APPENDIX E

CONCURRENT ENGINEERING CONSTRUCTABILITY REVIEW GUIDELINES

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SECTION 1 – CONSTRUCTABILITY

PURPOSE

The purpose of a Constructability Review is to determine if the project can be constructed as designed with the information provided on the drawings and in the specifications and copied notes.

The review may produce a better, quicker, more economical or safer way to construct the project. The emphasis is on “HOW” to construct the project.

In order to facilitate VDOT’s goal of “on time and on budget” roadway design must consider constructability during design and contract document development. The Concurrent Engineering process requires five Constructability Reviews, one for each stage of project development, and then a Bidability Review just prior to advertisement on all projects.

The purpose of a Bidability Review is to insure that the comments from the Pre-Advertisement Conference have been incorporated into the plans and contract documents.

The focus of this review is on quantities /estimate, suggested plan changes, specifications and special provisions.

CONSTRUCTABILITY REVIEW TEAM

Project development is a team effort under concurrent engineering with all disciplines of VDOT working together and at the same time to produce quality plans in the shortest time possible.

The formal Constructability Review is the responsibility of the Area* Construction Engineer and is requested by and furnished to the Project Manager in accordance with the Concurrent Engineering Process at the appropriate design milestones. The review team is made up of personnel from all disciplines having expertise in the areas of a particular project.

The first constructability review is performed prior to the Scoping Meeting. The team for this review is comprised of one or two District Construction personnel and a representative of the Residency. The construction representative(s) will also participate in the Scoping Meeting to discuss the potential problems so they can be minimized or eliminated during the design process.

The next four constructability reviews should include the participation of the design divisions or groups and the residency under the leadership of the Area Construction Engineer. The team size varies depending on the type of project. A “no-plan” or a small “minimum plan” project would be reviewed by one or two District Construction Personnel and representative of the Residency. The other projects are to be reviewed by a team representing the disciplines involved and two District Construction Personnel. The results of the reviews shall be recorded on a VDOT comment resolution sheet and provided to the Project Manager for incorporation to the project.

These teams need to be comprised of personnel who are familiar and experienced in the type of work included in the project such as roadway, utilities, drainage, bridge, landscaping, environmental, traffic flow, maintenance, etc. and is led by the Area Construction Engineer or Designee. Utilizing design staff helps in two ways. First, it utilizes experience in design parameters to ensure that the constructability review produces a reasonable conclusion that fits desired design requirements. Second, it provides designers experience in dealing with and understanding constructability issues and requirements.

The last review is the Bidability Review and should be conducted by District and Central Office Construction Personnel. The team size varies, between two to five persons, depending on the project work. These team members need to be familiar and experienced with the Specifications and Special Provisions of VDOT.

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* Rev. 7/17

PROJECT REVIEW FILES

At the start, the project manager should have an electronic file folder created for all documentation either in IPM or Falcon DMS. This folder will contain all of the reviews for each phase.

A schedule and budget should be worked up for the review and stored in the folder. All pertinent project correspondence should be obtained and placed in the folder.

The Project Manager should place all reports in IPM or Falcon DMS so that all members of the review team may have read access to the reports. The final recommendations or report will have a copy placed in this folder for future reference.

This preserves the recommendations so a future reviewer may access the file for past recommendations.

SITE VISIT

At each constructability review, the team should review the project in the field. If plans are available, they should be taken to the site visit to place notes on. This provides team members a chance to get acquainted with the current conditions of the project area and to note anything that may present a challenge during the construction of the project.

The team needs to note the existing vehicular, pedestrian and bicycle patterns, so they can be accommodated during construction. They should also take note of any recent changes in the area that may not be included in the project survey or addressed in the design. The type, number and above or below ground utilities should also be noted as they are a specific problem during construction. Any bridge(s) should be noted, especially if it goes over water as boat traffic may pose a problem. Existing drainage problems should also be noted. Existing retaining walls or noise barrier walls should be noted, especially the face treatment which may have to be reproduced. Photographs should be taken of potential problem areas.

If a site visit is not possible, then the GIS Integrator site should be utilized to obtain a drive through.

THE REVIEW

The review should start with a team meeting which should establish the goals and a time frame for the review. All team members should be familiar with the project prior to the review meeting. This should be accomplished by sending each member of the team information on the project including the UPC number, so they can view the project on Falcon prior to the meeting.

The Scoping Constructability Review should only take a day or two with the first part spent in the field looking over the project site. At this stage, there is only the basic scope of what the project is supposed to provide with no plans to review. This is the opportunity to take note of existing conditions that may present problems for construction if they are not compensated for in the design. The result of this review should be a report to the project manager noting areas of concern that need to be covered in the design as it progresses.

The Preliminary Field Inspection Constructability Review should take from two to four days with the first part spent in the field looking over the project site. At this stage conceptual plans should be available for the review. The basic components of the project work should be defined at this stage, also indicating the perceived sequence of construction. Since this review is before the public hearing, the right of way and easements should be closely reviewed to insure needed access by construction forces is adequate. Any traffic detours around the work zone should be known at this stage and comments or recommendations should be addressed prior to the public hearing. Recommendations included in the report to the project manager at this point should be global and address the large areas of work or major processes of construction.

The Public Hearing Constructability Review should take from two to four days with the first part spent in the field looking over the project site. Now that the horizontal and vertical geometry is set, this review should start addressing details of major components such as bridges, retaining walls and major drainage features (box culverts, multiple line and structures over 72” diameter). Placement and design of storm water management sites should be looked at closely to ensure temporary drainage is taken care of in the E&S control plans. All major channel changes should include the space necessary for their construction and maintenance. Environmental documents must address adequate construction area for the project. Utility relocations should be address and the timing and length of construction established. The preliminary Transportation Management Plan should be reviewed for impacts to the construction sequencing. Recommendations included in the report to the project manager at this point should be covering major items and address the large stages of work or major parts of construction.

The Field Inspection Constructability Review should take from three to six days with the first part spent in the field looking over the project site. The Sequence of Construction (SOC) and Maintenance of Traffic (MOT) should be well defined at this stage and reviewed to ensure that the project can be constructed as designed. A review of the plans should look for any potential problem areas, and special attention should be given to detail sheets that have been added. The right of way and easements should be

thoroughly checked to ensure that adequate areas have been provided for all construction elements. The result of this review should be a report to the project manager noting areas of concern that need to be improved or problems that need to be corrected prior to advertisement.

The Pre Ad Constructability Review should take from three to seven days with the first part spent in the field looking over the project site. At this stage, the plans should be complete with all recommendations incorporated.
This review is more detailed in looking for final changes in the plans. Traffic patterns and MOT should match for lane usage or proper detours indicated in plans with all required notes. The completed Transportation Management Plan should be reviewed for consistency with plan drawings and details. The project summaries should be looked at to ensure the required pay items are accounted for. Contacts with telephone numbers should also be noted in plans. All permit requirements need to be met in the plans or notes. A schedule for each phase should be established. The result of this review should be a report to the project manager noting needed adjustments to be made prior to advertisement.

Attached are Constructability Guidelines for PFI-PH, FI and PAC. These guidelines contain items to be considered when performing these reviews and have come from several sources and are only basic with the intent that they be added to by each District.

PFI – PH CONSTRUCTABILITY GUIDELINES

	CLEARING / GRUBBING / EARTHWORK
1.	Is there adequate access to the construction site?
2.	Is clearing and grubbing confined to the area within the construction limits?
3.	Have excess material and waste sites been addressed?
4.	Will unsuitable material shown on the plans, and found to be suitable during construction, be used in fills in lieu of borrow material?
5.	Is earthwork phasing consistent with activity needs?
6.	Can temporary fills be left in place or excess material placed within the project limits or on nearby right of way for use on future widening?
7.	Is suitable material available within the project limits for use as borrow materials?
8.	Are there any plants and/or special sites that need to be protected during clearing and grubbing? Are these locations properly noted and included within the plans?
	PLANS / DESIGN
1.	Has access for maintenance personnel (trash, landscape, electrical, structures, snow plow turnarounds, etc.) been adequately addressed in the design and provided for during construction?
2.	Has staging been phased to provide minimum number of stages and reasonable work areas and access?
3.	Is there sufficient room for access requirements?
4.	Are there any areas where improvements can be made to the alignment?
5.	Have cross-sections for grade changes at phase tie ins been checked?
6.	Have pedestrian and bicycle accommodations been addressed?
7.	Will any right of entry agreements or construction easements be required?
8.	If shoulders are required to carry traffic during staged construction, are they wide enough and structurally adequate or should reconstruction be required?
9.	Does existing pavement have a concrete base that is not shown?
10.	Is there enough headroom above or below structures to perform inspections?
11.	Are adequate transition areas shown beyond the project limits to provide for maintenance of traffic during construction?
12.	If Railroad involved, have preliminary Railroad requirements been coordinated?
	REMOVAL / DEMOLITION
1.	Are there clear limits of removal vertically and horizontally?
2.	Is there adequate construction access for demolition?
3.	Does locality have noise limits that will restrict night work?
4.	Is pedestrian access accounted for?
5.	Will sawed joints be required for pavement removals?

6.	Are there hazardous wastes on the project?
	STRUCTURES (BRIDGES, WALLS, MAJOR BOX CULVERTS)
1.	Is stream navigable either by law or local usage and has the project been coordinated with the Coast Guard, Corps of Engineers and any other applicable agencies for required clearances or any special features?
2.	Is water depth in channel sufficient to utilize barges or will temporary work bridges be needed?
3.	Is there sufficient clearance within the work zone for construction operations (such as crane swing)?
4.	Will construction be impacted by existing horizontal and vertical clearances?
5.	Curved retaining walls (RW-2 and RW-3) are very difficult to build, better to show straight sections instead of a curve. If curved is required for aesthetics, a different wall should be specified.
6.	Steps in retaining wall foundation should coincide with contraction joints.
7.	If span is movable, can stage construction work?
8.	If design features two separate and adjacent structures, during construction of the second structure, is there room to place a screed to allow for independent deflection of the structure in accordance with the plans and Specifications?
9.	Do staged construction travel lanes across bridges provide sufficient width for movement of contractor's equipment from one side of the bridge to the other and for snow removal?
10.	If staged construction, is sequence reasonable and are detours required? Determine minimum lane widths allowable?
	UTILITIES
1.	Are existing utilities and facilities accurately shown on plans?
2.	Are underground obstructions clearly marked?
3.	Are there utilities that will be impacted?
4.	Are there any conflicts with on-going or anticipated contracts or projects including permit work?
5.	Review the in-plan utility work to ensure that it is compatible with the phasing of the roadway.
6.	Are water or sewer lines being placed in deep cuts or fills that will require grading prior to installation? Will shoring/cofferdams be required?
7.	Check for poles, pedestals, controller that may be in conflict with new or existing underground or overhead utilities, drainage system, ditches, etc.
8.	Tree locations to be checked against relocated underground or overhead utilities.
9.	Check overhead utilities, guy wires for potential conflicts with operations and access of large equipment.

	DRAINAGE
1.	Are structures compatible in size for the pipes coming in and going out?
2.	Has offsite drainage been considered (beyond const. limits)?
3.	Are there any existing or proposed drainage issues that need to be addressed?
4.	Has guardrail post placement and installation over drainage structures, retaining structures or other features been considered?
5.	Planting trees or shrubs with large root balls in medians may conflict with under drain, and drainage structures.
6.	Is the location of storm sewer trunk lines compatible with grading sequences and maintenance of traffic plans?
7.	Have temporary drainage structures or stream diversions been considered?
8.	Adequate outfalls for project's stormwater discharge?
	MAINTENANCE OF TRAFFIC
1.	Is there enough room for impact attenuators?
2.	Are work zones in compliance with the guidelines as shown in WAPM?
3.	Do signalization, barricades, channelizing devices, and pavement markings conform to MUTCD?
4.	Is there sufficient clearance within the work zone for construction operations?
5.	Will school buses, mail carriers, fire trucks, emergency vehicles, permit vehicles or other local traffic require special maintenance of traffic provisions?
6.	Are the necessary restrictions (lane closure restrictions, hours of operation restrictions, holiday and weekend restrictions, major events, etc.) indicated in plan?
7.	Have the minimum number of lanes and minimum lane widths been shown consistently on the traffic control plans, the cross sections and the typical sections?
8.	Use existing pavement instead of temporary pavement if feasible.
9.	What effect will traffic barriers and other devices have on sight distance, driveways, intersections and turning radius?
10.	Can work be safely accessed, especially median work?
11.	Has consideration been given to shopping centers, churches, schools, military installations, seasonal traffic constraints, sports arenas, special local events, etc.?
12.	Can left or right turn lanes be maintained during construction and/or can they be closed for a certain phase or phases?
	MAINTENANCE OF TRAFFIC Continued
1.	Check location of existing, proposed or temporary traffic control signs, warning devices and barricades to determine if they are encroaching on lanes.
2.	Does traffic MOT plan consider any temporary methods required for structural steel erection over traffic? Closely review any temporary support systems and how they would be protected from traffic.

3.	Have temporary transitions been provided beyond the full depth construction limits to allow for maintenance of traffic during construction? Have temporary easements been set up for the transition areas?
4.	If project requires a lengthy phase, should permanent pavement markings/ markers be used in lieu of temporary?
	Will temporary lanes be required to maintain traffic while tie ins are constructed?
	SIGNALIZATION
1.	Will temporary signals be required?
2.	Review locations of temporary signals for how new design horizontal and vertical alignments will impact clear zone and vertical pole clearances of the existing signal components during construction phasing.
3.	Will proposed signals conflict with existing utilities?
	ENVIRONMENTAL / ROADSIDE
1.	Check to see if existing trees and shrubs that are not to be disturbed have been labeled.
2.	Are excavated materials being disposed of in an area above mean high water to prevent return into state water?
3.	Does project advertisement date and schedule to estimate contract time consider time periods where instream permit restrictions will prohibit work such as cofferdams, causeways, etc…? Can measures be taken to maximize the efficiency in which the project can be built around the environmental constraints?
4.	Will testing for contaminated soils be required due to foundation requirements?
	FUTURE WORK / MAINTENANCE ISSUES
1.	When doing a resurfacing project, has traffic barrier resetting or height adjustment been considered?
2.	Are there any maintenance problems or procedures anticipated as a result of the proposed construction?
3.	Is the project compatible with anticipated future widening projects?

FI CONSTRUCTABILITY GUIDELINES

	CLEARING / GRUBBING / EARTHWORK
1.	Is adequate clearing and access allowed to construct walls?
2.	Is clearing and grubbing confined to the area within construction limits?
3.	Are the limits of grubbing, clearing and landscaping clear?
4.	Are underground tanks, existing foundations and slabs located within the construction limits being removed?
5.	Will unsuitable material shown on the plans, and found to be suitable, be used in fills in lieu of borrow material?
6.	Are there adequate easements for construction?
7.	Are all necessary construction easements identified?
8.	Are right of entry agreements required and who will obtain them?
9.	How are tie-ins to be made and are they appropriate for existing conditions and phases (intersection conflicts, lane drop lengths, etc.)?
10.	Do cross sections reflect the embankment widening required for guardrail?
11.	Do the following items fit into the sequence of construction: wick drain locations, fill placement and settlement monitoring, retaining walls in multiple phases, stream diversions, sheeting for multiple phase construction?
12.	Do cross sections reflect the stages of construction?
13.	Is suitable material available within the project limits for use as borrow materials? If so, where and what quantity. Are these locations properly noted and included within the plans?
14.	Are there any plants and/or special sites that need to be protected during construction? If so, what, where, and quantity. Are these locations properly noted and included within the plans?
15.	Are there available approved sources for Materials needed for the project that are economically feasible and/or are alternate materials an option?
16.	Will sufficient fill material be available from the excavation areas in each stage or will borrow be required?
	PLANS / DESIGN
1.	Do site conditions conform to those represented in plan?
2.	Is sequence phased to provide minimum number stages, reasonable work areas and access?
3.	What effect will traffic barriers and other devices have on sight distance, driveways, intersections and turning radius?
4.	Have cross-sections for grade changes at phase tie ins been checked?
	PLANS / DESIGN Continued
1.	Is the construction phasing compatible with the maintenance of traffic phasing and/or utility relocation phasing?
2.	Do work hour restrictions allow time to perform work?

3.	Are the hours and locations of lane closures specified if necessary?
4.	Will night construction be required? Is temporary lighting available or will existing lighting be utilized?
5.	Is there sufficient clearance within the work zone for construction operations?
6.	Is there adequate access to the construction?
7.	How are tie-ins to be made and are they appropriate for existing conditions and phases?
8.	Is the sequence of construction compatible with the maintenance of traffic phasing and/or utility relocation phasing?
9.	Is staged construction adequately shown on the plans?
10.	Is construction staging addressed in the traffic control plans?
11.	Is transition from one phase into the next phase adequately addressed (horizontally and vertically)?
12.	Are there any safety issues between phasing and are they adequately addressed?
13.	Is the construction phasing compatible with the maintenance of traffic phasing and/or utility relocation phasing?
14.	Have all areas of repair been identified clearly on plans?
15.	When doing a resurfacing project, has traffic barrier resetting or height adjustment been addressed in the plans?
16.	Does project schedule recognize time of year / temperature restrictions for pavement surfacing (both surface treatments and plant mix)?
17.	Do the limits of milling/resurfacing encompass all areas with temporary striping for eradication (prevent “shadowing”)?
18.	For pavement widening, is there sufficient width available to place and compact asphalt (typically 6 feet)?
19.	For concrete pavement, is there sufficient room available for paver tracks (typically 3’-4 feet) on both sides between temporary barriers during construction?
	REMOVAL / DEMOLITION
1.	Is there adequate construction access for demolition?
2.	Does locality have noise limits that will restrict night work?
3.	Is pedestrian access accounted for?
4.	Will sawed joints be required for pavement removals and has a method of payment been included?
5.	Have hazardous materials been identified?
	STRUCTURES (BRIDGES, WALLS, MAJOR BOX CULVERTS)
1.	Are pile design loads and type shown? Do they require load testing and is space available? Are other substructure elements constructible (drilled shafts, spread footers, etc.)?
2.	How do the boring locations compare to the actual foundation locations?

3.	Is steam navigable either by law or local usage and have permit requirements been finalized?
4.	Have borings been taken in the appropriate locations and are they sufficient in number and depth?
5.	Is water depth in channel sufficient depth to utilize barges or has a preliminary design been done for any temporary work bridges?
6.	Do bridge bearings require special manufacturer?
7.	Have utilities through bridges been incorporated into bridge plans if necessary?
8.	If piles or sheeting are required, are their locations indicated adequately on the plans and can they be driven or do conflicts exist? Additional borings may be required. Are necessary permits in place?
9.	Is the structure compatible with the retaining wall/MSE system?
10.	Are straps or other devices on retaining walls in the way of excavation and or the foundation?
11.	Are traffic control plans for the bridge coordinated with roadwork phasing?
12.	If stage construction, will deck have cantilevered sections that require support? If so, is support concept noted on plans and criteria as to when required given for both existing and new decks?
13.	Are abutments, wing walls wide enough to support guardrail and the additional shoulder backing required for the guardrail?
14.	Is there adequate room available adjacent to drilled shafts to allow for removal of spoils and laydown room for rebar cage?
15.	Have provisions been made to maintain navigational lighting throughout construction?
16.	Will contractor have adequate room to place screed without impacting traffic?
17.	Is there room to offload and set girders or other structural components? Will transportation of beams/girders be restricted?
18.	Are heavy skew details required in structure, barriers, & sidewalks?
	UTILITIES
1.	Are there any conflicts between drainage and utility work?
2.	Are existing utilities and facilities accurately shown on plans?
3.	Are underground obstructions clearly marked?
4.	Are there any conflicts with on-going or anticipated contracts or projects?
5.	Are the signal pole locations in conflict with utilities and drainage structures?
6.	Are proposed utility relocations clear of proposed traffic control devices?
7.	Are the access doors and hydrants in agreement?
8.	Are existing utilities under structure, in parapets? If so, how are they maintained throughout contract period?
9.	Has guardrail post placement and installation over or near existing utilities been adequately addressed?

	DRAINAGE
1.	Are structures compatible in size for the pipes coming in and going out?
2.	Has offsite drainage been considered (beyond const. limits)?
3.	Has construction site drainage been adequately addressed?
4.	Are there any drainage problems between phases?
5.	Can water get to inlets or drainage structures during phase transitions and during each phase of construction?
6.	Have manholes, inlets, valve boxes, etc., requiring adjustment been noted?
7.	Are there provisions for temporary drainage and drainage of the construction area if necessary?
8.	Are there provisions for and a proposed method of connecting new and old drainage facilities?
9.	Are outfall locations of temporary and permanent drainage facilities identified?
10.	Will proposed or existing drainage structures function during different phases of construction?
11.	Have existing and proposed inverts been verified to assure tie-ins will fit?
12.	Have the plans been reviewed to verify that pipe is not in the pavement section and there are no conflicts between drainage structures and utilities? Has minimum cover over the pipe at the time subgrade is graded been verified?
13.	Are temporary drainage devices needed during different phases?
14.	Have clearances above and below pipes and structures been verified?
15.	If used, is pipe jacking methods or channel lining appropriate for given site conditions? Have borings been made to confirm the suitability of pipe jacking for a specific location?
16.	Have provisions for drainage been made on the property owner's side of retaining or sound wall?
17.	Has guardrail post placement and installation over drainage structures, retaining structures or other features been adequately addressed?
18.	Is there an existing underdrain system to be maintained during construction and/or tied into as a feature of the proposed new design?
19.	Is the sequence of construction compatible with the sequence that storm drains will have to be installed in order to maintain drainage in each stage?
20.	Have alternate methods such as pipe ramming been considered for locations specified for pipe jacking?
21.	If jacking of pipe is necessary, have the areas needed for jacking/receiving pits been considered for easements?
22.	Is select backfill / flowable backfill necessary for pipe crossings that must be performed in short/limited time frames?
23.	Can all drainage pipes be installed in open cut? How does open cut work with the MOT sequence? If not, what alternate (trenchless methods) are proposed?
	MAINTENANCE OF TRAFFIC
1.	Are the hours and locations of lane closures specified?
2.	Will night construction be required and has temporary lighting been considered?

3.	Are drop-offs adequately addressed and protected?
4.	During construction, is adequate access for residents and businesses in the area provided?
5.	Are flashing arrow boards and variable message signs at appropriate locations?
6.	If battered piles are used, will leads be over moving traffic?
7.	Will detours run through the winter? If so, has plowing of snow or maintenance of detour been considered?
8.	Is transition from one phase into the next phase adequately addressed?
9.	Are the traffic control plans clear and complete?
10.	Are the necessary restrictions (lane closure restrictions, hours of operation restrictions, holiday and weekend restrictions, etc.) indicated in plan?
11.	Is traffic addressed on side streets?
12.	Have detour routes been approved by the appropriate jurisdiction?
13.	Has duration of detours been identified?
14.	Is there adequate room for temporary slopes, ditches, and shoulders between existing and proposed roadways in each stage of construction and are they shown clearly in the MOT plans?
15.	Are traffic barrier service locations and correct attenuators identified? Is the traffic barrier service required to be secured to the roadway?
16.	Open Graded Drainage layers – any conflicts with maintenance of traffic (i.e. can't run traffic on this layer)?
17.	Are pavement underdrain outfalls available at MOT phase transitions?
18.	Has adequate time for curing of any underlying cement stabilized layers been addressed?
19.	Detours – Is a surface mix that is not susceptible to raveling being used if the detour is subject to winter time use?
20.	At MOT phase transitions \ tie-ins are any longitudinal joints in the final wheel paths? Can they be moved outside of the wheel paths?
21.	Have any MOT issues over cement or lime stabilized subgrades been addressed? Undercuts – Do depths present MOT of issues?
22.	Do the limits of pavement demolition/reconstruction work with the MOT plan?
23.	Has a temporary pavement section been shown on the MOT plans, where required?
23.	Do temporary pavement marking quantities reflect the life of the project?
24.	Are special arrangements for emergency vehicle access needed (tow trucks pre-positioned, signal light overrides, e.g.)?

	SIGNALIZATION
1.	Do poles locations and foundations conflict with utilities and drainage structures?
2.	Do anticipated sign footings conflict with underground structures and/or obstructions such as utilities, retaining walls/MSE slopes, storm drains, under drains, outlets, concrete traffic barriers, other footings, etc.?
3.	Do the location of signal heads, poles, loops, power supply, etc. match project phasing and/or maintenance of traffic?
4.	Is the power supply to the traffic and lighting devices going to change as a result of moving the utility lines during construction of the project?
5.	Will signals be required or able to remain interconnected during construction?
	ENVIRONMENTAL / ROADSIDE
1.	Have existing trees that are required to remain in place been identified?
2.	Where additional trees are planted, is there sufficient space (25'-30') for power mowers?
3.	Are excavated materials being disposed of in an area above mean high water to prevent return into state water?
4.	Have the impacts of construction windows required by environmental resource agencies been addressed?
5.	If wetlands/waterways are involved, are closure periods shown?
6.	Will plants fit into specified areas, such as behind sidewalks and between curbs and sidewalks and not impact ADA requirements?
7.	Do sediment and erosion control devices match different phases of construction?
8.	Where required, are the pipes/box culverts counter sunk?
9.	Have the necessary permits been applied for?

PAC CONSTRUCTABILITY GUIDELINES

	CLEARING / GRUBBING / EARTHWORK
1.	Sites for temporary fill and top soil storage. Laydown area on same side of road as fill area. Room for storage of excavated muck to be used as muck blanket. Indication of dump sites.
2.	Provisions (such as phasing of work) to minimize borrow and use of excavated material for fill. Phase quantities shown? Will phase plan work?
3.	Where subsoil excavation is shown, is there continuity in the thickness of the unsuitable layer from cross-section to cross-section?
4.	Underground obstructions clearly marked and who pays to have them removed from the site.
5.	Stabilization limits clearly shown. Is temporary stabilization required?
6.	Is blasting work needed/allowed? Blasting requirements covered in specifications?
7.	How is detour earthwork paid for (including placement and removal)?
8.	Is removal of asphalt concrete or Portland cement concrete addressed as separate pay items? If so, have earthwork quantities been addressed?
9.	Pay items for anticipated problem areas (e.g. geotextile fabric, stone, drainage pipe).
10.	Do Special Provisions or Specifications address unsuitable material removal and replacement and payment?
11.	Does contractor have adequate access to job site for equipment, materials, labor?
12.	Scheduling and phasing with activity needs.
13.	Access maintained to all occupied spaces by reviewing scheduling restrictions, sequence of work restrictions, delineated work areas.
14.	Defined and designated lay down area and sufficient space for trailers, material storage and operations.
15.	Requirements for local/state special permits.
16.	Haul route different from most direct route and indicated in TCP (Traffic Control Plan).
17.	Any walls or special access required to adjacent property.
18.	Easement of available adjacent property for storage and construction.
19.	Safe pedestrian access to business and residences provided for all, including mobility impaired.
20.	Is all required work covered by pay items?
21.	Are settlement periods consistent with planned project time? Are settlement platforms allowed?
22.	Does staged work necessitate winter shutdown of work and will it extend project beyond contract limits? Does traffic control devices estimate reflect shutdown?

	CLEARING / GRUBBING / EARTHWORK Continued
1.	Requirements for temporary bridges or other structures.
2.	Is temporary shoring required?
3.	Are there requirements for instrumentation?
4.	Are there unique soils conditions?
5.	If special provisions refer to geotech report, are geotech requirements enforceable?
6.	Are geotech recommendations consistent with typical installation methods?
7.	If ground water is expected, are dewatering requirements explicit?
8.	Is blasting required - does geotech report represent the ground?
9.	Is suitable material available within the project limits for use as borrow materials? If so, where and what quantity. Are these locations properly noted and included within the plans?
10.	Are there any plants and/or special sites that need to be protected during construction? If so, what, where, and quantity. Are these locations properly noted and included within the plans?
	PLANS / DESIGN
1.	Right-of-way and property line dimensions in the plan. Are temporary construction easements required to complete the work?
2.	Do site conditions conform to those represented in plan?
3.	Work elements identified clearly and all corresponding pay items are included with adequate quantities to construct project.
4.	Line and grade of ditches and fences for conflicts within existing cross-section. Access for cut slope rounding?
5.	Water table elevations and requirements for dewatering.
6.	Cross-sections for grade changes at phase tie ins and for temp. detours.
7.	Appropriate general notes and special provisions required for construction.
8.	Temporary paving tapers noted for stage construction.
9.	Limits of changes in pavement sections clearly noted.
10.	Temporary pavement sections required? If so, are they shown on the plans?
11.	Are top of slope & cuts shown. Any conflicts with Right of Way limits?
12.	Are the savings of special trees or monuments noted on the plans?
13.	Are seasonal water elevations of adjacent stream or lakes shown?
14.	Does project schedule recognize time of year / temperature restrictions for pavement surfacing (both surface treatments and plant mix)?
15.	Does the Grading Diagram/ Summary indicate that there is adequate fill material available for each stage of construction? If there is excess material in a stage, is there enough room for storage or must it be hauled off-site to temporary storage?
16.	Do the limits of milling/resurfacing encompass all areas with temporary striping for eradication (prevent “shadowing”)?
17.	For pavement widening, is there sufficient width available to place and compact asphalt (typically 6 feet)?

18.	For concrete pavement, is there sufficient room available for paver tracks (typically 3'-4 feet) on both sides between temporary barriers during construction?
	REMOVAL / DEMOLITION
1.	If structures to be removed or renovated, asbestos survey?
2.	If asbestos, creosote timber or contaminated soil is being removed are special instructions and disposal defined? Who will handle?
3.	Adequate provisions if signs or road markers to be removed and/or relocated.
4.	Appropriate milling details (e.g. limits are identified; special treatment at bridge ends; bridge overpass; consideration for existing/proposed loop detector cables) Identify where millings are to be disposed of.
5.	Availability of demolition site. Phase access desirable/required?
6.	Depth of embedment, required excavation and inside details of removable items.
7.	Coordinate the emptying of fuel tanks (e.g. fuel oil/propane for residents)
8.	Disassembly and adequate specified protection requirements. Disassembly of plant, structure, utility or equipment and adequate specified protection requirements to existing utility or structure.
9.	Is there salvage of existing material? If so, where do they go?
10.	Saw cutting depths and limits specified?
11.	Septic field/sewer/water connections addressed.
12.	Removal of Hazardous material specified?
13.	Existing paint types noted? (Especially if hazardous)
14.	Disposal of paint residue accounted for?
15.	Does locality have noise limits that will restrict night work?
16.	Disposal sites/limits for demolished materials clearly shown in the plans, if allowed?
	Protection of existing facilities?
	Requirements for dust control noted?
	STRUCTURES (BRIDGES, WALLS, MAJOR BOX CULVERTS)
1.	Pay items for performed pile holes, floating turbidity barrier, relocating barrier for pile foundation. Coffer dams, test piles, pile points.
2.	Does Corp. of Engineers, Regional Water Quality Control Board, Coast Guard, or Fish & Game permits require work not shown on plans?
3.	Is MOT plan coordinated with structures phasing?
4.	If battered pile used will leads be over moving traffic? Will they miss R.E. walls and Overhead lines? Will they clear all existing structures?
5.	Do plans show all utilities, existing pile locations and existing foundations in pile driving area?
6.	Are there any problems with R/W, i.e. right of way acquisition, utility, drainage, and temporary construction easements?
7.	Are standard plan notes correct or modified to meet existing or new conditions?
8.	Are heavy skew details required in structure, barriers, & sidewalks?

9.	Is foundation report available? Is it readable? Does it show ground water tables? Does it indicate possible layers/elevations or driving/ drilling difficulties?
10.	Are pile/drilled shaft load/driving tests required? Is space available and time accounted for in the project schedule?
11.	Are settlement periods specified? Are they acceptable within the specified working/calendar day schedule? Has the geotech designer modeled actual conditions?
12.	Are types of driving equipment and signalization limited by height or noise requirements (I.e. air traffic, overhead utilities, local noise ordinances, etc?)
13.	Identify soils, rocks and rock sizes for caisson drilling.
14.	Do easements provide sufficient room for shoring, access, benching/slope lay-back?
15.	Any special pile driving criteria or sequence or is barrier needed to protect pile?
16.	Do proposed piles conflict with existing piles?
17.	Have power service points for signing, lighting, signals, been confirmed?
18.	Is highway lighting properly detailed for bridge? pilaster detail?
19.	Can falsework be constructed meeting the minimum vertical clearance?
20.	Are expansion joint details complete if sidewalks, barriers and skews greater than 20 degrees?
21.	Review elements affected by post tensioning structure.
22.	Closure pour limits clearly noted?
23.	Prestressing notes shown on plans?
24.	Are structure drainage elements required? Are they located properly, do they flow into new or existing drainage patterns?
25.	Concrete required strength and type limits shown? Concrete finish specified?
26.	Future utility access openings provided?
27.	Access openings shown if utilities are installed? Open grades required in girder bays with water lines? Expansion couplers/slip joints noted at abutments/hinges?
28.	Utility casings shown in structure? Casing support/mounting details and intervals noted? Casing under approach slabs noted and described?
29.	Is water depth in channel sufficient depth to utilize barges?
30.	Will barges block boat traffic?
31.	If barges can't be used, have temporary bridges, fill of causeways been considered? Is method in accordance with permits?
	UTILITIES
1.	Utility conflicts and their relocation indicated in design.
2.	Disruptions of other utilities and provisions for restoration.
3.	Verification of new utilities connecting with existing.
4.	Availability of indicated existing utility ducts and their proximity to highway facility and traffic.
5.	Other utilities which new underground ducts intersect or transverse.

6.	Utility crossing resolved via scheduling restrictions (i.e., weekends, after hours) or temporary structures.
7.	Overhead utilities, guy wires for potential conflict with operations and access of large equipment.
8.	Utilities required for construction operation and field offices.
9.	Is condition of existing utility verified for possible tie-in problems?
10.	Are casings required under state highways?
11.	Is casing/utility pipe material shown on plans (existing)?
12.	Are crossings placed for future utilities?
13.	Are provisions made for temporary relocation of interfering existing utilities?
14.	Have staging plans been accounted for in plan utility work?
15.	Are plan provisions present for raising utilities to final grade if stage construction is required?
16.	Depiction of valve boxes, manholes, hydrants and provisions for relocation. If meters removed, are they salvaged or returned?
17.	Provisions for utility staging requirements? Is work clearly shown? Temporary facility needed?
18.	Requirement to pothole for existing utilities if information not available from design stage.
19.	Can more than one utility go into the same trench?
20.	Identify all abandoned utility lines.
21.	Identify overhead power lines (kV) for overhead crane constraints.
22.	Provide utility relocation schedule to be done by others.
23.	Are utility relocation agreements in place?
24.	Is Railroad protection insurance required? By which parties?
25.	Does sequence of construction agree with any time of year restrictions that utility may not be shut down?
26.	Has abandonment of utility lines been addressed?
27.	If any concrete barriers are required to be removed and reset to complete utility work as shown in the plans, is payment for moving the barrier addressed?
	DRAINAGE
1.	Existing drainage patterns, their continuity and high water indications.
2.	Drainage easement, if required, in the plan.
3.	Identification and adequacy of all drainage items and quantities.
4.	Ditches compatible with existing and proposed drainage structures.
5.	Needed elevations shown in the plan and compatibility of location of design with existing conditions.
6.	Drainage of construction area during work.
7.	Drainage facility provided with the lanes on which traffic is to be maintained during work. Provide typical ditch details so contractor and inspector know what is expected.
8.	Proposed method of connecting new and old drainage facility.

9.	Effect of overlay on intersections, gutters, curbs as regards to drainage and their adjustments.
10.	Outfall locations of temporary and permanent drainage facility, if any.
11.	Final contour grading matches drainage inlet requirements.
12.	Drainage facilities accessible for maintenance personnel.
13.	Is inlet protection, temporary silt fence and/or filter barrier shown on the plans?
14.	Is the correct type of pipe being used considering the pH and resistively of the soil and water?
15.	Review super-structure drainage system - cleanouts?
16.	Is there room to lay back the trench slopes?
17.	Temporary shoring requirements.
18.	Any dewatering requirements.
19.	Conflict between drainage and other utilities & structures (I.e. piling, footings, etc.)
20.	Planned cut-offs and switch-overs. Abandonment noted, including details and pay quantities for plugs, grout, flowable fill, etc.
21.	Temporary diversion channels designed for live streams & need for channel liner considered. (e.g. - for box culvert construction)
22.	Is phasing of drainage being installed to provide positive flow during construction. (from out to in)
23.	Is jacking of pipe necessary, has the location been explored for rock or other obstructions that would prevent this operation. Have other means such as pipe ramming been considered?
24.	Are structures compatible in size for the pipes coming in and going out.
25.	Are temporary drainage items listed in descriptions and summarized.
26.	Space between R/W line and drainage structure to allow for construction.
27.	Is the correct class / gauge of pipe being used for the cover / loading?
28.	Are foundation requirements noted for all applicable structures?
29.	Is stormwater management plan appropriate?
30.	Are erosion and sediment requirements adequate?
	MAINTENANCE OF TRAFFIC
1.	TCP (Traffic Control Plan) clear, complete, approved and conform to Local Agency Requirements.
2.	Temporary safety devices requirement and provision (i.e., guard rail, traffic barrier service, attenuators, earth mounds, crash cushions, temporary lighting, etc.)
3.	Locations of traffic control signs, warning devices and barricades. Check if they are encroaching on lanes.
4.	Traffic operation requirements properly addressed (i.e., signing, pavement markings, signal, temporary drainage, temporary lighting, temporary striping, etc.)
5.	Relocation item for barrier wall or fence (permanent or temporary).
6.	Location of flashing arrow boards, if needed, at appropriate places.
7.	Lanes on which traffic is to be maintained compatible to local conditions and intended to be paved. Is there enough storage area on off-ramps? Maintain access to local business/residents/construction site.

8.	Is there sufficient clearance within the work zone for the operation (such as crane swing room)?
9.	Adequate accommodations for intersecting and crossing traffic.
10.	Address pedestrian and bicycle accommodations, detours, protective measures.
11.	Are exits and entrances to the work zone adequate and safe? (I.e. sign distance and signing)
12.	Method of containing bridge slopes during phased construction (at end bent) and approach grade separations.
13.	Restrictions (e.g., lane closures, general construction or peak-hour restrictions in urban areas) indicated in plan.
14.	Note covering traffic signal modifications for phased construction.
15.	Note covering pay for traffic control items.
16.	Are the proper signs in the locations as noted in the MUTCD (or other applicable standard)?
17.	Detours for bridge falsework erection and removal operations clearly shown? Allowable lane/road/freeway closure specified? Traffic opening size adequate?
18.	Holiday traffic flow increases addressed?
19.	Emergency vehicle access maintained at all times for local residents and businesses?
20.	Use of amber lights on signs when maximum awareness is required.
21.	Indicate flagmen on detour plans when required; budget sufficient flagger hours; Should pilot vehicle be considered?
22.	Are restrictions on lane closures noted?
23.	Provisions for the contractor to submit a revised MOT. Requirements for the contractor to provide a MOT supervisor & inspections, or Traffic Control Supervisor.
24.	Are procedures to follow in case of accident in place? Are procedures for switch-overs in place, I.e. notifications, timing, etc.?
25.	Is the frequency of MOT inspection shown? Who repairs pavement in detours and construction zones?
26.	Roadway closures or detours shown on plans? Do closure hours in the Special Provisions allow enough time to perform the work?
27.	Staging construction limits shown and are the limits adequate for traffic configurations?
28.	Is work being planned for the minimum number of phases or traffic shifts?
29.	Are there horizontal or vertical differences that prevent shifting of traffic from phase to phase?
30.	Are navigable waterways being maintained?
31.	Are MOT typical sections complete?
32.	Will project go through the winter and are quantities sufficient for this work?
33.	Are the crew resource assumptions in the schedule used to establish contract time and milestones in compliance with the Transportation Management Plan?

	SIGNALIZATION
1.	Do pole locations conflict with utilities and drainage structures?
2.	Are controller, signal head, pull box, pedestrian pole locations shown?
3.	Verification of conduit street crossing to become overhead.
4.	Is existing controller compatible to added items?
5.	Fiberglass insulators, needed for span wire to power overhead lines and adequate provisions.
6.	Are number of detectors correct? Are temporary installations shown?
7.	Are any signs attached to the overhead span wire for the traffic signal?
8.	Disposition of existing signal poles and other equipment, if they are removed.
9.	Are signal arms long enough to provide sidewalk access?
10.	Have temporary power feeds been shown if required?
11.	Are temporary traffic signals required?
12.	Are regulatory and street signs shown?
13.	Who approves final installation and testing?
14.	Have asphalt milling limits been coordinated with loop detector locations?
15.	Will handicapped be able to access push buttons?
16.	Are the appropriate types of temporary pavement markings in accordance with time of year they are being placed?
17.	Are preemption devices required on temporary signals?
	ENVIRONMENTAL / ROADSIDE
1.	Have erosion and pollution control items/measures been included in the plans?
2.	DCR and local agency requirements are clearly identified.
3.	Provisions to prevent groundwater contamination/other environmental pollution. Are monitor/testing provisions shown?
4.	Does project have environmental protection safeguards with respect to dust control, erosion and disposal of wastes?
5.	Verification of landscaping and planting requirement and their conflicts with utilities (e.g. irrigation lines) and drainage (swales and ditches).
6.	Where additional trees are planted, is there sufficient space (25'-30') for power mowers?
7.	Provisions & pay items for silt fences, turbidity barriers, rock check dams, temp. seeding, construction entrances, etc. - monitor/testing intervals.
8.	Temporary fences for Environmentally Sensitive Areas.(i.e., playgrounds, parks)
9.	Do Special Provisions clearly indicate order of work relative to mitigation sites?
10.	Temporary graffiti control (during project)?
11.	Is pay item for mowing prior to owner acceptance needed?
12.	Are permit restrictions in concurrence with project schedule?
13.	Have all permits been acquired and are they current?
14.	Has the Virginia Stormwater Management Permit (VSMP) been applied for? (when required)

	FUTURE WORK / MAINTENANCE ISSUES
1.	Earthwork design (e.g., "temporary" borrow, "additional excess," detour material, embankment, etc.). If waste job, identify who is responsible to dispose of dirt or location to be placed for future work.
2.	Right-of-way acquisition (e.g., for signal and lighting, foundations, redesigned radii of drainage structures, utility relocation, construction easements, adequate work space, desirable clear zone, etc.).
3.	Utilities (e.g., accuracy of location, proposed relocation, conflicts with other structures, future MOT impacts, etc.). As-built elevations? Manholes/valves in wheel paths?
4.	Pavement (e.g., design criteria, flexibility to change, material alternatives, etc.). (cross slope and Superelevation) Keep all facilities below future subgrade where possible.
5.	Drainage structures (e.g., new and standardized structures, size of pipe, low head piping, interim drainage).
6.	Lighting and signs (e.g., conduit size, service point locations, design of structures, compatibility, power source, etc.). Overhead sign foundations spaced to allow for widening with accommodation for ramp tapers/sight distance.
7.	Other structures (e.g., mix design, strength, pile information, finishes, concrete and steel requirements, column geometrics, etc.)
8.	Complies with all local ordinances (I.e. noise, dust, etc.)
9.	Check for environmental constraints (permits, bird/animal habitat).
10.	Make note and details of new and disturbed landscaping areas, and how they are to be maintained, constructed, or re-installed.

REFERENCE SOURCES

AASHTO
Constructability Review Best Practices Guide
August 2000

Idaho DOT Constructability Guide:
https://apps.itd.idaho.gov/apps/manuals/Constructability/constructibilityPrintable.htm

NY DOT EI-99-013 Constructability Review document
https://www.dot.ny.gov/eieb?doc_type=EI

New Jersey DOT Constructability Guidelines
https://www.nj.gov/transportation/capital/pd/process_constructionmgmt.shtm

VDOT District Sources

Richmond District Constructability and Bidability Analysis Checklist
Hampton Roads District Constructability Review Checklist
NOVA District Constructability and Bidability Analysis Checklist
Salem District Constructability and Bidability Analysis Checklist
Culpeper District Constructability and Bidability Analysis Checklist