|--|--|-------------------|--------------------|------------------|------------------|-------------|
| RD-GEO-0105 | Geotech - Roadway Borings (50%) | 22 | 22 | 09-Jun-14 | 09-Jul-14 | 40 |
| RD-GEO-0110 | Geotech - Roadway Laboratory Testing (50%) | 22 | 22 | 09-Jun-14 | 09-Jul-14 | 40 |
| RD-GEO-0115 | Geotech - Roadway Borings (75%) | 22 | 22 | 09-Jul-14 | 08-Aug-14 | 40 |
| RD-GEO-0120 | Geotech - Roadway Borings (100%) | 22 | 22 | 08-Aug-14 | 09-Sep-14 | 40 |
| RD-GEO-0125 | Geotech - Roadway Laboratory Testing (100%) | 22 | 22 | 09-Sep-14 | 09-Oct-14 | 102 |
| Disposal Area Geotechnical Borings/Testing | | 44 | 44 | 24-Nov-14 | 23-Jan-15 | 24 |
| DA-GEO-0100 | Geotech - Disposal Area Borings (50%) | 22 | 22 | 24-Nov-14 | 24-Dec-14 | 2 |
| DA-GEO-0105 | Geotech - Disposal Area Borings (100%) | 22 | 22 | 24-Dec-14 | 23-Jan-15 | 2 |
| DA-GEO-0110 | Geotech - Disposal Area Laboratory Testing (100%) | 22 | 22 | 24-Dec-14 | 23-Jan-15 | 24 |
| Roadway Geotechnical Reporting | | 135 | 135 | 09-Sep-14 | 17-Mar-15 | 58 |
| RGR-GEO-0100 | Geotech - Develop Report - Roadway (25%) (add a month to this) | 22 | 22 | 09-Sep-14 | 09-Oct-14 | 58 |
| RGR-GEO-0105 | Geotech - Develop Report - Roadway (50%) | 22 | 22 | 09-Oct-14 | 10-Nov-14 | 58 |
| RGR-GEO-0110 | Geotech - Develop Report - Roadway (75%) | 22 | 22 | 10-Nov-14 | 10-Dec-14 | 58 |
| RGR-GEO-0115 | Geotech - Develop Report - Roadway (100%) | 22 | 22 | 10-Dec-14 | 09-Jan-15 | 58 |
| RGR-GEO-0155 | Geotech - Submit Final Geotechnical Report - Roadway (100%) | 1 | 1 | 09-Jan-15 | 12-Jan-15 | 58 |
| RGR-GEO-0160 | Geotech - VDOT Review 100% Roadway Report | 21 | 21 | 13-Jan-15 | 02-Feb-15 | 80 |
| RGR-GEO-0170 | Geotech - Resolve VDOT Comments Roadway Report (100%) | 30 | 30 | 02-Feb-15 | 16-Mar-15 | 58 |
| RGR-GEO-0180 | Geotech - Submit Final Roadway Report to VDOT | 1 | 1 | 16-Mar-15 | 17-Mar-15 | 58 |
| Poplar Creek Bridges Geotechnical Reporting | | 109 | 109 | 17-Nov-14 | 17-Apr-15 | 73 |
| PCB-GEO-0100 | Geotech - Develop Report - Poplar Creek Bridges (33%) | 22 | 22 | 17-Nov-14 | 17-Dec-14 | 28 |
| PCB-GEO-0105 | Geotech - Develop Report - Poplar Creek Bridges (67%) | 22 | 22 | 17-Dec-14 | 16-Jan-15 | 28 |
| PCB-GEO-0110 | Geotech - Develop Report - Poplar Creek Bridges (100%) | 22 | 22 | 16-Jan-15 | 17-Feb-15 | 28 |
| PCB-GEO-0150 | Geotech - Submit Final Geotechnical Report - Poplar Creek Bridges (100%) | 1 | 1 | 17-Feb-15 | 18-Feb-15 | 28 |
| PCB-GEO-0155 | Geotech - VDOT Review 100% Poplar Creek Report | 21 | 21 | 19-Feb-15 | 11-Mar-15 | 103 |
| PCB-GEO-0165 | Geotech - Resolve VDOT Comments 100% Poplar Creek Report | 22 | 22 | 11-Mar-15 | 10-Apr-15 | 73 |
| PCB-GEO-0175 | Geotech - Submit Final Poplar Creek Report | 5 | 5 | 10-Apr-15 | 17-Apr-15 | 73 |
| Levisa Fork Geotechnical Reporting | | 105 | 105 | 17-Nov-14 | 13-Apr-15 | 77 |
| LFB-GEO-0100 | Geotech - Develop Report - Levisa Fork Bridge (33%) | 22 | 22 | 17-Nov-14 | 17-Dec-14 | 77 |
| LFB-GEO-0105 | Geotech - Develop Report - Levisa Fork Bridge (67%) | 22 | 22 | 17-Dec-14 | 16-Jan-15 | 77 |
| LFB-GEO-0110 | Geotech - Develop Report - Levisa Fork Bridge (100%) | 22 | 22 | 16-Jan-15 | 17-Feb-15 | 77 |
| LFB-GEO-0150 | Geotech - Submit 100% Geotechnical Report - Levisa Fork Bridge (100%) | 1 | 1 | 17-Feb-15 | 18-Feb-15 | 77 |
| LFB-GEO-0155 | Geotech - VDOT Review 100% Levisa Fork Bridge Report | 21 | 21 | 19-Feb-15 | 11-Mar-15 | 109 |
| LFB-GEO-0165 | Geotech - Resolve VDOT Comments 100% Levisa Fork Bridge Report | 22 | 22 | 11-Mar-15 | 10-Apr-15 | 77 |
| LFB-GEO-0120 | Geotech - Submit Final Levisa Fork Bridge Report | 1 | 1 | 10-Apr-15 | 13-Apr-15 | 77 |
| Disposal Areas Geotechnical Reporting | | 71 | 71 | 23-Jan-15 | 04-May-15 | 2 |

| Activity ID | Activity Name | Original Duration | Remaining Duration | Start | Finish | Total Float |
|--|--|-------------------|--------------------|------------------|------------------|-------------|
| DAR-GEO-0100 | Geotech - Develop Report - Disposal Areas (50%) | 22 | 22 | 23-Jan-15 | 24-Feb-15 | 2 |
| DAR-GEO-0105 | Geotech - Develop Report - Disposal Areas (100%) | 22 | 22 | 24-Feb-15 | 26-Mar-15 | 2 |
| DAR-GEO-0145 | Geotech - Submit Final Geotechnical Report - Disposal Areas (100%) | 1 | 1 | 26-Mar-15 | 27-Mar-15 | 2 |
| DAR-GEO-0150 | Geotech - VDOT Review 100% Disposal Area Report | 21 | 21 | 28-Mar-15 | 17-Apr-15 | 4 |
| DAR-GEO-0160 | Geotech - Resolve VDOT Comments 100% Disposal Area Report | 10 | 10 | 17-Apr-15 | 01-May-15 | 2 |
| DAR-GEO-0170 | Geotech - Submit Final Disposal Area Report | 1 | 1 | 01-May-15 | 04-May-15 | 2 |
| Mineral Reserve Study | | 266 | 266 | 29-May-14 | 04-Jun-15 | 40 |
| MRS-GEO-0130 | Minerals - Review of Mineral Records (33%) | 22 | 22 | 29-May-14 | 27-Jun-14 | 159 |
| MRS-GEO-0135 | Minerals - Review of Mineral Records (67%) | 22 | 22 | 30-Jun-14 | 29-Jul-14 | 159 |
| MRS-GEO-0140 | Minerals - Review of Mineral Records (100%) | 22 | 22 | 30-Jul-14 | 28-Aug-14 | 159 |
| MRS-GEO-0100 | Geotech - Mineral Reserve Borings (33%) | 22 | 22 | 09-Sep-14 | 09-Oct-14 | 40 |
| MRS-GEO-0105 | Geotech - Mineral Reserve Borings (67%) | 22 | 22 | 09-Oct-14 | 10-Nov-14 | 40 |
| MRS-GEO-0110 | Geotech - Mineral Reserve Borings (100%) | 22 | 22 | 10-Nov-14 | 10-Dec-14 | 40 |
| MRS-GEO-0115 | Geotech - Mineral Reserve Laboratory Testing (33%) | 15 | 15 | 10-Dec-14 | 31-Dec-14 | 40 |
| MRS-GEO-0120 | Geotech - Mineral Reserve Laboratory Testing (67%) | 15 | 15 | 31-Dec-14 | 21-Jan-15 | 40 |
| MRS-GEO-0125 | Geotech - Mineral Reserve Laboratory Testing (100%) | 15 | 15 | 21-Jan-15 | 11-Feb-15 | 40 |
| MRS-GEO-0145 | Minerals - Develop Mineral Reserve Study (33%) | 22 | 22 | 11-Feb-15 | 13-Mar-15 | 40 |
| MRS-GEO-0150 | Minerals - Develop Mineral Reserve Study (67%) | 22 | 22 | 13-Mar-15 | 14-Apr-15 | 40 |
| MRS-GEO-0155 | Minerals - Develop Mineral Reserve Study (100%) | 22 | 22 | 14-Apr-15 | 14-May-15 | 40 |
| MRS-GEO-0160 | Minerals - VDOT Review Mineral Reserve Study | 21 | 21 | 15-May-15 | 04-Jun-15 | 56 |
| Environmental Engineering | | 176 | 176 | 25-Aug-14 | 27-Apr-15 | 68 |
| Environmental Engineering - JD Field Investigations | | 66 | 66 | 25-Aug-14 | 24-Nov-14 | 68 |
| JD-EP-0100 | Permitting - Permit Prep - JD Field Investigations (50%) | 22 | 22 | 25-Aug-14 | 23-Sep-14 | 68 |
| JD-EP-0110 | Permitting - Permit Prep - JD Field Investigations (100%) | 22 | 22 | 24-Sep-14 | 23-Oct-14 | 68 |
| JD-EP-0115 | Permitting - Permit Prep - JD Submittal Preparation | 22 | 22 | 24-Oct-14 | 24-Nov-14 | 68 |
| Environmental Engineering - Mitigation | | 110 | 110 | 25-Nov-14 | 27-Apr-15 | 68 |
| MIT-EP-0125 | Stream / Wetland Mitigation - Assess Required Mitigation (20%) | 22 | 22 | 25-Nov-14 | 24-Dec-14 | 68 |
| MIT-EP-0130 | Stream / Wetland Mitigation - Assess Required Mitigation (40%) | 22 | 22 | 25-Dec-14 | 23-Jan-15 | 68 |
| MIT-EP-0140 | Stream / Wetland Mitigation - Assess Required Mitigation (60%) | 22 | 22 | 26-Jan-15 | 24-Feb-15 | 68 |
| MIT-EP-0135 | Stream / Wetland Mitigation - Assess Required Mitigation (80%) | 22 | 22 | 25-Feb-15 | 26-Mar-15 | 68 |
| MIT-EP-0145 | Stream / Wetland Mitigation - Assess Required Mitigation (100%) | 22 | 22 | 27-Mar-15 | 27-Apr-15 | 68 |

EXHIBIT E

INSURANCE REQUIREMENTS

Contractor shall obtain, at no expense to the Department, with insurance companies authorized to do business in the State, with a "Best Rating" of B, the following insurance coverages, which shall be maintained throughout the term of this Amendment:

- (a) Comprehensive General Liability Insurance having minimum limits totaling \$2,000,000 each occurrence, \$4,000,000 aggregate, for death, bodily injury and property damage and destruction, which shall include coverage for, but not limited to (i) premises operations, (ii) contractual liability, (iii) cross-liability, (iv) products and completed operations, (v) explosions, and (vi) collapse and underground.
- (b) Automobile Liability Insurance which includes owned, non-owned and hired or borrowed vehicles on-site or off coverage with minimum limits totaling \$2,000,000 for each, bodily injury and property damage claims.
- (c) Unemployment Benefits Coverage as required under Law for all of its employees.
- (d) Workers Compensation and Employer's Liability Insurance as is required by Law, including, without limitation, Title 65.2 of the Code of Virginia, and Employer's Liability Insurance, with limits of \$1,000,000 each accident, \$1,000,000 for disease each employee and \$1,000,000 for disease policy limit. In addition, Contractor shall require any subcontractors engaged to perform any portion of the Work under this Amendment to carry Workers Compensation Insurance, as required by Law, and Employer's Liability Insurance.
- (e) Architects/Engineers Professional Liability Insurance covering the lead design engineer for acts, errors or omissions arising in connection with the Work for not less than \$5 million in the aggregate. Such insurance shall specifically delete any design-build or similar exclusions that could compromise coverage because of the design-build delivery of the Poplar Creek Section. Such insurance shall be maintained throughout the duration of any warranty period and for at least three years after the expiration of any warranty period.

Each of the above required policies of insurance shall be written on an "occurrence" basis, unless the policy is available only on a "claims made" basis, in which case, upon written authorization from the Department, Contractor shall obtain a "claims made" policy and insurance coverage shall be maintained for a period of at least five (5) years after the termination, cancellation, or expiration of this Amendment.

The amount of insurance coverage shall not be a limitation on the liability of Contractor under this Amendment, but shall be additional security for such liability. The liability insurance shall be primary and not contributory as to any insurance that the Department may have in effect.

All of the above insurance shall specifically provide that it applies separately to each insured against which a claim is made or suit is brought, except with respect to the limits of the insured's liability, and that all rights of subrogation against the Department and Contractor, and their respective successors and assigns, are waived

Within thirty (30) days of issuance by the Department of the notice to proceed and from time to time thereafter, when any renewal, substitute or replacement policy of insurance is obtained, Contractor shall provide the Department with copies of the policies of insurance certificates of worker's compensation coverage required by this Amendment.

The liability insurance policies shall name the Department as an additional insured. The policies shall also include written assurance of the insurers that the Department will be advised in writing not less than thirty (30) days prior to the cancellation of any policy.