Meeting Date

*Wednesday, April 5, 2017 @ 9:00am*

Building 5, Room 122

Only WVDOT & FHWA personnel may attend the Specifications Committee meeting.

**Approved Permanent Specification changes from last Committee meeting (2/1/17)**

- 651.2 Materials Organic matter & sampling update
- 626.5.1.1.2-Modular Block Facings Material subsection; mix design requirement changes
- 703.4-Grading of Coarse Aggregates
- 704.8-Shot Rock Making shot rock acceptance similar to class 7
- 707.9-Liquid Membrane-Forming Compounds For Curing Concrete Adds NTPEP requirements

**Approved Project Specific Special Provisions (SP) from last Committee meeting (2/1/17)**

- SP615 - Temporary Falsework
- SP498 - Ultra-Thin Asphalt Overlay
- SP619 - Anitrock Membrane
- SP663 - District Wide Striping Contract

**Items removed from Committee Agenda**

- SP627 - Finger Expansion Dam & Drainage System
- SP218 - Tied Concrete Block Erosion Mat

**Old Business - Provisions discussed at last Committee meeting**

<table>
<thead>
<tr>
<th>SECTION</th>
<th>TITLE</th>
<th>DESCRIPTION</th>
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</table>
| 616     | SP 616 - Drilled and Grouted Micropiles | 5th time to Committee; discussed in August, October, December, and February.  
Project Specific Special Provision (SP) for drilled and grouted Micropiles.  
Provision updated per comments at the February; a redline copy, showing the changes/updates to the SP (from what was presented at last meeting) is included.  
Approval expected in April. |
| 715     | 715.42.8 - Cabinets | 4th time to Committee; discussed in October, December, & February.  
Permanent Specification change with a rewrite of the Cabinets subsection.  
The provision is a redline copy, showing the changes/updates to the specification.  
Approval expected in April. |
<table>
<thead>
<tr>
<th>Code</th>
<th>Provision Details</th>
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<tbody>
<tr>
<td><strong>601</strong></td>
<td>SP 601 - Structural Concrete Internal Curing</td>
</tr>
<tr>
<td><strong>601</strong></td>
<td><strong>This is an update to previously approved SP's. 3rd time to Committee; discussed in December &amp; February.</strong></td>
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<tr>
<td><strong>601</strong></td>
<td>Project Specific Special Provision for Class H-IC Concrete. Most of the changes pertain to mix design requirements (i.e. no freeze-thaw testing, elimination of different batches with different SRA dosages, addition of shrinkage testing on Class H batch, etc.).</td>
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<tr>
<td><strong>601</strong></td>
<td>No updates to the provision. <strong>Approval expected in April.</strong></td>
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<tr>
<td><strong>601</strong></td>
<td><strong>601.7-Mixing</strong></td>
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<tr>
<td><strong>601</strong></td>
<td><strong>3rd time to Committee; discussed in December &amp; February.</strong></td>
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<tr>
<td><strong>601</strong></td>
<td>Permanent Specification change to 601.7 - Mixing. It limits the amount of water added to concrete mix (including job site additions) to an amount which would maintain the water-cement ratio (w/c) at or below the w/c that was established in the mix design.</td>
</tr>
<tr>
<td><strong>601</strong></td>
<td>There was a meeting with Industry &amp; DOH personnel to discuss this specification change in March; provision updated per comments at the meeting. The provision is a redline copy, showing the changes/updates to the specification. <strong>Approval expected in April.</strong></td>
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<tr>
<td><strong>604</strong></td>
<td>SP 604 - HDPE Heat Fusion Joining</td>
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<tr>
<td><strong>604</strong></td>
<td><strong>3rd time to Committee; discussed in December &amp; February.</strong></td>
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<tr>
<td><strong>604</strong></td>
<td>Project Specific provision for HDPE heat fusion joining.</td>
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<tr>
<td><strong>604</strong></td>
<td>Provision updated per comments at the February meeting; a redline copy, showing the changes/updates to the SP (from what was presented at last meeting) is included. <strong>Approval expected in April.</strong></td>
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<tr>
<td><strong>211 607 609 639</strong></td>
<td><strong>SP's for High Tension Cable Barrier System</strong></td>
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<td>Project Specific Special Provisions (SP) for High Tension Cable Barrier System.</td>
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<tr>
<td><strong>211 607 609 639</strong></td>
<td>Provision updated per comments at the February meeting; a redline copy, showing the changes/updates to the SP (from what was presented at last meeting) is included.</td>
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<td><strong>211 607 609 639</strong></td>
<td>Project Specifics SP's:</td>
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<tr>
<td><strong>211 607 609 639</strong></td>
<td>1. SP211 - Borrow Excavation by Modeling Surface (1st time to committee)</td>
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<td><strong>211 607 609 639</strong></td>
<td>2. SP607 - Guardrail and High Tension Cable Barrier System (3rd time to committee)</td>
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<td><strong>211 607 609 639</strong></td>
<td>3. SP607 - Guardrail and High Tension Cable Barrier System MASH (1st time to committee... same SP as #2 above, but for MASH testing requirements... redline copy showing changes from SP #2 above)</td>
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<td><strong>211 607 609 639</strong></td>
<td>4. SP609 - Concrete Mow Strip (2nd time to committee)</td>
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<td><strong>211 607 609 639</strong></td>
<td>5. SP639 - Construction Layout Stakes for Electronic Data (2nd time to committee)</td>
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<td>SP</td>
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<tr>
<td>616</td>
<td>SP 616 - Concreted in Piling</td>
</tr>
<tr>
<td>405</td>
<td>SP 405 - Scrub Seal Surface Treatment</td>
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<tr>
<td>421</td>
<td>SP 421 - Intelligent Compaction</td>
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<td>607</td>
<td>SP 607 - Guardrail</td>
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<td>661</td>
<td>SP 661 - Illuminated Signs</td>
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<tr>
<td>663 711</td>
<td>SP's for Interstate/APD Striping Contract</td>
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<tr>
<td>670</td>
<td>SP 670 - HDD</td>
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**Waterline Installation**

Project Specific special provision (SP) for waterline installation via horizontal directional drilling (HDD).

Provision has been updated, per comments at the February meeting.

### New Business - New Provisions for Spec Committee

<table>
<thead>
<tr>
<th>SECTION</th>
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| 405     | 405 - Chip Seal | 1st time to Committee.  
Proposed specification change is a complete section re-write. |
| 603     | 603.2 - Materials | 1st time to Committee.  
Proposed specification change to Section 603 - Prestressed Concrete Members; with revision to the 603.2 subsection. The update, adds references to the applicable MP.  
**Approval expected in April.** |
| 603     | 603.6.2 - Mix Design | 1st time to Committee.  
Proposed specification change to Section 603 - Prestressed Concrete Members; with revision to the 603.6.2 subsection.  
A redline copy, showing the proposed changes/updates to the provision is included. |
| 607     | SP607 | 1st time to Committee.  
Project Specific Special Provision (SP) for Bullnose Terminal and Thrie Beam guardrail. |
| 663     | SP663 - Route Shield | 1st time to Committee.  
Project Specific Special Provision (SP) for Type V, Pavement Markings Shield. |
| 204     | SP's for Recall Striping Contract | 1st time to Committee.  
Project Specific special provision (SP) for Recall Striping Contract. This is a complete re-write to the SP's utilized on these projects.  
- SP204-Mobilization  
- SP663-Pavement Markings  
- SP711-Paints, Coatings, Oil and Inks |
| 679     | 679.3.7.1 & 679.5.1 | 1st time to Committee.  
Proposed specification change to Section 679 - Overlaying of Portland Cement; with revision to the 679.3.7.1 & 679.5.1 subsections. The proposed specification change is a redline copy showing the changes to the provision. |
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<tr>
<td>668</td>
<td>SP668 - CCTV</td>
<td>1st time to Committee.</td>
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<td>Project Specific Special Provision (SP) for Closed Circuit Television.</td>
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<td>705</td>
<td>705.5 - Performance Graded Binders</td>
<td>1st time to Committee.</td>
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<td>Proposed specification change to Section 705 - Asphalt Materials; with revision to the 705.5 subsection.</td>
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<tr>
<td>714</td>
<td>714.2 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe</td>
<td>1st time to Committee.</td>
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<td>Proposed specification change to Section 714 - Concrete, Clay, Fiber and Plastic Pipe; with revision to the 714.2 subsection. Changes the MP references to the revised and corrected MP numbers.</td>
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<td>Approval expected in April.</td>
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<tr>
<td>715</td>
<td>715.22.2 - Materials</td>
<td>1st time to Committee.</td>
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<td>Proposed specification change to Section 715 - Miscellaneous Materials; with revision to the 715.22.2. Changes the MP references to the revised and corrected MP numbers.</td>
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<td>Approval expected in April.</td>
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**Deadline for Comments is MARCH 31, 2017**
Comments are requested on these Specification Changes and Project Specific Special Provisions. Please share your comments, they help in the decision making process.

Please Send Comments to: [DOHSpecifications@wv.gov](mailto:DOHSpecifications@wv.gov)

**Deadline for new items & updates to these provisions is APRIL 28, 2017**
If you are the 'champion' of any specification changes and/or project specific special provisions currently in the Specification Committee, it is your responsibility to edit/update/modify them in a timely minor per comments and discussion in Spec Committee. Failure to submit updates may result in removal of item and/or delays.

**Next Meeting**
Wednesday, June 7, 2017 at 9AM (tentative)
Building 5, Room 122: (If Available. If not available a change in venue will be attached on the door)

**2017 Standard Specifications Roads and Bridges**
**Electronic Copy (pdf):** The 2017 Standard Specifications Roads and Bridges can be viewed, printed, or downloaded from the Specifications Website. A link to the Specifications pages is here: [http://www.transportation.wv.gov/highways/contractadmin/specifications/Pages/default.aspx](http://www.transportation.wv.gov/highways/contractadmin/specifications/Pages/default.aspx)

**Print Version:** Hard copies of the 2017 Standard Specifications Roads and Bridges are available thru Contract Administration.
An order form for the new book is on Specifications Website. A link to the Specifications pages is here: [http://www.transportation.wv.gov/highways/contractadmin/specifications/Pages/default.aspx](http://www.transportation.wv.gov/highways/contractadmin/specifications/Pages/default.aspx)
2017 Specifications Committee
The Specification Committee typically meet every other month; 2017 meetings will be held in February, April, June, August, October, and December.
*Calendar subject to change, updates will be given, as needed.*

Specifications Committee Website
A copy of the meeting agenda can be found on the Specifications Committee Website
[http://www.transportation.wv.gov/highways/contractadmin/specifications/SpecComit/Pages/default.aspx](http://www.transportation.wv.gov/highways/contractadmin/specifications/SpecComit/Pages/default.aspx)

Material Procedures
Material Procedures (MPs) referenced in provisions are available upon request.

For questions regarding the Standard Specifications Roads and Bridges, Supplemental Specifications, Project Specific Special Provisions, or the Specifications Committee please e-mail [DOHSpecifications@wv.gov](mailto:DOHSpecifications@wv.gov)
File Format Structure and Progression of items thru Specifications Committee

The purpose of the below protocol is to provide guidance on the file structure of Proposed Specification & Project Specific Special Provision as they progress thru Specification Committee. This procedure would facilitate a means of tracking changes from meeting to meeting; as the agendas & provisions are posted publicly online on the Spec Committee website.

TYPES OF PROVISIONS:
There are three standard types of provisions typically discussed in committee:
1. Specification Changes – These are permeant changes to the WVDOT Standard Specifications.
   - Unless inserted into a project proposal, these changes typically go into effect in January (of subsequent year) with the Supplemental Specifications.
2. Project Specific Special Provisions (SP) – Are applied to specifically designated projects.
3. Updates to previously approved SP – Are changes/edits/updated to SP that have been approved by spec committee.

NEW BUSINESS ITEMS:
New items to should be setup & submitted in the following format:
2. Project Specific Special Provisions (SP) – Will be shown in all black.
3. Updates to approved SP – Shown as red-line copy

Each items should also include a description with:
- Brief overview of item
- Background info and/or reason for change

NOTE: Red-line copy is a form of editing in which indicate removal or addition of text. You can redline a Microsoft Word document by using the built in “Track Changes” feature or you can manually redline document with font color changes & strike-through.

OLD BUSINESS ITEMS:
Updated provisions that were discussed at the last committee meeting should be setup in the following format:
- Redline copy from prior meeting would not be shown
- Redline copy of new changes/updates (from previous meeting)

PROGRESSION OF ITEMS THRU COMMITTEE AND APPROVAL:
Depending on how important the project and/or comments/discussion of item at previous meeting, than several things can happen in no particular order
- Few comments/discussion/minor changes ... will recommend approval of item at next meeting
- A lot of comments/discussion ... will not recommend approval at next meeting; item will be updated and reviewed again at next meeting.
- SP’s in committee may be used in advertised project. Hope to work to address comments & finish approving at subsequent meeting.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: ______________________________
FEDERAL PROJECT NUMBER: ______________________________

FOR

SECTION 616
PILING

DRILLED AND GROUTED MICROPILES

DELETE THE ENTIRE SECTION AND SUBSTITUTE THE FOLLOWING:

616.1-DESCRIPTION:

This work is for the furnishing of all materials, products, accessories, tools, equipment, services, transportation, labor and supervision and manufacturing techniques required for testing and installing drilled and grouted micropiles.

The Contractor shall select installation means and methods and shall install a system of micropiles as shown on the Plans. The Engineer has already established the minimum diameters and bond zone length, locations and required load capacities and tolerable deflections of the micropiles. The micropile load capacities and deflections shall be verified by testing as specified herein.

In selecting the micropile installation means and methods, the Contractor is advised that the casing must extend a minimum of 1’-0” into bedrock unless otherwise noted. The estimated top of bond zone is shown on the contract plans for each substructure location, and will be determined in the field by the Engineer. The bond zone is to be in competent rock to the lengths shown on the drawings.

Production micro pile installation, except reaction piles if used, shall not begin prior to the completion of pre-production verification load test, the results are known, the report of the test submitted to the Engineer and accepted.

The Contractor will monitor and record the installation of all micropiles, will record the load test data, and interpret the results of all load tests as described in 616.4 of this Special Provision.
616.2-MATERIALS:

616.2.1-Water: Water for mixing grout will be potable, clean and free of substances that may be in any way deleterious to the grout or steel. Water shall be from a non-variable source and shall be in accordance with AASHTO T26.

616.2.2-Admixtures: Admixtures shall conform to the requirements of Section 707. Admixtures, which control bleed, improve flowability, reduce water content and retard set may be used in the grout subject to the review and acceptance by the Engineer. Accelerators will not be permitted. Admixtures with chlorides will not be permitted. Admixtures shall be compatible with the grout and mixed in accordance with the Manufacturer's recommendations. Their use will only be permitted after appropriate field tests on fluid and set grout properties.

616.2.3-Cement: All cement shall be Portland cement conforming to Subsection 701.1, ASTM C150 Type I, Type II, Type III or Type V and shall be the product of one manufacturer. The Contractor shall develop a mix design for the concrete grout and determine the maximum amount of water that can be added to achieve the specified grout strength. If the brand or type of cement is changed during a project, additional grout mix tests are to be conducted to ensure consistency of quality and performance in situ.

616.2.4-Fine Aggregate: Inert fillers such as sand may be used in the grout in special situations with prior approval of the Engineer. If sand is used as a Fine Aggregate it shall meet the requirements of Section 702.1.

616.2.5-Reinforcement: Reinforcing steel shall be as detailed in the Contract Plans shall be either:
   1. Solid deformed bars conforming to AASHTO M31, Grade 60 or Grade 75, or AASHTO M275, Grade 150; or
   2. Continuous-thread, hollow core steel bars (hollow injection rods) conforming to the quality, ductility and deformation requirements of AASHTO M31, Grade 60, Grade 75, Grade 85, Grade 95, or Grade 150.

   Bar couplers, if required shall meet the requirements specified in Article 5.11.3 of the AASHTO LRFD Bridge Design Specifications and shall develop the ultimate tensile strength of the bars without failure.

616.2.6-Pipe/Casing: If pipe or casing is required to support loads or reduce deflection, the permanent steel pipe/casing shall meet the tensile requirements. Permanent steel casing/pipe shall meet the requirements of API 5L Grade X52 or better or API CT Grade N80 or better.

   Pipe/Casing shall be “Prime” steel meeting the requirements of API 5L, Grade X52 or better or API 5CT Grade N80 or better (API, 1998). Coupon testing shall meet the requirements of ASTM A370 REV A. Do not join steel pipe sections by shop or field welding. Drill casing shall be of the flush joint type.

   Pipe/casing splices or threads shall develop the required nominal strength (both in compression and in tension) of the pipe cross section and shall provide proper alignment so that no eccentricity or angle occurs between the axes of the two lengths spliced.
Refer to Standard Specification Section 106.1.1.5 in regard to the “Use of Domestic Steel Products” which therein references “Buy America Requirements” that are applicable for this material.

Certified mill test reports shall provide sufficient information to satisfy the requirements of the Standard Specifications Section 106.1.1.5 in regard to providing domestic steel.

**616.2.7-Centralizers:** Centralizers shall be fabricated from plastic, steel or material that is non-detrimental to the inner reinforcing steel. Wood or aluminum shall not be used. Centralizers shall provide for the grout cover specified in Article 616.5.1 and shall permit the free flow of grout without misalignment of the reinforcement.

**616.2.8-Grout:** The minimum grout strength required will be as specified in the Contract Plans. Expansion additives in grout will not be allowed. Grout shall not be re-tempered or used after it has begun to set. Quality control and testing of grout shall conform to the applicable provisions of Subsections 601.3 and 601.4. The Contractor shall develop a mix design for the concrete grout and determine the maximum amount of water that can be added to achieve the specified grout strength. If the brand or type of cement is changed during a project, additional grout mix tests are to be conducted to ensure consistency of quality and performance in situ.

**616.2.9-Plates and Shapes:** Structural steel plates and shapes for pile top attachments shall conform to AASHTO M270, Grade 36 or Grade 50 as specified in the Contract Plans.

**616.2.10-Corrosion Protection:** Coating requirements shall be as specified in the Contract Plans. If epoxy coating is used, the minimum thickness of coating shall be 0.007 in. Epoxy coating shall be in accordance with ASTM A775 and Section 709.1 of the Standard Specifications. Bend test requirements shall be waived. Epoxy coating shall be factory applied only; on site epoxy coating shall not be permitted, except for minor field touch up. Any field touch up shall be completed per manufacturer’s specifications. Galvanization shall not be allowed as a means of corrosion protection for bars with yield strengths higher than Grade 75.

**616.3-CONSTRUCTION METHODS**

The Engineer has designed the micropiles. The estimated top of the bond zone is shown on the drawings. The actual top of bond zone elevation is expected to differ from the estimated elevation. The governing criterion for installation is the minimum bond zone length as shown on the drawings.

**616.3.1-Allowable Tolerances:** Centerline of piling shall not be more than 3 in. from indicated plan location at the top of pile.

Pile-hole alignment of vertical piles shall be within 2% of design alignment.

Pile-hole alignment of piles inclined up to 1:6 shall be within 4% of design alignment.

Pile-hole alignment of piles inclined greater than 1:6 shall be within 7% of design alignment.

Top elevation of pile shall be within + 1 in. to – 2 in. of the design vertical elevation. Centerline of core reinforcement shall not be more than ¼ in. from centerline of piling.

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616.3.2-Ground Conditions: The locations of test borings and logs of borings are provided in the Contract plans. Ground water levels are anticipated to be at the level of the river.

616.4-SUBMITTALS:

616.4.1-Pre-Construction Submittals: At least four weeks prior to the start of micropile installation, the Contractor shall submit four copies of a project reference list to the Engineer for approval, verifying the successful completion by the Contractor of at least five projects in the last five years involving construction totaling at least 100 micropiles of similar capacity to those required in these Plans and Specifications. The Contractor must have previous micropile drilling and grouting experience in soil/rock similar to these project conditions.

At least two-four weeks prior to the start of micropile construction, the Contractor shall submit four copies of a list identifying the on-site supervisors and drill rig operators and load testers assigned to the project to the Engineer for approval. The list shall contain a detailed summary of each individual’s experience in micropile construction and testing.

1. On-site supervisors shall have a minimum of two years’ experience in supervising construction of micropile installations of similar size and difficulty to those shown in the Plans and with similar geotechnical conditions to those described in the geotechnical report. The work experience shall be direct supervisory responsibility for the on-site micropile construction operations. Project management level positions indirectly supervising on-site micropile construction operations shall not be considered to be acceptable for this experience requirement.
2. Drill rig operators shall have a minimum one year experience in construction of micropile foundations.
3. Load testers shall have a minimum one year experience in testing of micropile foundations.

The Engineer shall approve or reject the Contractor’s qualifications and field personnel within ten working days after receipt of the submission. Work shall not be started on any micropile installation until the Contractor’s qualifications and field personnel are approved by the Engineer. The Engineer may suspend the micropile installation if the Contractor substitutes unapproved field personnel without prior approval by the Engineer. The Contractor shall be fully liable for the additional costs resulting from the suspension of work and no adjustments in contract time resulting from such suspension shall be allowed.

At least two-four weeks prior to the start of any micropile construction the Contractor shall submit their proposed schedule, construction methods and equipment prior to the placement of the pre-production micropile. The same crew which places the pre-production micropile shall also place the production micropiles. The Contractor shall allow seven days for acceptance.

Additional submittal(s) shall include:
1. Grout mix designs, and the procedure for placing the grout.
2. Detail for centralizer clips between the inner reinforcement and outer steel casings.
3. Detailed description of the drilling methods, construction procedure and sequence, and the proposed method for establishing and stabilizing the position of piles. Information on the headroom and space requirements for the installation equipment shall be provided in order to verify that the proposed installation equipment can perform at the site.
4. Detailed plans for the method proposed for the testing of the micropiles shall be provided prior to beginning the tests. This shall include all necessary drawings and details to clearly describe the method and the procedure to be used.

616.4.2 - Construction Records Submittals: The Contractor shall submit the following information two to four weeks prior to construction:

1. Certified mill test reports, properly marked, for the inner reinforcement steel and permanent casing showing the ultimate strength, yield strength, elongation, dimensions and material properties.
2. Calibration reports for each load cell, test jack, pressure gauge and master pressure gauge to be used. The calibration tests shall have been performed within six months of the date submitted.
3. Grout compression test results.
4. The working drawings shall include micropile installation details giving:
   a. Micropile type, number, location and pattern
   b. Micropile batter and orientation
   c. Micropile factored design load
   d. Maximum deflection of piles at factored design load
   e. Type and size of reinforcing steel
   f. Details of central reinforcing steel centralizers
   g. Minimum total bond length
   h. Total micropile length
   i. Tip elevation
   j. The proposed mix design for the cement grout.
   k. Grouting volumes and maximum pressures
   l. Micropile top connection details
   m. Micropile cut-off elevation
   n. Anticipated ground conditions

Shop drawings shall be submitted for review and approval for all structural steel, including micropile components, and corrosion protection system and shall be signed and sealed by a West Virginia Registered Professional Engineer.

For steel pipe used as permanent pipe/casing, or core steel, a minimum of two representative coupon tests or mill certifications shall be submitted on each truckload delivered to the project. A truckload is considered 40 tons or less. Certified mill test reports for the reinforcing steel shall be submitted for record purposes as the materials are delivered. The ultimate strength, yield strength, elongation, and chemical analyses shall be included.

For steel pipe/casing that is in tension and requires threaded joints, data demonstrating the adequacy of the joint under tensile loads shall be submitted.

The Contractor shall submit the grout mix designs, including details of all materials to be incorporated, and the procedure for mixing and placing the grout for approval. The submittal shall include certified test results verifying the acceptability of the proposed grout mix designs.

The Contractor shall submit for review and approval, detailed plans for the method proposed for testing of micropiles prior to any testing. The plans shall include all necessary drawings and details to clearly describe the test method and equipment proposed.
The Contractor shall submit for review and acceptance the proposed micropile load testing procedure. The testing procedure shall be provided in accordance with project specified schedules and shall be signed and sealed by a West Virginia Registered Professional Engineer.

The micropile verification load testing procedure shall be in general conformance with the latest versions of ASTM D1143 for compression or ASTM D3689 for tension as applicable, and shall indicate the minimum following information:

1. Type and accuracy of apparatus for measuring load
2. Type and accuracy of apparatus for applying the load
3. Type and accuracy of apparatus for measuring the pile deformation
4. Type and capacity of reaction load system, including sealed design drawings
5. Calibration reports for hydraulic jack and load and deformation devices

The Contractor shall submit calibration reports for each test jack, pressure gauge, load cell and master pressure gauge to be used. The calibration tests shall be performed by an independent testing laboratory. Calibration of pressure gauges shall be within six months prior to the date submitted. Testing shall not commence until these calibrations have been approved.

All Contractor construction submittals shall be submitted at least two (2)-four (4) weeks prior to the start of micropile construction. The Contractor shall submit the number of copies required by the contract documents of the required construction submittals for acceptance by the Engineer. Work shall not begin until the appropriate submittals have been approved.

616.4.3-Installation Records: The Contractor will prepare an installation record during construction for each micropile and provide to the Engineer. The records will include the following minimum information:

1. Pile Identification using the micropile designation shown in the plans, including inspector name, drill method and drill operator
2. Pile drilling start and finish times
3. Existing ground surface elevation
4. Top of Rock Elevation
5. Bottom of Casing Elevation
6. Material Type within bond zone
7. Final tip elevation
8. Cut-off elevation
9. Description of unusual installation behavior or conditions including deviations from planned parameters
10. Grout pressures attained, if applicable
11. Grout quantities pumped, including start and finish times
12. Pile materials and dimensions
13. Characteristics of all materials encountered during the drilling process, and their specific location(s) within the holes
14. The location of special features such as mud seams, open cracks, broken rock, etc.
15. Points where abnormal loss or gain of drill water has occurred
16. Groundwater levels or other items of interest for grouting
17. All significant actions of the bit
18. If any weak material, such as coal, clay, weathered rock or the like is encountered within the required bond length, the hole shall be extended to compensate for the weak material.

19. In addition, as-built drawings showing the locations of micropiles, their depths and inclination, and the details of their composition shall be submitted.

616.5-INSTALLATION:

The Contractor shall select the drilling method, the grouting procedure and the grouting pressure used for the installation of the micropiles. The procedures shall not damage adjacent facilities or newly installed piles.

The drilling equipment and methods shall provide an open borehole to the defined nominal diameter and full-length, as shown on Drawings, prior to placing grout and reinforcement. The micropile installation technique and sequence shall be consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project.

The drilling equipment, methods and sequence shall be suitable for drilling through the conditions to be encountered, with minimal disturbance to these conditions or any overlying or adjacent structure or service.

The borehole must remain open to the defined nominal diameter, full length prior to placing grout and reinforcement.

The inner reinforcement steel with centralizers shall be lowered, not dropped, into the stabilized drill holes to the desired depth. Partially inserted inner reinforcement bars shall not be driven or forced into the hole such that there will be no interconnection or damage to piles in which the grout has not achieved final set.

Centralizers shall be provided at 10 ft. maximum spacing on central reinforcement. The uppermost and lowermost centralizers shall be located a maximum of 5 ft. from the ends of the micropile. Centralizers shall permit the free flow of grout without misalignment of the reinforcement.

The grout shall be injected by tremie beginning at the bottom of the drilled borehole. The pipe casing shall be filled with a grout with a 28 day compressive strength as indicated on the Contract drawings and shall be without voids from bottom to top of micropile. The entire bond zone shall be completely filled with grout.

During construction, the Contractor shall observe the conditions in the vicinity of the micropile construction site on a daily basis for signs of ground heave or subsidence. If such signs of movement are observed, the Contractor will notify the Engineer immediately. The Contractor shall immediately suspend or modify drilling or grouting operations if ground heave or subsidence is observed, if the micropile structure is adversely affected, or if adjacent structures are damaged from the drilling or grouting. If the Engineer determines that the movements require corrective action, the Contractor shall take the corrective actions necessary to stop the movement or perform repairs. If the Engineer determines that problem encountered is the result of the Contractor’s methods or operations or due to the failure to follow the specified/approved construction sequence, the costs of providing corrective actions will be borne by the Contractor.

The Contractor shall verify pile top elevations and adjust all installed micropiles to the specified elevations.

Grout shall be injected in accordance with Article 616.5.1.
616.5.1-**Grouting:** The Contractor shall provide calibrated systems and equipment to measure the grout quality including, at a minimum, compressive strength according to AASHTO T106/ASTM C109 and grout density, quantity, and pumping pressure during the grouting operations. The Contractor shall keep and provide records showing the quantities, test data and grout pressures for inspection by the Engineer.

Grouting of the entire length of bond zone shall occur in the same day as drilling when installing micropiles in materials such as consolidated clays and weak rock, which can deteriorate and soften from exposure.

After drilling, the hole shall be flushed with water and/or air to remove drill cuttings and/or other loose debris.

The Contractor shall provide a stable, homogenous neat cement grout or a sand-cement grout with a minimum 28-day unconfined compressive strength as specified in the Contract Plans. The grouting equipment shall produce a collodially mixed grout free of lumps, undispersed cement or any other evidence of poor or incomplete mixing. Admixtures, if used, shall be mixed in accordance with manufacturer’s recommendations. The pump shall be equipped with a pressure gauge to monitor grout pressures. The pressure gauge shall be capable of measuring pressures of at least 150 psi or twice the actual grout pressures used by the Contractor, whichever is greater. The grouting equipment shall be sized to enable the grout to be pumped in one continuous operation. The grout shall be kept in constant agitation prior to pumping. A second pressure gauge shall be paced at the point of injection.

If pressure grouting is required, the pile should be pressure grouted through the casing. When the pressure reaches 100 psi, the casing shall be extracted a minimum of 2-ft increments until the entire bond zone is pressure grouted. Once the bond zone is grouted, the remaining casing can be tremie filled. Do not pump at a rate greater than one cubic foot per minute. Gravity method shall be used in lieu of pressure grouting if so noted in the contract plans.

Control the grout pressure and grout takes to prevent heave or damage.

The grout shall be placed within 1 hour or less after mixing the grout, or within the time recommended by the manufacturer, if admixtures are used. Grout not placed within the allowed time limit will be rejected.

The grout shall be injected from the lowest point of the drill hole (by tremie methods) until clean, pure grout flows from the top of the micropile. The entire bond zone shall be completely filled with grout. The tremie grout may be pumped through grout tubes, hollow stem augers, or drill rods. Subsequent to tremie grouting, all grouting operations associated with, for example, extraction of drill pipe/casing and pressure grouting, must ensure complete continuity of the grout column. The use of compressed air to directly pressurize the fluid grout is not permissible.

The entire pile shall be grouted to the design cut-off level. Minimum grout cover shall be:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Minimum Cover on Bar (in)</th>
<th>Minimum Cover on Coupler (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micropiles in Soil</td>
<td>1</td>
<td>1/4</td>
</tr>
<tr>
<td>Micropiles in Rock</td>
<td>1/2</td>
<td>1/4</td>
</tr>
<tr>
<td>Coated or Encapsulated Bars</td>
<td>1/2</td>
<td>1/4</td>
</tr>
</tbody>
</table>
Upon completion of grouting, the grout tube may remain in the hole, but it shall be filled with grout. Grout within the micropiles shall be allowed to attain the minimum design strength prior to being loaded.

If the Contractor uses a post-grouting system, all relevant details including grouting pressure, volume, location and mix design, shall be submitted as part of Article 616.4.2.

The Contractor shall make two sets of six two-inch cubes for each day of grouting one set near the beginning of the day and one set near the end of the day) and shall test two cubes after seven days cure, two cubes after 28 days of cure, and keep two in reserve. Cubes shall be cured and tested according to ASTM C109.

616.5.2-Pile Splices: If used, pile splices shall be constructed to develop the required factored design strength of the pile cross section and shall be without eccentricity or kink angle between the axes of the two lengths spliced. No welding will be permitted in a pile splice. The Contractor must provide a detail and receive approval of the proposed micropile splice prior to its use.

616.5.3-Pile Damage: If a micropile is deemed unacceptable by the Engineer due to improper or inadequate construction or to damage caused by the Contractor, that micropile shall be replaced unless otherwise approved by the Engineer. Replacement shall be at the Contractor's expense. Any modification, which requires changes to the structure, shall have prior review by and the acceptance of the Engineer.

616.6-Pile Load Tests:

Pile load tests shall be performed to verify the adequacy of the design and construction of the micropile system. Piles shall be tested under tension loads prior to testing under compression loads.

616.6.1-Pre-Production Verification Load Test: Perform one pre-production verification load test (on sacrificial pile) on land in an area acceptable to the Engineer. This pile load test shall be performed according to ASTM D1143 for compression or ASTM D3689 for tension as applicable, except as modified herein. The test pile with reaction/support piles or anchors shall be constructed prior to the commencement of the installation of production micropiles to confirm the Contractor's installation methods.

The micropile load test results shall verify the suitability of the design and installation methods, and shall be reviewed and accepted by the Engineer prior to the Contractor’s initiation of production micropile installation.

The drilling and grouting methods, pipe/casing and other reinforcement details, and depth of embedment for test the test pile shall be identical to the production piles, except where approved otherwise by the Engineer.

Commence the load test once the grout reaches the required design strength, and a minimum waiting period of 72 hours. The load test system may be setup during this period. The primary and auxiliary systems of measurement may also be setup during this period.

For sacrificial test piles, further load cycles may be conducted to failure.

The micropile load verification test results will be reviewed and accepted by the Engineer within seven days prior to installing the production micropiles.

1. The load testing program submittal shall be furnished to the Engineer prior to the start of load testing. This submittal shall provide the following information as a minimum:
Sketch of the Load Test Set-up:

a. Type and Accuracy of apparatus for measuring load
b. Type and Accuracy of apparatus for applying load
c. Type and Accuracy of apparatus for measuring the pile deformation
d. Type and capacity of reaction load system
e. Hydraulic jack and load cell calibration reports (both are required)

2. The drilling and grouting methods, casing diameter and depth of bond zone of the test pile shall be identical to the production piles.

3. The jack shall be positioned at the beginning of the test such that the unloading and repositioning of the jack during the test will not be required.

Incrementally load the test micropile in accordance with the following table. The pile top-movements will be measured and recorded at the end of the hold time for each load increment. Start measuring the hold time as soon as each test load increment is applied. Hold the 0.975 FDL for 10 minutes. Measure and record pile top-movement during this 0.975 FDL hold-period at 1, 2, 3, 4, 5, 6, 10, 20, 30, 50 and 60 minutes:

<table>
<thead>
<tr>
<th>Int.</th>
<th>Load</th>
<th>Hold Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AL</td>
<td>----</td>
</tr>
<tr>
<td>2</td>
<td>0.075 FDL</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>0.15 FDL</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>0.225 FDL</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>0.30 FDL</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>0.375 FDL</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>0.375 FDL</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>AL</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>0.15 FDL</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>0.30 FDL</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>0.375 FDL</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>0.45 FDL</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>0.525 FDL</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>0.60 FDL</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>0.675 FDL</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>0.75 FDL</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>AL</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>0.30 FDL</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>0.60 FDL</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>0.675 FDL</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>0.75 FDL</td>
<td>1</td>
</tr>
<tr>
<td>21</td>
<td>0.825 FDL</td>
<td>4</td>
</tr>
<tr>
<td>22</td>
<td>0.90 FDL</td>
<td>4</td>
</tr>
<tr>
<td>23</td>
<td>0.975 FDL</td>
<td>60 (Creep Test)</td>
</tr>
<tr>
<td>24</td>
<td>AL</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>0.30 FDL</td>
<td>1</td>
</tr>
</tbody>
</table>
The Contractor shall submit a written report providing micropile geometry and construction details within 7 working days after the completion of the verification test. The acceptance criteria for micropile verification load tests shall be:

1. The pile shall sustain the compression and tension design loads (0.75 FDL) with no more than the specified permissible total vertical movement at the top of the pile as measured relative to the top of the pile prior to the start of testing. If an Alignment Load is used, then the allowable movement will be reduced by multiplying by a factor of (0.75 FDL – AL)/0.75 FDL).

2. Test piles shall have a creep rate at the end of the 0.975 FDL increment that is not greater than 0.04 in./log cycle time (1 to 10 minutes) or 0.08 in./log cycle time (6 to 60 minutes) and has a linear or decreasing creep rate.

3. Failure does not occur by 1.50 FDL. Failure is defined as a slope of the load versus deflection curve (at end of increment) exceeding 0.025 in./kip.

### 616.6.2-Proof Load Tests During Construction:

One production micropile at Abutment 1 and one production pile at Abutment 2 the locations noted on the plans will be Proof Load Tested. Axial Pile load tests shall be performed according to ASTM D 3689, except as modified herein. The production piles are tested after pile installation to confirm the installation procedure has remained constant and to assure adequate uplift capacity.

Commence the load test once the grout reaches the required design strength, and a minimum waiting period of 72 hours. Neighboring production micropiles may be used as reaction piles. The load test system may be setup during this period. The primary and auxiliary systems of measurement may also be setup during this period.

The micropile load test results will be reviewed and accepted by the Engineer within seven days.

1. The load testing program submittal shall be furnished to the Engineer prior to the start of load testing. This submittal shall provide the following information as a minimum:
   - Sketch of the Load Test Set-up
   - Type and Accuracy of apparatus for measuring load
   - Type and Accuracy of apparatus for applying load

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>26</td>
<td>0.60 FDL</td>
<td>1</td>
</tr>
<tr>
<td>27</td>
<td>0.90 FDL</td>
<td>1</td>
</tr>
<tr>
<td>28</td>
<td>0.975 FDL</td>
<td>1</td>
</tr>
<tr>
<td>29</td>
<td>1.05 FDL</td>
<td>4</td>
</tr>
<tr>
<td>30</td>
<td>1.125 FDL</td>
<td>4</td>
</tr>
<tr>
<td>31</td>
<td>1.20 FDL</td>
<td>4</td>
</tr>
<tr>
<td>32</td>
<td>1.275 FDL</td>
<td>4</td>
</tr>
<tr>
<td>33</td>
<td>1.35 FDL</td>
<td>4</td>
</tr>
<tr>
<td>34</td>
<td>1.425 FDL</td>
<td>4</td>
</tr>
<tr>
<td>35</td>
<td>1.50 FDL</td>
<td>4</td>
</tr>
<tr>
<td>36</td>
<td>1.20 FDL</td>
<td>4</td>
</tr>
<tr>
<td>37</td>
<td>0.90 FDL</td>
<td>4</td>
</tr>
<tr>
<td>38</td>
<td>0.60 FDL</td>
<td>4</td>
</tr>
<tr>
<td>39</td>
<td>0.30 FDL</td>
<td>4</td>
</tr>
<tr>
<td>40</td>
<td>AL</td>
<td>15</td>
</tr>
</tbody>
</table>
Type and Accuracy of apparatus for measuring the pile deformation
Type and capacity of reaction load system
Hydraulic jack and load cell calibration reports (both are required).

2. The jack shall be positioned at the beginning of the test such that the unloading and repositioning of the jack during the test will not be required.

Incrementally load the designated micropiles to be tested in accordance with the following schedule. The pile top-movement will be measured and recorded at the end of the hold time for each load increment. Start measuring the hold time as soon as each test load increment is applied. Hold the 1.00 FDL for 10 minutes. Measure and record pile top-movement during this 1.00 FDL hold-period at 1, 2, 3, 4, 5, 6, 10, 20, 30, 50 and 60 minutes:

<table>
<thead>
<tr>
<th>Int.</th>
<th>Load</th>
<th>Hold Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AL</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>0.10 FDL</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>0.20 FDL</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>0.30 FDL</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>0.40 FDL</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>0.50 FDL</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>0.60 FDL</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>0.70 FDL</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>0.80 FDL</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>0.90 FDL</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>1.00 FDL</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>0.75 FDL</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>0.50 FDL</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>0.25 FDL</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>AL</td>
<td>1</td>
</tr>
</tbody>
</table>

The acceptance criteria for micropile proof load tests shall be:
1. The pile shall sustain the tension design loads (0.75 FDL) with no more than the specified minimum permissible total vertical movement at the top of the pile as measured relative to the pile prior to the start of testing. If an Alignment Load is used, then the allowable movement will be reduced by multiplying by a factor of \[(0.75 \text{ FDL} - \text{AL})/0.75 \text{ FDL}\].
2. Test piles shall have a creep rate at the end of the 1.00 FDL increment that is not greater than 0.04 in./log cycle time (1 to 10 minutes) or 0.08 in./log cycle time (6 to 60 minutes) and has a linear or decreasing creep rate.
3. Failure does not occur by 1.00 FDL test load.

If a production micropile fails to meet the acceptance criteria, modifications shall be made to the design, the construction procedures, or both, it shall be replaced at no additional cost to the Department.

Any modification that requires changes to the structure shall have prior review and acceptance of the Engineer. The cause for any modifications of design or construction
procedures shall be decided in order to appropriately determine any additional cost implications.

616.7-METHOD OF MEASUREMENT:

The number of linear feet of piles of the type specified to be paid for will be the actual length of piles remaining in the finished structure. All cut-offs remain the property of the Contractor for disposition.

The Contractor will be paid for grout used that is in excess of two times the theoretical amount required to fill an empty core hole from the bottom of the rock socket to the finished pile top elevation. The excess grout will be paid for by Force Account per Section 109.4 of the standard specifications.

616.8-BASIS OF PAYMENT:

The quantities, determined as provided above, will be paid for at the contract unit prices bid for the items listed below, which prices and payments shall be full compensation for furnishing all materials and doing all the work prescribed in a workmanlike and acceptable manner, including all labor, materials, tools, equipment, supplies and incidentals necessary to complete the work. The cost of preboring, filling of voids and splicing, except as noted in this special provision, shall be included in the price bid for the micropiles.

Loading tests will be paid for at the contract unit price for “Pile Loading Test”, or, in the absence of such a price bid, they will be paid for as extra work.

616.9-PAY ITEMS:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>616006-001</td>
<td>Micropile, “size”</td>
<td>Linear Feet</td>
</tr>
<tr>
<td>616007-001</td>
<td>Pile Loading Test, “Static”</td>
<td>Each</td>
</tr>
</tbody>
</table>

“size” shall be the size of the Micropile
“type” shall be the type of loading test.
715.42-TRAFFIC SIGNAL MATERIALS AND EQUIPMENT:

715.42.8-Cabinets:

DELETE SECTION 715.42.8 AND REPLACE WITH THE FOLLOWING:

715.42.8-Cabinets: The following are minimum design requirements for a TS2 Type 1 traffic control cabinet assembly. As a minimum, the cabinet assembly shall meet all applicable sections of the NEMA Standard publication No.TS2-2003 or most recent version. Where differences occur, this specification shall govern.

715.42.8.1-Cabinet Design and Construction: The cabinet shall be constructed from type 5052-H32 aluminum with a minimum thickness of 0.090 to 0.125 inches. The cabinet shall be designed and manufactured with materials that will allow rigid mounting, whether intended for pole, base or pedestal mounting. The cabinet must not flex on its mount. A rain channel shall be incorporated into the design of the main door opening to prevent liquids from entering the enclosure. The cabinet door opening must be a minimum of 80 percent of the front surface of the cabinet. A stiffener plate shall be welded across the inside of the main door to prevent flexing. Top of the cabinet shall incorporate a slope toward the rear to prevent rain accumulation.

Unless otherwise specified, the cabinet shall be supplied with a natural aluminum finish. Sufficient care shall be taken in handling to ensure that scratches are minimized. All surfaces shall be free from weld flash. Welds shall be smooth, neatly formed, free from cracks, blowholes and other irregularities. All sharp edges shall be ground smooth. Where painted cabinets are specified, the exterior shall be degreased and primed with a spray applied iron phosphate coat equivalent to a four-stage iron phosphate coat prior to painting. The final coat shall consist of a powder coat paint (TGIC or equivalent) applied with a minimum thickness of 2 mils.

All seams that are not welded shall be sealed with RTV sealant or equivalent material on the interior of the cabinet. All cabinets shall be supplied with a minimum of two (2) removable shelves manufactured from 5052-H32 aluminum. **Shelf-Shelves** shall be a...
minimum of 10 inches deep. Shelves to be designed to accommodate a minimum 50 pound loading.

The shelf shelves shall have horizontal slots at the rear and vertical slots at the front of the turned down side flange. The shelf shelves shall be installed securely by first inserting the rear edge of the shelf on the cabinet rear sidewall mounting studs, then lowering the shelf on the front sidewall mounting studs. The front edge of the shelf shall have holes punched every 6 inches to accommodate tie-wrapping of cables/harnesses. A minimum of two (2) sets of vertical "C" channels shall be mounted on each interior wall of the cabinet for the purpose of mounting the cabinet components. The channels shall accommodate spring mounted nuts or studs. All mounting rails shall extend to within 7 inches of the top and bottom of the cabinet. Sidewall rail spacing shall be no more than 9.0 inches center-to-center. Rear wall rail spacing shall be 19.0 inches center-to-center.

The main door and police door-in-door shall close against a weatherproof and dust-proof, closed-cell neoprene gasket seal. The gasket material for the main door shall be a minimum of 0.250 inches thick by 1.00 inch wide. The gasket material for the police door shall be a minimum of 0.250 inches thick by 0.500 inches wide. The gaskets shall be permanently bonded to the cabinet. The cabinet shall be equipped with a louvered air entrance. The air inlet shall be large enough to allow sufficient air flow per the rated fan capacity. Louvers must satisfy the NEMA rod entry test for 3R ventilated enclosures. A non-corrosive, vermin- and insect-proof, removable air filter shall be secured to the air entrance. The filter shall fit snugly against the cabinet door wall. The roof of the cabinet shall incorporate an exhaust plenum with a vent screen. Perforations in the vent screen shall not exceed 0.125 inches in diameter.

The main door cabinet shall be equipped with a three-point latching mechanism. The handle on the main door of the cabinet shall be manufactured from cast aluminum or stainless steel. The handle shall include a hasp for the attachment of an optional padlock. The cabinet door handle shall rotate counter-clockwise to open. The handle shall not extend beyond the perimeter of the main door at any time. The lock assembly shall be positioned so that the handle shall not cause any interference with the key when opening the cabinet door. The main door hinge shall be a one-piece, continuous piano hinge with a stainless steel pin running the entire length of the door. The hinge shall be attached in such a manner that no rivets or bolts are exposed. The main door shall include a mechanism capable of holding the door open at approximately 90, and/or (165 or 180) degrees under windy conditions. The main door shall be equipped with a standard Corbin #2 or exact equivalent. Minimum of two keys shall be supplied.

The police door-in-door shall be provided with a treasury type lock Corbin No. R357SGS or exact equivalent and have a minimum of one key. All base mounted cabinets require anchor bolts to properly secure the cabinet to its base. The cabinet flange for securing the anchor bolts shall not protrude outward from the bottom of the cabinet. Four anchor bolts shall be required for proper installation.

Each cabinet shall be of sufficient size to accommodate all equipment. At a minimum, the cabinet sizes are as follows:
POLE MOUNTED CABINETS | GROUND MOUNTED CABINETS
---|---
Height - 50 Inches | Height – 55 Inches
Width – 36 Inches | Width – 44 Inches
Depth – 17 Inches | Depth – 26 Inches

Dimensions shall not exceed these minimum dimensions by more than 2 inches.

Main door shall incorporate a shroud to cover the filtered louvered openings as appropriate for the design. The assembly is secured on the interior of the door over the filtered Louvers. The Shroud is louvered downward and matches the door louvers. All enclosures must be constructed, approved and marked in accordance with the requirements for Type 1 Industrial Control Panel Enclosures contained in UL 508A, the Standard for Industrial Control Panels. Enclosure must meet NEMA 3R rating requirements and be marked with UL approval sticker.

715.42.8.2-Terminals and Facilities/Main panel Design and Construction: The main panel shall be constructed from 5052-H32 brushed aluminum of 0.125 inches minimum thickness and installed so as to minimize flexing when plug-in components are installed. All main panels are provided with a mounting mechanism which allows easy access to all wiring on the rear of the panel without the removal of any cabinet shelves. Lowering of the main panel can be accomplished. Complete removal can be accomplished by the use of simple hand tools.

The terminals and facilities shall be available as a minimum in the following configuration:

- Sixteen load switch sockets, six flash transfer relay sockets, one flasher socket, 2- BIU sockets (expandable to 4), one 16-channel detector rack (expandable to 4) with one BIU, and one Type-16 MMU.

All load switch and flash transfer relay socket reference designators shall be silk-screen labeled on the front and rear of the main panel to match drawing designations. Socket pins shall be marked for reference on the rear of the panel. A maximum of eight load switch sockets may be positioned horizontally or stacked in two rows on the main panel. Main panels requiring more than eight load switch sockets shall be mounted in one horizontal or two vertical rows. All load switches shall be supported by a bracket, extending at least half the length of the load switch. The 16 load switch position main panels shall have all field wires contained on two rows of horizontally mounted terminal blocks. The upper row shall be wired for the pedestrian and overlap field terminations. The lower row shall be reserved for phase one through phase eight vehicle field terminations.

All field output circuits shall be terminated on a non-fused barrier type terminal block with a minimum rating of 10 amps. All field input/output (I/O) terminals shall be identified by permanent alphanumerical labels. All labels shall use standard nomenclature per the NEMA TS2 specification. It shall be possible to flash either the yellow or red indication on any vehicle movement and to change from one color indication to the other by use of a screwdriver. Field terminal blocks shall be wired to use four positions per vehicle or overlap phase (green, yellow, and red, flash). It shall not be necessary to de-buss field terminal blocks for flash programming.
The main panel shall contain at least one flasher socket (silk screen labeled) capable of operating a 15-amp, 2-pole, NEMA solid-state flasher. The flasher shall be supported by a bracket, extending at least half its length. One RC network shall be wired in parallel with each group of three flash-transfer relays and any other relay coils. All logic-level, NEMA-controller and Malfunction Management Unit input and output terminations on the main panel shall be permanently labeled. Cabinet prints shall identify the function of each terminal position. At a minimum, three 20-position terminal blocks shall be provided at the top of the main panel to provide access to the controller unit's programmable and non-programmable I/O. Terminal blocks for DC signal interfacing shall have a number 6-32 x 7/32 inch screw as minimum.

All main panel wiring shall conform to the following wire size and color:
- Green/Walk load switch output - brown wire - 14 gauge
- Yellow load switch output - yellow wire - 14 gauge
- Red/Don't Walk load switch - red wire output - 14 gauge
- MMU (other than AC power) - violet wire - 22 gauge
- Controller I/O - blue wire - 22 gauge
- AC Line (power panel to - black wire main panel) - 8 gauge
- AC Line (main panel) - black wire - 10 gauge
- AC Neutral (power panel to - white wire main panel) - 8 gauge
- AC Neutral (main panel) - white wire - 10 gauge
- Earth ground (power panel) - green wire - 8 gauge
- Logic ground - gray wire - 22 gauge
- Flash programming - Orange wire
- Flasher terminal - Black wire red or yellow field terminal - 14 gauge

All wiring, 14 AWG and smaller, shall conform to MIL-W-16878/1, type B/N, 600V, 19-strand tinned copper. The wire shall have a minimum of 0.010 inches thick PVC insulation with clear nylon jacket and rated to 105 degrees Celsius. All 12 AWG and larger wire shall have UL listed THHN/THWN 90 degrees Celsius, 600V, 0.020 inches thick PVC insulation and clear nylon jacketed. Connecting cables shall be sleeved in a braided nylon mesh or poly-jacketed. The use of exposed tie wraps or interwoven cables is unacceptable. All Terminals and Facilities configurations shall be provided with BIU wiring assignments consistent with NEMA TS2-2003 specifications. All Terminals and Facilities configurations shall be provided with sufficient RS-485 Port 1 communication cables to allow for the intended operation of that cabinet. Each SDLC communication cable connector shall be a 15-pin metal shell D subminiature type. The cable shall be a shielded cable suitable for RS-485 communications. All main panels shall be pre-wired for a Type-16 Malfunction Management Unit.

All wiring shall be neat in appearance. All cabinet wiring shall be continuous from its point of origin to its termination point. Butt type connections or splices are not acceptable. All connecting cables and wire runs shall be secured by mechanical clamps. Stick-on type clamps are not acceptable. The grounding system in the cabinet shall be divided into three separate circuits (AC Neutral, Earth Ground, and Logic Ground). These ground circuits shall be connected together at a single point as outlined in the NEMA TS2 Standard.
The main panel shall incorporate a relay, to be designed as K1, to remove +24 VDC from the common side of the load switches when the intersection is placed into mechanical flash. The relay shall have a momentary pushbutton located on the relay to apply power to the load switch inputs for ease of troubleshooting. All pedestrian push button inputs from the field to the controller shall be opto-isolated through the BIU and operate at 12 VAC. All wire (size 16 AWG or smaller) at solder joints shall be hooked or looped around the eyelet or terminal block post prior to soldering to ensure circuit integrity. Lap joint soldering is not acceptable.

715.42.8.3-Power Panel Design and Construction: The power panel shall integrated into the main panel and be located on the lower right portion of the cabinet. The power panel shall be wired to provide the necessary filtered power to the load switches, flasher(s), and power bus assembly. The power components shall be equipped with a removable plastic front cover for protection. The design will allow a technician to access the main and auxiliary breakers without removing the protective front cover.

The power panel portion of the main panel shall include the following components:

a. A minimum of one (1) 40-amp main breaker for 16 position cabinets. This breaker shall supply power to the controller, MMU, signals, cabinet power supply and auxiliary panels. Breakers shall be at minimum, a thermal magnetic type, UL listed for HACR service, with a minimum of 10,000 amp interrupting capacity.

b. A minimum of one (1) 15-amp auxiliary breaker. This breaker shall supply power to the fan, light and GFI utility outlet.

c. An EDCO model SHP-300-10 or exact approved equivalent surge arrester.

d. A 50 amp, 125 VAC radio interference line filter.

e. A normally-open, 50-amp, Solid State Relay (SSR). Shall be Crydom Model Number HA4875H or approved equal.

f. A minimum of one (1) 8-position neutral bus bar is capable of connecting three #12 wires per position.

g. A minimum of one (1) 6-position ground bus bar capable of connecting three #12 wires per position.

h. A minimum of one (1) NEMA type 5-15R GFI utility outlet.

i. The cabinet shall have a roll-out/swing-out concealable shelf/platform that can be used as platform for a laptop computer or other tools when the cabinet door is opened.

715.42.8.4-Power and SDLC Bus Panel: The Power and SDLC BUS Panel shall be manufactured from 0.090 - 0.125”, 5052-H32 aluminum. It shall provide a central location to supply filtered power for the controller, malfunction management unit, cabinet power supply, and all auxiliary equipment. It shall include the SDLC Bus connecting cables wired to a barrier type terminal block. As an alternate, SDLC Bus connections may be made via an SDLC Hub Assembly. All cabinet equipment requiring filtered power to operate shall be hardwired directly to the supplied barrier type terminal blocks on the Power and SDLC BUS Panel. All AC+ power sources shall be protected with a removable plastic cover plate. The SDLC Hub Assembly shall accommodate all D-Subminiature Female 15 (DB15) connectors as required, and a minimum of five (5) SLDC connections shall be provided.
715.42.8.5-Auxiliary Cabinet Equipment: The cabinet shall be provided with a thermostatically controlled (adjustable between 55-160 degrees Fahrenheit) ventilation fan in the top of the cabinet plenum. The fan plate shall be removable with the use of simple hand tools for serviceability. A minimum of one, maximum of two, exhaust fans shall be provided. The fan shall be a ball bearing type fan and shall be capable of drawing a minimum of 100 cubic feet of air per minute (CFM). The Fan/Thermostat assembly shall be connected to the Power panel by means of a 4 position plug-in cable or hardwired to an appropriate circuit breaker.

A LED cabinet lighting system may be used to illuminate the internal structure of the cabinet assembly. The LED cabinet lighting shall be a Luxem Bright LED module Model #772-Woo13 and approved power supply, or approved equivalent. This lighting system shall be wired directly to a door active switch mounted near the top of the door. Alternately, a fluorescent lighting fixture shall be mounted on the inside top of the cabinet near the front edge. The fixture shall be rated to accommodate at minimum a F15T8 lamp operated from a normal power factor UL or ETL listed ballast. The lamp shall be wired on the power panel or to a door activated switch mounted near the top of the door.

A re-sealable print pouch shall be mounted to the door of the cabinet. The pouch shall be of sufficient size to accommodate one complete set of folded cabinet prints. A minimum of two sets of complete and accurate cabinet drawings shall be supplied with each cabinet.

715.42.8.6-Vehicle Detection: A minimum of one Loop Detector rack shall be provided in each cabinet.

- Shall support up to 16 channels of loop detection (either eight 2 channel detectors or four 4 channel detectors), two 2-channel preemption devices and one BIU.

All connections to the back of the detector racks to the detector cards shall be soldered to a 44 terminal, double row, 3.962 mm (0.156 in.) contact spacing, Cinch Jones card edge connector 50-44A-30M, or equivalent centered vertically for each detector module. All designations shall correspond to the requirements of the TS2-2003 specification. Card Guides shall be provided on the top and bottom of the card rack for each connector position. Each cabinet shall contain a detector interface panel per each detector rack for the purpose of connecting field loops and vehicle detector amplifiers. The panels shall be manufactured from 0.090 or 0.125” thick 5052- H32 Aluminum and use barrier type terminal blocks.

One 16-position interface panel shall be provided for a 16-channel rack cabinet. The interface panel shall be secured to the left wall of the cabinet. Each interface panel shall allow for the connection of eight or sixteen independent field loops. A ground bus terminal shall be provided between each loop pair terminal to provide a termination for the loop lead-in cable ground wire. Each interface panel shall provide a barrier style terminal block to terminate the field wires for up to two 2-channel preemption devices.

Lightning protection device mounting holes shall be provided to accommodate the potential usage of an EDCO LCA-6, lightning protection device. A cable consisting of 20 AWG twisted pair wires shall be wired directly from the interface panel to the detector rack. The twisted pair wires shall be color coded red and white wire. No connectors shall be used to connect the interface panel to the detector rack.
All termination points shall be identified by a unique number and silk screened on the panel. Each detector rack shall accommodate rack mountable preemption devices such as EMTRAC or Opticom.

715.42.8.7-Cabinet Test Switches and Police Panel: A test switch panel shall be mounted on the inside of the main door. The test switch panel shall provide as a minimum the following:

a. Signals On/Off Switch - In the OFF position, power shall be removed from signal heads in the intersection. The controller shall continue to operate. When in the OFF position, the MMU shall not conflict or require reset.

b. Auto/Flash Switch - When in the flash position, power shall be maintained to the controller and the intersection shall be placed in flash. The controller shall not be stop timed when in flash. Wired according to NEMA-TS2-2003 the MMU forces the controller to initiate the start-up sequence when existing flash.

c. Stop Time Switch - When applied, the controller shall be stop timed in the current interval.

d. Control Equipment Power On/Off - This switch shall control the controller, MMU, and cabinet power supply AC power. The TS2 controller to be provided with the cabinet assembly shall provide vehicular and pedestrian call inputs from its keyboard while in the standard status display.

The police door switch panel shall contain the following:

a. Signals On/Off Switch - In the OFF position, power shall be removed from signal heads within the intersection. The controller shall continue to operate. When in the OFF position, the MMU shall not conflict or require reset.

b. Auto/Flash Switch – When in the flash position, power shall be maintained to the controller and the intersection shall be placed in flash. The controller shall be stop timed when in flash. Wired according to NEMA-TS2-1998 the MMU forces the controller to initiate the start-up sequence when exiting flash.

c. Auto/Manual Switch - Cabinet wiring shall include provisions for an Auto/Manual switch and a momentary push button or hand cord. The Auto/Manual switch and push button or hand cord shall not be provided unless it is called for in the Customer Specification.

All toggle type switches shall be heavy duty and rated 15 amps minimum. Single- or double-pole switches may be provided, as required. Any exposed terminals or switch solder points shall be covered with a non-flexible shield to prevent accidental contact. All switch functions must be permanently and clearly labeled. All wire routed to the police door-in-door and test switch push button panel shall be adequately protected against damage from repetitive opening and closing of the main door.

715.42.8.8-Auxiliary Devices:

715.42.8.8.1-Load Switches: Load switches shall be solid state and shall conform to the requirements of Section 6.2 of the NEMA TS2 Standard. Signal load switches shall have a minimum rating of 10 amperes at 120 VAC for an incandescent lamp load. The front of the load switch shall be provided with three indicators to show the input signal.
from the controller to the load switch. Load switches shall be dedicated per phase. The use of load switches for other partial phases is not acceptable. The full complement of load switches shall be supplied with each cabinet to allow for maximum phase utilization for which the cabinet is designed.

715.42.8.8.2–Flashers: The flasher shall be solid state and shall conform to the requirements of section 6.3 of the NEMA TS2 Standard. Flashing of field circuits for the purpose of intersection flash shall be accomplished by a separate flasher. The flasher shall be rated at 15 amperes, double pole with a nominal flash rate of 60 FPM. A full complement of flasher shall be provided.

715.42.8.8.3-Flash Transfer Relays: All flash transfer relays shall meet the requirements of Section 6.4 of the NEMA TS2 Standard. The coil of the flash transfer relay must be de-energized for flash operation. The full complement of relays shall be supplied with each cabinet to allow for maximum phase utilization for which the cabinet is designed.

715.42.8.8.4-Malfunction Management Units (MMU): Each cabinet assembly shall be supplied with one MMU as defined by the requirements of Section 4 of the NEMA TS2 Standard. Malfunction Management Units shall be a Type 16. The MMU shall be Model MMU-16 (EDI Model MMU-16) or approved equal.

715.42.8.8.5-Bus Interface Units (BIU): All BIUs shall meet the requirements of Section 8 of the NEMA TS2 Standard. A full complement of BIUs meeting Section 5.3.1.4 if the NEMA Publication No. TS2-2003 shall be supplied per cabinet. Bus Interface Units shall be supplied with each cabinet to allow for maximum phase and function utilization for which the cabinet is designed. A minimum of 3 BIUs shall be provided for each cabinet. Each Bus Interface Unit shall include power on, transmit and valid data indicators - all indicators shall be LEDs. A Type 1 Interface shall be defined as defined by Section 5.3, the controller interface shall conform to the Standard Publication NO. TS2-2003.

715.42.8.8.6-Cabinet Power Supply: The Cabinet power supply shall meet the requirements of Section 5.3.5 of the NEMA TS2 Standard. The Cabinet Power supply shall provide LED indicators for the line frequency, 12 VDC, 12 VAC, and 24 VDC outputs. The cabinet power supply shall provide (on the front panel) jack plugs for access to the +24 VDC for test purposes. Cabinet power supply shall be provide with each cabinet assembly per manufacturer’s specifications. And be wired directly to the Power Bus Assembly via a 12-pin Molex Robotic type connector Model# 54332-1270 or exact equivalent.

715.42.8.9-Testing: Each controller and cabinet assembly shall be tested as a complete entity under signal load for a minimum of 48 hours. Each assembly shall be delivered with a signed document detailing the cabinet final tests performed. The cabinet
shall be assembled and tested by the controller manufacturer or authorized local distributor to ensure proper component integration and operation.

**715.42.8.10-Warranty:** The controller and Malfunction Management Unit shall be warranted by the manufacturer against mechanical and electrical defects for a period of two years from date of shipment. The manufacturer's warranty shall be supplied in writing with each cabinet and controller. Second party extended warranties are not acceptable. The cabinet assembly and all other components shall be warranted for a period of one year from date of shipment. Any defects shall be corrected by the manufacturer at no cost to the owner.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION
FOR

STATE PROJECT NUMBER: ____________________________
FEDERAL PROJECT NUMBER: ____________________________

FOR

SECTION 601
STRUCTURAL CONCRETE

DELETE THE HEADING AND REPLACE WITH THE FOLLOWING:

SECTION 601
STRUCTURAL CONCRETE INTERNAL CURING

601.1-DESCRIPTION:
ADD THE FOLLOWING TO THIS SUBSECTION:

Class H-IC concrete shall be used for bridge decks when designated in the plans.

This mix shall be used to produce a concrete of high durability with low permeability and low cracking potential. The absorbed water within the saturated lightweight fine aggregate (LFA) provides internal moisture that is slowly released to the hydrating cement within the paste matrix of the concrete. This saturated LFA is intended to inhibit autogenous shrinkage and early age cracking of the bridge deck.

601.2-MATERIALS:
ADD THE FOLLOWING TO THE TABLE:

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SECTION OR SUBSECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightweight Fine Aggregate (LFA)</td>
<td>601.2.1</td>
</tr>
<tr>
<td>Shrinkage Reducing Admixture (SRA)</td>
<td>707.17</td>
</tr>
</tbody>
</table>
ADD THE FOLLOWING SUBSECTION:

601.2.1-Lightweight Fine Aggregate (LFA): LFA for Class H-IC shall meet the requirements of ASTM C1761 with the following exceptions:

In Section 7.4, the LFA shall have a minimum absorption of 15.0%, instead of 5%. This value shall be determined as outlined in Section 10, except that the immersion period shall be 24 ± 0.5 hours, instead of 72 ± 4 hours. This value shall be expressed as a decimal and noted as ABS\textsubscript{LFA}.

M\textsubscript{SD} shall be determined as outlined in Section 10.4, except that the LFA shall be covered with water for 24 ± 0.5 hours, instead of 72 ± 4 hours. That 24-hour value of M\textsubscript{SD} shall be used in Equation (2), in Section 10.5.1, to calculate the 24-hour absorption of the lightweight fine aggregate (ABS\textsubscript{LFA}). That 24-hour value of M\textsubscript{SD} shall also be used in Equation (3), in Section 10.5.1, to calculate the relative density of the lightweight fine aggregate. The relative density of the lightweight fine aggregate obtained in Equation (3) in Section 10.5.1 shall be expressed as SG\textsubscript{LFA}.

Suitable test data from an Independent Laboratory, approved by the Engineer, shall be acceptable as evidence of the testing for compressive strength, shrinkage, resistance to freezing and thawing, and presence of popouts required in Section 9.2.

601.3-PROPORTIONING:

ADD THE FOLLOWING TO THIS SUBSECTION:

Class H-IC concrete is internally cured Class H concrete, used in bridge decks. Class H-IC concrete shall consist of a homogenous mixture of cement, fine aggregate, highly saturated lightweight fine aggregate (LFA), coarse aggregate, microsilica admixture, fly ash or ground granulated blast furnace slag, chemical admixtures including a shrinkage reducing admixture (SRA), and water.

The Class H-IC mix shall consist of an existing approved Class H mix design with a portion of the fine aggregate replaced with LFA. In the existing approved Class H mix design, a volume of normal fine aggregate, in SSD condition, equal to V\textsubscript{SSD LFA} (as defined below) shall be removed and replaced with the V\textsubscript{SSD LFA} in order to maintain the proper batch volume. Minor adjustments will be permitted in order to ensure that the actual batch volume is as close as possible to the design batch volume of 27 cubic feet. However, these changes shall be documented and submitted to the Engineer.

A shrinkage reducing admixture (SRA) shall be also used in Class H-IC concrete. In order to evaluate the performance of the SRA, a Control Batch of Class H-IC, containing all of the required materials for Class H-IC concrete except the SRA, shall first be produced by a WVDOH Approved Laboratory. In addition to the standard mix design testing requirements for Class H concrete, testing for length change, in accordance with ASTM C157, shall be performed on this Control Batch.

All specimens, tested for length change in accordance with ASTM C157, shall be cured as outlined in Section 10, and then stored in air as outlined in Section 11.1.2. Comparator readings up to, and including, 28 days after the completion of the 28-day curing period shall be submitted with the Class H-IC mix design for approval, then the remaining comparator readings, at 8, 16, 32, and 64 weeks shall be submitted as an addendum to the mix design, after those readings are all completed.
Two additional Class H-IC batches shall also be produced at the same time by a WVDOH Approved Laboratory, except that both of these batches shall contain a SRA. Both of these batches shall contain the Manufacturer’s recommended dosage rate of the SRA, which will produce the optimum shrinkage reduction for the Class H-IC mix. In addition to the standard mix design testing requirements for Class H concrete, both of these batches shall also be tested for length change in accordance with ASTM C157, as outlined in the paragraph above.

A trial batch of the previously approved Class H concrete mix, from which the Class H-IC mix was developed, as outlined in the second paragraph of this Section, shall also be produced, by a WVDOH Approved Laboratory, at the same time as the Class H-IC trial batches. However, the only testing required for this Class H batch shall be length change, in accordance with ASTM C157, as outlined above.

Design mixture testing requirements for the two Class H-IC concrete batches with the SRA shall be the same as the design mixture testing requirements for Class H concrete, except that the maximum permeability requirement of 750 coulombs shall not apply. The same permeability testing which is required for Class H concrete will be required in the mix design testing for the two Class H-IC batches at the optimum SRA dosage rate, but it shall be used for informational purposes only.

A summary of the testing required in the mix design for Class H-IC is included in Table 601.3.1D below.

The amount of LFA to be used in the mix design development shall be calculated as follows:

Determine the amount of Dry LFA to be used in the mix:

\[ M_{\text{Dry LFA}} = 46 \div \text{ABS}_{\text{LFA}} \]

- \( M_{\text{Dry LFA}} \) = Mass of Dry LFA (expressed in lbs.)
- \( \text{ABS}_{\text{LFA}} \) = 24-hour absorption of the LFA as determined in Section 601.2.1, expressed as a decimal

Determine the amount of Mass of Saturated Surface Dry (SSD) LFA to be used in the mix:

\[ M_{\text{SSD LFA}} = M_{\text{Dry LFA}} \times (1 + \text{ABS}_{\text{LFA}}) \]

- \( M_{\text{SSD LFA}} \) = Mass of LFA in SSD condition (expressed in lbs. and based on 24-hour immersion)

Determine the volume of SSD LFA to be used in the mix:

\[ V_{\text{SSD LFA}} = \frac{M_{\text{SSD LFA}}}{(\text{SG}_{\text{LFA}} \times 62.4 \text{ lb/ft}^3)} \]

- \( V_{\text{SSD LFA}} \) = Volume of SSD LFA (expressed in lbs. and based on 24-hour immersion)
- \( \text{SG}_{\text{LFA}} \) = Specific Gravity of LFA as determined in Section 601.2.1

In no case shall the \( V_{\text{SSD LFA}} \) be less than 25% of the total fine aggregate SSD volume of the entire mix.

Water absorbed in the LFA is retained within the aggregate during mixing and does not affect the mix water. Therefore, batch weights shall not be adjusted for the absorbed moisture in
the pre-wetted LFA. However, any free moisture on the surface of the LFA shall be accounted for and adjustments made in the mix water.

601.3.1-Mix Design Requirements:
ADD THE FOLLOWING TO THIS SUBSECTION:

Determine the air content of the plastic concrete of both trial batches in the mix design by both AASHTO T152 and T196. If the results from the two test methods are 0.50% or less in difference, then either method may be used for air content testing in the field. If the results from the two test methods differ by more than 0.50%, AASHTO T196 must be used for air content testing in the field.

<table>
<thead>
<tr>
<th>Class of concrete</th>
<th>Design 28 Day Compressive Strength (Pounds per Square inch)</th>
<th>Target Cement Factor (lbs./c.y. *)</th>
<th>Maximum Water Content (lb. of water / lb. of cement **)</th>
<th>Standard Size of Coarse Aggregate (Number)</th>
<th>Entrained Air (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-IC</td>
<td>4000</td>
<td>658</td>
<td>0.40</td>
<td>57,67</td>
<td>6½</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class of concrete</th>
<th>Design 28 Day Compressive Strength (Mpa)</th>
<th>Target Cement Factor (Kg per cu. M. *)</th>
<th>Maximum Water Content (L/Kg Of cement **)</th>
<th>Standard Size of Coarse Aggregate (Number)</th>
<th>Entrained Air (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-IC</td>
<td>28</td>
<td>390</td>
<td>0.40</td>
<td>57,67</td>
<td>6½</td>
</tr>
</tbody>
</table>

* The target cement factor of Class H-IC concrete shall consist of Option 1 or Option 2 from Table 601.3.1C. The Contractor may choose either option.

<table>
<thead>
<tr>
<th>Option</th>
<th>Cement</th>
<th>Fly Ash</th>
<th>Ground Granulated Furnace Slag</th>
<th>Microsilica</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.39 ft³ (0.068 m³)</td>
<td>0.84 ft³ (0.024 m³)</td>
<td></td>
<td>30 lbs. (13.6 kg)</td>
</tr>
<tr>
<td>2</td>
<td>2.15 ft³ (0.061 m³)</td>
<td></td>
<td>1.08 ft³ (0.031 m³)</td>
<td>30 lbs. (13.6 kg)</td>
</tr>
</tbody>
</table>

MP 711.03.26 shall be used to control the cement factor in all classes of concrete except Class H and Class H-IC.
### TABLE 601.3.1D

<table>
<thead>
<tr>
<th>Class H-IC Batch Description</th>
<th>Testing Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Batch of Class H-IC with no SRA</td>
<td>3 shrinkage specimens in accordance with ASTM C157, air storage Standard required mix design testing for Class H, as required by MP 711.03.23</td>
</tr>
<tr>
<td>Two Batches of Class H-IC with SRA at optimum dosage rate</td>
<td>3 shrinkage specimens in accordance with ASTM C157, air storage Standard required mix design testing for Class H, as required by MP 711.03.23</td>
</tr>
<tr>
<td>Class H Batch</td>
<td>3 shrinkage specimens in accordance with ASTM C157, air storage</td>
</tr>
</tbody>
</table>

ADD THE FOLLOWING SUBSECTION:

**601.3.1.1-Previously Approved Class H-IC Mix Designs:** Previously approved Class H-IC concrete mix designs shall be permitted to be used on projects, without the additional testing required by this Special Provision.

**601.3.2.1-Consistency:**

ADD THE FOLLOWING TO THIS SUBSECTION:

The slump of Class H-IC concrete shall not exceed 7 inches (175 mm) under any circumstances.

**601.3.2.2-Air Content:**

ADD THE FOLLOWING TO THIS SUBSECTION:

The requirements in this Section regarding air content for Class H concrete shall also apply to Class H-IC concrete.

**601.4.5-Tests for Permeability Acceptance:**

DELETE THE SUBSECTION

**601.6-HANDLING, MEASURING, AND BATCHING OF MATERIALS:**

ADD THE FOLLOWING TO THIS SUBSECTION:

Unless otherwise approved by the Engineer, LFA shall be shipped from the LFA Supplier in a saturated-surface dry (SSD) or wetter condition. The SSD condition is defined as the moisture condition where the internal moisture content of the aggregate is equal to the potential absorption of the aggregate. Within 24 hours of receipt of the LFA, the Concrete Supplier shall...
verify that the LFA is in a SSD or wetter condition by placing a representative sample of the LFA on brown paper towels, as outlined in Section 10.4.3 of ASTM C1761. The LFA shall be considered to be in a SSD condition if moisture appears on the clean paper towels. If the LFA is not in a SSD condition at this time, it shall be thoroughly saturated by soaking or other methods approved by the Engineer. LFA shall be maintained in a SSD or wetter condition from the time it is received at the Concrete Supplier until the time of batching. This moisture content shall be maintained through the use of sprinklers, soaking, or other methods approved by the Engineer. Excess water shall be drained from the lightweight fine aggregate prior to batching. Manipulation of LFA stockpiles may be necessary to ensure uniform wetting and draining.

The Concrete Supplier shall perform testing, as close as possible to the time of batching to ensure that the absorbed moisture of the LFA is greater than or equal to the $\text{ABS}_{\text{LFA}}$ established in 601.2.1 and used in Section 601.3. If the results of this testing show that the absorbed moisture of the LFA is less than the $\text{ABS}_{\text{LFA}}$ established in 601.2.1 and used in Section 601.3, additional moisture shall be added to the LFA until such a condition is reached that the absorbed moisture of the LFA is greater than or equal to the $\text{ABS}_{\text{LFA}}$ established in 601.2.1 and used in Section 601.3.

Cementitious materials shall not be introduced into the mixer drum until after all aggregates and at least 80% of the batch water are introduced into the mixer drum in order to ensure that the LFA remains in (SSD) condition as dryer materials are sequentially batched after the introduction of the LFA.

601.9.1-Cold Weather Concreting:
ADD THE FOLLOWING TO THIS SUBSECTION:

The requirements in this Section which apply to Class H concrete shall also apply to Class H-IC concrete.

ADD THE FOLLOWING SUBSECTION:

601.10.1.5-Test Slab: A minimum of 10 calendar days prior to the start of construction, the Contractor shall fabricate a test slab at least 16 feet wide by 16 feet long by 8 inches thick. The same concrete mix, containing LFA, which is to be used during construction, shall be used to fabricate this test slab. All quality control testing required by the Concrete Supplier and Contractor, which is required during construction, shall be conducted during the fabrication of this test slab. Testing shall include but not be limited to LFA aggregate and normal aggregate moisture testing and plastic concrete tests including air content, slump, 7-day compressive strength tests, unit weight, and yield. Permeability tests shall not be required. The concrete shall be batched, mixed, and transported in the same manner that it will be during construction. Finishing operations may be performed by hand, but curing operations shall be identical as those to be used during construction. The 7-day compressive strength results shall be submitted to the Engineer as soon as possible after completion of the test.

A representative from the LFA Supplier shall be present throughout the entire test slab fabrication process to provide guidance and direction in all aspects of the operation. The LFA Supplier’s representative shall also witness the testing of the absorbed moisture of the LFA and other aggregate moisture testing prior to the start of batching. Any costs
associated with having the representative from the LFA Supplier present shall be considered incidental and shall be included in the unit bid price.

The Contractor shall notify the Engineer of the date of fabrication of this test slab a minimum of 10 calendar days prior to the date of fabrication. The Engineer shall be present during the fabrication of this test slab.

601.10.4.1-Fogging equipment:
ADD THE FOLLOWING TO THIS SUBSECTION:

The requirements in this Section which apply to Class H concrete shall also apply to Class H-IC concrete.

601.11.4.1-Class H Bridge Decks:
ADD THE FOLLOWING TO THIS SUBSECTION:

The requirements in this Section shall also apply to Class H-IC concrete.

601.12-CURING AND PROTECTING CONCRETE:
ADD THE FOLLOWING TO THIS SUBSECTION:

The requirements in this Section which apply to Class H concrete shall also apply to Class H-IC concrete.

601.13-PROTECTIVE SURFACE TREATMENT:
ADD THE FOLLOWING TO THIS SUBSECTION:

The requirements in this Section which apply to Class H concrete shall also apply to Class H-IC concrete.

601.14-METHOD OF MEASUREMENT:
ADD THE FOLLOWING TO THIS SUBSECTION:

The method of measurement for Class H-IC concrete shall be the same as the method of measurement for Class H concrete.

601.16 - PAY ITEMS:
ADD THE FOLLOWING PAY ITEMS:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>601009-010</td>
<td>Class H-IC Concrete</td>
<td>Cubic Yard</td>
</tr>
<tr>
<td>601100-001</td>
<td>Concrete Mix Design, Class “class”**</td>
<td>Each</td>
</tr>
</tbody>
</table>

* Sequence Number
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION

FOR
SECTION 601
STRUCTURAL CONCRETE

601.7-MIXING:

ADD THE FOLLOWING AFTER THE FIFTH PARAGRAPH IN THE SUBSECTION:

For all classes of concrete except Class H and concrete for specialized overlays, the total amount of water in a concrete mix, including any water added to a truck mixer at the job site, shall not be more than the amount which would cause the water-cement ratio (w/c) of that concrete mix to exceed the w/c which corresponds to the Mix Design Approved Strength, as outlined in Section 5.4 of MP 711.03.23. The maximum water amount shall also be shown in the Attachment 3 of MP 711.03.23 for all approved concrete mix designs that were used, in the trial batches at the minimum cement factor, in the approved mix design. However, under no circumstances shall the w/c in Table 601.3.1A be exceeded.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: ______________________________
FEDERAL PROJECT NUMBER: ______________________________

FOR

SECTION 604
PIPE CULVERTS

604.1–DESCRIPTION:

ADD THE FOLLOWING SUBSECTION.

604.1.1-Heat Fusion Joining: The purpose of this special provision is to describe the work and material required to install a new solid wall high density polyethylene (HDPE) pipe.

604.2–MATERIALS:

ADD THE FOLLOWING SUBSECTION.

604.2.5-Materials: The pipe shall be solid wall HDPE in accordance with AASHTO M 26. The pipe shall have a Standard Dimension Ratio of 32.5.

604.6–LAYING AND JOINING:

604.6.1–Rigid and Flexible Conduits:

DELETE PARAGRAPH SIX AND REPLACE WITH THE FOLLOWING:

When noted on the plans, Item 604056-001, “Corrugated Polythene Pipe with Heat Fusion Joining”, shall be joined by heat fusion joining. The Contractor shall adhere to ASTM F2620
or ASTM D3261, and the manufacture installation requirements. This shall include all joints and bends necessary to complete the segment of pipe as depicted in the plans.

604.14–PAY ITEMS:

ADD THE FOLLOWING TO THE TABLE:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>604056-001</td>
<td>Corrugated Polythene Pipe with Heat Fusion Joining, “size”</td>
<td>Linear Foot (Meter)</td>
</tr>
</tbody>
</table>

“size” - size of pipe culvert, in inches. (supplemental description required).
211.7-METHOD OF MEASUREMENT:
   211.7.1-Cubic Yard (Meter) Measurement:

   DELETE THE CONTENTS OF THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

   The quantity of work done will be measured in cubic yards (cubic meters) actually obtained and incorporated in the work, determined by a volume computation using the “Existing Terrain Model” and “Final Constructed Terrain Model” as described in Special Provision 639. No shrink or swell factor will be applied to the volume computation.

   The Existing Terrain Model and the Plan Terrain Model will be provided by the Division. The Constructed Terrain Model and the Final Constructed Terrain Model shall be provided by the Contractor.

   All cost for the Contractor to provide the Constructed Terrain Model and the Final Constructed Terrain Model shall be included in Item 211001-*, “Unclassified Borrow Excavation”.

   DRAFT
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION

FOR

STATE PROJECT NUMBER: 
FEDERAL PROJECT NUMBER:

FOR

SECTION 607
GUARDRAIL

DELETE THE HEADING AND CHANGE TO THE FOLLOWING:

SECTION 607
GUARDRAIL AND HIGH TENSION CABLE BARRIER SYSTEM

607.1-DESCRIPTION:

ADD THE FOLLOWING TO THE SUBSECTION:

The work includes furnishing and erecting a 4 wire rope High Tension Cable Barrier (HTCB) system and all necessary appurtenances meeting the requirements of National Cooperative Highway Research Program (NCHRP) 350 or Manual for Assessing Safety Hardware (MASH) for the cable barrier system, terminals and all appurtenances. The system shall have a letter of eligibility from FHWA for Test Level 4 (TL4) for 6:1 side slopes.

The work shall conform to the lines, grades, and locations shown on the Plans or as directed by the Engineer. The cable barrier shall be placed in accordance with the cable system manufacturer’s instructions and in accordance with the Division approved shop drawings and submittals prepared by the manufacturer of the cable barrier system.

Unless provided for on the plans, the work covered by this special provision includes only that work necessary to install the cable barrier system and appurtenances. It includes the following:

1. Furnishing and placement of concrete foundations for the anchors, line posts and the end terminals.
2. Providing and installing the cable system and all hardware and appurtenances for a complete and functional cable barrier system by one manufacture. All components are to be of the same type.
3. Conducting installation training prior to the installation of the barrier system and maintenance training after installation of the system.
4. No Value Engineering Change Proposals for alternative barrier types will be considered.

607.2- MATERIALS:

ADD THE FOLLOWING TO THE SUBSECTION:

607.2.1-HTCB Materials: The wire rope shall be galvanized, 3/4”-3x7 meeting requirements of AASHTO M30-92 Type I, Class A coating with minimum breaking strength of 39,000 pounds. Wire rope shall be pre-tensioned. Provide a Certificate of Quality from the wire rope manufacturer with each cable spool specifying breaking strength, modulus of elasticity and the amount of force used to elongate the wire rope.

Provide factory swaged threaded terminals for connecting the wire ropes at the turnbuckles. A maximum of two wedge-type connections that secure the wire rope by compression may be used per wire rope per segment.

Threaded terminals, turnbuckles and fittings shall be galvanized after threading and meet the requirements of ASTM A-153. The fittings shall be designed for the cable arrangement used and fully fitted connections shall have minimum breaking strength of 36,800 pounds, certified by test reports that shall be submitted to the Engineer. Turnbuckles shall be of the solid or closed body type with two holes to determine cable stud thread penetration. Turnbuckles shall be installed at a maximum spacing of 1000 Feet intervals.

The line posts shall meet the manufacturer’s specifications and be consistent with the post size specified in the FHWA NCHRP-350 or MASH acceptance letter. Furnish steel posts meeting the requirements of ASTM A-36 galvanized to ASTM A-123 requirements following fabrication. The posts shall be designed to hold the wire at the design height. The posts shall be inserted in galvanized metal sockets or sleeves conforming to the manufacturer’s design. Provide a low density polyethylene (or similar type material) excluder profiled to fit tightly around the post to prevent debris from entering the sockets.

The line post shall foundation shall be compatible with the concrete mow strip as shown in the plans.

The line post shall have retroreflective sheeting on every fourth post or 50 feet, whichever is less. The sheeting shall be Type XI, Fluorescent-yellow meeting the requirements of Section 715.9.2.4 with a minimum surface area of 9 square inches. Place Fluorescent-yellow sheeting applied directly on both sides of the post. A post cap method of sheeting attachment that may detach upon impact to the line post, shall not be permitted. The retroreflective sheeting shall be placed as high as possible on the line post.

All materials including wire rope, fittings, posts, reflectorized spacers or post caps, and terminals shall meet the approved manufacturer’s specifications and details and shall be approved by the Engineer prior to installation.

“Open wedge” connections as allowed on GR-3 low tension cable systems shall not be used. Swaged fittings shall be required. Connections at anchorages needed to field adjust the cables may be “closed wedge” compression type fittings.
Any damage (break in the coating) to exposed steel or metal that is required to be galvanized shall be repaired or retouched to the satisfaction of the Engineer or shall be replaced with fittings or materials with the factory coating intact.

The End Terminals shall have a minimum of 120 square inches of Type XI retroreflective sheeting meeting the requirements of Section 715.9.2.4 affixed to each of the terminal posts.

607.2.2-Geotechnical Data: The known soil data to the Division is made part of the Contract documents. Any additional soil data required, shall be the responsibility of the Contractor.

It is the Contractor’s responsibility to supply the cable barrier manufacturer with any soil information needed to design the End Terminal Foundations.

All soil information gathering shall be considered incidental to construction of the cable system at no additional cost to the contract.

The existing median shall be graded to a proposed 6:1 or flatter side slope where shown in the plans. The proposed grading and drainage work required shall not be part of this provision and shall be paid for separately per the appropriate items in this contract.

The cable barrier system described below requires side slopes of 6:1 or flatter. The steepening or elimination of the 6:1 grading and related drainage work by Value Engineering Proposal, Practical Design Change Proposal or other contract revisions shall not be considered applicable to this contract.

607.2.3-Submittals: Submittals listed below shall be provided at least 30 days prior to initiating work and submitted electronically.

1. Provide an FHWA Eligibility Letter for National Cooperative Highway Research Program (NCHRP) 350 or Manual for Assessing Safety Hardware (MASH) FHWA Eligibility Letter for the cable barrier system, terminals and all appurtenances. The system shall be approved for Test Level 4 (TL4) for 6:1 side slopes.
2. The cable system manufacturer shall be responsible for the design of any transitions between existing or proposed guardrail and the cable system that is not compatible by the manufacturer of the proposed HTCB system as shown on the plans. This design shall be submitted to the Division at least 30 days prior to beginning work and must be approved by the Engineer prior to beginning work on the barrier. The cable may not be tied to any guardrail or bridge structure but must be “overlapped” in a manner approved by the Engineer.
3. Provide manufacturer’s drawings, general notes, specifications and installation manuals for all components proposed for installation.
4. Provide manufacturer’s guidelines and instructions for repairs that may be required to the cable system and all appurtenances following a vehicle hit.
5. Submit material specifications and technical data information on all materials proposed for use on the project.
6. The design of the cable system termini, depth and size of line posts, concrete footings, and the concrete end-anchors shall bear the seal of a Registered Professional Engineer currently licensed in West Virginia.
7. Provide an Installation Plan, with schedule, for the barrier. The Installation Plan shall be linked to the Transportation Management Plan for the project and shall be subject to the approval of the Engineer.
8. Detailed drawings of all post and hardware including a post with all four (4) cable heights defined and construction tolerances to be met.

9. Two (2) sets of As-Built plans shall be submitted showing the locations of the turnbuckles and splice locations of the complete project.

10. The complete foundation design for all Cable End Terminal Foundations shall be submitted to the Engineer. The design shall provide detailed reinforcement layout, dimensions and material properties defined as a minimum. Plans must be sealed by a Registered Professional Engineer licensed in West Virginia.

11. Line Post Foundation shall be designed when geotechnical soil conditions are not met as required by the HTCB manufacturer’s standard criteria.

12. Blank Sample of the proposed Cable Tension Log are to be submitted upon completion.

**607.2.4-Design Criteria:** Base the minimum design load for the Cable End Terminal to cable connections on the theoretical cumulative tension expected at -20 degrees Fahrenheit. Limit Cable End Terminal foundation lateral deflection to 1 inch at the proposed ground surface using a minimum factor of safety of 2.0.

**607.2.5-Preconstruction Conference:** A Preconstruction Conference with all parties shall be held at least 30 days prior to commencement of the work to install the barrier system. At that time, all materials and methods must have been approved by the Engineer.

**607.4-ERECTING RAIL ELEMENTS:**

ADD THE FOLLOWING TO THE SUBSECTION:

**607.4.1-High Tension Cable Barrier System:** The cable barrier system and end terminals shall consist of pre-tensioned wire rope (cable), steel line posts set in steel sockets in concrete footings, end-anchors and all fittings meeting National Cooperative Highway Research Program (NCHRP) Report 350 or MASH for Test Level 4 for approach slopes of 6H:1V.

The cable barrier system shall be 4 wire ropes with post spacing at 15 feet or less as approved by the Engineer. The dynamic deflection shall be less than 8 feet using NCHRP 350 or MASH testing requirements. In locations where a dynamic deflection distance of 8 feet is not attainable between a fixed object, the post spacing shall be decreased per manufacturer’s engineering calculations to reduce the deflection to achieve the required deflection.

The specified maximum dynamic deflection of 8 feet shall be met along the entire length of each cable barrier segment between end anchors. In addition to meeting the NCHRP 350 or MASH testing requirements, the manufacturer shall provide documentation demonstrating that the proposed system meets the dynamic deflection requirements at the maximum distance between anchors that the system will be installed as specified in the plans. The documentation may be in the form of field testing results and/or computer simulations. Any testing or study supporting the claims shall either be done by the manufacturer and accepted by appropriate governmental entities or done by reputable and recognized testing or evaluation entities using the manufacturer’s materials and system design. If the manufacturer cannot adequately demonstrate the ability of their system to meet the dynamic deflection requirements
at the maximum distance between anchors specified in the plans, they shall be required, at the sole discretion of Division, to reduce post spacing and/or add additional anchors until the requirements are met and approved by the Engineer. Any additional cost associated with reducing the post spacing and adding anchors shall be considered incidental to construction and included in price bid for this item.

The manufacturer of the cable system must have been in operation for at least 3 years and must have successfully installed a minimum of 50 miles of high tension cable systems in the United States. The manufacturer shall present evidence of such to the Engineer at the barrier system preconstruction conference.

The cable barrier system shall be designed so that line post repairs following a vehicle hit can be made quickly by two maintenance technicians using readily available hand tools. In addition, the cable barrier manufacturer shall provide written repair instructions for all elements of the cable system including the cables, anchors, and connections. All repair instructions shall be provided in an electronic version and in a printed and bound version (minimum 2 copies).

607.4.2-Construction Methods:

607.4.2.1-Installation of the Cable Barrier Line Posts: Any grading and excavation shall be completed to finished line and grade prior to installation of the line posts.

Excavate for line posts in accordance with the approved manufacturer’s drawings. Each post shall be at the proper location, elevation, alignment and depth as proposed and approved. Excavation of line post footings shall be performed to place concrete, as required by the manufacturer, in undisturbed soil for the bottom and sides. In the event backfill is necessary, specification procedures must be followed to achieve the proper backfill method and compaction. Size and depth of footings shall be as approved by the Engineer but shall not be less than 14” diameter and 36” deep (14”x36”) unless larger sizes are recommended by the manufacturer and approved by the Engineer.

The galvanized steel line post sleeves shall be placed in concrete footings in accordance with the approved manufacturer’s drawings. Footings shall have reinforcing bars in accordance with the manufacturer’s approved shop drawings.

The line post footings shall be compatible with a concrete mow strip, as called for in the plans, and shall be separated by expansion material sufficient to protect both from cracking.

The line posts shall be set in the line post sleeves paying close attention to the horizontal and vertical alignment of the posts. It is critical that the posts be set to achieve the proper wire rope height. Line posts shall be set to achieve the vertical and horizontal tolerances set by the manufacturer in the approved shop drawings and installation manuals. Posts and foundations not set at the proper line and grade shall be replaced prior to the installation of the wire rope.

Delineators shall be installed on the HTCB system posts and shall conform to Section 661 of the Specifications for delineators installed on cable barrier systems, except with regards to spacing. Delineators shall be installed on the 5 posts nearest each end of the terminal. Delineators shall also be installed throughout the remainder of the system length at spacing of 80 feet in tangent sections and 40 feet in curved sections. Where this spacing cannot be obtained due to post spacing, the delineators shall be installed to provide spacing that is not greater than the specified spacing. The reflective sheeting shall be applied only
to the side of the delineator facing traffic. Delineators must be an integral part of the system and no separate posts shall be installed. Alternative delineator systems will be considered subject to the approval of the Engineer.

607.4.2.2-Installation of End Terminals: Install terminals in conformance with the requirements of the cable system manufacturer’s instructions and as approved by the Engineer.

End terminals shall be placed in excavations of natural, undisturbed ground, to size and shape required by the manufacturer based on soil types and ground conditions. If over-excavation is unavoidable as verified by the Engineer prior to installation of the concrete, the sides must be vertical and additional concrete shall be used to fill completely the excavated area.

Provide an end terminal for each separate connection for each separate run of cable. Cables shall not be tied to anything but an approved terminal and shall not be tied to any proposed or existing guardrail, bridge structure or other unapproved object.

No incomplete runs subject to traffic shall be left overnight or unprotected. At the end of each working day, any section started shall be completed by the end of the day if the roadway is under traffic.

Any end-anchor movement exceeding 1 inch within twelve (12) months of complete installation will require re-construction and re-tensioning of the system by the Contractor at their cost as directed by the Engineer.

607.4.2.3-Installation of Wire Rope: The wire rope shall be installed at the elevation and proper height as approved in the manufacturer’s design and approved drawings.

Tension shall be applied meeting manufacturer’s recommendations. Check the tension per manufacturer’s recommendations.

Three weeks following the initial tensioning, check and adjust the tension as necessary. No additional compensation will be provided for any subsequent tensioning required.

Maintain a tension log showing time, date, location, cable temperature, ambient air temperature and final tension reading, signed by the person performing the tension testing. The log will be reviewed to verify that the measured tension matches the temperature/tension chart provided by the manufacturer and is within the stated variance. The log shall be provided to the Engineer after tensioning is complete.

The number and location of splices will be subject to the approval of the Engineer. Splices shall be staggered in accordance with the manufacturer’s recommendations. Cable splices shall be made in accordance with the recommendations of the cable manufacturer.

607.4.3-Maintenance During Construction: Once the cable system has been erected the cable and that section of roadway returned to traffic, the Contractor is responsible for maintaining and repair of the cable barrier system until final acceptance of the entire project. Should the cable barrier be damaged by the traveling public, Contractor shall repair the barrier within 24 hours. The cable barrier posts shall be replaced and the cable reinstalled to the post. If that section of cable has been inspected and certified to by the manufacturer, the cable will be re-inspected and recertified as with the initial installation.
All repairs made to the cable barrier or terminals, no matter the cause of the repair, prior to final acceptance, shall be considered incidental to construction at no additional cost to the contract.

607.4.4-Cable System Installation Training and Certification:

607.4.4.1-Manufacturer’s Certification: A manufacturer’s representative shall be present during the installation of the first section of the cable barrier system and shall supervise installation of all components (i.e. posts, anchors, tensioning). Upon completion of the entire system, a manufacturer’s representative shall inspect and certify in writing that the cable system was installed in accordance with the manufacturer’s design and requirements.

607.4.4.2-Training Prior to Installation On-Site Installation Training: All training shall be provided by the cable system manufacturer. Provide a minimum of 2 hours of classroom training on the installation of the system. This training shall be provided at the WVDOH District Office responsible for the construction of the system. The location and time of this training shall be subject to the approval of the Engineer.

Provide on-site field instruction using a minimum 2000-foot section of the system. The amount of training will be as necessary to provide the field training on all aspects of system installation, line post installation, wire rope installation and tensioning and testing, and terminal installation.

Provide Certification by the manufacturer of the system for the participants of the training. This certification shall require participants to pass a written examination prepared and given by the system manufacturer. The Contractor shall have certified personnel on the site at all times during the installation of all elements of the system.

The training and certification instruction described above shall be provided for a minimum of twenty participants to include the Contractor, WVDOH (Construction, Maintenance and Traffic Operations personnel) and FHWA. Twelve slots shall be reserved for WVDOH and FHWA and the remainder for the Contractor.

607.4.4.3-Training Following Installation: Provide a minimum of two hours of classroom instruction on the maintenance and repair of the cable system. This training shall be provided at the WVDOH District Office responsible for maintenance. The scheduling and location of this training shall be as approved by the Engineer.

Provide a minimum of one hour of on-site field instruction on the maintenance and repair of the system.

A training session of two hours shall be provided to address the needs of emergency response personnel involved in extricating vehicles from the cables and the safety of the responders with techniques in minimizing damage to the system.

The training shall be for a maximum of 20 participants including WVDOH (Construction, Maintenance, and Traffic Operations), FHWA and representatives of local fire and rescue services.
607.6-METHOD OF MEASUREMENT:

ADD THE FOLLOWING TO THE END OF THE SUBSECTION:

The quantity of HTCB will be measured in feet along the top cable constructed, tested and accepted. Each segment of HTCB shall be between Length of Need (LON) points as shown on the plans. The measured length between LON points shall pay for all 4 cables of the system, line post, line post foundation and appurtenances. The length of the End Terminals outside of the LON shall not be included in this measurement. The approved shop drawings shall define the location of the LON point of the system.

The Cable End Terminals will be measured separately and will be the actual number constructed and accepted.

The Cable End Terminal Foundations will be measured separately and will be the actual number constructed and accepted.

607.8-PAY ITEMS:

ADD THE FOLLOWING TO THE TABLE:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>607xxx-*</td>
<td>HTCB Installation &amp; Maintenance Training</td>
<td>Hour</td>
</tr>
<tr>
<td>607xxx-*</td>
<td>High Tension Cable Barrier</td>
<td>Linear Foot</td>
</tr>
<tr>
<td>607xxx-*</td>
<td>Cable End Terminal</td>
<td>Each</td>
</tr>
<tr>
<td>607xxx-*</td>
<td>Cable End Terminal Foundation</td>
<td>Each</td>
</tr>
</tbody>
</table>

* Sequence Number
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION

FOR

STATE PROJECT NUMBER: ____________________________
FEDERAL PROJECT NUMBER: ____________________________

FOR

SECTION 607
GUARDRAIL

DELETE THE HEADING AND CHANGE TO THE FOLLOWING:

SECTION 607
GUARDRAIL AND HIGH TENSION CABLE BARRIER SYSTEM

MASH 2009

607.1-DESCRIPTION:

ADD THE FOLLOWING TO THE SUBSECTION:

The work includes furnishing and erecting a 4 wire rope High Tension Cable Barrier (HTCB) system meeting the requirements of Manual for Assessing Safety Hardware (MASH) 2009 for the cable barrier system, terminals and all appurtenances. The system shall have a letter of eligibility from FHWA for Test Level 3 (TL-3) for 6:1 side slopes.

The work shall conform to the lines, grades, and locations shown on the Plans or as directed by the Engineer. The cable barrier shall be placed in accordance with the cable system manufacturer’s instructions and in accordance with the Division approved shop drawings and submittals prepared by the manufacturer of the cable barrier system.

Unless provided for on the plans, the work covered by this special provision includes only that work necessary to install the cable barrier system and appurtenances. It includes the following:

1. Furnishing and placement of concrete foundations for the anchors, line posts and the end terminals.
2. Providing and installing the cable system and all hardware and appurtenances for a complete and functional cable barrier system by one manufacture. All components are to be of the same type.
3. Conducting installation training prior to the installation of the barrier system and maintenance training after installation of the system.
4. No Value Engineering Change Proposals for alternative barrier types will be considered.

607.2- MATERIALS:

ADD THE FOLLOWING TO THE SUBSECTION:

607.2.1-HTCB Materials: The wire rope shall be galvanized, 3/4”-3x7 meeting requirements of AASHTO M30-92 Type I, Class A coating with minimum breaking strength of 39,000 pounds. Wire rope shall be pre-tensioned. Provide a Certificate of Quality from the wire rope manufacturer with each cable spool specifying breaking strength, modulus of elasticity and the amount of force used to elongate the wire rope.

Provide factory swaged threaded terminals for connecting the wire ropes at the turnbuckles. A maximum of two wedge-type connections that secure the wire rope by compression may be used per wire rope per segment.

Threaded terminals, turnbuckles and fittings shall be galvanized after threading and meet the requirements of ASTM A-153. The fittings shall be designed for the cable arrangement used and fully fitted connections shall have minimum breaking strength of 36,800 pounds, certified by test reports that shall be submitted to the Engineer. Turnbuckles shall be of the solid or closed body type with two holes to determine cable stud thread penetration. Turnbuckles shall be installed at a maximum spacing of 1000 Feet intervals.

The line posts shall meet the manufacturer’s specifications and be consistent with the post size specified in the FHWA MASH2009 acceptance letter. Furnish steel posts meeting the requirements of ASTM A-36 galvanized to ASTM A-123 requirements following fabrication. The posts shall be designed to hold the wire at the design height. The posts shall be inserted in galvanized metal sockets or sleeves conforming to the manufacturer’s design. Provide a low density polyethylene (or similar type material) excluder profiled to fit tightly around the post to prevent debris from entering the sockets.

The line post shall foundation shall be compatible with the concrete mow strip as shown in the plans.

The line post shall have retroreflective sheeting on every fourth post or 50 feet, whichever is less. The sheeting shall be Type XI, Fluorescent-yellow meeting the requirements of Section 715.9.2.4 with a minimum surface area of 9 square inches. Place Fluorescent-yellow sheeting applied directly on both sides of the post. A post cap method of sheeting attachment that may detach upon impact to the line post, shall not be permitted. The retroreflective sheeting shall be placed as high as possible on the line post.

All materials including wire rope, fittings, posts, reflectorized spacers or post caps, and terminals shall meet the approved manufacturer’s specifications and details and shall be approved by the Engineer prior to installation.

“Open wedge” connections as allowed on GR-3 low tension cable systems shall not be used. Swaged fittings shall be required. Connections at anchorages needed to field adjust the cables may be “closed wedge” compression type fittings.
Any damage (break in the coating) to exposed steel or metal that is required to be galvanized shall be repaired or retouched to the satisfaction of the Engineer or shall be replaced with fittings or materials with the factory coating intact.

The End Terminals shall have a minimum of 120 square inches of Type XI retroreflective sheeting meeting the requirements of Section 715.9.2.4 affixed to each of the terminal posts.

607.2.2-Geotechnical Data:  The known soil data to the Division is made part of the Contract documents. Any additional soil data required, shall be the responsibility of the Contractor.

It is the Contractor’s responsibility to supply the cable barrier manufacturer with any soil information needed to design the End Terminal Foundations.

All soil information gathering shall be considered incidental to construction of the cable system at no additional cost to the contract.

The existing median shall be graded to a proposed 6:1 or flatter side slope where shown in the plans. The proposed grading and drainage work required shall not be part of this provision and shall be paid for separately per the appropriate items in this contract.

The cable barrier system described below requires side slopes of 6:1 or flatter. The steepening or elimination of the 6:1 grading and related drainage work by Value Engineering Proposal, Practical Design Change Proposal or other contract revisions shall not be considered applicable to this contract.

607.2.3-Submittals:  Submittals listed below shall be provided at least 30 days prior to initiating work and submitted electronically.

1. Provide an FHWA Eligibility Letter meeting the requirements of Manual for Assessing Safety Hardware (MASH) 2009 for the cable barrier system, terminals and all appurtenances. The system shall be approved for Test Level 3 (TL-3) for 6:1 side slopes.

2. The cable system manufacturer shall be responsible for the design of any transitions between existing or proposed guardrail and the cable system that is not compatible by the manufacturer of the proposed HTCB system as shown on the plans. This design shall be submitted to the Division at least 30 days prior to beginning work and must be approved by the Engineer prior to beginning work on the barrier. The cable may not be tied to any guardrail or bridge structure but must be “overlapped” in a manner approved by the Engineer.

3. Provide manufacturer’s drawings, general notes, specifications and installation manuals for all components proposed for installation.

4. Provide manufacturer’s guidelines and instructions for repairs that may be required to the cable system and all appurtenances following a vehicle hit.

5. Submit material specifications and technical data information on all materials proposed for use on the project.

6. The design of the cable system termini, depth and size of line posts, concrete footings, and the concrete end-anchors shall bear the seal of a Registered Professional Engineer currently licensed in West Virginia.

7. Provide an Installation Plan, with schedule, for the barrier. The Installation Plan shall be linked to the Transportation Management Plan for the project and shall be subject to the approval of the Engineer.
8. Detailed drawings of all post and hardware including a post with all four (4) cable heights defined and construction tolerances to be met.
9. Two (2) sets of As-Built plans shall be submitted showing the locations of the turnbuckles and spice locations of the complete project.
10. The complete foundation design for all Cable End Terminal Foundations shall be submitted to the Engineer. The design shall provide detailed reinforcement layout, dimensions and material properties defined as a minimum. Plans must be sealed by a Registered Professional Engineer licensed in West Virginia.
11. Line Post Foundation shall be designed when geotechnical soil conditions are not met as required by the HTCB manufacturer’s standard criteria.
12. Blank Sample of the proposed Cable Tension Log are to be submitted upon completion.

607.2.4-Design Criteria: Base the minimum design load for the Cable End Terminal to cable connections on the theoretical cumulative tension expected at -20 degrees Fahrenheit. Limit Cable End Terminal foundation lateral deflection to 1 inch at the proposed ground surface using a minimum factor of safety of 2.0.

607.2.5-Preconstruction Conference: A Preconstruction Conference with all parties shall be held at least 30 days prior to commencement of the work to install the barrier system. At that time, all materials and methods must have been approved by the Engineer.

607.4-ERECTING RAIL ELEMENTS:

ADD THE FOLLOWING TO THE SUBSECTION:

607.4.1-High Tension Cable Barrier System: The cable barrier system and end terminals shall consist of pre-tensioned wire rope (cable), steel line posts set in steel sockets in concrete footings, end-anchors and all fittings meeting MASH 2009 for Test Level 3 for side slopes of 6H:1V.

The cable barrier system shall be 4 wire ropes with post spacing at 12 feet or less as approved by the Engineer. The dynamic deflection shall be less than 8 feet using MASH 2009 testing requirements. In locations where a dynamic deflection distance of 8 feet is not attainable between a fixed object, the post spacing shall be decreased per manufacturer’s engineering calculations to reduce the deflection to achieve the required deflection.

The specified maximum dynamic deflection of 8 feet shall be met along the entire length of each cable barrier segment between end anchors. In addition to meeting the MASH 2009 testing requirements, the manufacturer shall provide documentation demonstrating that the proposed system meets the dynamic deflection requirements at the maximum distance between anchors that the system will be installed as specified in the plans. The documentation may be in the form of field testing results and/or computer simulations. Any testing or study supporting the claims shall either be done by the manufacturer and accepted by appropriate governmental entities or done by reputable and recognized testing or evaluation entities using the manufacturer’s materials and system design. If the manufacturer cannot adequately demonstrate the ability of their system to meet the dynamic deflection requirements at the maximum distance between anchors specified in the plans, they shall be required, at the sole
discretion of Division, to reduce post spacing and/or add additional anchors until the requirements are met and approved by the Engineer. Any additional cost associated with reducing the post spacing and adding anchors shall be considered incidental to construction and included in price bid for this item.

The manufacturer of the cable system must have been in operation for at least 3 years and must have successfully installed a minimum of 50 miles of high tension cable systems in the United States. The manufacturer shall present evidence of such to the Engineer at the barrier system preconstruction conference.

The cable barrier system shall be designed so that line post repairs following a vehicle hit can be made quickly by two maintenance technicians using readily available hand tools. In addition, the cable barrier manufacturer shall provide written repair instructions for all elements of the cable system including the cables, anchors, and connections. All repair instructions shall be provided in an electronic version and in a printed and bound version (minimum 2 copies).

607.4.2-Construction Methods:

607.4.2.1-Installation of the Cable Barrier Line Posts:  Any grading and excavation shall be completed to finished line and grade prior to installation of the line posts.

Excavate for line posts in accordance with the approved manufacturer’s drawings. Each post shall be at the proper location, elevation, alignment and depth as proposed and approved. Excavation of line post footings shall be performed to place concrete, as required by the manufacturer, in undisturbed soil for the bottom and sides. In the event backfill is necessary, specification procedures must be followed to achieve the proper backfill method and compaction. Size and depth of footings shall be as approved by the Engineer but shall not be less than 14” diameter and 36” deep (14”x36”) unless larger sizes are recommended by the manufacturer and approved by the Engineer.

The galvanized steel line post sleeves shall be placed in concrete footings in accordance with the approved manufacturer’s drawings. Footings shall have reinforcing bars in accordance with the manufacturer’s approved shop drawings.

The line post footings shall be compatible with a concrete mow strip, as called for in the plans, and shall be separated by expansion material sufficient to protect both from cracking.

The line posts shall be set in the line post sleeves paying close attention to the horizontal and vertical alignment of the posts. It is critical that the posts be set to achieve the proper wire rope height. Line posts shall be set to achieve the vertical and horizontal tolerances set by the manufacturer in the approved shop drawings and installation manuals. Posts and foundations not set at the proper line and grade shall be replaced prior to the installation of the wire rope.

607.4.2.2-Installation of End Terminals:  Install terminals in conformance with the requirements of the cable system manufacturer’s instructions and as approved by the Engineer.

End terminals shall be placed in excavations of natural, undisturbed ground, to size and shape required by the manufacturer based on soil types and ground conditions. If over-excavation is unavoidable as verified by the Engineer prior to installation of the concrete,
the sides must be vertical and additional concrete shall be used to fill completely the excavated area.

Provide an end terminal for each separate connection for each separate run of cable. Cables shall not be tied to anything but an approved terminal and shall not be tied to any proposed or existing guardrail, bridge structure or other unapproved object.

No incomplete runs subject to traffic shall be left overnight or unprotected. At the end of each working day, any section started shall be completed by the end of the day if the roadway is under traffic.

Any end-anchor movement exceeding 1 inch within twelve (12) months of complete installation will require re-construction and re-tensioning of the system by the Contractor at their cost as directed by the Engineer.

607.4.2.3-Installation of the wire rope: The wire rope shall be installed at the elevation and proper height as approved in the manufacturer’s design and approved drawings.

Tension shall be applied meeting manufacturer’s recommendations. Check the tension per manufacturer’s recommendations.

Three weeks following the initial tensioning, check and adjust the tension as necessary. No additional compensation will be provided for any subsequent tensioning required.

Maintain a tension log showing time, date, location, cable temperature, ambient air temperature and final tension reading, signed by the person performing the tension testing. The log will be reviewed to verify that the measured tension matches the temperature/tension chart provided by the manufacturer and is within the stated variance. The log shall be provided to the Engineer after tensioning is complete.

The number and location of splices will be subject to the approval of the Engineer. Splices shall be staggered in accordance with the manufacturer’s recommendations. Cable splices shall be made in accordance with the recommendations of the cable manufacturer.

607.4.3-Maintenance During Construction: Once the cable system has been erected the cable and that section of roadway returned to traffic, the Contractor is responsible for maintaining and repair of the cable barrier system until final acceptance of the entire project. Should the cable barrier be damaged by the traveling public, Contractor shall repair the barrier within 24 hours. The cable barrier posts shall be replaced and the cable reinstalled to the post. If that section of cable has been inspected and certified to by the manufacturer, the cable will be re-inspected and recertified as with the initial installation.

All repairs made to the cable barrier or terminals, no matter the cause of the repair, prior to final acceptance, shall be considered incidental to construction at no additional cost to the contract.

607.4.4-Cable System Installation Training and Certification:

607.4.4.1-Manufacturer’s Certification: A manufacturer’s representative shall be present during the installation of the first section of the cable barrier system and shall supervise installation of all components (i.e. posts, anchors, tensioning). Upon completion of the entire system, a manufacturer’s representative shall inspect and certify in writing that the cable system was installed in accordance with the manufacturer’s design and requirements.
607.4.4.2-On-Site Installation Training: All training shall be provided by the cable system manufacturer. Provide a minimum of 2 hours of classroom training on the installation of the system. This training shall be provided at the WVDOH District Office responsible for the construction of the system. The location and time of this training shall be subject to the approval of the Engineer.

Provide on-site field instruction using a minimum 2000-foot section of the system. The amount of training will be as necessary to provide the field training on all aspects of system installation, line post installation, wire rope installation and tensioning and testing, and terminal installation.

Provide Certification by the manufacturer of the system for the participants of the training. This certification shall require participants to pass a written examination prepared and given by the system manufacturer. The Contractor shall have certified personnel on the site at all times during the installation of all elements of the system.

The training and certification instruction described above shall be provided for a minimum of twenty participants to include the Contractor, WVDOH (Construction, Maintenance and Traffic Operations personnel) and FHWA. Twelve slots shall be reserved for WVDOH and FHWA and the remainder for the Contractor.

607.4.4.3-Training Following Installation: Provide a minimum of two hours of classroom instruction on the maintenance and repair of the cable system. This training shall be provided at the WVDOH District Office responsible for maintenance. The scheduling and location of this training shall be as approved by the Engineer.

Provide a minimum of one hour of on-site instruction on the maintenance and repair of the system.

A training session of two hours shall be provided to address the needs of emergency response personnel involved in extricating vehicles from the cables and the safety of the responders with techniques in minimizing damage to the system.

The training shall be for a maximum of 20 participants including WVDOH (Construction, Maintenance, and Traffic Operations), FHWA and representatives of local fire and rescue services.

607.6-METHOD OF MEASUREMENT:

ADD THE FOLLOWING TO THE SUBSECTION:

The quantity of HTCB will be measured in feet along the top cable constructed, tested and accepted. Each segment of HTCB shall be between Length of Need (LON) points as shown on the plans. The measured length between LON points shall pay for all 4 cables of the system, line post, line post foundation and appurtenances. The length of the End Terminals outside of the LON shall not be included in this measurement. The approved shop drawings shall define the location of the LON point of the system.

The Cable End Terminals will be measured separately and will be the actual number constructed and accepted.
The Cable End Terminal Foundations will be measured separately and will be the actual number constructed and accepted.

607.8-PAY ITEMS:

ADD THE FOLLOWING TO THE TABLE:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>607xxx-*</td>
<td>HTCB Installation &amp; Maintenance Training</td>
<td>Hour</td>
</tr>
<tr>
<td>607xxx-*</td>
<td>High Tension Cable Barrier</td>
<td>Linear Foot</td>
</tr>
<tr>
<td>607xxx-*</td>
<td>Cable End Terminal</td>
<td>Each</td>
</tr>
<tr>
<td>607xxx-*</td>
<td>Cable End Terminal Foundation</td>
<td>Each</td>
</tr>
</tbody>
</table>

* Sequence Number
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: ________________________________
FEDERAL PROJECT NUMBER: ________________________________

FOR

SECTION 609
SIDEWALKS

609.1-DESCRIPTION:

DELETE THE SUBSECTION AND REPLACE THE FOLLOWING:

Concrete Mow Strip: This work shall consist of the construction of Portland cement concrete mow strip in accordance with these Specifications and in reasonably close conformity with the lines and grades shown on the Plans or established by the Engineer.

6079.7-EXPANSION JOINTS:

DELETE THE SUBSECTION AND REPLACE THE FOLLOWING:

Expansion joints 1/4 inch (6 mm) wide shall be constructed at 30 ft. (9 m) intervals. Expansion joints shall be filled with preformed joint filler, which shall be shaped to fit the concrete section being placed.

Expansion joints, of the type specified above, shall be constructed between all such appurtenances and the sidewalk mowstrip.

Expansion joint material shall be placed between the concrete mow strip and the line post foundations.
609.9-METHOD OF MEASUREMENT:

ADD THE FOLLOWING TO THE SUB-SECTION:

DELETE THE SUB-SECTION AND ADD THE FOLLOWING:

Concrete Mow Strip will be measured in linear feet (meters), square yards (meters), complete in place and accepted, which will be determined by the length measured upon the surface multiplied by the width constructed as shown on the plans. Any required excavation for the Concrete Mow Strip shall be incidental to the pay item for Concrete Mow Strip.

609.11-PAY ITEMS:

ADD THE FOLLOWING PAY ITEM:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>609xxx-*</td>
<td>Concrete Mow Strip</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Square Yard (Meter)</td>
</tr>
</tbody>
</table>

* Sequence Number
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  

SPECIAL PROVISION  

FOR  

STATE PROJECT NUMBER: ____________________________  
FEDERAL PROJECT NUMBER: ____________________________  

FOR  

SECTION 639  
CONSTRUCTION SURVEYING  

DELETE THE HEADING AND CHANGE TO THE FOLLOWING:  

SECTION 639  
CONSTRUCTION LAYOUT STAKES FOR ELECTRONIC DATA  

639.1-DESCRIPTION:  

DELETE THE SUB-SECTION AND REPLACE WITH THE FOLLOWING:  

When this item is included in the Proposal, it shall consist of furnishing, reviewing, and maintaining all necessary electronic data records for the proper prosecution of the work with the use of electronic grading under the Contract. This work shall conform to all provisions as outlined in the Specifications.  

639.3-CONSTRUCTION LAYOUT STAKES:  

DELETE THE SECOND AND THIRD PARAGRAPHS AND REPLACE WITH THE FOLLOWING:  

The Contractor shall be responsible for having the layout staking work conform to the lines, grades, elevations, and dimensions called for on the Plans. The Contractor shall furnish a copy of their survey records and, if applicable as per 639.3.1, an electronic copy of the Constructed Terrain Model.  

ADD THE FOLLOWING TO THE END OF THE SECTION:

639.3.1-Terrain Models and Control Data: The contractor shall use electronic stake out procedures as described in this section. The software utilized by the Contractor shall perform the volume computations as per section 109. For the purposes of these specifications a terrain model is a digital representation of a ground surface or terrain as defined more clearly below:

a) Existing Terrain Model: A digital representation of the ground elevations for the project prior to prosecution of the work.
b) Plan Terrain Model: A digital representation of the grading shown in the contract plans.
c) Constructed Terrain Model: A digital representation of the project construction grading at a given time during the prosecution of work.
d) Final Constructed Terrain Model: A digital representation of the final cross sections grading for the project.
e) Control Data: A digital file containing the Point Name and the XYZ values of any ground control points and a digital file representing the geometric alignment of the project centerline(s).

639.3.2-Review of Terrain Models and Control Data: At the “Notice to Proceed”, Upon request, prospective bidders may obtain copies of the Division will provide the Contractor a copy of the Existing Terrain Model, Plan Terrain Model, Horizontal and Vertical alignments, and a copy of the project control in ASCII format for evaluation. The Contractor shall evaluate this information as to its accuracy and submit to the Engineer for evaluation noting discrepancies relative to its representation of existing contours and other possible errors or issues with the electronic data prior to the award of the contract. The Division will review and respond to the Contractor within seven days. Any corrections to the electronic data will be performed by the Division and any time extensions due the Contractor for this corrective action shall be in accordance with Section 108. The Contractor may request in writing that a “Conditional Notice to Proceed” be issued to allow work to begin on items not affected by the Excavation.

During excavation operations the Contractor will perform field survey checks, to verify the tops and toes of slopes, fronts and backs of benches and bench grades, ditch line elevations, the limits of fill benches, transition benches, other planned undercuts and tops of select embankment, or as directed by the engineer, to ensure that the project is constructed reasonably close to the lines and grades shown on the original x-sections.

During placement of the borrow material the median slope shall be field verified to be in accordance with the details in the plans and the Plan Terrain Model.

Any delays attributed to the contractor will not be eligible for time extensions as per section 108.6.2.

639.3.2.1-Partial Review of Terrain Models and Control Data: The Contractor may review the Electronic Data defined above in partial segments of the project to allow work to begin sooner. If reviewing the data in partial segments the Contractor will submit in writing to the Engineer noting what section of the roadway data is being reviewed. This information will detail the areas being evaluated by noting the Plan Station numbers ie: STA XXX+XX to STA YYY+YY or coordinates. All the time constraints and review
process will be in accordance with section 639.3.2 before any work is done on this section. Future project sections will be reviewed in this manner.

639.3.3-Submittals: All submissions of any records in an electronic medium must be in such a format that it is directly compatible with current software products used by the Department as per Section 639.3.4. These records shall be furnished as they are completed during the progress of the work for review and payment by the Engineer. Any inspection or checking of the Contractor’s layout by the Engineer and the acceptance of all or any part of it shall not relieve the Contractor of their responsibility to secure the proper dimensions, grades, and elevations of any part of the work.

The Final Constructed Terrain Model shall be submitted in digital format to be used to update the Division’s Existing Terrain Model for future work. The Final Constructed Terrain Model is subject to review by the Division before acceptance. The Contractor shall be responsible to address corrections in the model. Upon acceptance of the Final Constructed Terrain Model this data and model shall become the property of the Division.

639.3.4-Software Requirements: Any spreadsheets must be submitted in electronic format such as Microsoft Excel or other applicable formats. The software utilized in preparation of the various Terrain Models must be compatible with the current Bentley Systems© software products used by the Department.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION
FOR
STATE PROJECT NUMBER: _________________________
FEDERAL PROJECT NUMBER: _________________________
FOR
SECTION 616
PILING

616.1–DESCRIPTION:

ADD THE FOLLOWING TO THE SUBSECTION:
DELETE THE CONTENTS OF THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

This work shall consist of furnishing steel bearing piles of the kind and dimensions designated in the plans to the required bearing or penetration in accordance with these Specifications—this Special Provision and in reasonably close conformity with the lines and spacing shown on the Plans or established by the Engineer.

All piles shall be predrilled into rock and backfilled with concrete. Pile Driving is prohibited, unless called for in the Plans.

616.3–PREPARATION FOR DRIVING:

DELETE THE ENTIRE CONTENTS OF THE SUBSECTION

616.4–EQUIPMENT FOR DRIVING:

DELETE THE ENTIRE CONTENTS OF THE SUBSECTION
616.12–PREDRILLED PILING:

DELETE THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

The piles shall be predrilled into hard-bedrock and concrete tremied around the piles to the top of rock socket elevation as indicated in the plans. The bottom of the drilled boreholes shall be cleaned to the satisfaction of the Engineer prior to placement of concrete. Mini-Sid Inspection and CSL testing are waived. Pile alignment shall meet the criteria as defined in Section 616.6. Temporary Casing shall be used to keep the drill hole open during pile installation. The temporary casing shall be installed to the top of bedrock. The Rock Socket for the pile shall be a minimum diameter of three (3) feet. Sheer studs, when required in the plans, shall be welded onto all piles.

The boreholes shall be drilled to the elevation specified in the plans and concrete shall be tremied in the annular space around the pile to the elevation specified in the plans from the bottom of the hole. The annular space around the piles shall be backfilled with Class DC Concrete (4,500 psi). The Concrete shall be tremied according to Section 625 – Drilled Caisson Foundations.

The unconcreted zone above the top of concrete shall be as specified in the plans and backfilled with clean, dry sand to the bottom of the pile cap elevation.

616.15–BASIS OF PAYMENT:

ADD THE FOLLOWING TO THE END OF THE SECTION:

“Steel Piling, Predrilled and Backfilled with Concrete” of the size specified shall be paid for the actual length of piles remaining in the finished structure. The cost of temporary casing, concrete and sand for backfilling, and incidentals necessary to complete the work will be included in the bid price for piling. shall be incidental to applicable Pay Item for Section 616. Class DC Concrete shall be paid in accordance with Section 601.

616.16–PAY ITEMS:

ADD THE FOLLOWING ITEM TO THE TABLE:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>616001-001</td>
<td>Steel Piling, Predrilled and Backfilled with Concrete, “size”</td>
<td>Linear Foot</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Meter)</td>
</tr>
</tbody>
</table>

“size” = Piling Size
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION
FOR

STATE PROJECT NUMBER: ____________________________
FEDERAL PROJECT NUMBER: ____________________________

FOR

SECTION 405
SURFACE TREATMENTS

DELETE THE HEADING AND CONTENTS AND REPLACE THE FOLLOWING:

SECTION 405
SCRUB SEAL TREATMENT

405.1-DESCRIPTION:
This work shall consist of the construction of a wearing course, composed of asphalt material and aggregate, in one or more applications upon an existing surface, in accordance with these Specifications and in reasonably close conformity with the lines, grades, thicknesses, and cross sections shown on the Plans or established by the Engineer.

The type of Scrub Seal will be indicated on the Plans (ex Standard, Rejuvenating, RAP, etc.). The contractor may select the polymer modified emulsion grade from the table below, unless otherwise indicated. The District If approved by the Engineer the Contractor may specify the use of screened RAP as aggregate.

The contractor shall notify the engineer a minimum of two weeks 14 calendar days prior to starting any surface treatment operation.

405.2-MATERIALS:
The materials shall conform to the requirements of the following Subsections of Division 700:
TABLE 405.2a
Materials

<table>
<thead>
<tr>
<th>Materials</th>
<th>Subsection</th>
<th>Kind or Gradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1Coarse Aggregate</td>
<td>703.1-4</td>
<td>See Table 405.2b</td>
</tr>
<tr>
<td>2Polymer Modified Cationic Emulsified Asphalt</td>
<td>705.12</td>
<td>CRS-2P CRS-2L</td>
</tr>
</tbody>
</table>

1When RAP is specified as course aggregate the RAP shall be screened and meet the requirements of Table 405.2c
2Engineered asphalt emulsions may be used with testing and approval prior to construction. Testing shall be done a minimum of two weeks prior to the projected start date and follow the process outlined in Materials Procedure 401.02.25 Certification of Asphalt and Tar Shipping Terminals.

TABLE 405.2b
Aggregate Gradations

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Washed #8 3/8” (9.5) Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4” (19 mm)</td>
<td>100</td>
</tr>
<tr>
<td>1/2” (12.5 mm)</td>
<td>100</td>
</tr>
<tr>
<td>3/8” (9.5 mm)</td>
<td>95-100</td>
</tr>
<tr>
<td>1/4” (6.4 mm)</td>
<td>0-35</td>
</tr>
<tr>
<td>#8 (2.36 mm)</td>
<td>0-3</td>
</tr>
<tr>
<td>#200 (75 μm)</td>
<td>0-1.0</td>
</tr>
</tbody>
</table>

RAP screenings shall be produced by crushing asphalt concrete pavement, free of detrimental quantities of deleterious materials, and have a minimum sand equivalent of 80.

TABLE 405.2c
RAP Aggregate Gradation

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Fractionated Rap 1/2” (12.5 Mm) Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4” (19 mm)</td>
<td>100</td>
</tr>
<tr>
<td>1/2” (1.5 mm)</td>
<td>95-100</td>
</tr>
<tr>
<td>3/8” (9.5 mm)</td>
<td>0-15</td>
</tr>
<tr>
<td>1/4” (6.4 mm)</td>
<td>0-10</td>
</tr>
<tr>
<td>#8 (2.36 mm)</td>
<td>0-3</td>
</tr>
<tr>
<td>#200 (75 μm)</td>
<td>0-5.0</td>
</tr>
</tbody>
</table>

If an asphalt rejuvenator is specified in the plans, it shall be preapproved through the Materials Division and meet the requirement of RA1, RA5, or RA25 in the ASTM D4552 standard.

405.3-WEATHER RESTRICTIONS:
Scrub Seal Treatment shall be constructed only when the condition of the existing surface is satisfactory to the Engineer, when the temperature of the material-pavement being overlaid treated is 5060°F (10°C) or above, and when other weather conditions are satisfactory for construction. No Scrub Seals shall be performed between October 1 and May 1.

Operations shall be suspended immediately when rain begins or when the project engineer-Contractor determines that a rain event is imminent.

405.4-EQUIPMENT:

Equipment shall include equipment for heating asphalt material, a self-powered emulsion distributor, scrub broom, an aggregate spreader, and compaction equipment. Equipment shall also include scrapers, hand brooms, shovels, and other items as may be necessary to thoroughly clean the existing surface.

405.4.1-Distributor Truck: The distributor shall be so designed, equipped, maintained and operated that asphalt material may be applied uniformly on variable widths of surface up to 16 ft. (4.6 m) at readily determined and controlled rates from 0.05 to 2.0 gal. per sq. yd. (0.22 to 9.3 liters m²) with uniform pressure and with an allowable variation from any specified rate not to exceed 0.02 gal. per sq. yd. (0.09 liter m²). The distributor shall also have a cab-metering system that will automatically adjust the flow of the asphalt material as the speed of the truck changes and allow the operator to adjust the rate of application from the cab of the truck.

Distributor equipment shall include a tachometer, pressure gages, and accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with a power unit for the pump, and full circulation spray bars adjustable laterally and vertically. A manifold connection shall be provided and hand spraying equipment shall be available to cover areas and patches inaccessible to the distributor.

Verification Documentation of distributor truck calibration within the last 12 months shall be available on the project site, preferably located within the cab of the truck.

405.4.2-Scrub Broom: Scrub brooms shall be composed of a rigid steel frame with hydraulically operated street brooms attached. The main body of the frame shall be a minimum of 8-6 feet wide by 8 feet long. The minimum frame reach width shall be 16 feet. The maximum transverse width of the frame at any point shall not exceed 4 feet. The nearest and furthest members, paralleling the back of the distributor truck, and the diagonal members shall be equipped with street brooms. The leading member and the trailing member shall have broom heads angled at 15 degrees off the centerline of the supporting member. The diagonal members shall have broom heads attached in line with the centerline of the supporting member. Each individual street broom attached to the scrub broom assembly shall be 3-1/2 inches wide x 8 inches high x 16 inches (minimum) long and shall have stiff nylon bristles. Bristle height shall be maintained at a minimum of 5 inches. The scrub broom may be equipped with hinged wing assemblies which shall not to exceed 4 feet per side including diagonals, and shall be equipped with street brooms.

The weight of the broom assembly shall be such that it does not remove the asphalt emulsion from the roadway surface.
The scrub broom frame shall be attached to and pulled by the distributor truck. The distributor truck shall be equipped with the means to mechanically lift the scrub broom off of the roadway surface at intermediate points of completion and remain in the elevated position during transit.

**405.4.3-Aggregate Spreader:** The spreader for cover grades of coarse aggregates shall be self-propelled and capable of laying a uniform surface. It shall be a mechanical revolving cylinder type or mechanical roller hopper spreader that can be so adjusted to spread accurately the required amounts of materials per square yard.

**405.4.4-Compaction Equipment:** Compaction equipment shall be a pneumatic-tired roller conforming to the requirements of Section 401.9.10. With a minimum tire pressure of 60 psi. The project shall have a minimum of 3 rollers operating together to embed the aggregate in the emulsion. It is recommended that the rollers operate at a speed of 4 - 7 miles per hour during operation, but shall not exceed 10 mph.

**405.5-PREPARING AND REPAIRING EXISTING SURFACE:**
No scrub seal shall be applied until breaks, holes, depressions, and other irregularities in the existing surface have been repaired, to the satisfaction of the Engineer, and cured sufficiently to permit the asphalt material to be placed in a uniform application. Patching and leveling material shall be plant mixed. Hand patching will be permitted where necessary.

**405.6-CLEANING AND SWEEPING:**
Immediately before starting construction, the existing surface shall be swept and thoroughly cleaned by the use of tools or machinery as may be required to remove all mud, dirt, dust, vegetation, and other caked or loose material foreign to the type of surface to be placed. Cleaning shall be done to a minimum width of one foot on each side beyond the width of the surface to be placed excluding the shoulder. Materials collected in the cleaning operation shall be removed and disposed of as directed.

**405.7-APPLICATION OF ASPHALT MATERIAL:**
After the existing surface has been cleaned, and is in a dry condition, the asphalt material shall be applied by means of a pressure distributor. The spray bar shall be raised to a sufficient height so as to uniformly and completely coat the entire surface. The rate of application of asphalt material shall begin at the application 0.30 to 0.50 gallons per square yard, or as modified by the plans. Application temperatures of the asphalt material shall be within the range specified in Subsection 705 for the particular material being used, or in accordance with the manufacturers recommendations.

Except when required to maintain traffic, surface treatment operations shall be done upon the full width of the section.

After application, asphalt material shall completely and uniformly cover the underlying pavement and be free of streaks and voids.

**405.7.1-Scrubbing:** Immediately following application, the asphalt material shall be scrubbed into the existing pavement surface with a scrub broom that is pulled behind the
distributor truck. Scrubbing shall fill cracks and voids, force the emulsion into the existing pavement surface, and distribute the material uniformly over the roadway cross section.

405.7.2-Test Strip: The initial application rate shall be 0.35 gallons per square yard. The Contractor may suggest a different application rate backed up with design documentation, sealed by a WV Professional Engineer, in accordance with the McLeod Method or the Asphalt Institute Method on designing surface treatments.

If so requested by the Engineer, the Contractor shall apply emulsion on 100-foot test strips at different rates to assist in determination. The initial rate, and any necessary adjustments thereto during spreading, shall be approved by the Engineer.

405.8-APPLICATION OF AGGREGATE:

Immediately following each application of asphalt material, aggregate at the rate or rates called for in 405.12 shall be spread with the spreader in such a manner that the entire area being treated is uniformly covered. Equipment shall be operated so that asphalt material will be covered with aggregate before equipment passes over the area that was tacked with asphalt material. Additional aggregate shall be spread if necessary, and hand spreading shall be done to cover areas inaccessible to the spreading equipment. When directed by the Engineer, the aggregate shall be dried or moistened as required in order to obtain a near Surface Saturated Dry condition.

If the process must stop during that application any asphalt material that has been applied to the surface shall be covered with aggregate to prevent breaking of the emulsion prior to embedment of the aggregate.

405.8.1-Test Strip: The initial spread rate shall be 20 pounds per square yard. The Contractor may suggest a different application rate backed up with design documentation, sealed by a WV Professional Engineer, in accordance with the McLeod Method or the Asphalt Institute Method on designing surface treatments.

If so requested by the Engineer, the Contractor shall spread screenings on 100-foot test strips at different rates to assist in determination. The initial rate, and any necessary adjustments thereto during spreading, shall be approved by the Engineer.

The calculated spread rate upon completion shall be within 5 percent of the rate approved by the Engineer.

405.9-BROOMING AND ROLLING:

Immediately following spreading of the aggregate, the entire surface of the aggregate shall be rolled until the aggregate is keyed into the asphalt material. Any area that ravels shall be repaired and rrolled. Rolling shall be parallel to the centerline and shall begin at the edges of the treatment and progress toward the center, each trip uniformly overlapping the preceding trip.

Rolling shall cease before the aggregate is crushed to any appreciable extent. Rollers shall be the type and weight specified in 405.4. The minimum number of rollers shall be three (3), more may be used to obtain embedment of the aggregate to the satisfaction of the Engineer.

The roller speed shall be operated between 3 and 7 miles per hour to prevent aggregate pick up and ensure embedment. Water, to prevent adhesion of the asphalt material to the roller wheels, shall not be used in excessive amounts. The use of fuel oil, paraffin oil, and kerosene on rollers or other equipment, for the purpose of preventing material from picking up or sticking, is
prohibited.

405.10-JOINTS:

The longitudinal construction joints between adjacent lanes shall be kept clean of material foreign to the surface being treated. The joints shall be constructed without overlaps or gaps between the materials.

The beginning of the project and all transverse joints shall be covered with paper to prevent overlapping of the seal and provided a uniform joint. Following its use, the paper shall be removed and disposed of satisfactorily to the satisfaction of the Engineer Division.

405.11-FOG SEAL:

No less than 3 calendar days, but no more than 7 calendar days after the application of the scrub seal the surface shall have a fog seal applied. The surface shall be swept to remove loose material and an asphalt emulsion shall be applied at a rate of 0.10 gallons per square yard to the surface. Any raveled areas, flushed areas, or other defects in the scrub seal shall be repaired by the Contractor prior to the application of the fog seal.

405.12-PROTECTION OF PAVEMENT AND TRAFFIC CONTROL:

The Contractor shall be responsible for the protection of the surface against damage by their equipment and personnel. Traffic shall not be permitted on any part of the work under construction until the treatment has cured sufficiently to prevent raveling or pickup under traffic. The Contractor shall be liable for any damage and cost to repair. The applicable provisions of 636 shall apply for regulating traffic.

405.13-SEQUENCE OF OPERATIONS AND QUANTITIES OF MATERIALS:

The quantities and kinds of materials to be used and the sequence of applications and operations for the various treatments shall be as follows in accordance with Section 405.7 and 405.8. The quantities shown are the rates per square yard (meter).

Maximum quantities of asphalt material shall be used only when the old surface is open or porous. The rates of aggregate and asphalt material may be adjusted by the engineer when in the opinion of the engineer adequate coverage is not being obtained.

405.14-QUALITY CONTROL TESTING:

Quality control is the responsibility of the Contractor, as specified in 106.1.

405.14.1-Quality Control Plan: The Contractor shall design-develop and submit a quality control plan in accordance with applicable section of MP307.00.50, excluding the attached page, detailing the methods by which the quality control program will be conducted. The quality control plan must be approved by the Engineer prior to the commencement of the work. After review, the quality control plan will be approved by the Engineer. Samples will be obtained at a minimum frequency of one sample per day of aggregate placement.

405.14.2-Acceptance Testing: Acceptance sampling and testing of aggregates is the responsibility of the Division, except for furnishing the necessary materials. Quality control
sampling and testing performed by the Contractor may not be used by the Division for Acceptance.

405.14.3-Acceptance for the Grading of Coarse Aggregate: Acceptance for gradation shall be on the basis of test results on consecutive random samples from a lot. A lot shall be considered the quantity of material represented by an average test value, not to exceed five sublots. Generally at the beginning of the project, the average shall be started on the second sample in accordance with MP 300.00.51. A sublot is the quantity of material represented by a single gradation test. In the case where only one sample is taken, this sublot shall be considered the lot. The material shall be sampled and tested in accordance with the applicable specification. The gradation test results shall be plotted on a control chart in accordance with MP 300.00.51. When the average, or when the most recent three consecutive individual test values fall outside the limits of Table 405.2b or Table 405.2e703.4—the lot of material represented will be considered nonconforming to the extent that the last of its sublots is nonconforming. When this occurs, the last sublot shall have its price adjusted in accordance with Table 405.14.3.2. In the case where the average is nonconforming and the last sublot contained is conforming, then there would be no price adjustment. In no event, however, shall a sublot of material have its price adjusted more than once, and the first adjustment, which is determined, shall apply.

405.14.3.1-Degree of Nonconformance: When a sublot of material is to have its price adjusted, the percentage point difference between the nonconforming test value and the specification limit shall be determined for each sieve size determined to be nonconforming and this value shall be multiplied by its appropriate multiplication factor as set forth in Table 405.14.3.1 to determine the degree of nonconformance on that sieve.

<table>
<thead>
<tr>
<th>Nonconforming Sieve Size</th>
<th>Multiplication Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 in (100mm) to No 16 (1.18mm)</td>
<td>1.0</td>
</tr>
<tr>
<td>No 40 (4.25µm) to No 50 (300µm)</td>
<td>2.0</td>
</tr>
<tr>
<td>No 100 (150µm)</td>
<td>3.0</td>
</tr>
<tr>
<td>No 200 (75µm)</td>
<td>5.0</td>
</tr>
</tbody>
</table>

The total measure of nonconformance of an individual sublot is the sum of all nonconformances on the various sieve sizes of that sublot. When the total degree of nonconformance has been established and it is 12.0 or less, the material will be paid for at an adjusted contract price as specified in Table 405.14.3.2. When the degree of nonconformance is greater than 12.0, the nonconforming sublot shall be resolved on an individual basis, requiring a special investigation by the Engineer to determine the appropriate course of action to be followed.

If the degree of nonconformance exceeds 8.0 then the contractor shall cease operations and review material and the quality control procedure to come in compliance with these specifications.
405.14.3.2-Price Adjustment: Aggregates not conforming with the gradation requirements will be paid for at the adjusted aggregate contract price based on the degree of nonconformance as specified in Table 405.14.3.2.

**TABLE 405.14.3.2**

Adjustment of Contract Price for Gradation not Within Specifications

<table>
<thead>
<tr>
<th>Degree of Nonconformance</th>
<th>Percent of Contract Price to be Reduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 to 3.0</td>
<td>2</td>
</tr>
<tr>
<td>3.1 to 5.0</td>
<td>4</td>
</tr>
<tr>
<td>5.1 to 8.0</td>
<td>7</td>
</tr>
<tr>
<td>8.1 to 12.0</td>
<td>11</td>
</tr>
<tr>
<td>Greater than 12</td>
<td>*</td>
</tr>
</tbody>
</table>

* The Division will make a special evaluation of the material and determine the appropriate action. Pending resolution of the matter, additional lifts of treatment or pavement shall not be placed over the nonconforming material.

405.15-METHOD OF MEASUREMENT:

No materials shall be removed from the Project for any purpose until the operation has been completed and the quantities of materials incorporated into the operations have been determined, except when authorized by the Engineer.

The quantities of work done will be measured as follows:

The quantity of "Surface Treatment Aggregate" shall be measured by the ton (megagram) of material complete in place and accepted.

The number of tons (megagrams) of "Surface Treatment Aggregate" shall be determined by the total of the weights shown on receipted delivery truck tickets, or determined by the Contractor from the total and weigh slips for each vehicle load weighed on an approved standard scale, and certified by the Contractor to be correct. All truck scales shall be mounted on solid foundations which will insure their remaining plumb and level. All truck scales shall be inspected and sealed by the West Virginia Division of Labor, Bureau of Weights and Measures, or other appropriate agencies of the State or its political subdivisions. The Division may, at its option, accept inspection and sealing by out of state agencies when the material is weighed outside West Virginia. A weigh person shall be provided by the producer. The weigh person shall certify that the weight of the material, as determined either by the truck is correct. Each truck shall be weighed empty prior to each load. A digital recorder shall be required on all truck scales. The digital recorder shall produce a printed record of the gross, tare and net weights, and the time, date, truck identification and project number. Provision shall be made for constant zero compensation and further provision shall be made so that the scales may not be manually manipulated during the printing process. The system shall be interlocked so as to allow printing only when the scale has come to rest. In case of a breakdown of the automatic equipment, the Engineer may permit manual operation for a reasonable time, normally not to exceed 48 hours, while the equipment is being repaired.

The quantity of "Asphalt Material" shall be the number of gallons (liters) incorporated into the completed work, which volume will be measured as prescribed in 109.1.

There shall be no additional compensation allowed for "Cleaning and Sweeping".
The Quantity of “Scrub Seal Treatment” when specified to be paid by the square yard shall be measured by the total length of the area the surface treatment is applied times the average applied width of the treated area. This calculation shall correspond with the quantities on the plans, ±5.0%.

When items for maintaining traffic are included in the Contract, they will be measured and paid as provided in 636.

**405.16-BASIS OF PAYMENT:**

The quantities, determined as provided above, will be paid for at the contract unit prices bid for the items listed below, which prices and payments shall be full compensation for furnishing all the materials and doing all the work prescribed in a workmanlike and acceptable manner, including all labor, tools, equipment, supplies, and incidentals necessary to complete the work.

The Quantity of “Scrub Seal Treatment” when specified to be paid by the square yard shall include the cleaning and sweeping, asphalt material, aggregate and all labor and equipment required to perform the operation.

**405.17-PAY ITEMS:**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>405001-*</td>
<td>Surface Treatment Aggregate</td>
<td>Ton (Megagram)</td>
</tr>
<tr>
<td>405012-*</td>
<td>Asphalt Emulsion Material</td>
<td>Gallon (Liter)</td>
</tr>
<tr>
<td>405013-*</td>
<td>Asphalt Emulsion Material, Fog Seal</td>
<td>Gallon (Liter)</td>
</tr>
<tr>
<td>405014-*</td>
<td>Scrub Seal (Complete In-Place)</td>
<td>Square Yards (Meters)</td>
</tr>
<tr>
<td>405015-*</td>
<td>RAP Aggregate</td>
<td>Ton (Megagram)</td>
</tr>
<tr>
<td>405016-*</td>
<td>Asphalt Rejuvenator</td>
<td>Gallon (Liter)</td>
</tr>
</tbody>
</table>

* Sequence number
421.1-DESCRIPTION:
The work shall consist of providing Intelligent Compaction (IC) Rollers or IC Equipment for Rollers used for compaction of all types of asphalt mixtures.

The unit of measurement for IC will be either by the ton (megagram) or square yard (square meter) of asphalt mix placed.

The work will be accepted in accordance with these Specifications and the applicable requirements of Sections 400 or 410 of the Standard Specifications.

421.2-MATERIALS:
IC is a construction methodology, no IC materials are incorporated into the completed project.

421.3-EQUIPMENT:
In addition to the equipment specified in Subsection 401.9.9, a minimum of two (2) of the rollers are to be IC rollers are to be used on the project at all times. These two (2) IC rollers are preferred as a combination of the breakdown and finish rollers. The Contractor may elect to use IC on the intermediate rollers. All IC rollers will meet the following minimum characteristics:

421.3.1: Are equipped with a mounted positioning system to track the location of the roller location within the paving limits and track the number of passes of the rollers. This system may use Real Time Kinematic (RTK-GPS), Global Navigational Satellite System (GNSS), or other preapproved, by the Engineer, tracking units that monitor the location. Accuracy of the positioning system is to be a minimum of 12 inches.

421.3.2: Are equipped with non-contact temperature sensors for measuring pavement surface temperatures.
421.3.3: Equipped with integrated on-board documentation systems that are capable of displaying real-time color-coded maps, which shall include including the location of the roller, number of roller passes, machine settings, together with the material temperature, speed and the frequency and amplitude of roller drums. The display unit is must be capable of transferring the data by means of a USB port.

421.3.4: When Intelligent Compaction Measured Value (IC-MV) is specified in the plans the output from the roller shall be designated as the Intelligent Compaction Measured Value (IC-MV) which represents the stiffness of the materials based on the vibration of the roller drums and the resulting response from the underlying materials. In addition to the equipment requirements of 421.3 the following apply.

421.3.4.1: Rollers shall be equipped with accelerometers mounted in or about the drum to measure the interactions between the rollers and compacted materials in order to evaluate the applied compactive effort. The IC rollers must have the approval of the Engineer prior to use.

421.3.4.2: The integrated on-board display must also show real-time stiffness response values.

421.3.4.3: The output from the on-board documentation system must be compatible with standardized data analysis software, Veta, which is available free online. www.intelligentcompaction.com/veta/

421.4-WORK PLAN:

The Contractor shall submit to the Engineer an IC Work Plan at the Preconstruction Conference and at least 2 weeks prior to the beginning construction. Describe in the work plan the following:

1. Compaction equipment to be used including:
   a. Equipment Vendor(s)
   b. Roller model(s),
   c. Roller dimensions and weights,
   d. Description of IC measurement system,
   e. Position tracking capabilities,
   f. Documentation system,
   g. Temperature measurement system, and
   h. Software.

2. Roller data collection methods including sampling rates and intervals and data file types.

3. Transfer of data to the Engineer including method, timing, and personnel responsible. Data transfer shall occur at minimum twice per day or as otherwise directed by the Engineer, and Data transfer is to be either electronic or digital.

4. Training plan and schedule for roller operators, project foreman, project surveyors, and Division personnel; including both classroom and field training. Training should be conducted at least 1 week before beginning IC construction. The training is to be performed by a qualified representative(s) from the IC Roller manufacturer(s) to be used on the project.
421.5-CONSTRUCTION:

Do not begin work until the Engineer has approved, in writing, the IC submittals and the IC equipment. The Contractor shall follow the requirements established in Section 400 or 410 for materials, equipment, acceptance plans, production, placement, and adjustments; except as noted or modified in this Specification. The Contractor shall provide the Engineer at least one day’s notice prior to beginning construction or prior to resuming production if operations have been temporarily suspended. Ensure paving equipment complies with all requirements specified in Section 400 or 410. The IC roller temperatures will be verified by the Division.

421.5.1-Pre-Construction Test Section(s) Requirements: Test methods shall be those listed in Section 401.5.1.

1. Prior to the start of production, ensure the proper setup of the GPS, IC roller(s) and the rover(s) by conducting joint GPS correlation and verification testing between the Contractor, GPS representative and IC roller manufacturer using the same datum. (Note: If non-GPS tracking is used, verify locations with survey grade control points.)

2. Compare coordinates between the roller and rover receivers. If the coordinates are within 12.0 in. of each other, the comparison is acceptable. If the coordinates are not within 12.0 in., diagnose and perform necessary corrections and repeat the above steps until verification is acceptable.

3. Do not begin paving until acceptable GPS correlation and verification has been obtained.

4. The Contractor and the Department should conduct random location verification testing during production to ensure data locations are accurate. The recommended rate is once per day.

5. All acceptance testing shall be as outlined in the applicable Section 400 or 410 Specification.

421.6-CONTRACTORS QUALITY CONTROL:

421.6.1-Quality Control Testing: Quality control of asphalt pavement is the responsibility of the Contractor.

421.6.2-Response to Test Results: The response to quality control tests for the test sections and during production compaction shall follow the Quality Control plan and include as a minimum the following:

1. Temperature. Follow the procedure outlined for corrective action when the QC or IC temperature readings are not within the recommended laydown values for the mixtures.

2. Density/Compaction. Follow the procedure outlined for corrective action when the maximum specific density (Gmm) results fall below 92.0%.

3. IC Coverage Area and Uniformity Criteria. Follow the procedures outlined when the IC criteria for coverage or the minimum IC-MV targets criteria are not being met.

421.6.3-Pre-Mapping: Pre-paving mapping (pre-mapping) with an IC roller of the existing support materials is recommended prior to tacking operations, in order to identify weak areas. The pre-mapping may be part of the test section evaluation of the project.

1. Pre-mapping is recommended on underlying materials such as soils subgrade, aggregate bases, rubbelized concrete, or similar.
2. Mapping is not recommended on stabilized base, milled/non-milled existing asphalt pavements, concrete pavements, or similar underlying hard surfaces.

**421.7 through 421.11: Blank**

**421.12-METHOD OF MEASUREMENT:**

The Division will measure the total tons or square yards of asphalt mixtures compacted using the IC rollers. Compaction is to be performed by a minimum of two IC rollers, material compacted by rollers not equipped with properly functioning IC equipment will not be accepted for payment of the bid item asphalt mixtures IC rolled. Use of non-IC rollers can be accepted on small areas due to equipment malfunctions **at with** the written approval of the Engineer. Paving operations should be suspended for equipment malfunctions that will extend over multiple days of operation.

**421.13-BASIS OF PAYMENT:**

The Division will make payment for the completed and accepted quantities under the following:

1. Payment is full compensation for all work associated with providing IC equipped rollers, transmission of electronic data files, two copies of IC roller manufacturer software, and training.
2. Delays due to IC equipment malfunction (ie. loss of GPS satellite reception of signals, digital communication errors, or IC roller breakdowns) will not be considered justification for contract modifications or contract extensions.

There will be no additional compensation for Interim Pavement Markings.

**421.14-PAY ITEMS:**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>421001-001</td>
<td>Intelligent Compaction For Asphalt Pavement,</td>
<td>Ton (MG)</td>
</tr>
<tr>
<td>421001-002</td>
<td>Intelligent Compaction For Asphalt Pavement,</td>
<td>Square Yard (SY)</td>
</tr>
<tr>
<td>421001-003</td>
<td>Intelligent Compaction For Asphalt Pavement,</td>
<td>Lump Sum (LS)</td>
</tr>
</tbody>
</table>
607.2-MATERIALS:

**REMOVE THE FOLLOWING ITEM FROM THE TABLE:**

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SUBSECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galvanized Steel Deep Beam Type Guardrail Fasteners and Anchor Bolts</td>
<td>712.4</td>
</tr>
</tbody>
</table>

**ADD THE FOLLOWING SUBSECTION:**

**607.2.1-Zinc-Aluminum-Magnesium alloy coating:** The steel guardrail used on the project shall utilize a hot-dip zinc-aluminum-magnesium alloy (ZAM®) coating. This requirement does not apply to end treatments, transitions, or terminals on the project.

**607.2.1.1-Approved Products:**

<table>
<thead>
<tr>
<th>Product Coating</th>
<th>Manufacturer’s Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZAM®</td>
<td>Wheeling-Nisshin, Inc. P.O. Box 635 Follansbee, WV 26037</td>
</tr>
<tr>
<td></td>
<td>(304) 527-2800</td>
</tr>
</tbody>
</table>
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: ____________________________

FEDERAL PROJECT NUMBER: ____________________________

FOR

SECTION 661

TRAFFIC SIGNS AND DELINEATORS

661.1-DESCRIPTION:

ADD THE FOLLOWING TO THE SECTION.

661.1.2-Internally Illuminated Sign: This special provision sets forth the minimum requirements for an Internally Illuminated Sign.

661.1.2.1-Construction:
1. The body of the sign shall consist of a two-piece aluminum frame.
2. All seams shall be continuously welded for a watertight seal.
3. The color of the exterior of the sign shall be glossy black.
4. All exterior of the sign assembly shall be powder-coat paint in accordance with MIL-C-24712.
5. Finish shall meet the requirement of ASTM D 3359, ASTM D 3363 and ASTM D552.
6. A quality assurance shall be in place, meeting MIL-1-4508A or equivalent.
7. All hardware shall be type 304 or 316 Stainless Steel.
8. The module shall be a single, self-contained device, not requiring on-site assembly for installation onto existing mast arms or poles.
9. The EL-SNS assembly including the frame structure, sign face and mountain assemblies shall be designed, tested and constructed so that no permanent deformation, warping or failure will occur when subjected to 110 mph wind loads.
10. The assembly and manufacturing process for the module shall be designed to assure all internal LED and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.
11. The LED sign shall be activated by a photocell provided separately. An optional 
photocell feature can be provided with the sign. The optional photocell will be 
installed and mounted where required to prevent false triggering.

12. The sign shall incorporate over-current protection through the use of an in-line fuse. 
The fuse rating and type shall be appropriate for varying size and power 
configurations.

13. Sign shall be capable of being installed on Cable, Mast Arm Supports and 
upright supports. Must be capable of being single-sided or double-sided.

661.1.2.2-EL-SNS Assembly:
1. The EL-SNS shall consist of maximum of two (2) aluminum strip light engines 
with a secondary collimating optic lens.
2. The EL-SNS shall operate with a Class 2 UL approved constant current source 
power supply.
3. The EL-SNS shall utilize state-of-the-art high-power/high-flux LED package and a 
high efficient heat-dissipating metal carrier’s body.

661.1.2.3-Physical Dimension:
1. Nominal message bearing surface:
2. Standard widths of 48”, 72” and 96”.
3. Standard height is 18”; customized heights are available.
4. The maximum allowable weight shall be 124 lbs. excluding the hanging bracket.

661.1.2.4-Environmental Requirements:
1. The EL-SNS shall be rated for use in the ambient operating temperature range of 
-40° to 50°C.
2. The EL-SNS shall be protected against dust and moisture intrusion per NEMA 
3. The sign face shall be smooth on the outside to reduce dust and dirt collection.
4. The EL-SNS shall have UL approved foam gaskets where applicable to provide a 
water-tight seal between
5. The two-piece aluminum frame structure and between the sign face and aluminum 
frame structure.

661.1.2.5-Materials:
1. Materials used for the sign face and EL-SNS construction shall conform to ASATM 
specifications where applicable.
2. Enclosures containing the power supply and electronic components of the EL-SNS 
shall be made of UL940O flame retardant material.
3. The sign face shall be constructed from a minimum 1/8” weather-proof polymer.
4. All printed circuit boards (PCB) shall be conformably coated or epoxy potted for 
moisture resistant.
5. All wiring connections within the EL-SNS fixture shall terminate through a UL 
approved connector and/or junction box. All connectors inside the EL-SNS fixture 
and on the load side of power source shall be UL listed appliance materials (AWM) 
stranded copper wire with thermoplastic insulation.
661.1.2.6 - Module Identification:
1. Each EL-SNS shall be identified on the backside with the manufacturer’s name and serial number.
2. The following operating characteristics shall be identified: nominal operating voltage, power consumption and Volt-Ampere.
3. EL-SNS shall have a prominent and permanent vertical indexing if message surface is nondescriptive, i.e., UP ARROW or the word UP or TOP, for correct indexing and orientation inside a signal housing.

661.1.2.7 - Photometric Requirements:
1. When measured normal to the plane of the face surface, the average luminous intensity shall not be less than 70 cd/m2.
2. When measured normal to the plane of the face surface, the luminous intensity uniformity (i.e., minimum/maximum) throughout the sign face shall not be less than 67%.

661.1.2.8 - Chromaticity:
1. When measured normal to the plane of the face surface, the color temperature of white LED shall be between 3500° to 8500°K.

661.1.2.9 - Electrical:

Voltage Range
1. EL-SNS shall operate from a 60 +/-3 Hertz ac line power over a voltage range from 90 Vac rms to 260 Vac rms.
2. Nominal operating voltage for all measurements shall be 120 or 240 +/-3 Vac rms.
3. Fluctuation in the line over the voltage range shall not affect luminous intensity by more than +/-10%.
4. The LED circuitry shall prevent flickering at less than 100Hz over the entire voltage range.

Transient Voltage Protection
1. The EL-SNS on-board circuitry shall include voltage surge protection two withstand high – repetition noise transients and low-repetition, high energy transients as stated in Section 2.1.6 NEMA Standard TS-2, 1992.

EMC Noise
1. The EL-SNS and the on-board circuitry must meet Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.

661.1.2.10 - Warranty: All sign components, except power supply, shall be warranted for a minimum of 3-years. Power Supply to be warranted for a minimum of 1 year.
661.5-METHOD OF MEASUREMENT:

ADD THE FOLLOWING TO THIS SECTION:

661.5.5 Internally Illuminated Sign: This will include the following: Sign Assembly, Electrical Components, mounting hardware, cable, photoelectric cell, power supply, miscellaneous hardware and testing to assure proper operation.

661.6-BASIS OF PAYMENT:

ADD THE FOLLOWING TO THIS SECTION:

661.6.5 Internally Illuminated Sign: All material and work required to install the Internally Illuminated Sign to be bid as item 661030-001 per each sign.

661.7-PAY ITEMS:

ADD THE FOLLOWING TO THIS SECTION:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>661030-001</td>
<td>Internally Illuminated Sign (*)</td>
<td>Each</td>
</tr>
</tbody>
</table>

* Per size (4’, 6’, 8’) per type (single-sided or double-sided)
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR THE
INTERSTATE /APPALACHIAN PAVEMENT MARKING CONTRACT

STATE PROJECT NUMBER: ____________________________

FEDERAL PROJECT NUMBER: ____________________________

SECTION 663
PAVEMENT MARKINGS

663.2 – MATERIALS:

ADD THE FOLLOWING AS THE FIRST PARAGRAPH:

The Successful Contractor shall employ only one (1) pavement marking scheme per contract unless otherwise directed by the Engineer. A pavement marking scheme consists of one particular binder, bead/ceramic type(s), application rate and associated tolerances as specified by the manufacturer. There shall be no materials testing associated with the warranted pavement marking scheme, but the binder and bead/ceramic type, application rate and all other particulars shall be provided to the Engineer at the Pre-Construction Conference.

ADD THE FOLLOWING TO THE TABLE:

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SUBSECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Or Yellow Fast-Dry Traffic Paint, Type IX</td>
<td>711.43</td>
</tr>
</tbody>
</table>

663.4 – PAVEMENT PREPARATION – PREMARKING, CODING

DELETE THE SECTION AND REPLACE WITH THE FOLLOWING:

The Department will be responsible for coding and spotting where old markings cannot be determined or if the Department desires to make changes in existing markings. Where existing markings cannot be determined by the Contractor, the Division shall be given notification of seven (7) days prior to commencement of work for the Division to perform any necessary coding and spotting for these areas.

The Engineer may add or delete any route from the schedule.
The Contractor may begin painting upon Notice-To-Proceed. All materials shall be applied as recommended by the material manufacturer. This shall include surface pre-treatment, if required.

663.5 – APPLICATION:
663.5.1 General

ADD THE FOLLOWING TO THE SUBSECTION:

The pavement marking material shall be mixed uniformly throughout and shall have a homogeneous dispersement of color and beads when applied to the pavement. Prior to commencement of work, and only if required by the binder manufacturer, all existing edge, lane or center lines will be fully eradicated in accordance with Section 636.7 - Eradication of Pavement Markings. When eradicating lane or center lines, the Contractor shall replace the lines within twenty-four hours from the start of eradication. The eradication shall be incidental to Pay Items 663001 and 663002.

The Contractor shall provide pavement markings on Interstate and Expressway routes in city limits only on Sunday, unless otherwise directed by the Engineer.

663.5.2.1 – Approved Equipment and Personnel:

DELETE PARAGRAPH TWO OF THE SECTION AND REPLACE WITH THE FOLLOWING:

The Contractor within seven (7) days prior to commencement of the project shall submit to the Engineer a detailed list of all equipment and the resumes of all personnel within the confines of who will or may perform any work on the project. The Contractor shall also provide certification from the binder manufacturer that the Contractor is qualified to apply the manufacturer's material in conformance with these specifications.

ADD THE FOLLOWING TO THE END OF THE SECTION:

The Contractor shall provide a calibrated measuring device for placing pavement marking materials.

The Contractor is responsible for quality control, and shall employ a Project Control Coordinator (PCC) at the Contractor's expense. The PCC shall be designated and in attendance at the Pre-Construction Conference. This PCC shall be a member of the District Pavement Marking Crew. The PCC shall be responsible for all communication between the District Pavement Marking Crew and District Personnel. Communications shall be provided to the District, and shall be employed between the PCC and the District in the form of cellular phone technology, two-way radio, or other form of communication during working hours (communications shall be at the Contractor's expense and shall be integral to the contract cost).

The PCC shall be required to fill out all Daily Centerline Report(s) and provide these completed forms to the Engineer for payment. The Contractor shall provide the District all collective daily centerline reports on a weekly basis. The Contractor's weekly centerline...
reports shall be delivered to the Engineer the first work day of the following week. Failure to deliver centerline reports will delay payment for this work.

The Engineer will randomly check the accuracy of these reports. If a discrepancy of more than 2% is found, the Contractor will be required to have an independent consultant, approved by the Division, verify all pay items on this contract. The cost of this consultant will be the responsibility of the Contractor and no reimbursement will be made by the Department.

663.6 – METHOD OF MEASUREMENT:

DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

The quantities listed in the proposal are for estimation purposes only. The quantity of pavement marking lines to be paid for shall be the actual number of pavement markings which have been satisfactorily placed.

663.8 – PAY ITEMS

ADD THE FOLLOWING TO THE TABLE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>663001-046</td>
<td>Edge Line Type IX Black Contrast - 10 in</td>
<td>Mile</td>
</tr>
<tr>
<td>663002-082</td>
<td>Lane Line, Type IX Black Contrast - 6 in</td>
<td>Linear Foot</td>
</tr>
<tr>
<td>663002-084</td>
<td>Lane Line, Type IX Black Contrast - 10 in</td>
<td>Linear Foot</td>
</tr>
</tbody>
</table>
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR THE
INTERSTATE /APPALACHIAN PAVEMENT MARKING CONTRACT

STATE PROJECT NUMBER: ____________________________

FEDERAL PROJECT NUMBER: _________________________

SECTION 711
PAINTS, COATINGS, OILS AND INKS

ADD THE FOLLOWING TO THE SECTION:

711.43 – WHITE OR YELLOW FAST-DRY TRAFFIC PAINT (TYPE IX):

711.43.1 – General: The pavement marking material shall be formulated as a medium life pavement marking system capable of providing a minimum of two years of continuous performance as specified by the retroreflective parameters established within this contract. The binder, as provided by the pavement marking manufacturer shall be lead free and be suitable for bituminous and concrete pavements. The Contractor shall employ a binder which is placed at no less than 20 mils. The material shall be capable of retaining reflective glass beads or ceramic elements of the drop-on or spray-on type as specified by the bead / ceramics manufacturer.

711.43.1.1 – Definitions:

- **Acceptance Date Of Warranted Work** – the date when the warranted work is completed and is continuously open to traffic. This is the date of initial acceptance and constitutes the start date for the warranty period.

- **Initial Acceptance** – The Division and the Contractor shall jointly review all completed warranted work. If the Division determines that the warranted work is in compliance with the Contract Specifications and is continuously open to traffic then the Date of Initial Acceptance occurs. If the work does not meet contract requirements, the Contractor shall make all necessary corrections at it’s expense according to the specifications here-in. The date on which initial acceptance occurs is termed the “Acceptance Date of Warranted Work”.

- **Warranty Bond** – a bond issued in the amount of $________________ by a surety which guarantees that the warranty requirements of this contract will be met.
• **Warranty Period** – the time frame within the contract that the warranty criteria as specified in the provision and specifications for sections 711.43 and 715.40 are to remain in effect.

• **Warranted Work** – work that is guaranteed to meet the warranty requirements throughout the warranty period as stipulated in sections 711.43 and 715.40.

• **Warranty Work** – corrective action taken by the Contractor to bring the warranted work into compliance with the specifications and provisions of the contract.

**711.43.2 – Color and Retroreflectivity Requirements:** The Contractor shall provide a pavement marking system to meet the following performance requirements:

**MAP-21 Section 1504 Requirements:** Reflective elements that are manufactured using glass and that are applied to temporary traffic zone paint shall meet all applicable state and federal requirements pertaining to materials content. Specifically, such elements shall meet the requirements of Section 1504 of MAP-21. Prior to application of the markings, the Contractor shall provide certifications of compliance with Section 1504 of MAP-21 for all applicable reflective elements. These certifications shall be from each supplier of applicable reflective elements to be used on the project, and shall identify the reflective elements being used on the project by stating the identifier used by the supplier(s), such as the product name(s) or product code number(s). Each supplier’s certification shall be accompanied by a certification(s) from an independent testing laboratory. The lab certification(s) shall certify that a representative sample of the supplier’s product(s) has been tested, and that the product(s) meets the requirements of Section 1504 of MAP-21. The lab certification(s) shall provide clear indication that the products tested include the product(s) specified by the supplier(s) in their certification letter(s), and shall indicate the date(s) that the testing was performed. The date of testing for each product shall be one (1) year or less prior to the letting date of the Contract. The representative sample(s) tested are not required to be from the same batch or lot number assigned to the reflective elements used on the project.

**COLOR:** Each color installed shall match those chromaticity limits within this section. Color determination and testing will be made at any point within the contract period. The color shall show no appreciable discoloration due to aging during the life of this contract. Pavement markings may be visually checked by the Engineer or designee at any time during the life of this contract. Additionally, the Engineer or designee, may at any time during the life of this contract use a portable colorometer to determine if the markings have faded or darkened beyond the CIE Chromaticity Coordinate Limits listed in the following table:

<table>
<thead>
<tr>
<th>COLOR</th>
<th>CIE CHROMATICITY COORDINATE LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>X</td>
</tr>
<tr>
<td>White</td>
<td>0.480</td>
</tr>
<tr>
<td>Yellow</td>
<td>0.575</td>
</tr>
</tbody>
</table>

The color shall show no appreciable discoloration due to aging during the life of this contract. Pavement markings shall be visually checked by the Engineer or designee upon the completion of the Project or after thirty days following application of the binder.
RETROREFLECTIVITY: Dry, Wet Recovery and Wet Continuous

- Reflectivity values of applied pavement marking system shall maintain values of 300 MCD/M²/LX for white pavement markings and 225 MCD/M²/LX for yellow pavement markings.

All values aforementioned shall be maintained for a minimum of 75 days after August 15th, 2017 completion date as measured with a LTL-X retroreflectometer or equal 30 meter device approved by the Traffic Engineering Division (TED). Mobile Reflectivity instruments shall be considered a 30 meter device. The Mobile Retroreflectivity reading shall be the primary source of measurement of retroreflectivity. Once it has been established that all the aforementioned values have been maintained for the 75 day period, the Contractor shall submit the Initial Acceptance for Pavement Marking Warranty Form, and this shall be considered Initial Acceptance of the Contract work to be warranted.

The Contractor will also be required to take and record a minimum of five (5) readings per color per day utilizing an LTLX-retroreflectometer. These readings shall be recorded on the daily report and should be taken throughout the day. All readings shall be submitted to the District Construction Office.

711.43.3 - Sampling and Testing Procedures for Performance Samples: During the pavement marking contract, the pavement marking materials furnished and installed under this project shall show no signs of failure greater than five (5) percent loss due to blistering, excessive cracking, bleeding, staining, discoloration, smearing or spreading under heat, deterioration due to contact with oil or gasoline, chipping, spalling, poor adhesion to the pavement, damage from traffic and normal wear. Snowplow damage shall be considered as normal wear within this contract.

The following values shall be maintained after the date of Initial Acceptance and its respective retroreflectivity until August 15th, 2018.

- Retroreflectivity values of 190 MCD/M²/LX for white, and 160 MCD/M²/LX for yellow pavement markings.

Loss due to pavement failure, unless caused by the marking material, will not be considered as a material failure and will not be included in the loss calculations and/or retroreflectivity readings.

Periodic pavement marking reviews shall be performed throughout the project locations and warranty period. These reviews will occur at any time after the markings have been placed. These reviews will evaluate the pavement marking material within the project limits for either day and night acceptability considering all requirements listed above.

During the life of this contract if any markings are found deficient, the Contractor will be given notification stating the locations and the type of deficiency. These notifications will be given at any time during the life of the contract, but no later than 60 days after project completion date.

Upon notification, if the Contractor does not complete the replacement of all of the deficient pavement markings by the end of twenty (20) calendar days, the Contractor shall be
subject to liquidated damages as described within Section 108.7 of the West Virginia Division of Highway's Standard Specifications until replacement is completed. No direct payment shall be made for the replacement of any deficient pavement marking during the warranty period as such work shall be considered as incidental to the work as paid for by the various pavement marking items in the contract.

711.43.4 – Initial Acceptance: A copy of the Initial Acceptance for Pavement Marking Warranty from will be sent to the Contractor’s warranty bond surety agent by the Division. Neither the Initial Acceptance nor any prior inspection acceptance or approval by the Division diminishes the Contractor’s responsibility under this warranty (note: a copy of the form is located at the end of this provision).

711.43.5 – Warranty Bond: The Contractor shall furnish a single term warranty bond, in the amount stipulated in Section 711.43.1.1. The effective starting date of the warranty bond shall be the Acceptance Date of Warranted Work. The warranty bond will be released at the end of the Warranty Period or after all warranty work has been satisfactorily completed whichever is later.
WEST VIRGINIA DIVISION OF TRANSPORTATION

INITIAL ACCEPTANCE FOR PAVEMENT MARKING WARRANTY FORM

CONTRACT ID:

STATE PROJECT NUMBER:

SURETY NAME:

SURETY ADDRESS:

CONTRACTOR NAME:

CONTRACTOR ADDRESS:

WORK TYPE:

DATE ACCEPTED

PROJECT ENGINEER:

INITIAL ACCEPTANCE OF WARRANTY WORK APPROVAL

CONTRACTOR’S SIGNATURE:

ENGINEER’S SIGNATURE:

ACCEPTANCE DATE:

cc: Surety Company, Financial Services - Payments
WEST VIRGINIA
DIVISION OF TRANSPORTATION
PAVEMENT WARRANTY BOND

Bond Number __________________

KNOWN ALL MEN BY THESE PRESENTS:
That we, (hereinafter called the “Principal”), and
______________________________________________________, a corporation duly organized under the laws of the
State of _________________________ and duly licensed to transact business in the State of West Virginia
(hereinafter called “Surety”), are held and firmly bound unto the West Virginia Division of Transportation (hereinafter
called the “Obligee”), in the sum of Dollars ($), for the payment of which sum well and truly to be made, we, the said
Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and
severally, firmly by these presents.

WHEREAS, the said Principal has heretofore entered into a contract with the West Virginia Division of Transportation
dated ______________________under Contract ID
and;

WHEREAS, the said Principal is required to guarantee the installed Contract Surface Course under said contract,
against specific pavement defects which may develop during the period(s) of years beginning the date(s) of the
Acceptance Date of Construction by the Obligee.

In no event shall losses paid under this bond aggregate more than the amount of the bond.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if said Principal shall faithfully
carry out and perform the said guarantee, and shall, on due notice, repair and make good at its own expense any and
all specific pavement defects in the said work which may develop during the period specified above or shall pay over,
make good and reimburse to the said Obligee all loss and damage which said Obligee may sustain by reason of failure
or default of said Principal so to do, then this obligation shall be null and void; otherwise shall remain in full force
and effect.

PROVIDED HOWEVER, that in the event of any default on the part of said Principal, a written statement of the
particular facts showing such default and the date thereof shall be delivered to the Surety by registered mail, within
thirty (30) days after the Obligee or his representative shall learn of such default and that no claim, suit or action by
reason of any default of the Principal shall be brought hereunder after the expiration of thirty (30) days from the end
of the warranty period as herein set forth.

Signed this day of ,.

Contractor
By
Surety ________________________________
By
Attorney-In-Fact
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: ____________________________
FEDERAL PROJECT NUMBER: ____________________________

FOR

SECTION 670
WATERLINE INSTALLATION

670.1-DESCRIPTION:

ADD THE FOLLOWING SENTENCE TO THE END OF THE PARAGRAPH ONE:

This work shall also consist of installing underground utilities using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring or guided horizontal boring. HDD method shall be at location shown on the plans.

670.2-MATERIALS:

ADD THE FOLLOWING:

High Density Polyethylene (HDPE) pipe and fittings shall conform to ASTM D2513. Materials used for the manufacture of polyethylene pipe and fittings shall be PE 2708 (PE2406) medium density polyethylene meeting cell classification 234373E per ASTM D 3350; and shall be Listed in PPI (Plastics Pipe Institute) TR-4 with standard grade HDB ratings of 1250 psi at 73°F, and 1000 psi at 140°F. Materials shall be stabilized against ultraviolet deterioration and shall be suitable for unprotected outdoor storage for at least four (4) years.
670.4-WATER PIPE:
   670.4.2-Laying and Joining:
   D. Plastic Pipe:

ADD THE FOLLOWING AS A NEW ITEM IX:

IX. Heat Fusion Joint: Butt, socket, and saddle fusion joints in polyethylene water piping shall be made using procedures that have been qualified and approved by the Operator.

The Operator shall ensure that all persons making heat fusion joints have been qualified to make joints in accordance with the Operator’s Approved Qualified Fusion Procedures. The Operator shall maintain records of qualified personnel, and shall certify that qualification training was received not more than 12 months before commencing construction. The Contractor shall ensure that all persons making heat fusion joints are qualified in accordance with this section.

The Manufacturer shall offer qualified fusion procedures and training materials for the use of the Operator.

Butt Fusion Of Unlike Wall Thickness: Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR, for example, SDR 9 (9.3, 9.33) to SDR 11 (11.5) or SDR 11 (11.5) to SDR 13.5. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means or electrofusion. Standard DR’s for polyethylene pipe are 7.3, 9, 11, 13.5, 17 and 21.

Joining By Other Means: Polyethylene water pipe and fittings may be joined together or to other materials by transition fittings, fully restrained mechanical couplings, or electrofusion. These devices shall be designed for joining polyethylene to another material and shall be approved by the Operator for use in his gas distribution system. When joining by other means, the installation instructions of the joining device manufacturer shall be observed. When mechanical OD compression couplings are used, polyethylene gas pipe shall be reinforced with a stiffener in the pipe bore. Stiffeners shall be properly sized for the diameter and wall thickness of polyethylene pipe being joined. For service pipe connections, the stiffener length shall match the pipe end penetration depth into the coupling.
ADD THE FOLLOWING NEW SUBSECTION:

670.4.8-Directional Drilling Installation:

670.4.8.1-Equipment: The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing & delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. A berm, minimum of 12” high, shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) to prevent spills into the surrounding environment.

670.4.8.2-Quality Assurance: The requirements set forth in this document specify a wide range of procedural precautions necessary to insure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification. Adherence to the specifications contained herein, or the Engineer's approval of any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract.

670.4.8.3 - Licenses and Permits: A licensed and insured Contractor shall perform all underground gas distribution piping construction work. The contractor performing underground gas piping work must have insurance equal to or exceeding the limits specified in 103.6 of the WV DOT Standard Specifications for Road and Bridges. The Contractor shall secure all necessary permits before commencing construction.

670.4.8.4-Execution:

670.4.8.4.1-General: The Engineer must be notified 48 hours in advance of starting work. The Directional Bore shall not begin until the Engineer is present at the job site and agrees that proper preparations for the operation have been made. The Engineer approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract.

670.4.8.4.2-Site Preparation: Work site as indicated on drawings, within right-of-way or easement, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.
670.4.8.4.3-Drill Path Survey: Entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings.

670.4.8.4.4-Pipe: Pipe shall be welded/fused together in one length, if space permits. Pipe will be placed on pipe rollers before pulling into bore hole with rollers spaced close enough to prevent excessive sagging of pipe.

670.4.8.4.5-Pilot Hole: Pilot hole shall be drilled on bore path with no deviations greater than 5% of depth over a length of 100'. In the event that pilot does deviate from bore path more than 5% of depth in 100', Contractor will notify Engineer and Engineer may require Contractor to pull-back and re-drill from the location along bore path before the deviation.

670.4.8.4.6-Reaming: Upon successful completion of pilot hole, contractor will ream bore hole to a minimum of 25% greater than outside diameter of pipe using the appropriate tools. Contractor will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.

670.4.8.4.7-Pull-Back: After successfully reaming bore hole to the required diameter, contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations contractor will not apply more than the maximum safe pipe pull pressure at any time. In the event that pipe becomes stuck, contractor will cease pulling operations to allow any potential hydro-lock to subside and will commence pulling operations. If pipe remains stuck, contractor will notify Engineer. Engineer and contractor will discuss options and then work will proceed accordingly.

670.4.8.4.8-Pipe Testing: After swabbing all mains, test pipe according to 670.4.6.

670.4.8.4.9-Disinfection: After testing pipe, disinfect pipe according to 670.4.7.

670.4.8.3.10-Site Restoration: Following drilling operations, contractor will demobilize equipment and restore the work-site to original condition. All excavations will be backfilled and compacted to 95% of original density. Landscaping will be restored to original. All mud shall be disposed of by the Contractor.

670.4.8.3.11-As-Builts: Contractor shall maintain a daily project log of drilling operations and a guidance system log with a copy given to Engineer at completion of project. As-built drawings shall be certified as to accuracy by the Contractor.
670.11-METHOD OF MEASUREMENT:
The directional drilling will be measured, in linear feet, based on the length of directional drilling installed, and shall include all material and installation. The length of the water pipe shall be measured in accordance with 670.11.1

670.13 – PAY ITEMS:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>670007-*</td>
<td>“size” Polyethylene Tubing, Class “class”</td>
<td>Linear Feet (Meter)</td>
</tr>
</tbody>
</table>

* Sequence number
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

SECTION 405
SURFACE TREATMENTS

DELETE THE ENTIRE CONTENTS AND REPLACE THE FOLLOWING:

SECTION 405
CHIP SEALS

405.1-DESCRIPTION:
This work shall consist of the construction of a wearing course, composed of asphalt emulsion immediately followed by a single layer of aggregate, in one or more applications, followed by a fog seal. The type of Chip Seal will be indicated on the Plans.

The contractor shall notify the Engineer a minimum of two weeks prior to starting any Chip Seal operation. In addition, the contractor shall submit proposed sources of all materials.

405.2-MATERIALS:

405.2.1-Aggregate: The aggregate shall be from an approved source and shall conform to the requirements of the Standard Specifications Section 703.1-4. It is expected that the aggregate will be washed to reduce dust content. The aggregates shall be crushed with a minimum of 80% two face fracture. Aggregates shall meet the following gradations when specified in section 405.12:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
</tr>
</tbody>
</table>
| 25    | 1"
| 1"    | 100    | 100    |        |        |        |        |
| 19    | 3/4 "  | 100    | 100    |        |        |        |        |
| 12.5  | 1/2 "  | 90     | 100    | 100    | 100    |        |        |
| 9.5   | 3/8 "  | 5      | 30     | 90     | 100    | 100    | 100    |
| 4.75  | # 4    | 0      | 10     | 5      | 30     | 90     | 100    |
| 2.38  | # 8    | 0      | 10     | 5      | 30     |        |        |
| 1.19  | # 16   | 0      | 2      |        |        | 0      | 10     |
| 0.6   | # 30   | 0      | 2      |        |        |        |        |
| 0.3   | # 50   | 0      | 2      |        |        |        |        |
| 0.075 | # 200  | 0      | 2      | 0      | 2      | 0      | 2      |
405.2.2-Asphalt Emulsion: The asphalt emulsion for Chip Seals and the emulsion for the fog seal shall be from an approved source and shall meet the requirements of the Section 705.

405.3-WEATHER RESTRICTIONS:
Chip Seal shall be constructed only when the condition of the existing surface is satisfactory to the Engineer, when the temperature of the existing pavement is 50° F (10° C) or above, and when other weather conditions are satisfactory for construction. The temperature may be waived but only when approved by the Engineer. No Chip Seal shall be performed between October 1 and May 1.

Chip Seal operations shall be suspended immediately when rain begins or when the Engineer determines that a rain event is imminent.

405.4-EQUIPMENT:
Equipment shall include equipment for emulsion distribution, aggregate spreading, compaction, and sweeping before and after application. Equipment shall also include scrapers, hand brooms, shovels, and other items as may be necessary to thoroughly clean the existing surface.

405.4.1-Emulsion Distributor: The distributor shall be so designed, equipped, maintained and operated that asphalt material may be applied uniformly on variable widths up to 16 ft. (4.6 m) at readily determined and controlled rates from 0.05 to 2.0 gal. per sq. yd. (0.22 to 9.3 liters sq. m) with uniform pressure and with an allowable variation from any specified rate not to exceed 0.02 gal. per sq. yd. (0.09 liter sq. m).

The distributor shall also have a cab-metering system that will automatically adjust the flow of the asphalt material as the speed of the truck changes and allow the operator to adjust the rate of application from the cab of the truck.

Distributor equipment shall include a tachometer, pressure gages, and a thermometer for measuring temperatures of tank contents.

Distributors shall be equipped with a power unit for the pump, and full circulation spray bars adjustable laterally and vertically. A manifold connection shall be provided and hand spraying equipment shall be available to cover areas and patches inaccessible to the distributor.

Verification of distributor truck calibration within the past 12 months shall be available on the project site, preferably located within the cab of the truck.

405.4.2-Aggregate Spreader: The aggregate spreader shall be self-propelled with front discharge capable of adjusting to evenly and accurately distribute at the required placement rates.

405.4.3-Compaction Equipment: A minimum of two self-propelled pneumatic tire rollers shall be used, at a minimum of 12 tons each. Roller tires shall have a minimum of 60 psi.

405.4.4-Sweepers: Power sweepers, pickup sweepers, or rotary brooms shall be used for surface preparation as well as removing any loose aggregate after compaction. Steel bristles shall not be used on the Chip Seal after compaction.
405.5-PREPARING AND REPAIRING EXISTING SURFACE:
No chip seal shall be applied until breaks, holes, depressions, and other irregularities in the existing surface have been repaired and cured sufficiently to permit the asphalt material to be placed in a uniform application. Patching and leveling material shall be plant mixed. Hand patching will be permitted where necessary. Remove all existing thermoplastic markings and raised pavement markers. Protect any drains or other utility covers. Apply a light fog seal to asphalt patched surfaces less than 2 months old, using an asphalt emulsion that is compatible with the emulsion being used for the chip seal.

405.6-CLEANING AND SWEEPING:
Immediately prior to construction, the existing surface shall be swept and thoroughly cleaned to remove all mud, dirt, dust, vegetation, and other caked or loose foreign material. Cleaning shall be done to a minimum width of one foot on each side beyond the width of the surface to be placed excluding the shoulder. Materials collected in the cleaning operation shall be removed and disposed of as directed.

405.7-APPLICATION OF ASPHALT MATERIAL:
After the existing surface has been cleaned, and is in a dry condition, the asphalt material shall be applied by means of a pressure distributor. The spray bar shall be raised to a sufficient height so as to uniformly and completely coat the entire surface. The rate of application of asphalt material shall be in accordance with section 405.12, or as modified by the plans. Application temperatures of the asphalt material shall be within the range specified in Subsection 705 for the particular material being used, or as documented by the manufacturer.

Except when required to maintain traffic, Chip Seal operations shall be done upon the full width of the section.

After application, asphalt material shall completely and uniformly cover the underlying pavement and be free of streaks, voids, and puddles.

405.8-APPLICATION OF AGGREGATE:
Immediately following each application of asphalt material, aggregate at the rate or rates called for in 405.12 shall be spread with the spreader in such a manner that the entire area being treated is uniformly covered. No traffic, construction or otherwise, shall be allowed on the asphalt material before placing aggregate. Additional aggregate shall be spread if necessary, and hand spreading shall be done to cover areas inaccessible to the spreading equipment. The aggregate shall be dried or moistened as required in order to obtain a near Surface Saturated Dry condition.

If the process must stop during that application any asphalt material that has been applied to the surface shall be covered with aggregate to prevent breaking of the emulsion prior to embedment of the aggregate.

405.9-ROLLING AND SWEEPING:
Immediately following spreading of the aggregate, the entire surface of the aggregate shall be rolled until the aggregate is keyed into the asphalt material. Any area that ravells shall be repaired and rerolled. Rolling shall be parallel to the centerline and shall begin at the edges of the treatment and progress toward the center, each trip uniformly overlapping the preceding trip. There shall be at least three passes made with a pneumatic roller.

Rolling shall cease before the aggregate is crushed to any appreciable extent. Rollers shall be the type and weight specified in 405.4.3. To ensure aggregate embedment before the emulsion
has set, the minimum number of rollers shall be two (2). More rollers may be used to obtain compaction to the satisfaction of the Engineer.

The roller speed shall not exceed 10 miles per hour to prevent aggregate pick up and ensure embedment. Water, to prevent adhesion of the asphalt material to the roller wheels, shall not be used in excessive amounts. The use of fuel oil, paraffin oil, and kerosene on rollers or other equipment, for the purpose of preventing material from picking up or sticking, is prohibited.

After the emulsion has cured, sweeping can commence. The status of being cured shall be determined by the ability to sweep all loose aggregate from the surface without removing any aggregate adhered to the asphalt emulsion.

405.10-JOINTS:

The longitudinal construction joints between adjacent lanes shall be kept clean of material foreign to the surface being treated. The joints shall be constructed without overlaps or gaps between the materials.

The beginning of the project and all transverse joints shall be covered with paper to prevent overlapping of the seal and provided a uniform joint. Following its use, the paper shall be removed and disposed of satisfactorily.

405.11-PROTECTION OF PAVEMENT AND TRAFFIC CONTROL:

The Contractor shall be responsible for the protection of the surface against damage by their equipment and personnel. Traffic shall not be permitted on any part of the work under construction until sweeping has been completed. The applicable provisions of 636 shall apply for regulating traffic.

405.12-SEQUENCE OF OPERATIONS AND QUANTITIES OF MATERIALS:

The quantities and kinds of materials to be used and the sequence of applications and operations for the various treatments shall be as follows. Maximum quantities of asphalt emulsion may be used only when the old surface is open or porous. Sweep each layer of multiple layers. The rates of aggregate and asphalt emulsion may be adjusted by the Engineer. The contractor may suggest different application rates to the Engineer for consideration by submitting a project specific Chip Seal design based on McLeod or Modified Kearby Design Methods.

<table>
<thead>
<tr>
<th>Type</th>
<th>Layer</th>
<th>Asphalt Emulsion (gal/SY)</th>
<th>Aggregate (lb/SY)</th>
<th>Gradation</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>First</td>
<td>0.15 to 0.25</td>
<td>8 to 10</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>First</td>
<td>0.25 to 0.40</td>
<td>15 to 25</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Double</td>
<td>First</td>
<td>0.25 to 0.40</td>
<td>25 to 35</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>0.25 to 0.35</td>
<td>10 to 20</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Triple</td>
<td>First</td>
<td>0.30 to 0.50</td>
<td>25 to 45</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>0.30 to 0.50</td>
<td>25 to 35</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>0.25 to 0.35</td>
<td>10 to 20</td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>

405.13-FOG SEAL:

Unless otherwise specified, a fog seal shall be applied. This shall be done no less than 3 calendar days, but no more than 7 calendar days, after the application of the Chip Seal. The surface
shall be swept to remove loose material and an asphalt emulsion shall be applied uniformly at a rate of 0.10 gallons per square yard to the surface. Any raveled areas, flushed areas, or other defects in the scrub seal shall be repaired prior to the application of the fog seal.

**405.14-TESTING AND ACCEPTANCE:**

**405.14.1-Quality Control Testing:** Quality Control is the responsibility of the Contractor, as specified in 106.1. The contractor shall design and submit a quality control plan in accordance with applicable section of MP307.00.50 detailing the methods by which the quality control program will be conducted.

**405.14.2-Acceptance Testing:** Acceptance sampling and testing is the responsibility of the Division. Acceptance for aggregate will be based on the uniformity of the aggregate and the dust content. Samples shall be taken from the conveyor belt of the aggregate spreader, in accordance with MP 700.00.06. A sublot shall be defined as one lane mile. Fractions of a mile less than 0.5 will be included in the previous sublot, and fractions of a mile greater than 0.5 will be a separate sublot.

**405.14.2.1-Acceptance of Aggregate Uniformity:** The more uniform the material, the better performance potential of the chip seal. Uniformity of the aggregate will be measured by the Coefficient of Uniformity, $C_u$, as defined in ASTM D2487. Adjustments per sublot will be as follows.

<table>
<thead>
<tr>
<th>$C_u$</th>
<th>Percent Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>$&lt;1.7$</td>
<td>1% incentive per 0.1 below</td>
</tr>
<tr>
<td>$1.7 – 3.0$</td>
<td>No Adjustment</td>
</tr>
<tr>
<td>$3.1 – 4.0$</td>
<td>2% disincentive per 0.1 above</td>
</tr>
<tr>
<td>$&gt;4.1$</td>
<td>*Special evaluation to consider remove and replace</td>
</tr>
</tbody>
</table>

**Table 405.13.2.1 Adjustment Of Contract Item Price For Aggregate Uniformity**

**405.14.2.2-Acceptance of Aggregate Dust Content:** Dust content will be determined by AASHTO T11. Adjustments per sublot will be as follows.

<table>
<thead>
<tr>
<th>% Dust</th>
<th>Percent Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 – 1.0$</td>
<td>2% incentive</td>
</tr>
<tr>
<td>$1.1 – 2.0$</td>
<td>No Adjustment</td>
</tr>
<tr>
<td>$2.1 – 3.0$</td>
<td>2% disincentive</td>
</tr>
<tr>
<td>$3.1 – 3.5$</td>
<td>5% disincentive</td>
</tr>
<tr>
<td>$3.6 – 4.0$</td>
<td>8% disincentive</td>
</tr>
<tr>
<td>$4.1 – 4.5$</td>
<td>12% disincentive</td>
</tr>
<tr>
<td>$&gt;4.5$</td>
<td>*Special evaluation to consider remove and replace</td>
</tr>
</tbody>
</table>

**Table 405.13.2.2 Adjustment Of Contract Item Price For Dust Content**
**4015.15-METHOD OF MEASUREMENT:**

The quantity of “asphalt emulsion” shall be the number of gallons (liters) incorporated into the completed work, which volume will be measured as described in 109.1.

Chip Seal aggregate shall be paid for by the Square Yard (Square Meter), measured by the total length of the area times the average applied width of treated area.

**405.16-BASIS OF PAYMENT:**

The quantities, determined as provided above, will be paid for at the contract unit prices bid for the items listed below, which prices and payments shall be full compensation for furnishing all the materials and doing all the work prescribed in a workmanlike and acceptable manner, including all labor, tools, equipment, supplies, and incidentals necessary to complete the work.

**405.17-PAY ITEMS:**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>405xxx-*</td>
<td>Surface Treatment Aggregate</td>
<td>Square Yards (Square Meters)</td>
</tr>
<tr>
<td>405xxx-*</td>
<td>Asphalt Emulsion Material</td>
<td>Gallon (Liter)</td>
</tr>
<tr>
<td>405xxx-*</td>
<td>Asphalt Emulsion Material, Fog Seal</td>
<td>Gallon (Liter)</td>
</tr>
</tbody>
</table>

* Sequence number
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 603
PRESTRESSED CONCRETE MEMBERS

603.2-MATERIALS:

ADD THE FOLLOWING SENTENCE AT THE END OF THE SUBSECTION:

Component materials used in the fabrication of precast and prestressed concrete members, and any ship loose materials pertaining to precast and prestressed concrete items, shall be approved in accordance with MP 603.02.10.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 603
PRESTRESSED CONCRETE MEMBERS

603.6.2-Mix Design:

DELETE THE FIRST PARAGRAPH OF THE SUBSECTION ADD REPLACE WITH THE FOLLOWING:

Concrete mixtures shall be established initially by methods in accordance with ACI 318, Chapter 5, 301, Chapter 4. Class S-P concrete mixtures shall be developed in accordance with MP 711.03.23 and the requirements of this Section, not the ACI methods. Mixes may be designed either by a commercial laboratory or by PCI certified concrete plant personnel. Prior to adoption of a mix design as a plant standard, it shall be field tested by use of the production plant batching and mixing equipment, construction methods, and curing to be used in production of the members. The use of a previous mix design can be approved for a project if sufficient test data (30 or more tests) are available from the past year for evaluation (ACI 301, Chapter 3, method).
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: _______________________
FEDERAL PROJECT NUMBER: ____________________

FOR

SECTION 607
GUARDRAIL

607.1-DESCRIPTION:

ADD THE FOLLOWING ITEM TO THE END OF THE LIST OF PARAGPH TWO:

Type 6, Galvanized Steel Modified Thrie Beam

ADD THE FOLLOWING PARAGRAPH TO THE END OF SUBSECTION:

The Thrie Beam Bullnose Terminal shall be of the standard generic type as shown in the special details of the Plans.

607.4-ERECTING RAIL ELEMENTS:

ADD THE FOLLOWING SUB-SECTION:

607.4.6-Type 6 Guardrail (Galvanized Steel Modified Thrie Beam): This rail shall be erected in accordance with the requirements of 607.4.2 and as shown on the Plans.

607.4.7-Thrie Beam Bullnose Terminal: This terminal shall be erected in accordance with the requirements of 607.4.2 and as shown on the Plans.
607.6-METHOD OF MEASUREMENT:

ADD THE FOLLOWING SENTENCE TO THE END OF FIRST PARAGRAPH:

The quantity of work done will be measured in linear feet (meters) of Steel Modified Thrie Beam of the type indicated on the special details in the Plans, complete in place and accepted, measured along the face of the rail from center to center of end posts.

ADD THE FOLLOWING PARAGRAPH TO THE END OF THE SUBSECTION:

Where Steel Thrie Beam Bullnose Terminals are used, they will be measured separately and the pay limit for each terminal shall be as shown on the special details in the plans.

607.8-PAY ITEMS:

ADD THE FOLLOWING PAY ITEMS TO THE TABLE:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>607xxx-*</td>
<td>Type 6 Modified Thrie Beam Guardrail, Class I</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>607xyy-*</td>
<td>Thrie Beam Bullnose Terminal</td>
<td>Each</td>
</tr>
</tbody>
</table>

* Sequence number
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION
FOR

STATE PROJECT NUMBER: ____________________________
FEDERAL PROJECT NUMBER: ____________________________

FOR

SECTION 663
PAVEMENT MARKINGS

663.3-TYPES OF PAVEMENT MARKINGS:

ADD THE FOLLOWING

663.3.14-Route Shields: Route Shields shall be either a red, white and blue interstate route symbol or a black and white US or WV route Symbol with appropriate route number.

663.6-METHOD OF MEASUREMENT:

DELETE THE THIRD PARAGRAPH OF THE SECTION AND REPLACE WITH THE FOLLOWING:

Route Shields, Yield Triangle, Handicap Symbol, Bicycle Symbol, Arrow, Lane Letter, Railroad Crossing Marking intersection markings shall be measured in units of each, completely installed as specified herein. One unit of the Railroad Crossing Marking shall consist of the large “X” and the two “R” letters necessary to install the complete marking in one direction.

663.8-PAY ITEMS:

ADD THE FOLLOWING ITEM:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>663011-011*</td>
<td>Route Shield, Type V, “size”</td>
<td>Each</td>
</tr>
</tbody>
</table>
204.5–BASIS OF PAYMENT:

INSERT THE FOLLOWING SUBSECTION:

204.5.1-Replacement (Call-Back) Pavement Marking Mobilization: The following items will be used for Replacement Pavement Marking mobilizations.

204.5.1.2-Item 204003-000 Mobilization Per Job Order: The Contractor will be paid one unit of the Bid Item - 204003-000 "Mobilization, Per Job Order" for each time the Contractor is a work order. The contractor will not be paid for work being performed to correct retroreflectivity failure that were found to have been deficient from previous work orders.

If the Contractor is already in the District due to the terms and reasons of this Contract, the Contractor will not be paid "Mobilization, Per Job Order".

204.6–PAY ITEMS:

ADD THE FOLLOWING TO THE TABLE:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>204003-000</td>
<td>Mobilization Per Job Order</td>
<td>Each</td>
</tr>
</tbody>
</table>
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION
FOR THE
RECALL STRIPING CONTRACT

STATE PROJECT NUMBER: ____________________________
FEDERAL PROJECT NUMBER: ____________________________

SECTION 663
PAVEMENT MARKINGS

663.4-PAVEMENT PREPARATION-PREMARKING, CODING:

ADD THE FOLLOWING TO THE SUBSECTION:

The Department will be responsible for coding and spotting where the old markings cannot be determined or if the Department desires to make changes in existing markings. The Department must be given notification of twelve (12) days prior to commencement of work in area.

663.5-APPLICATION:
663.5.1-General:

ADD THE FOLLOWING TO THE SUBSECTION:

The pavement marking material shall be mixed uniformly throughout and shall have a homogeneous dispersement of color and beads when applied to the pavement.

Pavement marking lines shall be straight or of uniform curvature and shall conform with the tangents, curves, and transitions as specified in the pavement marking standards and/or as directed by the Engineer.

The finished lines shall have well-defined edges and be free of horizontal fluctuations. The lateral deviation shall not exceed 1.5 inch from the proposed location alignment as specified in the Standards and/or directed by the Engineer. When striping interchanges, material will be applied for the full length of all ramps, including all wraps around all islands and curbs, gore areas, etc.
The Contractor shall be responsible for removing all pavement marking materials spilled upon the roadway surface or adjoining area. The Contractor shall use methods acceptable to the Engineer for removing the spilled material in accordance with Section 636.7 Eradication of Pavement Markings.

Any pavement marking which is crossed by a vehicle and tracked shall be replaced and any subsequent marking made by the vehicle shall be removed in accordance with section 636.7 by methods acceptable to the Engineer and at no additional cost to the Department.

Prior to commencement of work, and only if required by the binder manufacturer, all existing edge, lane or center lines will be fully eradicated in accordance with Section 636.7 - Eradication of Pavement Markings. When eradicating lane or center lines, the Contractor shall replace the lines within twenty-four hours from the start of eradication. The eradication shall be incidental to the Pay Items of the Contract.

The Contractor shall be responsible for cleaning any Raised Pavement Markers (RPMs) that are painted and must replace any RPMs that cannot be cleaned to the satisfaction of WVDOH. The Contractor, when painting center lines, shall either offset or retard pavement marking lines to avoid painting the RPM reflectors.

ADD THE FOLLOWING SUBSECTION:

663.5.10-Recall Pavement Marking/Projects: The contractor shall be responsible for recall or supplementary pavement markings. The quantities listed within this contract are estimated. Once the contractor begins a work order, he shall continue until the work order is completed.

The Contractor shall begin pavement markings at designated route(s) within three (3) calendar days after receiving notification. The contractor will be required to place all markings within ten (10) calendar days. The contractor will continually coordinate work on this project with the District personnel responsible for roadway projects.

663.7-BASIS OF PAYMENT:

663.7.1-General:

DELETE THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

663.7.1-General: The quantity of pavement marking lines to be paid shall be the actual number of linear miles of pavement markings which have been satisfactorily placed.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR THE
RECALL STRIPING CONTRACT

STATE PROJECT NUMBER: _____________________________

FEDERAL PROJECT NUMBER: ___________________________

SECTION 711
PAINTS, COATINGs, OILS AND INKS

711.41-WHITE OR YELLOW FAST-DRY TRAFFIC PAINT (TYPE II):

711.41.1 – General:

DELETE THE LAST PARAGRAPh OF THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

The Contractor shall employ only one paint scheme per contract unless otherwise directed by the Director of WVDOH Traffic Engineering Division in writing. The paint scheme shall consist of one particular binder, bead type(s), application rate and associated tolerances as specified by the Manufacturer. The paint scheme shall be submitted to the Engineer at the Pre-Construction Conference and a letter of certification from the Manufacturer and Contractor stating the materials to be used meet the materials specifications set forth in the Contract.

The warranty and performance criteria of this specification shall apply to Type II marking placed on or after April 15th and prior to November 1st. Markings placed between November 1st and April 15th shall meet the minimum reflectivity at the time of installation; at the discretion of the WVDOH Project Engineer, visual inspection can be made for reflectivity acceptance. Visual inspection should be done at night. Failure based on visual inspection will be painted by Contractor at no additional cost to WVDOH. Retroreflectivity failures to pavement failure, unless caused by the marking material, will not be considered as a material failure and will not be included in the loss calculations and/or retroreflectivity readings.
711.41.3- Sampling and Testing Procedures for Performance Samples:

ADD THE FOLLOWING TO THE END OF THE SUBSECTION:

If any markings are found by WVDOH to be deficient for any reason, the Contractor shall be given written notification stating the locations and the type of deficiency. The contractor shall completely replace all deficient markings, as directed by the Engineer, within ten (10) calendar days of written notification.

If the contractor does not complete the replacement of all deficient pavement markings by the end of the ten (10) calendar day placement period; or the contractor does not comply with the commencement or start date of the Recall Job Order, the contractor shall be subject to liquidated damages as described within Section 108.7 until replacement is completed. These liquidated damages shall not stop during the winter shutdown period and shall be in combination with cumulative with any other liquidated damages incurred.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 679
OVERLAYING OF PORTLAND CEMENT

679.3-CONSTRUCTION METHODS:
679.3.7-Placing and Finishing Specialized Concrete Overlay:

DELETE SUBSECTION 679.3.7.1 AND REPLACE THE FOLLOWING.

679.3.7.1-General: The following requirements shall apply for specialized concrete overlay placements:

a) The normal overlay thickness shall be as shown on the plans. Under any circumstances, the overlay shall not be less than 1 ¼ inches (31 mm). The overlay thickness shall be determined in accordance with Section 679.3. The Contractor shall restore the concrete overlay in a uniform manner to match existing grade unless otherwise directed by the Engineer. Under any circumstances, the overlay shall not be less than 1 ¼ inches.

b) The prepared surface of the structural slab shall be protected from contamination by any source and shall be in a saturated surface dry condition immediately prior to concrete placement.

c) Concrete may be mixed at the point of deposition.

d) When placing Specialized Concrete Overlays on a newly placed deck, the deck concrete shall be a minimum of 28 days old. The sidewalks, parapets, or curbs shall be a minimum of 7 days old.

679.5-FINAL BRIDGE DECK FINISH:
679.5.1-Straightedge Test:

DELETE THE CONTENTS OF THE SUBSECTION AND REPLACE THE FOLLOWING:

679.5.1-Straightedge Test: After defective or damaged concrete has been repaired and cured in accordance with 679.4.9 and before opening to traffic, the bridge deck shall be grooved as set forth in 679.5.2 perpendicular (or radial) to the centerline of the roadway. Prior to grooving, the entire deck shall be checked by the Contractor in the presence of the Engineer with an approved rolling straightedge as outlined in section 601.11.4.
679.5.2-Finished Deck Grooving:

DELETE THE CONTENTS OF THE SUBSECTION AND REPLACE THE FOLLOWING:

679.5.2-Finished Deck Grooving:

_679.5.2.1-Transverse Grooving:_ After corrective grinding and before opening to traffic, grooves shall be cut into the concrete using a mechanical saw. These grooves shall be 0.10 inch (2.5 mm) wide and 0.25 inch (6 mm) deep. Groove spacing shall be 1.5 inches (37 mm) center to center. No later than one week prior to grooving operations, the Contractor shall provide the Engineer with two accurate, easily readable gauges with which to verify groove dimensions. Groove depth and spacing tolerances are limited to ±1/16 inch (1.5 mm). Groove width tolerances are ±0.02 inch (0.5 mm) and ±0.0 inch (0 mm). Grooves shall be cut continuously across the deck to within 1 ft. (300 mm) of gutter lines or drainage structures. Grooves shall also be continuous across the full width of the deck surface including construction joints. Grooves shall terminate within 1 in. (25 mm) of any exposed metal component or elastomeric concrete of an expansion joint. When the deck is skewed and the contractor is using gang blades to saw the grooves, the maximum distance (measured perpendicular to the centerline of the expansion joint) from the last groove termination in the pass to the expansion joint shall be 1 ft., 8 inches (200 mm). Radial grooving shall be performed in increments limited to 12 ft. (3.6 m) of bridge length.

_679.5.2.2-Longitudinal Grooving:_ Use diamond blades mounted on a multi-blade arbor on self-propelled machines that were built for grooving of concrete surfaces. The groove machines shall have depth control devices that detect variations in the pavement surface and adjust the cutting head height to maintain the specified depth of the groove. The grooving machines shall have devices to control alignment. Do not use flailing or impact type grooving equipment. More than one size grooving machine may be required in order to saw the grooves as specified.

Provide an experienced technician to supervise the location, alignment, layout, dimension, and grooving of the surface.

Saw grooves parallel to the bridge centerline in a continuous pattern across the surface. Begin and end sawing 9 to 12 inches (220 to 300 mm) from any device in place in a bridge deck, such as scuppers or expansion joints. Stop sawing a minimum of 2 inches (50 mm) to a maximum of 24 inches (600 mm) from skewed expansion joints. Maintain a clearance of a minimum of 2 inches (50 mm) and a maximum of 4 inches (100 mm) from the grooves to longitudinal joints in the deck. Maintain a minimum clearance of 9 inches (220 mm) to a maximum of 30 inches (750 mm) clearance between the grooves and the curb or parapet toe. However, at no point shall un-grooved portions of deck extend beyond edge line and into the temporary or permanent travelled lanes. Saw grooves in a uniform pattern spaced at 3/4 inch minus 1/4 inch or plus 0 inches (19 mm minus 6 mm or plus 0 mm). Saw grooves 0.15 inches (4 mm) deep and 0.10 inches (3 mm) wide. Groove tolerances for depth are ±0.0625 inches (2 mm) and minus 0 inches (0 mm). Groove tolerances for width are ±0.02 inches (0.5 mm) and minus 0 inches (0 mm).

For staged, or phased bridge deck work, saw the grooves parallel to the final, permanent bridge centerline. If the different stages or phases of the bridge deck work occur within one construction season, any stage opened to traffic shall receive an interim coarse broom finish.
during placement, then saw the longitudinal grooves after the final stage. The interim broom finish will not be allowed as a surface texture when opened to traffic over a winter season. Saw longitudinal grooves in the deck prior to opening to traffic for a winter season.

For bridge decks that widen from one end to the other, saw the longitudinal grooves parallel to the centerline of the roadway. On the side of the bridge that widens, saw the longitudinal grooves to follow the edge line. Saw longitudinal grooves in the gore areas, avoiding the overlapping of grooves.

At the beginning of each work shift, furnish a full complement of grooving blades with each saw that are capable of cutting grooves of the specified width, depth, and spacing.

If during the work, a single grooving blade on a machine becomes incapable of cutting a groove, continue work for the remainder of the work shift. The Contractor is not required to cut the groove omitted because of the failed blade. Should two or more grooving blades on a machine become incapable of cutting grooves, cease operating the machine until it is repaired.

Continuously remove all slurry and remaining residue from the grooving operation and leave the deck surface in a clean condition. Prevent residue from grooving operations from flowing across shoulders or across lanes occupied by public traffic or from flowing into gutters or other drainage facilities. Remove solid residue before the residue is blown by passing traffic or by wind.

Provide water as necessary to saw grooves according to this subsection.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: __________________________

FEDERAL PROJECT NUMBER: __________________________

FOR

SECTION 668
CCTV-(CLOSED CIRCUIT TELEVISION)

668.1-DESCRIPTION:

Functional Requirements-The primary function of the CCTV system is to verify nonstandard conditions detected by the system, surveillance of major construction projects, events, or other reported information from an external source. Images from CCTV cameras will be displayed at operator workstations within the WVDOH Transportation Management Center (TMC), on a limited number of peripheral systems as designated by the ITS Coordinator. The Contractor is responsible for integration of the CCTV communication to the WVDOH Transportation Management Center (TMC). The CCTV system shall provide display and selection control over any camera to any operator workstation or system monitor as designated by the WVDOH. Closed Circuit Television (CCTV) camera installation Contractor requirements: general electrical work as a prime or as a subcontractor – five (5) years, communications, including radio, wire and wireless - one (1) year.

All electrical work shall conform to current requirements of the National Electrical Code, latest edition, all local codes and Section 631 of the Standard Specifications.

All details not specified or not shown on the Plans shall conform to the requirements of the latest issue of the Manual on Uniform Traffic Control Devices, (referred to as the MUTCD). This Manual is published by the Federal Highway Administration of the U.S. Department of Transportation and supplemented by the publication "Official Ruling on Request" and the West Virginia Division of Highways Traffic Engineering Division Directives.
668.2-MATERIALS:

The CCTV shall be IP addressable, using a H.264 Video Encoder, or approved equal that provides a pressurized housing that incorporates a high performance pan/tilt positioner that is sealed from the environment. The environmental constraints are as described below, however, in addition to these restraints the camera unit shall be sealed from rain, dust, dirt, and other undesirable contaminants. The pan/tilt assembly shall be environmentally sealed but not pressurized. The entire camera unit shall have been tested and passed a water immersion test according to IEC 60529 section 14.2.7 using an immersion depth of 1 meter measured at the bottom of the camera and a test duration of 30 minutes. All components of the camera shall have an IP67 rating.

The CCTV shall provide a color output, while converting to monochrome output in lowlight conditions as desired. System software shall be provided by the manufacturer that will control the camera functions as described (camera DSP functions, lens functions, positioner pan/tilt functions, as well as those auxiliary equipment such video switchers, screen splitters, monitor selectors, VCR(s) (if applicable), and other such equipment). The manufacturer, or manufacturer’s representative shall be on-site for each camera field set-up.

(a) Camera Control – The CCTV system shall provide any operator the capability to select a camera for display and to view that camera image at their workstation or on a system monitor. The CCTV system shall also fully support operators in panning, tilting, and zooming CCTV cameras. If the camera supports this functionality the operator shall be able to reset the camera and exercise iris and focus controls.

(b) Preset Scenes – The CCTV system shall enable users to create up to the number of vendor supported preset scenes for each camera. The scene shall comprise camera position (pan and tilt), zoom, focus, and/or controller selection options. Each preset scene shall allow an associated text phrase. The contractor shall establish an initial set of preset scenes for each camera.

(c) Field of View Restrictions – The contractor shall provide the capability to restrict the field of view, if necessary, for any camera where privacy zones or pan/tilt limit commands are available.

(d) User Conflicts – Any number of users shall be able to control Cameras and their accessories simultaneously. However, only one user at a time shall be able to control a given camera. If a user attempts to control a camera that is already under the control of another user, the software shall display a message on the second user’s screen shall indicate that the first user has taken control of the camera. The supervisor shall have the ability to over-ride the lock function on any camera.

668.3-SYSTEM COMPATIBILITY:

The Contractor shall be responsible for coordinating with WVDOH’s ITS Coordinator to ensure equipment capability with regard to components and communication.

668.4-COMMUNICATIONS:

CCTV camera(s) shall communicate through the CCTV manufacturer’s system software over a wireless network (cellular HSPDA) or POTS system. The Contractor shall be responsible
for furnishing and installing all conduits, junction boxes and communication cables install on West Virginia right-of-way as specified within the plans. The Contractor shall be responsible for the installation and correct operation of all communications systems from the switch located in the field cabinet to the field device. Testing of the Contractor’s work will be performed at the switch in the field cabinet. Wireless communications shall employ a cellular modem that incorporates ATT/Cingular’s “HSPDA” communications system.

668.5-EQUIPMENT AND MATERIALS:

All equipment and materials shall be new. All equipment shall be the latest model and shall contain the latest firmware unless it can be shown that an earlier version is required for compatibility with existing WVDOH communication protocols.

668.5.1-Cabinet: The cabinet/enclosure shall be a NEMA 4X stainless steel enclosure. The cabinet/enclosure shall have a continuously hinged door on one side, and shall be provided with a standard, #2 keyed brass lock. The enclosure shall be sized by the contractor that will provide ample space for all electrical connections, bus bar, surge protection, cellular modem/antennae, H.264 encoder, and all other functional equipment pertinent to the operation of the CCTV.

668.5.2-Cable: The Contractor shall provide a separate power conductor from the nearest power control station or other pertinent power service as approved by the Engineer. Any conductor deriving power from a light source shall utilize a separate conductor to bypass any photocell control.

(a) The Contractor shall size this conductor so that there is less than a 5% power loss from the control station to the CCTV.

(b) The CCTV power conductor shall be distinctive from all other conductors within the existing raceway(s).

668.5.3-Grounding Unless otherwise specified, ground wiring shall be solid bare copper #4 AWG and securely connected inside enclosures with #4 AWG copper clamp connectors. Nuts and washer securing the wire are not acceptable. All grounding shall meet the National Electric Code. Ground wires shall be exothermically welded to the ground rods. Ground rod clamps are not acceptable. The following devices shall be grounded:

(a) Cabinet
(b) Camera system
(c) Communications

The resistance to ground shall be less than 10 Ohms as measured with a ground resistance meter or equivalent.
668.6-WARRANTY:  
The Contractor shall provide an equipment list containing the following information:
(a) Type of equipment
(b) Field location
(c) Make
(d) Model
(e) Serial Number
(f) Date of Purchase
(g) Manufacturer’s contact information
(h) Equipment vendor contact information if different
(i) Date of installation
(j) Date warranty expires

The Contractor shall provide a copy of all equipment warranty information to the WVDOH ITS Coordinator. The Contractor shall, if necessary to satisfy the manufacturer’s warranty requirements, ship and receive defective equipment still under warranty on behalf of the WVDOH. The cost for this service shall be incidental to the cost of the equipment. The WVDOH shall receive a minimum two (2) year warranty for all CCTV components on receipt or employment of device(s).

668.6-ASSEMBLY:  
The Contractor shall provide a CCTV Assembly at the site(s) shown on the plan. The CCTV Assembly shall be a WTI SideWinder, or approved equal.

The Contractor shall obtain approval from the ITS Coordinator prior to the WVDOH Preconstruction Meeting. Proposed alternates shall be commercially available, as well as the attendant system software. The Contractor shall identify to the WVDOH Traffic Engineering Division (TED) an installed site where the proposed CCTV Assembly has been operating at least one-year in a similar climate region. A dedicated manufacturer’s representative, as well as the ITS Coordinator shall be present when installing the CCTV.

668.6.1-Product Description: The video Camera Positioning System shall provide dual mode, day (color) and night (monochrome) video camera with optical zoom lens and a high speed positioning system. The lens has a focal length of 3.4mm to 119mm (35:1) with auto/manual focus. A digital zoom range of up to 12X provides an effective zoom ratio of 350:1. The effective focal length is 3.4mm to 1190mm. The ¼” format Progressive Scan CCD image sensor and lens combination results in an effective horizontal angle of view of 55.8 wide angle to 1.7° max. telephoto. The camera shall provide Wide Dynamic Range (WDR) by use of dual shutter exposure technique. In addition, the camera shall be provided with electronic stabilization using the two-motion-frequency selectable stabilization method. The pan function shall provide 360° of continuous rotation, with a variable speed from 0.0003° per second to 100° per second. The tilt function shall provide 360° of continuous movement, (0° to 360°) with a variable speed from 0.0003° per second to 100° per second. Up to 64 presets
shall be available for storing and recalling zoom, pan and tilt positions. The CCTV positioner shall be capable 8 or 16-point compass annotation with primary direction spelled out and intermediate directions abbreviated with two letters and a tour sequence defined using up to 64 preset positions. All camera and pan & tilt functions are operable via RS-422 serial communications. Communications protocol command set shall be public domain.

668.6.2: Features:

(a) ¼” Progressive Scan Color Sensor
(b) Horizontal Resolution of 540 TV Lines
(c) 35:1 (33.4m to 119m) optical zoom lens
(d) Continuous digital zoom with selectable range from OFF to 12X
(e) Effective overall focal length from 3.4 to 1190mm
(f) Electronic Image Stabilization
(g) Auto/Manual Focus
(h) Selectable shutter speeds from ½ second to 1/30,000 second
(i) Composite video output; NTSC format
(j) Adjustable color balance
(k) Crystal or Internal phase adjust line-lock, software adjustable
(l) Programmable on screen character generator
(m) Wide Dynamic Range (WDR) by use of dual shutter exposure technique
(n) RS-422 serial control protocol command set to be public domain.
(o) Camera Addressing via serial control
(p) 8 or 16 point compass annotation
(q) 4” diameter Sealed enclosure Pressurized with dry nitrogen
(r) Continuous rotation capability in either direction
(s) Variable pan speed from 0.0003°/sec to 100°/sec (Preset Mode)
(t) Variable tilt speed from 0.0003°/sec to 100°/sec
(u) 64 zoom, focus, pan and tilt preset positions, each with a unique user programmable preset ID
(v) H.264 compression algorithm using an external Video Encoding device
(w) Shall utilize QuickTime Multi-media player platform

668.6.3 - Camera Specifications:

(a) Imager: Solid State Interline transfer Progressive Scan CCD with mosaic-type color compensating filter.
(b) Image Areas: 1/3” Format 3.6mm (H) x 2.7mm (V)
(c) Resolution “ 520 horizontal; 340 vertical
(d) Picture Element (total) 811 (H) x 508 (V)
(e) Video Output: NTSC, 1 V p-p @ 75 ohms, unbalanced
(f) Maximum Lens Aperture: f/1.4 (wide) to f/4.2 (tele)
(g) Optical Zoom Range: 35X, 3.4mm to 119mm
(h) Digital Zoom Range: 1X (OFF) through 12X, Smooth transition from Optical to Digital
(i) Effective Digital Focal Length: 119mm to 1428mm
Optical Zoom Speed: Two speeds, from approx. 2.0 seconds to 4.6 seconds full range

Horizontal Angle of View: Optical: 55.8° to 1.7°; At 10X Digital: 55.8° to 1.7°

Minimum Focus Distant: 40” in tel, 0.4” in wide angle

Electronic Stabilization: Two-motion-frequency selectable stabilization method

Digital Compass: 8-point compass annotation with primary direction speed out and intermediate directions abbreviated with two letters

Auto Focus: Selectable Auto/Manual Minimum Scene Illumination for Reliable Auto Focus, 30% video

Manual Focus Speed: One speed, approx. 2.0 seconds to full range

Zoom and Focus Presets: 64 preset positions, focus is auto, if programmed, shall display the Preset ID

Flash Memory: Update firmware and new features via serial communication

Long Term Integration Range: (Short Shutter) provides manual selection of integration duration for enhanced sensitivity. Integration times are, ½ second, ¼ second, 1/8 second, 1/15 second, 1/30 second. Frame Store video output provides continuous video output, updated at the integration rate.

Long Term Selectable shutter speeds of 1/60; 1/120; 1/180; 1/250; 1/500; 1/1000; 1/2000; 1/4000; 1/10,000; and 1/30,000 second.

Auto Iris: Iris automatically adjusts to compensate for changes in scene illumination to maintain constant video level output within sensitivity specifications.

Manual Iris: Changing the video level shall do the effect of an open/close iris. To give the effect of open iris, a decrease in the video level value shall change and to give the effect of close iris an increase in the video level shall change

Gamma: 0.4

AGC: 0 to 25 dB

Color Balance: Auto Tracking Color Balance/manual with adjustable Red and Blue Levels

Signal and Noise Ratio: >50 dB

Synchronization: Crystal or Phase-Adjust Line Lock on 60Hz.

Sensitivity: 3200K): Scene Illumination

F1.4, Wide Angle
0.5 Lux @ 1/60Sec., F1.4, Shutter, Color I.R Cut On@
0.05 Lux @ 1/2Sec., F1.4, Shutter, Color I.R.Cut On
0.2 Lux@ 1/60Sec. F1.4, Shutter, monochrome mode I.R. Cut Off
0.01ux@ 1/4Sec., F1.4, Shutter, monochrome mode I.R. Cut Off

668.6.3-Camera Housing: The camera housing shall be a corrosion resistant and tamperproof sealed and pressurized Housing with five pounds psi dry nitrogen with Schrader purge fitting and 20 psi relief valve for each camera. The camera housing shall include a loss of pressure sensor that will trigger an alarm message that will be inserted in the video output signal. The enclosure shall be constructed from 6061-T6 standard aluminum tubing with a wall thickness of 0.25 inches +/- 0.03 inches. Internal components shall be mounted to a rail assembly. A copper plated spring-steel ring shall be used to ensure electrical bonding of the
rail assembly and components to the camera housing. The housing exterior shall be finished by pre-treatment with conversion coating and baked enamel paint. The camera enclosure shall be designed to withstand the effects of sand, dust, and/or hose-directed water.

The internal humidity of the housing shall be less than 10 percent, when sealed and pressurized. Desiccant packs shall be securely placed inside the housing to absorb any residual moisture and maintain internal humidity at 10 percent or less.

The outside surface of the camera lens shall be treated with a high temperature vacuum deposited hydrophilic coating to minimize lens leaning.

The inside surface of the camera lens shall be treated with an electrically conductive coating to allow direct heating of the lens glass to prevent fogging.

The temperature sensor and microprocessor controlled image sensor heater shall provide reliable operation of the zoom lens down to -34°C.

668.6.5-Mechanical Specifications (DSP Camera Assembly):

**Weight:**
Max weight of 5.0 lbs.

**Dimensions:**
- Length (less connectors): Maximum 15.0 inches
- Housing Diameter: Maximum 4.5 inches
- Height (Including mounting base): Maximum 7.0 inches

**Mounting:**
4 mounting nuts on bottom of base

668.6.5.1 - Character Generator Specifications:
(a) ID Characters are White with a Black Border.
(b) A maximum of six (6) lines of user programmable alphanumeric text can be displayed. Plus 2 fixed lines for low-pressure indicator and Privacy Zones.
(c) Text can only be displayed in uppercase characters.
(d) Camera ID: Up to 2 lines, each up to 24 characters long. If both lines are programmed Line 1 of Camera ID shall always appear above Line 2 of Camera ID regardless of top or bottom selection.
(e) Preset ID: 1 line, up to 24 characters long, user programmable for each of the 64 preset positions. When a preset position is recalled the corresponding preset ID shall be displayed. The preset ID shall remain displayed until a pan, tilt, zoom, manual focus, auto focus select, or another preset command is received.
(f) Compass Annotation: 8-point or 16 point compass annotation shall be settable for a true north position. Display shall include North, NE, East, SE, South, SW, West, and NW. Position shall be user selectable for a 3-second time out or permanent display and for enable/disable.
(g) Azimuth and Elevation: Position shall be displayed in 0-359 degrees for AZ position and +95 to -95 in EL elevation. Shall be user selectable for 3-second time out or permanent display and for enabled/disabled.
(h) Low Pressure Indicator: 1 line, “Low Pressure”, messages can be displayed in “blinking” or “non-blinking” mode and be displayed when activated by low internal pressure. Adjustable set points by altitude shall be provided via the serial port to activate low-pressure. Message shall be enabled or disabled. In maintenance mode readings of the internal pressure of the camera housing shall be displayed from 5 down to 1 PSI, in .1 PSI increments.

(i) Internal Temperature Indicator: 1 line, in degrees C numeric messages can be displayed in “blinking” or “non-blinking” mode. Message shall be enabled or disabled. In maintenance mode, camera readings of the internal temperature of the camera housing in 1 degree increments.

(j) Sector Message: Up to 16 sectors in 360° may be defined with up to 24 characters long. Message shall be programmable via the RS422 serial communications.

668.6.5.2-Message Positioning:
(a) Right Side Positioning is accomplished by padding left side of message with spaces.
(b) Messages can be positioned at either the top or the bottom of the display.
(c) Blank lines are not displayed. Any programmed line being displayed shall fill in toward the top if top positioning is selected, or toward the bottom if the bottom position is selected.
(d) Display Order

668.6.5.3-Privacy Zones:
(a) Video blanked for up to 8 Privacy zones shall be provided. The video shall be blanked out for privacy. A one (1) line, numeric message can be displayed. Message shall be displayed in “blinking” or “non-blinking” mode and be enabled or disabled. Privacy Zones shall be programmed via the RS422 serial communications.

668.6.5.4-Communication and Camera Addressing Protocol:
(a) Control and addressing shall be via RS422/RS232 optically isolated serial communications. Additional protocols shall consist of WTI, Axis, Cohu, American Dynamics, Javelin, Philips/Bosh, Vicon and Pelco-D. The National Transportation Communications of ITS Protocol (NTCIP) 1205 protocol communications shall be included as an option. Refer to NTCIP 1205 protocol for detailed description. This allows for migration to the NTCIP standard, while still maintaining operation of existing CCTV system protocols.
(b) Upon receipt of any given command, the Camera Positioning System shall not take longer than 1.0 second to respond.
(c) All programmable functions shall be stored in non-volatile Memory and shall not be lost if a power failure occurs. System configurations such as video privacy zones, preset text and sector I.D. shall be able to be stored in a computer file and a camera personality can be cloned or uploaded into a camera in the event that a camera replacement is necessary.
688.6.5.5-Pan and Tilt Positioning Specifications:
   (a) Continuous rotation capability in either direction
   (b) 360° of continuous tilt movement, 360° unobstructed
   (c) Pan Speed (Operator Control): Variable from 0.0003°/sec to 100°/sec
   (d) Pan Speed (Preset Control): >100°/sec
   (e) Tilt Speed (Operator Control): Variable from 0.0003°/sec to 100°/sec
   (f) Tilt Speed (Preset Control): 100°/sec
   (g) 64 Pan and Tilt preset positions with repeatability within +/- 0.5°
   (h) The positioning system shall be invertible for mounting to a ceiling connection

688.6.5.6-Tour Specifications:
   (a) 8 tour sequence can be defined
   (b) The tour is programmed by selecting the preset position by number, and then selecting the dwell time. The presets can be used in any order, and the same preset may be used more than once as long as the total number of preset positions used does not exceed 32.
   (c) The dwell time defines the length of time paused at each preset position. It can be from 1 second to 60 seconds the dwell time can be changed individually for all stops on the tour.
   (d) If the appropriate preset ID is programmed, it shall be displayed for each preset position used on the tour.
   (e) The tour shall stop upon receipt of a pan command
   (f) All programmable functions shall be stored in non-volatile memory

688.6.5.7-Power Requirements:
   (a) Operating Voltage: 89VAC to 135VAC, 120VAC Nominal 50/60 Hz. (±3.0 Hz) National Electrical Manufacturers Association (NEMA) standard TS-2 (1998) for traffic control system. 2.1.2 Or 24VAC nominal (21.6 – 26.4) 60 Hz Or 230VAC nominal (207 – 253) 50 Hz

   The line variation specifications shall be tested to meet these specifications by an outside agency, other than the camera manufacturer. The tests shall be provided upon request.

   (b) Primary Input Power Interruption: The is defined in section 2.1.4 “power interruption” NEMA standard TS-2 (1998). Transients Power Service: The CCTV field equipment shall meet the requirements of section 2.1.6 “transients, power service” of the NEMA standard TS-2 (1998). The surge specifications shall be tested to meet these specifications by an outside agency, other than the camera manufacturer. The tests shall be provided upon request.
   (c) Power consumption shall not exceed a total of 50 Watts
   (d) 30 Watts for camera/receiver/P&T driver (pan & tilt in motion)
   (e) 20 Watts for heater (heater on)
668.7-ENVIRONMENTAL SPECIFICATIONS:
(a) Ambient Temperature Limits (Operating): -34°C to +74°C (-29°F to 165°F) NEMA 2.1.5.1 Standard TS-2 (1998)
(b) Ambient Temperature Limits (Storage): -45°C to +85°C (-50°F to 185°F) NEMA 2.1.5.1 Standard TS-2 (1998). The environmental specifications shall be tested to meet these specifications by an outside agency, other than the camera manufacturer. The tests shall be provided upon request.
(c) Humidity: Up to 100% relative humidity (per MIL-E.5400 T, paragraph 3.2.24.4) IP 67 Rating
(d) Other: Withstands exposure to sand, dust, fungus, and salt atmosphere per MIL-E-5400 T, paragraph 3.2.24.7, 3.2.24.8, and 3.2.24.9.
(e) Shock: Up to 10G’s, 11ms, in any axis under non-operating conditions, per MIL-E-5400 T, paragraph 3.2.24.7, 3.2.24.8, and 3.2.24.9.
(f) Vibration: Sine vibration from 5 to 30Hz, 1/2g, 3 axis one hour without damage
(g) Wind Loading: 150 MPH Wind load survivability, operability to 70 MPH.

668.8-MECHANICAL SPECIFICATIONS:
(a) Weight: Shall not exceed 19 lbs.
(b) Dimensions: maximum of 11” (h) x maximum 13” (w)

668.9-MOUNTING CONFIGURATIONS:
(a) The Camera Positioning System shall include these possible mounting configurations, a wall mount, pole mount, parapet mount, corner mount or pedestal mount.

668.10-MAIN INTERFACE CONNECTOR:
(a) The main interface connector shall be equivalent to an Amphenol 206036-3 with back shell 206070-1 and mating connector equivalent to an Amphenol 206037-11 with clamp 206070-1.

668.11-INSTALLATION CCTV:
Assembly shall be installed as shown in plans and according with the CCTV manufacturer’s instructions. All materials shall be installed in a neat and professional manner. All installation services will comply with all warranty provisions and warranty contract maintenance services in accordance with these specifications. All installations services shall comply with all local, state and federal building, and electrical codes. All coax/power/control assemblies shall use watertight fittings. All wiring entry and exits shall be made at the side or underneath components; no exposed top entry or exits are permitted. This requirement extends to all enclosures, or any other externally exposed devices. The CCTV assembly shall include a method of connecting CCTV keyboard controller/device for field testing of camera functions. All CCTV assemblies shall be installed so that the camera assembly is in a fixed position as oriented and shown on the plans.
HIGH MAST TOWER INSTALLATION:
(a) The fitting (typically a vertical two (2) inch galvanized steel conduit section) for the CCTV on the lowering device shall be designed to support and lower a closed circuit television camera, lens, housing, pan/tilt/zoom (PTZ) mechanism, cabling, connectors and other supporting field components without damage or causing degradation of camera operations (see drawing).
(b) The camera housing shall be supported by the luminaire high-mast lowering ring, and will be counter-balanced to the opposing/adjacent lighting fixture(s). The camera shall be “piped down” approximately two (2) feet below the horizontal axis of the present luminaire(s) – in this manner, the CCTV housing shall be inverted.
(c) There shall be an accessible ‘hub’ in close proximity of the CCTV for access to the camera’s “quick” disconnect.
(d) The high mast tower cabling shall be as prescribed by the lowering device manufacturer to allow for consistent power to the camera device. The CCTV cable shall have a quick disconnect within close proximity to the camera housing, as well as at the base of the high mast tower for installation and maintenance concerns.
(e) The Contractor shall provide a continuous, separate power to supply power to the CCTV. This power shall not be controlled by photocell. All coax/power/control connections shall be protected from exposure to the weather.
(f) The camera shall be weighted and balanced to assure that the alignment of pins and connectors are proper for the camera support to be raised into position without binding the lowering ring.
(g) The Contractor shall demonstrate to the Engineer the proper and repeated operation of the lowering device. Proper camera operation and electrical connections shall be verified by the ITS Coordinator.

LUMINAIRE POLE INSTALLATION:
(a) CCTV assembly shall be mounted to a vertical upright affixed at the top of the luminaire pole. Typical attachment will be made at the top of the designated pole by an adapter plate (see figure).
(b) A two (2) inch, galvanized conduit mast shall be utilized as the vertical support structure for the CCTV fixture. This conduit sized as necessary and approved by the Engineer and shall be referred to as the CCTV Support Channel.
(c) Plan and verify the system cable routing prior to any installation.
(d) Most CCTV units already have an integrated cabling “pig-tail”, so care must be used in routing the system cable up to the designated pole and exit the access port near the pole mount bracket prior to permanently mounting the camera unit (contractor shall need the manufacturer’s mating connector(s) both at the end of the CCTV’s “pig-tail”, as well as within the cabinetry).
(e) Provisions shall be made to support the vertical cabling within the structure itself, so that undue tension is not placed on the CCTV cabling.
(f) Utilize manufacturer’s strap tensioner to secure stainless steel straps to pole per recommendation.
STRUCTURE INSTALLATION:

(a) A minimum of a two (2) inch, galvanized conduit shall be utilized as the vertical support structure for the CCTV fixture, or as prescribed by the CCTV representative and approved by The Engineer.

(b) Plan and verify the system cable routing prior to any installation.

(c) Contractor to attach the CCTV Support Channel to the apex of the vertical upright of an existing sign structure pole as noted within plans.

(d) Most CCTV units already have an integrated cabling “pig-tail”, so care must be used in routing the system cable down the designated structure and exit the access port near the channel mount bracket prior to permanently mounting the camera unit (contractor shall need the manufacturer’s mating connector(s) both at the end of the CCTV’s “pig-tail”, as well as within the cabinetry).

(e) A minimum of six (6) inches of the CCTV Support Channel shall be connected within the peak of the structure, and this channel shall be connected by a minimum of two (2) stainless steel through-bolts. The opening at this entrance shall be sealed with a rubber boot.

(f) The Contractor shall mount the CCTV adaptor plate to the Support Channel by the manufacturer’s recommendations. The height of this adaptor plate/CCTV shall be as designated on plans or by note.

(g) Provisions shall be made to support the vertical cabling within the structure itself, so that undue tension is not placed on the CCTV cabling.

(h) Utilize manufacturer’s strap tensioner to secure stainless steel straps to pole per recommendation

668.12-SPECIFICATIONS FOR CCTV KEYBOARD CONTROLLER:

668.12.1-Description: The Contractor shall furnish a CCTV Keyboard Controller/Field Operating Device for the purpose of camera installation, set-up and testing.

668.12.2-Materials: The CCTV Controller/Field Operating Device shall be compatible with the WTI SideWinder, or approved equal, and shall meet the following minimum requirements within 668.13.

668.13-SOFTWARE (NETWORK CAMERA ADMIN. /MONITORING SOFTWARE):

The Contractor shall provide an IP addressable, Network ready CCTV control system for general surveillance of installed camera(s). This software shall provide a Graphics Based User Interface (GBUI) with icon maps for intuitive control and response. This software shall be able to integrate or combine the WVDOH’s existing GIS Graphic Interface. This Software will be able to provide support for up to 1000 cameras and shall utilize an industry standard Ethernet infrastructure with TCP/IP and RS-232 Serial Com Interfaces, as well as “QuickTime” multi-media player platform. This software shall be designed to operate on existing personnel computer systems with Windows TM 4.0 and later and Windows 98 and later networks. This software shall easily configure and control the camera digital signal processing (DSP) camera within its software.
This software shall place all essential system elements on the computer monitor. Within the GBUI the operator shall be able to access live video from any camera within the network access control camera functions (pan/tilt/zoom, focus, iris, power, color balance), and store and recall presets positions for fast system configuration.

668.13.1-Firmware: The CCTV Controller/Field Operating Device shall be capable to “receive” functions controlled by the Controller/Field Operating Device herein shall be supported.

668.13.2-Specifications for Surge Devices: The Contractor shall furnish video surge device, data surge device (cellular) and power surge device within the CCTV camera cabinet. The Contractor shall provide for surge suppression devices (10 kA surge current capacity) that are in series with each line (camera video connection, PTZ circuit, and Power circuit) within the cabinet location, as well as at the video camera.

Suggested Surge Suppression should be:
(a) EDCO Part# CX12-BNC-Y or approved equal.
(b) The surge protector shall have a clamping voltage response time of less than one nanosecond. The surge protector shall have a maximum clamping voltage of 12 volts when subjected to a 3kA 8x20 microsecond wave.

RF Conductor Surge Devices shall meet all manufacturer recommendations for the particular use of the radio/cellular antenna coax conductors.
(a) Power Conductor Surge Devices
(b) Northern Technologies TCS-HWR or approved equal
(c) Nominal Line Voltage 120 volts
(d) Max. Continuous Line Voltage 132 Vrms
(e) Nominal Clamping Voltage 216 Vpk

668.1-COMMUNICATIONS SPECIFICATION:
Cellular communications shall utilize HSPDA (High Speed Packet Data Access) broadband wireless modem compatible with manufacturer’s CCTV camera. The Contractor is responsible for setting up the data/video communications, and that this communications access shall be prioritized over all localized cellular transmissions.

668.1.2-Description Wireless Communications: Equipment shall consist of furnishing and installing cellular modem, antenna, power supply, mounting hardware and all associated equipment necessary to establish a wireless communications network for CCTV.
668.1.3-Plain Old Telephone Systems Specifications (POTS): When utilizing an existing POTS system, the contractor shall furnish and install all necessary communication equipment to establish a communications network to the TMC. The contractor shall make all necessary inquiries to upgrade the POTS system to broadband, and shall make preparations to utilize a new broadband service with approval of the Engineer.

668.1.4-Testing: The Contractor shall demonstrate proper functioning of all devices at the field communications demarcation point. The field communications demarcation point is the location where the communications equipment supplied by the contractor is installed. After the device(s) are successfully operated at the field demarcation point, a 30 day equipment burn-in test will begin after device(s) have been successfully employed and remotely controlled from the system software provided. If the 30 day burn-in test fails, the WVDOH will test the device at the field cabinet. If the device cannot be operated at the field cabinet, the Contractor shall repair or replace any device until a satisfactory operation is provided. The 30 day burn-in shall begin for that device after successful operation.

668.1-METHOD OF MEASUREMENT AND BASIS OF PAYMENT:

The CCTV Assembly will be measured for payment per unit each complete and in place after passing component and subsystem/software and communication testing. This price includes the color camera, encoder/decoder software/hardware, IP addressable system software, zoom lenses, environmental enclosure, pan/tilt unit, housing assembly, mount and mounting hardware, cabinetry, cellular modem(s), connections, surge protection and incidentals to complete an operating CCTV.
705.5-SUPPLEMENTAL SPECIFICATION FOR SECTION 705 ASPHALT MATERIALS

705.5-PERFORMANCE GRADED BINDERS:

DELETE THE CONTENTS OF THE SUBSECTION REPLACE WITH THE FOLLOWING:

705.5-PERFORMANCE GRADED BINDERS:
Performance graded binders shall conform to the requirements of AASHTO M-320. Manufacturers are not required to perform Direct Tension Testing, AASHTO T-314.

In addition to the above requirements, asphalt binders shall meet the requirements specified in Table 705A.

<table>
<thead>
<tr>
<th>Binder Grade Designations</th>
<th>Non-recoverable creep compliance at 3.2kPa, Jnr(3.2), kPa-1, Max Note 1</th>
<th>% Difference in Non-Recoverable Creep Compliance, Jnr(diff), %, Max Note 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG 58 – 28</td>
<td>-</td>
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<tr>
<td>PG 64 – 22</td>
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<td>PG 70 – 22</td>
<td>-</td>
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</tr>
<tr>
<td>PG 76 – 22 Note 2</td>
<td>0.5 @ 64°C</td>
<td>-</td>
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</tbody>
</table>

Note 1: The binders shall be tested in accordance with AASHTO T-350.
Note 2: The indication of elastic response for binders tested in accordance with AASHTO T-350 shall be determined using the appendix X1-INDICATIONS OF ELASTIC RESPONSE in AASHTO M 332.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 714
CONCRETE, CLAY, FIBER AND PLASTIC PIPE

714.2-REINFORCED CONCRETE CULVERT, STORM DRAIN AND SEWER PIPE:
DELETE THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

714.2-REINFORCED CONCRETE CULVERT, STORM DRAIN AND SEWER PIPE:
This pipe shall conform to the requirements of AASHTO M 170 or ASTM C 76 and MP 714.03.30.
715.22-PRECAST CONCRETE MEDIAN BARRIERS (PERMANENT):
   715.22.2-Materials:

DELETE THE LAST SENTENCE IN THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

Sampling and testing of materials shall be in accordance with the minimum frequency stated in MP 603.02.10.