June Specifications Committee Meeting Agenda

Meeting Date
Wednesday, June 6, 2018 @ 9:00am
Building 5, Room 855

Approved Permanent Specification changes from last Committee meeting (4/4/18)
- 709.4-Weld Wire Reinforcement for Concrete Adds reference to MP 709.04.40
- 710.5-Wood Post Removes round guardrail post

Approved Project Specific Special Provisions (SP) from last Committee meeting (4/4/18)
- SP607 - High Tension Cable Guardrail
- SP604 - Pipe Lining

Items removed from Committee Agenda
- None

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>
| 102     | 102.16-Pre-construction Data | 4th time to Committee; discussed in December, February, and April
Proposed specification change to 102.16 subsection. The intent of the change is to reduce the proposal size by listing supporting project documents (geotechnical report, environmental documentation, etc.) as an exhibit on bidx.

No update to the proposed specification. A redline copy, showing the proposed changes to the existing specification is included.

Approval expected in June |

| 604     | Section 604 - Pipe Culverts | 3rd time to Committee; discussed in February and April.
Proposed specification change to Section 604. It is a complete Section re-write.

The specification has been updated. It is redline copy, showing proposed changes from the last meeting. |

| 708     | 708.9-Bitumen Sealant | The material requirements changes/updates related to the Pipe Culverts revision are also included:
1. 708.9-Bitumen Sealant
2. Section 713 Metal Pipe
3. Section 714 Concrete and Plastic Pipe |

| 713     | Section 713 - Metal Pipe | |

<p>| 714     | Section 714 - Concrete and Plastic Pipe | The Division 700 specifications are redline copies, showing the proposed changes to the specification. |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>606</td>
<td>Section 606 - Underdrains</td>
<td><strong>3rd time to Committee; discussed in February and April.</strong> Proposed specification change to Section 606. It updates the materials and pay items. The provision is a redline copy, showing the proposed changes to the specification. <strong>Approval expected in June</strong></td>
</tr>
<tr>
<td>616</td>
<td>SP616 - Dynamic Load Test</td>
<td><strong>3rd time to Committee; discussed in February and April.</strong> Project Specific Special Provision for dynamic load test. The testing helps avoid weld cracking or damaging piling. The provision has been updated per comments at the last meeting. It is shown as a redline copy, showing the proposed changes/updates to the provision (from what was presented at last meeting). <strong>Approval expected in June</strong></td>
</tr>
<tr>
<td>615</td>
<td>615.5.6.3-Installation</td>
<td><strong>3rd time to Committee; discussed in February and April.</strong> Proposed specification change to update/adds ASTM F3125 requirements. Three reference updates are included: 1. 615.5.6.3-Installation 2. 626.5.1.1.5-Metal Soil Reinforcing or Attachment Devices 3. 709.24-High Strength Bolts The provisions have been updated per comments at the last meeting. They are redline copy showing the changes to the existing specifications. <strong>Approval expected in June</strong></td>
</tr>
<tr>
<td>626</td>
<td>626.5.1.1.5-Metal Soil Reinforcing or Attachment Devices</td>
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<tr>
<td>709</td>
<td>709.24-High Strength Bolts</td>
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<tr>
<td>496</td>
<td>SP496-High Performance Thin Overlay</td>
<td><strong>2nd time to Committee; discussed in April.</strong> This is an update to an previously approved SP. Update to Project Specific Special Provision for HPTO, updating nomenclature. The provision has been updated per comments at the last meeting. A redline copy, showing the proposed changes to the provision is included. <strong>Approval expected in June</strong></td>
</tr>
<tr>
<td>212</td>
<td>SP212 - Shoring</td>
<td><strong>2nd time to Committee; discussed in April.</strong> Project Specific Special Provision for shoring. It is for excavation heights which would require significant shoring such as tied-back or other complicated systems. The provision has been updated per comments at the last meeting. A redline copy, showing the proposed changes/updates to the provision is included.</td>
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<tr>
<td>Section</td>
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<tr>
<td>405.4.2</td>
<td>Aggregate Spreader, 405.13-Fog Seal</td>
<td>2nd time to Committee; discussed in April. Proposed specification change to Section 405-Chip Seals, changing how the sampling is performed. No update to the proposed specification. A redline copy, showing the proposed changes/updates to the current specification is included.</td>
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<tr>
<td>405.13</td>
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<tr>
<td>407</td>
<td>Section 407 - Fog Seal</td>
<td>2nd time to Committee; discussed in April. Permanent Specification change. New addition to the Spec book for Fog Seal. The provision has been updated. A redline copy, showing the proposed changes/updates, from the last meeting is included.</td>
</tr>
<tr>
<td>408.2</td>
<td>Materials, 408.14-Pay Items</td>
<td>2nd time to Committee; discussed in April. Proposed specification change to Section 408-Tack Coat, adding non-tracking asphalt material requirements and pay item to the specifications. The provision has been updated per comments at the last meeting. A redline copy, showing the proposed changes/updates to the specification is included.</td>
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<tr>
<td>408.14</td>
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<tr>
<td>410.7.1.5</td>
<td>Bond Strength, 410.13.6.2-Bond Strength Calculations</td>
<td>2nd time to Committee; discussed in April. Proposed specification change to Section 410-PWL, with revision to the 410.7.1.5 &amp; 410.13.6.2 subsections. The revision implements the bond strength payment structure on PWL projects. The specification has been updated per comments at the last meeting. A redline copy, showing the proposed changes/updates to the specification is included.</td>
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<tr>
<td>410.13.6.2</td>
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<tr>
<td>614</td>
<td>Section 614 - Piling Walls</td>
<td>2nd time to Committee; discussed in April. Proposed specification change is a complete section re-write. No update to the proposed specification. The provision is a redline copy, showing the proposed changes to the current specification.</td>
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<td>614</td>
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<tr>
<td>616</td>
<td>Section 616 - Steel Bearing Piling</td>
<td>2nd time to Committee; discussed in April. Proposed specification change is a complete section re-write. The specification has been updated per comments at the last meeting. The provision is a redline copy, showing the proposed changes to the specification.</td>
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<td>616</td>
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<tr>
<td>709</td>
<td>709.12-Structural</td>
<td>The material requirements changes/updates related to the revision are also included:</td>
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<tr>
<td>709</td>
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<tr>
<td>Section</td>
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<tr>
<td>618</td>
<td>Section 618 - Cast Bronze and Rolled Copper-Alloy Expansion Plates</td>
<td>2nd time to Committee; discussed in April. Proposed specification is to delete the Section, as it is outdated and there no recent use of its items. No update to the proposed specification. Approval expected in June</td>
</tr>
<tr>
<td>625</td>
<td>625.4.3-Casing</td>
<td>2nd time to Committee; discussed in April. Proposed specification is Section 625-Drilled Caisson Foundation; with update to 625.4.3. It removes an invalid reference from the subsection. No update to the proposed specification. The provision is a redline copy, showing the proposed changes to the existing specification. Approval expected in June</td>
</tr>
<tr>
<td>634</td>
<td>Section 634 - Concrete Cribbing</td>
<td>2nd time to Committee; discussed in April. Proposed specification is to delete the Section, as it is outdated and there has no recent use of its items. No update to the proposed specification. Approval expected in June</td>
</tr>
<tr>
<td>635</td>
<td>Section 635 - Metal Cribbing</td>
<td>2nd time to Committee; discussed in April. Proposed specification is to delete the Section, as it is outdated and there has no recent use of its items. No update to the proposed specification. Approval expected in June</td>
</tr>
<tr>
<td>636</td>
<td>636.1-Description, 636.2-Materials, 636.4-Aggregates and Dust Palliatives, 636.23-Method of Measurement, 636.24-Basis of Payment, 636.25-Pay Items</td>
<td>2nd time to Committee; discussed in April. Proposed specification change to Section 636-Maintaing Traffic. The update removes reference to &quot;Bituminous Material for Dust Palliative&quot; and &quot;Calcium Chloride for Dust Palliative&quot; as the item has no recent use. It also proposes changing Shadow Vehicle units from Day to Month. The provision has been updated per comments at the last meeting. It is a redline copy, showing the proposed changes to the existing specification.</td>
</tr>
<tr>
<td>707</td>
<td>707.15-Performance Requirements for Concrete Hydration Control Stabilizing Admixtures</td>
<td>2nd time to Committee; discussed in April. Proposed specification change to Section 707; with update to 707.15 subsection. It clarifies the requirements for testing, in the mix design, that must be performed in order to get the 3-hour discharge time for excessive haul time outlined in Section 601.7.</td>
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</table>
No update to the proposed specification. The provision is a redline copy, showing the proposed changes to the existing specification.

Approval expected in June

New Business - New Provisions for Spec Committee

<table>
<thead>
<tr>
<th>SECTION</th>
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<tbody>
<tr>
<td>102</td>
<td>102.3-Issuance of Proposal Forms, 102.7-Irregular Proposals</td>
<td><strong>1st time to committee.</strong> Proposed specification change to Section 102; with update to 102.3 and 102.7 subsection. To further address procedures on prequalification limit exceeds. A redline copy, showing the proposed changes to the existing specification is included.</td>
</tr>
<tr>
<td>218</td>
<td>SP218 - Tied Concrete Block Erosion Matting</td>
<td><strong>1st time to committee.</strong> Project Specific Special Provision for tied concrete block erosion control matting. It is a permanent erosion control mat for slopes, channels, inlet/outlet protection.</td>
</tr>
<tr>
<td>311</td>
<td>311.5.1-Quality Control Testing</td>
<td><strong>1st time to committee.</strong> Proposed specification change to Section 311; with update to 311.5.1 subsection. It updates an invalid reference in the subsection. A redline copy, showing the proposed changesUpdates to the existing specification is included.</td>
</tr>
<tr>
<td>420</td>
<td>Section 420 - Single / Multiple Course Micro Surfacing</td>
<td><strong>1st time to committee.</strong> Proposed specification change adding Micro Surfacing section to the spec book. This item has been utilized on past project via Project Specific Special Provision, SP 495. The proposed specification is redline copy showing the changes to the current SP.</td>
</tr>
<tr>
<td>501</td>
<td>501.23.1.1</td>
<td><strong>1st time to committee.</strong> Proposed specification change to Section 501; with update to the basis of payment subsection 501.23.1.1. A redline copy, showing the proposed changes/updates to the existing specification is included.</td>
</tr>
<tr>
<td>615</td>
<td>615.3.2.1-Weathering Steel Bridges</td>
<td><strong>1st time to committee.</strong> Proposed specification change to Section 615; with update to 615.3.2.1 subsection. It updates the ASTM requirements of high strength fasteners. A redline copy, showing the proposed changes/updates to the existing specification is included.</td>
</tr>
<tr>
<td>622</td>
<td>622.2.4-Preservative Treatment</td>
<td><strong>1st time to committee.</strong> Proposed specification change to Section 622; with update to 622.2.4 subsection. It updates the wood preservative treatment reference in</td>
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<tr>
<td>Section</td>
<td>Details</td>
<td>Status</td>
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<tr>
<td>642</td>
<td><strong>1st time to committee.</strong> Proposed specification change to Section 642; with update to 642.6.4, 642.7, and 642.9 subsections. The revision updates ditch check item and removes bales of hay/straw from it. It also adds Inlet Protection item to the specifications. A redline copy, showing the proposed changes/updates to the existing specification is included.</td>
<td>642.6-Temporary Pipe, Contour Ditches, Berms, Slope Drains, Ditch Checks, Silt Fence, Premanufactured Ditch Checks and Super Silt Fence, 642.7-Method of Measurement, 642.9-Pay Items</td>
</tr>
<tr>
<td>660</td>
<td><strong>1st time to committee.</strong> Proposed specification change to Section 660; with update to 660.19.2, 660.19.7, 660.20.2, and 660.20.3 subsections. The revision adds pedestrian detector item to the section. It also updates the detectors &amp; signal section basis of payment items. A redline copy, showing the proposed changes/updates to the existing specification is included.</td>
<td>660.19.2-Detectors, 660.19.7-Miscellaneous Signal, 660.20.2-Detector, 660.20.3-Signal Section</td>
</tr>
<tr>
<td>707</td>
<td><strong>1st time to committee.</strong> Proposed specification change to Section 707; with addition of subsection 707.4.1.1. It adds fly ash requirements.</td>
<td>707.4.1</td>
</tr>
<tr>
<td>707</td>
<td><strong>1st time to committee.</strong> Proposed specification change to Section 707; with addition of subsection 707.18. It adds ASTM requirements for foaming agent admixtures.</td>
<td>707.18-Foaming Agent Admixtures</td>
</tr>
<tr>
<td>710</td>
<td><strong>1st time to committee.</strong> Proposed specification change to Section 710; with update to 710.3, 710.5, 710.7, and 710.8 subsections. It updates the wood preservative treatment reference in the subsection to meet current AWPA and EPA manuals and requirements. A redline copy, showing the proposed changes/updates to the existing specification is included.</td>
<td>710.3-Preservative Treatment, 710.5-Wood Post, 710.7-Common Lumber, 710.8-Service and Lighting Poles</td>
</tr>
<tr>
<td>715</td>
<td><strong>1st time to committee.</strong> Proposed specification change to Section 715; with update to 715.42.2.1, 715.42.5.1, and 715.42.5.4 subsections. The revision adds audible pedestrian detector requirements. A redline copy, showing the proposed changes/updates to the existing specification is included.</td>
<td>715.42.2.1-Definition of Terms, 715.42.5.1-General Design Requirements, 715.42.5.4-Audible Pedestrian Push Buttons</td>
</tr>
<tr>
<td>716</td>
<td><strong>1st time to committee.</strong></td>
<td>716.1.1.1-Soil,</td>
</tr>
</tbody>
</table>
### 716.1.2-Granular Material
Proposed specification change to Section 716; with update to 716.1.1 & 716.1.1.1.2 subsections. It updates % passing No. 200 sieve to 50% and adds 3" particle size requirements to the two subsections.

A redline copy, showing the proposed changes/updates to the existing specification is included.

### 716
716.1.1.2-Granular Material  
**1st time to committee.**
Proposed specification change to Section 716; with update to 716.1.1.2 subsection. It allows RAP material to be used.

A redline copy, showing the proposed changes/updates to the existing specification is included.

### 601
SP601  
**1st time to committee.**
Project Specific Special Provision for shotcrete of patching concrete structures.

### 601
SP601  
**1st time to committee.**
Project Specific Special Provision for embedded galvanic anodes, in conjunction with patching concrete structures.

### 601
SP601  
**1st time to committee.**
Project Specific Special Provision for epoxy bonding compound, in conjunction with patching concrete structures & prior to FRP wrap installation.

### 601
SP601  
**1st time to committee.**
Project Specific Special Provision for sealing cracks with pressure injected epoxy resin, prior to FRP wrap installation.

### 601
SP601  
**1st time to committee.**
Project Specific Special Provision for concrete protective coating.

### 668
SP668  
**1st time to committee.**
Project Specific Special Provision for portable video camera CCTV (closed circuit television) trailer.

6/1/18 UPDATE:

**1st time to committee.**
General discussion of Alternative Design and Alternative Bidding (ADAB) specification.

### Comments
Comments are requested on these Specification Changes and Project Specific Special Provisions. Please share your comments by June 4, 2018, they help in the decision making process.

Please Send Comments to: DOHSpecifications@wv.gov

**Deadline for new items & updates to these provisions is July 3, 2018**
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 manner.
per comments and discussion in Spec Committee. *Failure to submit updates may result in removal of item and/or delays.*

**Next Meeting**
Wednesday, August 1, 2018 at 9am
Building 5, Room 855: *(If Available. If not available a change in venue will be attached on the door)*

**2017 Standard Specifications Roads and Bridges & 2018 Supplemental Specifications**

**Electronic Copy (pdf):** The 2017 Standard Specifications Roads and Bridges & 2018 Supplemental Specifications can be viewed, printed, or downloaded from the Specifications Website. A link to the Specifications pages is here:  
http://transportation.wv.gov/highways/contractadmin/specifications

**Print Version:** Hard copies of the 2017 Standard Specifications Roads and Bridges & 2018 Supplemental Specifications are available thru Contract Administration. An order form for the book is on Specifications Website. A link to the pages is here:  
http://transportation.wv.gov/highways/contractadmin/specifications

**2018 Specifications Committee**
The Specification Committee typically meet every other month; on the first Wednesday. 2018 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://transportation.wv.gov/highways/contractadmin/specifications/SpecComit

**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

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**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 permanent 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 – 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:
1. Specification Changes – Shown as red-line copy (see note)
2. Project Specific Special Provisions (SP) – Will be shown in all black.
3. Updates to approved SP – Shown as red-line copy

Each item 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, then 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
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 102
BIDDING REQUIREMENTS AND CONDITIONS

102.16-PRE-CONSTRUCTION DATA:
DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

Prospective bidders may review files at the West Virginia Division of Highways, Capitol Complex, Charleston, West Virginia. These files may contain additional information not included in the contract documents—proposals—including, but not limited to, old plans, old shop drawings, geotechnical information, environmental documents, permit applications, permits, asbestos reports, hazardous waste reports, and other data. Copies may be obtained upon request and payment of printing fees. If provided, the additional documents will be posted as an Exhibit for the project and can be found on the WVDOH Bid Express website. All additional documents are to be considered as part of the proposal documents, unless the additional documents specifically states that it is for informational purposes only. Documents marked “for informational purposes only” are not to be considered contract documents, and potential bidders rely upon information contained therein at their own risk. Any requests for additional information or other pre-construction data should be presented to the Division through the Division’s Bid Express website.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 604
PIPE CULVERTS

604.1-DESCRIPTION:
This work shall consist of the construction or reconstruction of pipe culverts, in accordance with these Specifications and in reasonably close conformity with the lines, grades, dimensions, and locations shown on the plans or established by the Engineer.

604.2-MATERIALS:
Materials shall conform to the requirements of the following Subsection of Division 700:

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SUBSECTION</th>
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<tbody>
<tr>
<td>Aluminum Alloy Structural Plate-Arch Box Culvert</td>
<td>713.18</td>
</tr>
<tr>
<td>Aluminum Coated Corrugated Steel Pipe and Pipe Arch</td>
<td>713.24</td>
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<tr>
<td>Bitumen Sealant</td>
<td>708.9</td>
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<tr>
<td>Clay-Lined Reinforced Concrete Pipe</td>
<td>714.9</td>
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<tr>
<td>Controlled Low Strength Material</td>
<td>219</td>
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<tr>
<td>High Density Polyethylene (Profile Wall)</td>
<td>714.19</td>
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<tr>
<td>High Density Polyethylene (Steel-Reinforced)</td>
<td>714.26</td>
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<tr>
<td>Crushed Aggregate Backfill</td>
<td>704.6, Class 1 or Class 3</td>
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<tr>
<td>End Section for Corrugated Steel Pipe or Pipe Arch</td>
<td>713.20</td>
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<tr>
<td>Fine Aggregate</td>
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<tr>
<td>Flexible Watertight Gaskets for Circular Concrete Pipe</td>
<td>708.7</td>
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<tr>
<td>Granular Material for Culvert Bedding</td>
<td>716.1.1.2</td>
</tr>
<tr>
<td>Joint Mortar</td>
<td>708.8</td>
</tr>
<tr>
<td>Miscellaneous Concrete</td>
<td>715.12</td>
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<tr>
<td>Polypropylene Pipe</td>
<td>714.17</td>
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<td>Polyvinyl Chloride (PVC) Pipe</td>
<td>714.22</td>
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<tr>
<td>Precast Reinforced Concrete Box Culverts</td>
<td>714.7</td>
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<tr>
<td>Reinforced Concrete Elliptical Pipe</td>
<td>714.4</td>
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<tr>
<td>Reinforced Concrete End Section for Arch-Shaped Concrete Pipe</td>
<td>714.8</td>
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<tr>
<td>Reinforced Concrete End Section for Elliptical Concrete Pipe</td>
<td>714.8</td>
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<tr>
<td>Reinforced Concrete End Section for Round Concrete Pipe</td>
<td>714.8</td>
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When the locations of manufacturing plants allow, the plants may be inspected periodically for compliance with specified manufacturing methods, and material samples may be obtained for laboratory testing for compliance with material quality requirements. This may be the basis for quality acceptance of manufactured lots.

All materials will be subject to inspection for acceptance as to condition at the latest practicable time the Engineer has the opportunity to check for compliance prior to or during incorporation of materials in the work.

All references to "corrugated steel pipe" are considered applicable to uncoated pipe and the various combinations of coated pipes (asphalt coated, etc.) and paving classes (paved invert, full paved, etc.) for which the base metal conforms to AASHTO M 218 or AASHTO M 274.

The sheet thickness for corrugated steel pipe shall be as designated on the Plans.

Corrugations of 2-2/3 by ½ inches (68 mm by 13 mm) shall be furnished for corrugated metal pipe unless otherwise specified.

Corrugated steel pipe and pipe arch with 2-2/3” x ½”, 3” x 1”, and 5” x 1” (68 mm by 13 mm, 75 x 25 mm and 125mm x 25mm) corrugations shall be helically fabricated. Where 5” x 1” (125 mm x 25 mm) corrugations are specified for corrugated steel pipe and pipe arch, 3” x 1” (75 mm x 25 mm) corrugations may be substituted.

604.2.1-Quality Control Testing: Quality control of the granular material and crushed aggregate backfill is the responsibility of the Contractor as specified in 106.1.

The Contractor shall maintain necessary equipment and qualified personnel to perform all sampling and testing necessary to determine the magnitude of the various properties of the material governed by the Specifications and shall maintain these properties within the limits of the Specifications.

The Contractor shall submit a quality control plan detailing the methods by which the quality control program will be conducted. This plan, prepared in accordance with the guidelines set forth in the appropriate portions of MP 307.00.50 and MP 717.04.21, shall be submitted to the Engineer at the preconstruction conference. The work shall not begin until the plan is reviewed for conformance with the contract documents.

604.2.2-Acceptance Testing: Quality control sampling and testing performed by the Contractor may be used by the Division for Acceptance.

604.2.3-Sampling and Testing: Frequency of sampling and testing shall be in accordance with the contractor’s quality control plan. The minimum sampling and testing frequencies for gradation shall be as indicated in Attachment 1 of MP 307.00.50. The material shall be
sampled in accordance with MP 700.00.06. The minimum sampling and testing frequency for compaction will be in accordance with MP 717.04.21.

604.2.4-Acceptance Plan:
604.2.4.1-Compaction: Compaction of backfill material shall meet 604.8.

604.2.4.2-Gradation: 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. When the average, or when the most recent three consecutive individual test values fall outside the limits specified in Table 704.6.2A, 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 604.134.1. 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.

604.2.4.3-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 604.2.4.3

<table>
<thead>
<tr>
<th>Nonconforming Sieve Size</th>
<th>Multiplication Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ½ in. (37.5 mm)</td>
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</tr>
<tr>
<td>¾ in. (19 mm)</td>
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<tr>
<td>No. 4 (4.75 mm)</td>
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<tr>
<td>No. 40 (425 µm)</td>
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</tr>
<tr>
<td>No. 200 (75 µm)</td>
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</tr>
</tbody>
</table>

The total measure of nonconformance of an individual sublot is the sum of all nonconformance of an individual 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 for at an adjusted contract price as specified in Table 604.134.1.

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.

CONSTRUCTION METHODS

604.3-GENERAL:
Subject to the provisions prescribed, the flow line of a pipe culvert may be altered from that shown on the plans.
Galvanized steel pipe or bands shall not come in contact with aluminized steel pipe or bands. The diameter of pipe, as used in this Section, is the largest dimension, horizontal or vertical.

604.4-TRENCH EXCAVATION:

604.4.1-Pipe Culverts 18 Inches (450 mm) Through 96 Inches (2400 mm): In complete or partial fill sections, before trenching is begun, the fill shall be constructed for a minimum distance of six diameters on each side of the pipe and to a height of 2 feet (600 mm) over the top of the pipe or to the surface of the completed embankment if less than 2 feet (600 mm) above the top of the pipe.

The minimum width of the trench, in either cut of fill sections, shall be calculated using the formulas below. The Contractor shall increase these minimums to a width that allows the jointing of the pipe, and adequate placement and compaction of the backfill.

- **Minimum excavated trench width:**
  - Rigid Pipe = Outside Diameter + 24 Inches
  - Flexible Pipe = \((1.5 \times \text{Outside Diameter}) + 12\) Inches

- **Pipe Culverts of 36 inches (615 mm) diameter or less:**
  = Outside Diameter + 18 Inches (450mm) on each side of the conduit

- **Pipe Culverts with diameter greater than 36 inches (615 mm)**
  = Outside Diameter + 24 Inches (600 mm) on each side of the conduit

604.4.1.1-Pipe Culverts Installed Using Controlled Low Strength Material (Type F Trench): When using a controlled low strength material (CLSM) the width of the trench shall not be less than the applicable details of the Standard Detail Volume I.

604.4.2-Pipe Greater Than 96 Inches (2400 mm): In complete or partial fill sections, before trenching is begun, the fill shall be constructed for a distance of six diameters on each side of the pipe and to a minimum height of 25 percent of the largest vertical dimension of the pipe.

Installation of the pipe shall be as detailed in the plans, including the type and amount of backfill and bedding.

For flexible pipe, the Contractor shall submit shop drawings detailing all erection procedures including anticipated movements during backfilling operations. Backfill operations shall also be detailed to show lift thicknesses, sequence of lifts and shape of the culvert during these operations.

The Contractor shall submit a plan of field control for the installation insuring the pipe is erected in accordance with the shop and erection drawings.

604.4.3-Structural Plate Arches Box Culvert: Excavation for the foundations of structural plate arches box culvert shall be as for box culverts and structures and in accordance with 212.3.

604.5-BEDDING:
604.5.1-General: The pipe bedding shall conform to one of the classes described below as specified. When no bedding class is specified, the requirements for Class B bedding shall apply. Unless otherwise noted in the plans, bedding shall conform to the following requirements. Rigid pipe bedding shall be granular material or crushed aggregate backfill with a 3 inch (75 mm) minimum thickness. Flexible pipe bedding shall be crushed aggregate backfill with a 4 inch (100 mm) minimum thickness. The bedding material placed under the middle 1/3 of the pipe diameter shall be loosely placed and uncompacted to allow for cradling of the pipe bottom. Bedding outside of the middle 1/3 shall be compacted.

When a firm foundation is not found at grade, due to unstable in situ soils, the presence of foreign material or trash, or due to the presence of moisture eight percent in excess of optimum, the unsatisfactory material shall be removed for the width of the pipe plus 18 inches (450 mm) on each side and replaced with granular material.

When rock or unyielding material is present in the trench bottom, 6 inches of granular material shall be installed below the bottom of the pipe.

604.5.2-Class A Bedding: Class A bedding shall consist of a continuous concrete cradle conforming to the plan details.

604.5.3-Class B Bedding: Class B bedding shall consist of bedding the pipe in an earth foundation of uniform density, carefully shaped by means of a template to fit the lower pipe exterior for at least 15 percent of the overall height of the pipe. Recesses shall be made in the trench bottom to accommodate the bell, when bell and spigot type is used. Fine aggregate shall be used to level the foundation.

604.5.4-Class C Bedding: Class C bedding shall be in accordance with the details shown on the Plans.

604.6-LAYING AND JOINING:

604.6.1-Rigid and Flexible Pipe: The pipe placing, unless the Contractor is otherwise directed, shall begin at the downstream end of the pipe. The lower segment of the pipe shall be in contact with the shaped bedding throughout its full length. Bell or groove ends of rigid pipes and outside circumferential laps of corrugated steel pipe shall be placed facing upstream. Paved or partially lined culverts shall be laid so that the longitudinal centerline of the paved segment coincides with the flow line.

Rigid pipes may be of either bell and spigot or tongue and groove design, unless one type is specified. The method of joining pipe sections shall be such that the ends are fully entered, and the inner surfaces are reasonably flush and even.

Joints for rigid pipes shall be made with flexible watertight gaskets or bitumen sealant, or by a combination of these types.

When mortar joints are used for tongue and groove and bell and spigot pipe, they shall be made by plastering up to the quarter point the joint mortar before the succeeding joint is placed. Thickness of mortar shall be sufficient to maintain proper invert grade. The accessible outer joint shall then be filled with an excess of mortar to form a bead around the outside of the pipe and finished smooth on the inside. For grouted joints, molds or runners shall be used to retain the poured grout. When Portland cement mixtures are used, the completed joints shall be
protected against rapid drying by suitable covering material. When rubber or plastic gaskets are used, they shall be installed to form a flexible leak resistant seal.

Flexible pipes shall be joined by couplings in accordance with manufacturer’s recommendations, and the pipe shall be fastened to preserve the alignment, provide leak resistant seal, and prevent the separation of sections.

Pipe culverts shall be inspected before any backfill is placed. Any pipe found to be out of alignment, unduly settled, or damaged shall be removed and re-laid or replaced.

604.6.2 Aluminum Structural Plate–Arches Box Culvert: Aluminum structural plate arches box culvert shall be set on footings installed on a foundation as shown on the Plans. Beginning at the upstream end, the first side plates shall be set on the bolted to a base angles or set into a keyway formed in a concrete footing. Then the remaining side plates and the top plates of the arch shall be bolted into place using only enough bolts to hold them without tightening securely. Drift pins may be used to assist in matching bolt holes. Temporary props may be used to hold plates in place until connections are made. After the plates comprising the first arch–ring have been assembled, the next set shall be placed in the same manner, finishing each set of side plates with a top plate before placing in the same manner, finishing each set of side plates with a top plate before placing the next set of side plates. New plates shall be lapped one corrugation on the outside of the preceding plates. When all the plates are in position, the remaining bolts shall be inserted and all nuts firmly tightened. Steel bolts shall be torqued during installation to a minimum of 100 feet lbs. (135 Newton meters), and a maximum of 300 feet lbs. (400 Newton meters). Aluminum bolts shall be torqued during installation to a minimum of 100 feet lbs., (135 Newton meters), and a maximum of 150 feet lbs. (200 Newton meters). The bolts shall be torqued per manufacture recommendation. For power driven tools, the hold-on period may vary from 2 to 5 seconds. Bolts shall be of sufficient length to provide for a full nut. When the structure is asphalt coated, all bolts and nuts shall be coated inside and outside of the structure, after completion of bolt tightening, with asphalt material conforming to the requirements of 713.3.

604.7 ELONGATION: Blank

When specified on the plans, factory elongation of flexible pipe shall be not less than four percent and not more than six percent vertically. Elongation shall be maintained during shipping, storing and handling.

604.8 BACKFILLING:

The use of a bulldozer or other bladed equipment in placing backfill is expressly forbidden. Mechanical equipment with various type buckets may be used. All pipe, after being bedded and backfilled, shall be protected by a four feet 4 feet (1200 mm) cover of fill, or more if necessary, before heavy equipment is permitted to cross during the construction of the roadway. The Contractor will be held responsible for any damage to the pipe resulting from movement of equipment over the structure.

604.8.1 Initial Backfill Zone: Backfill–Rigid Pipe initial backfill material shall be suitable random granular material free from particles larger than 3 inches (75 mm) 1 inch (25mm), crushed aggregate backfill, or controlled low strength material. For flexible pipe, the initial backfill material shall be crushed aggregate backfill or controlled low strength material. After
The pipe is installed, random material and crushed aggregate. The initial backfill material shall be placed along the pipe in layers not to exceed 4 inches (100 mm) compacted; to a minimum of the spring line for rigid pipe and to a minimum height of 6 inches (150 mm) over the top of flexible pipe. Controlled low strength material shall be placed according to Section 219. Any of the and any types of controlled low strength material may be used. For flexible pipe, the backfill material shall be crushed aggregate backfill or controlled low strength material. Unless otherwise specified in the plans, the controlled low strength material can be used as a substitute for random material or crushed aggregate backfill at the contractor’s option.

The quality control testing and acceptance of controlled low strength material shall be according to 219.

The quality control testing and acceptance for compaction of the random backfill material shall be in accordance with applicable sections of 207 and 716 and crushed aggregate backfill according to 717, with the following exception:

Testing will be conducted on both sides of the pipe and testing within a lot may include tests on both sides of the pipe. For pipe installations in an embankment where existing tests are on file for the adjacent embankment material, the target percentage of dry density for the pipe backfill will be equal to the average of the X values for the tests in the adjacent lots of embankment material or a minimum value of 95, whichever is greater. For embankments where no tests are on file, the target percentage of dry density will be 95. A lot shall have five (5) density tests performed for quality control.

For pipes less than 60 inches (1500 mm) in diameter, a lot will normally consist of the quantity of backfill required for each 75 linear feet (23 m) of pipe installed.

For pipes 60 inches (1500 mm) in diameter and larger, a lot will normally consist of not more than 5 lifts of backfill. For pipe with lifts of backfill placed for the full length of the pipe, a sublot will normally consist of a lift of backfill placed on both sides for the full length of the pipe. For pipes that are backfilled in segments, a sublot will normally consist of a lift of backfill placed on both sides for the length of each segment of pipe backfilled.

Backfill placed outside embankments and roadbed is to be compacted to or better than the average total dry density for the existing soil. An average total dry density will be determined from representative density tests conducted for each existing soil. Quality control testing will normally consist of one test per 100 linear feet (30 m) of pipe installed, and lot evaluations are not required. The moisture tolerance is not applicable.

The use of a bulldozer or other bladed equipment in placing backfill is expressly forbidden. Mechanical equipment with various type buckets may be used. Care shall be taken to compact the material under the haunches of the pipe, to place the backfill evenly on each side of the pipe to retain its vertical axis, and to avoid displacement. The backfill and compaction efforts shall be advanced simultaneously on both sides of the pipe.

604.8.2-Final Backfill Zone: Unless otherwise noted in the plans, the area above initial backfill zone shall be suitable random material free from particles larger than 1 inch (25 mm), crushed aggregate backfill, or controlled low strength material. This method of backfilling and compacting shall be followed until the top of the trench is reached.

In the case of pipe 60 inches (1500 mm) through 108 inches (2700 mm) in diameter, not in trench condition, this backfilling and compacting the area above initial backfill zone shall be carried to a height of 2 feet (600 mm) over the top of the pipe and to a width not less than the outside diameter of the pipe plus one diameter on each side. Above this
elevation, the embankment shall be placed and compacted in the normal manner. All pipes, after being bedded and backfilled, shall be protected by a four foot (1200 mm) cover of fill, or more if necessary, before heavy equipment is permitted to cross during the construction of the roadway. The Contractor will be held responsible for any damage to the pipe resulting from movement of equipment over the structure.

604.8.3-Backfill Testing: The quality control testing and acceptance of controlled low strength material shall be according to 219. The quality control testing and acceptance for compaction of the random backfill material shall be in accordance with applicable sections of 207 and 716, granular material according to 716, and crushed aggregate backfill according to 717, with the following exception:

Testing will be conducted on both sides of the pipe and testing within a lot may include tests on both sides of the pipe. For pipe installations in an embankment where existing tests are on file for the adjacent embankment material, the target percentage of dry density for the pipe backfill will be equal to the average of the X values for the tests in the adjacent lots of embankment material or a minimum value of 95, whichever is greater. For embankments where no tests are on file, the target percentage of dry density will be 95. A lot shall have five (5) density tests performed for quality control.

For pipes less than 60 inches (1500 mm) in diameter, a lot will normally consist of the quantity of backfill required for each 75 linear feet (23 m) of pipe installed.

For pipes 60 inches (1500 mm) in diameter and larger, a lot will normally consist of not more than 5 lifts of backfill. For pipe with lifts of backfill placed for the full length of the pipe, a sublot will normally consist of a lift of backfill placed on both sides for the full length of the pipe. For pipes that are backfilled in segments, a sublot will normally consist of a lift of backfill placed on both sides for the length of each segment of pipe backfilled.

Backfill placed outside embankments and roadbed is to be compacted to or better than the average total dry density for the existing soil. An average total dry density will be determined from representative density tests conducted for each existing soil. Quality control testing will normally consist of one test per 100 linear feet (30 m) of pipe installed, and lot evaluations are not required. The moisture tolerance is not applicable.

604.9-FIELD PAVING:

When field paving is required for structural plate pipe arches, the following provisions shall govern:

The surface to be field paved shall be thoroughly cleaned and dried, and the priming material shall be sufficiently applied with a brush or a mop to coat the surface and to fill all seams or joints. After the priming material has been applied, a wire mesh, having not less than Size # W 1.4 wire and having openings not more than 4 inches (100 mm) by 6 inches (150 mm), shall be placed on top of the corrugations and securely fastened to the bolts with wire or suitable clips.

The reinforcing mesh shall have a width 1 foot (300 mm) less than the width of the finished paving and shall be fastened to the structure near each edge and at the center of the mesh at points not more than 2 feet (600 mm) apart along the longitudinal barrel of the structure. The asphalt paving material shall be applied in such a manner that smooth pavement will be formed in the invert, filling the corrugations for at least 25 percent of the circumference of a pipe or 38 percent of the circumference of a pipe arch. The paving thickness shall be sufficient to cover the crests of the corrugations a minimum of 1 inch (25 mm). The placing of the mastic shall be followed closely.
by the uniform application of a seal coat applied over the paving. The seal coat shall be applied while the paving material is still hot.

The Contractor may pave with Portland cement concrete or use shotcrete. If practicable, such paving shall be delayed until completion of the fill over the structure. Before the placing of the paving, the surface of the plates shall be cleaned, or to the plates or to the asphalt coating if asphalt coated plates are used. When paving with Portland cement concrete or shotcrete, mesh reinforcement, fastening of mesh, and paving dimensions shall be as specified for asphalt paving except that the minimum thickness over the crest of the corrugations shall be 1-½ inches (40 mm).

Concrete used shall have a design 28-day compressive strength of 3,000 psi (21 MPa) (equivalent to Class B in 601.3); concrete may be hand mixed and shall be handled and placed as directed by the Engineer. After initial set has taken place, the paving shall be flooded or kept moist by sprinkling for three days. Liquid membrane-forming compound, conforming to 707.9 may be used for curing at a minimum application rate of one gallon per 150 square feet (0.25 liters per m²) of concrete surface. Other methods of curing may be used if approved by the Engineer.

Field paving with shotcrete shall conform to the applicable provisions of 623. When paving with shotcrete, the exposed surface shall be brought to a uniform surface by screeding or troweling. After completion of the shotcrete paving, the rebound material shall be cleaned from the culvert above the paved surface. Shotcrete shall be cured by (a) covering with burlap mats and keeping them wet for at least seven days after placing, (b) flooding for a period of at least seven days or, (c) applying liquid membrane curing compound, conforming to 707.9, at a minimum rate of one gallon per 150 per feet (0.25 liters per m²) of shotcrete surface for each application. Shotcrete cured by membrane forming compound shall receive two applications; the second application shall be made after the first application has set. Other methods of curing may be used if approved by the Engineer.

After the completion of the fill over the pipe or pipe arch, any gaps which develop between the plates and the concrete or shotcrete paving shall be filled by pouring heated asphalt material complying with requirements of 713.3.

When field paving is specified for metal pipes and metal pipe arches, the methods and materials used shall be the same as specified except that the wire mesh shall be tied to the corrugated metal at points not exceeding 30 inches (750 mm) in any direction and not exceeding 9 inches (225 mm) from the edges of paving. Attachment may be by use of ½” diameter (12 mm) (minimum) commercially available galvanized or cadmium-plated lag screws twisted firmly into holes drilled in the valleys of the corrugations or by other approved means.

Prior to using Portland cement concrete or shotcrete for paving culverts with coatings containing aluminum, the aluminum-concrete contact area shall be coated with commercially-available paint.

604.10-REMOVE AND RELAY PIPE:

When specified, the Contractor shall remove, salvage, clean, safely store, and relay existing culverts. The construction requirements in this Section shall apply equally in the case of remove and relay pipe. The Contractor shall restore or replace, any pipe designated for reuse that incurs damage or destruction through faulty handling or storage. All pipes salvaged for relaying shall be cleaned of all foreign material prior to reinstallation.

604.11-JACKING PIPE:
Jacking or tunneling may be designated on the Plans or may be permitted if written approval is obtained. Culverts to be jacked shall be reinforced concrete pipe. The strength of pipe designated in the Contract will be designated as required for vertical load only. Additional reinforcement or strength of pipe required to withstand jacking pressure shall be determined and furnished by the Contractor without additional cost to the Division. Variation from theoretical alignment and grade at the time of completion of jacking placement shall not exceed 0.2 feet for each 20 feet (10 mm per m) of pipe so placed.

An approach trench shall be constructed on the side from which jacking operations shall take place. The end of the approach trench away from the jacking face shall be cut perpendicular to the axis of the jacking operation to provide bearing surface for the back stop and the jack blocking. The length of the approach trench shall be such that the distance between the jack blocking and the face of the bore shall be equal to 5 feet (1500 mm) plus the length of the individual pipe sections. The jacking face shall be a minimum of 3 feet (1 m) above the top of the pipe; the face shall be cut vertically and shall be shored to prevent raveling and slipping. A sump shall be constructed in one corner of the trench to provide drainage. The back stop shall be constructed of heavy timbers or steel rails capable of withstanding the jacking force.

In the event the site of jacking operations is such that an approach trench cannot be constructed, the jack blocking shall be constructed to carry the reaction of the jack to the ground. This may be accomplished by means of timber, steel, or concrete vertical back stops set into the ground with the tops supported by diagonal members bearing against an embedded anchorage.

Directly opposite the approach trench, an exit trench shall be constructed to line and grade. The exit trench shall be constructed in the same manner as the approach trench except that no back wall is necessary.

Jacks shall be of sufficient capacity to overcome soil resistance to the jacking operation and shall be operated in pairs. As a guide, capacity of jacks for concrete pipe shall be a minimum of 50 tons (45 Mg) each. For large pipe, more than one pair of jacks may be required. Small track jacks may be used to start the pipe.

Pipe guides shall be constructed in the approach trench and may be either timber or steel rail or concrete guides on a cradle. Since the pipe guides will support the pipe as it enters the jacking face, the pipe guides shall be accurately set to line and grade, and excavation for the guides shall be made to grade to avoid occurrence of settlement. Guides shall be spaced, as required.

Reaction of the jack to the pipe shall be transmitted by either a jacking frame or jacking beams constructed of timber or steel. Jacking frames and beams shall be so placed as to exert equal pressure on each side of the pipe. For pipes 36 inches (900 mm) in diameter or smaller, a steel jacking ring may be used in lieu of the jacking frame.

The pressure from the jacking frame or beams may be transmitted to a jacking collar or head on the pipe itself. Jacking collars or heads for concrete pipe shall be constructed to prevent damage to the pipe ends. Jacking collars and jacking frames shall be constructed to allow passage of men and material.

Joints of concrete pipe shall be cushioned and protected from infiltration of fine materials occurring during the jacking operation by insertion of a plywood or OSB of 1/2”-3/4” thickness cushioning material into each pipe joint. After the pipe is in position, the joints shall be pointed from the inside with mortar joint compound. The use of a jacking shield is permitted.

To prevent the pipe from "freezing" and becoming incapable of movement, jacking operations should, if possible, be carried out on a 24-hour basis. Alignment and grade of the pipe
guides shall be checked at least once each shift. To aid in the prevention of "freezing," the pipe shall be lubricated in a manner and with a material meeting the approval of the Engineer.

Excavation for the bore shall be to grade at the bottom and approximately 1 inch (25 mm) greater than the diameter of the pipe at the top and sides. As excavation proceeds, the jacking shall proceed until the effective limit of the jacking is reached, at which time additional blocking shall be added. This process shall be continued until there is room for an additional pipe section. For long runs of pipe, the use of intermediate jacking stations will be allowed as approved by the Engineer.

Pipe cover shall be a minimum of one diameter or 3 feet (900 mm) from top of pipe to bottom of the subgrade of ballast when jacking under a highway.

After the pipe has been jacked into place, the annular area between the pipe wall and the remaining soil shall be pressure grouted to remove any change of settling. The backfill shall be tightly compacted around both ends of the culvert to prevent erosion. Any departure from the above specifications necessitated due to site conditions shall be approved in writing by the Engineer.

Areas resulting from caving or excavation outside the above limits shall be backfilled with grout, or by a method which will fill the voids. Joints shall be completed as specified for the type of pipe being installed.

604.12-INSPECTION AND ACCEPTANCE:

In addition to the visual inspection performed by the Department during the initial installation of pipe culverts, a post installation inspection will be conducted before final acceptance. No sooner than 30 days following installation, the Engineer will visually inspect all pipe. Any cracks, differential movement, efflorescence, rust stains, spalls, exposed reinforcement, slabling, dents, buckling, holes, damaged coating, obstructions, improperly engaged joints, improper gasket placement, excessive joint gaps, misaligned joints, excessive deflection, or undue horizontal or vertical misalignment will be cause for repair or replacement at no cost to the Division.

604.12.1-Rigid Pipe Criteria: Concrete pipe cracks equal to or less than one hundredth of an inch (0.01) are considered hairline and minor. Cracks greater than five hundredth of an inch (0.05) or less than one tenth of an inch (0.1) shall be sealed by the method proposed by the manufacturer and approved by the Engineer. Concrete pipe with cracks with width greater than one tenth of an inch (0.1) shall be replaced by the Contractor to the satisfaction of the Engineer.

604.12.2-Flexible Pipe Criteria: Flexible pipe deflection equal to or less than 5 percent of the original diameter will not require remediation. Deflections of 5 percent up to 7.4 percent of the original diameter will be evaluated by the Engineer. If flexible pipe is deflected 7.5 percent of the original diameter, the pipe shall be replaced by the Contractor to the satisfaction of the Engineer.

Plastic pipe with cracks exceeding 1/8 inch width by 6 feet long shall be evaluated by the Engineer for structural and hydraulic integrity.
604.12.3-Testing of Pipe: A post installation camera/video inspection of pipe culverts and laser/mandrel deflection inspection of flexible pipe shall be conducted by the Contractor on all pipe culverts that meet the following requirements:

1. Cumulative total of 250 linear feet (75 m) or more of pipe culverts on project
2. Project located on NHS routes

The Contractor may visually inspect, in the presence of the Engineer, in lieu of camera/video inspection where pipe culverts size, orientation, and location allow for easy visual examination.

The Contractor shall issue a report in digital format, detailing all issues or deficiencies noted during the inspection, including a remediation plan for each deficiency, no later than 7 days after completion of the inspection.

604.12.3-METHOD OF MEASUREMENT:

Pipe of the different types and sizes, both new and re-laid, will be measured by the linear foot (m) in place, the measurement being made along the centerline of each pipe installed. Branch connections, tees, wyes, and elbows will be measured along their centerlines and these lengths included in the total lengths of the pipe. Wyes, tees, and other branch connections will be measured along the centerlines to points of intersection. Pipe with sloped or skewed ends will be measured along the invert. The portion of pipe extending through to the inside face of headwalls of all types, manholes, inlets, boxes, or other structures shall be included in the measurement.

End sections will be measured by the number of units installed.

Pipe designated on the Plans to be installed by the jacking method will be measured separately by the linear foot (m) in place and shall be the actual portion jacked, completed in place, and accepted.

604.13.4-BASIS OF PAYMENT:

The quantities, determined as provided above, will be paid for at the contract unit prices bid for the items listed in 604.14.5, which prices and payments shall be full compensation for excavation and bedding, except as otherwise provided, backfilling, jacking when called for, furnishing all 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 unit price bid for end sections shall include excavation and backfill.

When, by the authority of the Engineer, the flow line of a pipe is lowered from that shown on Plans, or due to a lack of a firm foundation, or due to a solid rock foundation, unsatisfactory material is removed and replaced with suitable material, the work of excavation, replacement, and compaction of material will be paid for in accordance with 109.4.

1. For pipe culverts less than 48-inches (1200 mm) diameter, the work of excavation, measured in excess of 1 foot (300 mm) below the original planned pipe elevation, will be paid for under the provisions of 109.4. When suitable material is not available from the project excavation, payment for replacement material below final grade line will be made in accordance with 109.4.

2. For pipe culverts 48-inches (1200 mm) diameter or larger, all additional excavation below the original planned pipe elevation and for a width not in excess of the outside pipe diameter plus 18 inches (450 mm) on each side of the pipe, will be paid for at the unit bid price for Item 207001.* "Unclassified Excavation". When no Item 207001.* is included in the Proposal, payment for excavation, backfill compaction and replacement material will be
made in accordance with 109.4. When suitable material is not available from the project excavation, replacement material will be paid for in accordance with 109.4.

**604.134.1-Price Adjustment:** Crushed aggregate backfill not conforming with the gradation requirements as described in 604.2.4.2 will be paid for at the adjusted contract price base on the degree of nonconformance as specified in Table 604.134.1.

A revised unit price for calculation purposes in 307.9.1 will be established based on the unit bid cost minus the cost of the pipe.

<table>
<thead>
<tr>
<th>TABLE 604.134.1</th>
<th>Adjustment of Contract Price for Gradation not Within Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of Nonconformance</td>
<td>Percent of Contract Price to be Reduced</td>
</tr>
<tr>
<td>1.0 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.

**604.145-PAY ITEMS:**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>604020-*</td>
<td>“size” Structural Plate Pipe Arch, YZ</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>604024-*</td>
<td>“size” Full Asphalt Coated Structural Plate Arch, YZ</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>604037-*</td>
<td>“size” Reinforced Concrete Pipe, Class **</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>604038-*</td>
<td>“size” Reinforced Concrete Pipe End Section</td>
<td>Each</td>
</tr>
<tr>
<td>604039-*</td>
<td>“size” Reinforced Concrete Pipe Arch, Class **</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>604040-*</td>
<td>“size” Reinforced Concrete Pipe Arch End Section</td>
<td>Each</td>
</tr>
<tr>
<td>604041-*</td>
<td>“size” Reinforced Concrete Elliptical Pipe, YX</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>604043-*</td>
<td>“size” Clay Lined Reinforced Concrete Pipe, Class **</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>604045-*</td>
<td>“size” Polypropylene Pipe</td>
<td>Linear Foot (Meter)</td>
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<tr>
<td>604050-*</td>
<td>“size” High Density Polyethylene Pipe (profile wall)</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>604051-*</td>
<td>“size” High Density Polyethylene Pipe (steel reinforced)</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>604052-*</td>
<td>“size” Polyvinyl Chloride Pipe</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>604053-*</td>
<td>“size” Relaid Existing Pipe</td>
<td>Linear Foot (Meter)</td>
</tr>
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<td>604054-*</td>
<td>“size” Jacked Pipe, Reinforced Concrete Pipe, Class **</td>
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<td>“size” Precast Concrete Box Culvert</td>
<td>Linear Foot (Meter)</td>
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<tr>
<td>604071-*</td>
<td>“size” Reinforced Concrete Pipe Safety Slope End Section</td>
<td>Each</td>
</tr>
<tr>
<td>604073-*</td>
<td>“size” Elliptical Reinforced Concrete Pipe Safety Slope End Section, YX</td>
<td>Each</td>
</tr>
<tr>
<td>604074-*</td>
<td>“size” Aluminum Structural Plate Box Culvert, YZ</td>
<td>Linear Foot (Meter)</td>
</tr>
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<td>604075-*</td>
<td>“size” Field Paved Aluminum Box Culvert, YZ</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>604076-*</td>
<td>“size” Aluminum Coated Corrugated Steel Pipe, YZ</td>
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<td>604077-*</td>
<td>“size” Aluminum Coated Corrugated Steel Pipe Arch, YZ</td>
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<tr>
<td>ITEM</td>
<td>DESCRIPTION</td>
<td>UNIT</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------</td>
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<tr>
<td>604078-*</td>
<td>“size” Aluminum Coated Corrugated Steel Pipe Asphalt Coated, YZ</td>
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</tr>
<tr>
<td>604079-*</td>
<td>“size” Aluminum Coated Corrugated Steel Pipe Arch Asphalt Coated, YZ</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>604080-*</td>
<td>&quot;size&quot; Aluminum Coated Corrugated Steel Pipe Half Asphalt Coated and Paved Invert</td>
<td>Linear Foot (Meter)</td>
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<tr>
<td>604090-*</td>
<td>“size” Corrugated Steel Pipe End Section</td>
<td>Each</td>
</tr>
<tr>
<td>604091-*</td>
<td>“size” Corrugated Steel Pipe Arch End Section</td>
<td>Each</td>
</tr>
<tr>
<td>604092-*</td>
<td>“size” Corrugated Steel Pipe Safety Slope End Section</td>
<td>Each</td>
</tr>
</tbody>
</table>

* Sequence number
** Class designated by Roman numerals.
  “special design” may be used for unique circumstance
X = Type of elliptical pipe in accordance with the following table
Y = a letter, if present, designating base metal thickness or type of elliptical concrete pipe in accordance with the following table.
Z = a one digit number designating metal pipe corrugations or Roman numerals designating concrete pipe class or a one digit number designating elliptical concrete pipe class in accordance with the following table.
For Aluminum Box Culverts, haunch and crown plate thicknesses as specified on the Plans.
<table>
<thead>
<tr>
<th>Y</th>
<th>Steel</th>
<th>Aluminum</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>64 (1.63)</td>
<td>60 (1.52 mm)</td>
</tr>
<tr>
<td>B</td>
<td>79 (2.0)</td>
<td>75 (1.90 mm)</td>
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<tr>
<td>C</td>
<td>109 (2.77)</td>
<td>105 (2.67 mm)</td>
</tr>
<tr>
<td>D</td>
<td>138 (3.51)</td>
<td>135 (3.43 mm)</td>
</tr>
<tr>
<td>E</td>
<td>168 (4.27)</td>
<td>164</td>
</tr>
<tr>
<td>F</td>
<td>188 (4.78)</td>
<td>---</td>
</tr>
<tr>
<td>G</td>
<td>218 (5.54)</td>
<td>---</td>
</tr>
<tr>
<td>H</td>
<td>249 (6.32)</td>
<td>---</td>
</tr>
<tr>
<td>J</td>
<td>4 BOLTS/FT (13 BOLTS/M) 280 (7.11)</td>
<td>---</td>
</tr>
<tr>
<td>K</td>
<td>6 BOLTS/FT (19 BOLTS/M) 280 (7.11)</td>
<td>100 (2.54 mm)</td>
</tr>
<tr>
<td>L</td>
<td>8 BOLTS/FT (26 BOLTS/M) 280 (7.11)</td>
<td>125 (3.18 mm)</td>
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<tr>
<td>M</td>
<td>313 (7.95)</td>
<td>150 (3.81 mm)</td>
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<td>N</td>
<td>375 (9.52)</td>
<td>185 (4.41 mm)</td>
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<tr>
<td>P</td>
<td>---</td>
<td>200 (5.08 mm)</td>
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<tr>
<td>Q</td>
<td>---</td>
<td>225 (5.72 mm)</td>
</tr>
<tr>
<td>R</td>
<td>---</td>
<td>250 (6.35 mm)</td>
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<table>
<thead>
<tr>
<th>Z</th>
<th>Metal Corrugations</th>
<th>Pipe Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 ½&quot; x ¼&quot; (37.5 x 6.25 mm)</td>
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</tr>
<tr>
<td>2</td>
<td>2/3&quot; x ½&quot; (66.8 x 12.5 mm)</td>
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</tr>
<tr>
<td>3</td>
<td>3&quot; x 1&quot; (75 x 25 mm)</td>
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<tr>
<td>5</td>
<td>5&quot; x 1&quot; (125 x 25 mm)</td>
<td>---</td>
</tr>
<tr>
<td>6</td>
<td>6&quot; x 2&quot; (150 x 50 mm)</td>
<td>---</td>
</tr>
<tr>
<td>7</td>
<td>7½&quot; x ¾&quot; x ¾&quot; (190 x 19 x 19)</td>
<td>---</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VX</th>
<th>Concrete Pipe</th>
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</thead>
<tbody>
<tr>
<td>H</td>
<td>Horizontal Elliptical</td>
</tr>
<tr>
<td>V</td>
<td>Vertical Elliptical</td>
</tr>
</tbody>
</table>
DELETE THE CONTENTS AND TITLE OF SUBSECTION 708.9 AND REPLACE WITH THE FOLLOWING:

**708.9-BITUMEN SEALANT:**

Bitumen Sealant used as a joint sealer for concrete and masonry shall meet the requirements of ASTM C990.

**708.9-ASPHALT PLASTIC CEMENT:**

--- **708.9.1 General Requirement:** Asphalt plastic cement is intended for use as a joint sealer for concrete and masonry. It shall consist of an asphalt base, volatile petroleum solvents, and mineral stabilizers, mixed to a smooth, uniform consistency, suitable for trowel application.

--- **708.9.2 Composition:**

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
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</thead>
<tbody>
<tr>
<td>Nonvolatile Matter, %</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Mineral Matter (Ash), %</td>
<td>15</td>
<td>45</td>
</tr>
</tbody>
</table>

--- **708.9.3 Physical Requirements:** Uniformity. A thoroughly stirred sample shall show no separation of solvent or setting that cannot be overcome by moderate stirring after standing for 6 hours at room temperature in a closed container.

--- Workability. The asphalt plastic cement shall spread readily without drawing or pulling when applied to a metal test panel and spread to a thickness of approximately 1/8 inch (3 mm).

--- Behavior at 60°C (140°F). A sample cured at room temperature for one hour, and heated in a (60°C ± 2°C) oven for five hours shall show no blistering and not more than 1/4 inch (6 mm) sagging or slipping.

--- Behavior at 0°C (32°F). After completion of the 60°C behavior test, the sample shall be cooled to 0 ± 2°C for one hour. Immediately after this exposure, the sample shall be...
bent around a 1-inch (25 mm) diameter mandrel. The sample shall show no cracking of the asphalt or separation of the asphalt from the panel.

708.9.4 Test Methods: Nonvolatile matter Test in accordance with ASTM D 2822.
Ash Transfer approximately 5 grams of the sample (weighed to the nearest 0.01 g) to a crucible and heat at a low temperature (not above a dull red heat) until all carbon is consumed. Cool in a desiccator, weigh and calculate the percentage of ash.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 713
METAL PIPE

713.1-BLANK

713.2-METALLIC COATED CORRUGATED STEEL PIPE AND PIPE ARCH:
   Metallic coated corrugated steel pipe and pipe arch shall conform to the requirements of
   AASHTO M 36 for Type I and Type II pipe.
   Special sections, such as elbows, for these conduits shall be of the same gage as the conduit to
   which they are jointed, and shall conform to the applicable requirements of AASHTO M 36.

713.3-BITUMINOUS ASPHALT COATED CORRUGATED STEEL PIPE AND PIPE ARCH:
   Bituminous Asphalt coated corrugated steel pipe, pipe arches, coupling bands, elbows, and
   other special sections shall conform to the requirements of AASHTO M 190. Coating and invert
   paving shall be of the type specified.

713.4-FULL BITUMINOUS ASPHALT COATED AND FULL PAVED CORRUGATED STEEL PIPE:
   The pipe shall conform to the applicable requirements of AASHTO M 190 and in addition thereto, when riveted corrugated steel pipe is used, the rivets shall be placed on the outside crests of corrugations. Bituminous Asphalt coating shall be in accordance with the requirements for Type A; the paving shall be in accordance with the requirements for Type B except that the pavement shall be formed on the inside for the entire circumference of the pipe. Smooth lined pipe over 30 inches (750 mm) in diameter shall have lifting lugs attached to each section when manufactured.

713.5-FIBER BONDED FULL BITUMINOUS COATED CORRUGATED STEEL PIPE AND PIPE ARCH:

--- 713.5.1 Type A, Fiber Bonded Full Bituminous Coated: Fiber bonded full bituminous coated conduits shall comply with the requirements of AASHTO M 36 for base metal, and fabrication where applicable. The conduit shall be formed from sheets which have been coated on both sides with a layer of aramid fibers, applied in a sheet form by pressing them into a molten metallic bonding medium. Immediately after the metallic bond has solidified, the fibers shall be thoroughly saturated with a bituminous saturant. The finished sheets shall be of first class commercial quality, free from blisters and unsaturated spots. In addition, the conduit
shall be coated inside and out with a bituminous material complying with the requirements of AASHTO M 190, Type A.

713.5.2 Type C, Fiber Bonded Full Bituminous Coated and Paved Invert: Fiber bonded full bituminous coated and paved conduits shall comply with all the requirements of 713.5.1 and shall be paved to conform with the requirements in AASHTO M 190, Type C.

713.6 FIBER BONDED FULL BITUMINOUS COATED AND FULL PAVED CORRUGATED STEEL SEWER PIPE:
Fiber bonded full bituminous coated and full paved steel sewer pipe shall comply with the requirements of 713.5.1, where applicable, and in addition thereto, the rivets shall be placed on the outside crests of the corrugations and the inside of the pipe shall be paved so that a smooth surface will be formed filling the corrugations of the pipe with a minimum thickness of 1/8 in. (3 mm) over the crests of the corrugations. Smooth lined pipe over 30 inches (750 mm) in diameter shall be provided with lifting lugs for each section when manufactured.

713.7-CORRUGATED STAINLESS STEEL CULVERTS AND UNDERDRAINS:
Corrugated stainless steel culverts and underdrains shall comply with the requirements of zinc coated (galvanized) corrugated iron or steel culverts and underdrains, AASHTO M 36, with the following exceptions (Numbers refer to Subsections in AASHTO M 36):

1. SCOPE:
   1.1 This specification covers corrugated stainless steel culverts and underdrains.

3. IRON OR STEEL SHEETS:
   3.1 The stainless steel sheets shall conform with the requirements of SAE Standard J-405B, Alloy Grade SAE 5140.

6. SHEET MANUFACTURER'S GUARANTEE:
   6.1 The manufacturer of the sheets shall submit with the certified analysis a guarantee providing that all metal furnished conforms with the Specification requirements, shall bear a suitable identification brand or mark, and shall be replaced without cost to the purchaser when not in conformity with the specified analysis and sheet thickness; and the guarantee shall be so worded as to remain in effect as long as the manufacturer continues to furnish material.

7. RIVETS:
   7.1 Rivets shall conform to the requirements of SAE Standard J-405B, Alloy Grade SAE 51430, or ASTM A 276, Type 430.

10. CORRUGATIONS:
    Corrugations shall be annular, spiral or a combination of annular and spiral.

12. RIVETED SEAMS:
    12.2 For pipe with 1 in. (25 mm) deep corrugations, ½ in. (12 m) diameter bolts and nuts conforming to the requirements of ASTM A 276. Type 430, may be used in lieu of rivets or spot welds on a one-for-one replacement ratio.
    In Table 2, substitute sheet thickness as follows:
    .048 (1.2 mm)  .105 (2.7 mm)
15. RESISTANCE SPOT WELDED SEAMS:
   15.1.2 The welding shall be performed in such a manner that (1) the exterior surfaces of 90 percent or more of the spot welds on a length of pipe shall show no evidence of burning of the metal. Discoloration of the spot weld surfaces will not be cause for rejection.

   15.3.5 In Table 3, substitute sheet thickness as follows:
   
<table>
<thead>
<tr>
<th>Inches (mm) (Approx.)</th>
<th>Pounds (Mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>.048 (1.2 mm)</td>
<td>3,100 (1.40)</td>
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<tr>
<td>.060 (1.5 mm)</td>
<td>4,100 (1.85)</td>
</tr>
<tr>
<td>.075 (1.9 mm)</td>
<td>5,200 (2.36)</td>
</tr>
<tr>
<td>.105 (2.7 mm)</td>
<td>7,000 (3.17)</td>
</tr>
<tr>
<td>.135 (3.4 mm)</td>
<td>8,500 (3.85)</td>
</tr>
<tr>
<td>.164 (4.2 mm)</td>
<td>10,000 (4.52)</td>
</tr>
</tbody>
</table>

19. TYPE III PIPE:
   19.1 Culverts furnished under this type shall consist of stainless steel corrugated metal pipe to be used in underdrains. Unless otherwise specified the pipe shall be perforated.

21. COUPLING BANDS:
   21.1 Revise third sentence as follows: The coupling bands shall be made of base metal conforming to SAE Specification J-405B, Alloy Grade 51409.

23. WORKMANSHIP:
   23.1.10 Delete this Subsection.

24. REPAIR OR DAMAGED SPELTER COATING:
   Delete this Subsection.

25. Add the following notation: This Section applies only with reference to those factors applicable to a stainless steel sheet.

713.8-STRUCTURAL PLATE FOR PIPE, PIPE ARCH, AND ARCHES:
   These conduits, and bolts and nuts for connecting plates, shall conform to the requirements of AASHTO M 167.

713.9-FULL BITUMINOUS ASPHALT COATED STRUCTURAL PLATE PIPE, PIPE ARCH, AND ARCHES:
   These conduits shall conform to the requirements of AASHTO M 167 and shall be coated with bituminous asphalt material. When the coating can be applied in the shop it shall conform to the requirements of AASHTO M 190, Type A Coating. When the coating must be applied in the field the coating shall conform to the requirements of AASHTO M 243. The bituminous-asphalt coating shall coat the entire inside and outside of the pipe and is not required between the metal sheets at the splices.

713.10-STAINLESS STEEL STRUCTURAL PLATE PIPE: Blank
   Stainless steel structural plate pipe shall comply with the applicable requirements of
March 7, 2018

structural plate pipe, AASHTO M 167, with the following exceptions (Numbers refer to Subsections in AASHTO M 167):

1. **SCOPE:**
   This specification covers stainless steel structural plate pipe.

2. **BASE METAL:**
   The stainless steel sheets shall conform with the requirements of SAE Standard J 405B, Alloy Grade SAE 51409.

4. **GAGE DETERMINATIONS AND TOLERANCE:**
   In Table II substitute as follows:

<table>
<thead>
<tr>
<th>Gage</th>
<th>Sheet Thickness (Inches)</th>
<th>Tolerance Under</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.276 (7 mm)</td>
<td>.012 (300 μm)</td>
</tr>
<tr>
<td>3</td>
<td>.245 (6.2 mm)</td>
<td>.012 (300 μm)</td>
</tr>
<tr>
<td>5</td>
<td>.215 (5.5 mm)</td>
<td>.012 (300 μm)</td>
</tr>
<tr>
<td>7</td>
<td>.184 (4.7 mm)</td>
<td>.012 (300 μm)</td>
</tr>
<tr>
<td>8</td>
<td>.164 (4.2 mm)</td>
<td>.012 (300 μm)</td>
</tr>
<tr>
<td>10</td>
<td>.135 (3.5 mm)</td>
<td>.012 (300 μm)</td>
</tr>
<tr>
<td>12</td>
<td>.105 (2.7 mm)</td>
<td>.012 (300 μm)</td>
</tr>
</tbody>
</table>

8. **CERTIFIED ANALYSIS AND GUARANTEE:**
   The manufacturer of the sheets shall submit with the certified analysis a guarantee providing that all metal furnished conforms with the specification requirements, shall bear a suitable identification brand or mark, and shall be replaced without cost to the purchaser when not in conformity with the specified analysis and sheet thickness; and the guarantee shall be so worded as to remain in effect as long as the manufacturer continues to furnish material.

10. **BOLTS AND NUTS FOR CONNECTING PLATES:**
    Material for bolts and nuts shall conform to the chemical and mechanical requirements of ASTM A 276, Type 431, Condition T. Size and geometric configuration shall conform to the applicable requirements of ASTM A 325, Paragraph 5.

713.11 **METALLIC COATED CORRUGATED STEEL UNDERDRAIN PIPE:**
    Metallic coated corrugated steel underdrain pipe shall conform with the requirements of AASHTO M 36 Type III.

713.12 **BITUMINOUS-ASPHALT COATED CORRUGATED STEEL UNDERDRAIN PIPE:**
    This pipe shall conform to the requirements of AASHTO M 36, Type III, and shall be coated with bituminous asphalt material conforming to the requirements of AASHTO M 190, Type A coating, except that the minimum coating thickness, shall be 0.03 in. (750 μm) Coupling bands shall be fully coated. The specified minimum diameter of perforations shall apply after coating.
713.13 through 713.15-BLANK

713.14 CORRUGATED ALUMINUM ALLOY PIPE AND PIPE ARCHES:
________ Corrugated aluminum alloy pipe and pipe arches shall conform to the requirements of AASHTO M 196, Type I and II. Helically corrugated aluminum alloy culvert pipe shall conform to the requirements of AASHTO M 211.
________ Certification from the manufacturer will be the basis of acceptance for band material and rivets used in the fabrication.

713.15-BITUMINOUS COATED CORRUGATED ALUMINUM ALLOY PIPE AND PIPE ARCHES:
________ Bituminous coated corrugated aluminum alloy pipe, pipe arches, coupling bands, elbows, and other special sections shall conform to the requirements of AASHTO M 190. Coating and invert paving shall be of the type-specified.

713.16-CORRUGATED ALUMINUM ALLOY PIPE UNDERDRAIN:
________ Corrugated aluminum alloy pipe underdrain shall conform to the requirements of AASHTO M 196, Type III.

713.17-BITUMINOUS COATED CORRUGATED ALUMINUM ALLOY PIPE UNDERDRAIN:
________ This pipe shall conform to the requirements of AASHTO M 196, Type III, and shall be coated with bituminous material conforming to the requirements of AASHTO M 190, Type A coating, except the minimum coating thickness shall be 0.03 in. (750 μm) Coupling bands shall be fully coated. The specified minimum diameter of perforations shall apply after coating.

713.18-ALUMINUM ALLOY STRUCTURAL PLATE FOR PIPE, PIPE ARCH, AND ARCHES:
________ These conduits and the bolts and nuts for connecting plates shall conform to the requirements of AASHTO M 219.

713.19-FULL BITUMINOUS COATED ALUMINUM ALLOY STRUCTURAL PLATE PIPE, PIPE ARCH, AND ARCHES:
________ These conduits shall conform to the requirements of AASHTO M 219 and shall be coated with bituminous material conforming to the requirements of AASHTO M 190, Type A coating.

713.20-END SECTIONS FOR CORRUGATED STEEL PIPE AND PIPE ARCHES:
________ End sections for corrugated iron or steel pipe and pipe arches shall be of the thickness recommended by the manufacturer, and they shall conform to the applicable requirements of AASHTO M 36 and the details shown on the Plans.

713.21-END SECTIONS FOR CORRUGATED ALUMINUM ALLOY PIPE AND PIPE ARCHES:
________ End sections for corrugated aluminum alloy pipe and pipe arches shall be of the thickness recommended by the manufacturer and they shall conform to the applicable requirements of AASHTO M 196 or M 211 and the details shown on the Plans.
713.22 BLANK  713.21 through 713.23:  Blank

713.23 PRECOATED, METALLIC COATED STEEL PIPE AND UNDERDRAIN:
—— Precoated sheets shall have a Type B coating conforming with the requirements of AASHTO M 246. The minimum thickness shall be 10 mils (250 μm) on the inside and 3 mils (75 μm) on the outside of the pipe.
—— Precoated, metallic coated steel pipe and underdrain shall conform to the requirements of AASHTO M 245 with the following exceptions (numbers refer to subsections of AASHTO M 245):

19.1 Coupling bands, conforming to the requirements of AASHTO M 218, will not require organic coating.

22.1.1 Damaged areas of spelter coating shall be painted in this sequence:
   1. Zinc rich primer conforming to Section 711.21.
   2. Red oxide lacquer primer.
   3. Lacquer.

22.1.2 Areas of damaged polymeric coating only shall be painted in this sequence after the areas are rubbed with commercially available acetic acid (such as vinegar) and dried:
   1. Red oxide lacquer primer.
   2. Lacquer.

—— The primer and lacquer as specified above must be mutually compatible when applied and compatible with the polymeric coating. The red oxide primer and lacquer, which are commercially available, shall be allowed to completely dry between coats and before handling and backfilling. If the lacquer is applied from a spray can, a minimum of two coats is required. The first coat should provide a light covering, and the second coat should be applied heavily just to the point of running.

713.24 ALUMINUM COATED CORRUGATED STEEL PIPE AND PIPE ARCH:
These conduits shall conform to AASHTO M 36 requirements for aluminum coated or aluminum-zinc coated corrugated steel pipe and pipe arch.
SECTION 714
CONCRETE AND PLASTIC PIPE

714.1 NONREINFORCED CONCRETE PIPE: Blank
This pipe shall conform to the requirements of AASHTO M 86 or ASTM C 14.

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 711.03.30. Class III, IV, and V reinforced concrete pipe are to be used.

714.2.1 Special Design: When reinforced concrete pipe pay item includes Special Design designation, the following shall apply per designation in the plans.

714.2.1.1 Structural: High fill cover heights or loads, which require special reinforcing and design of reinforced concrete pipe.

714.2.1.2 Cement Content: Corrosive environments, which require special concrete mix to improve the sulfate resistance. Table 714.2.1.2 illustrates the material requirements for a given sulfate concentration.

<table>
<thead>
<tr>
<th>Table 714.2.1.2</th>
<th>Sulfate Concentration for Reinforced Concrete Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative Degree of Sulfate Attack</td>
<td>% Water-Soluble Sulfate in Soil Samples</td>
</tr>
<tr>
<td>Negligible</td>
<td>0.00 - 0.09</td>
</tr>
<tr>
<td>Positive</td>
<td>0.10 - 0.19</td>
</tr>
<tr>
<td>Severe</td>
<td>0.20 - 2.00</td>
</tr>
<tr>
<td>Very Severe</td>
<td>&gt;2.00</td>
</tr>
</tbody>
</table>
714.3-REINFORCED CONCRETE ARCH CULVERT, STORM DRAIN AND SEWER PIPE:
   This pipe shall conform to the requirements of AASHTO M 206 or ASTM C 506.

714.4-REINFORCED CONCRETE ELLIPTICAL CULVERT, STORM DRAIN AND SEWER PIPE:
   This pipe shall conform to the requirements of AASHTO M 207 or ASTM C 507.

714.5-PERFORATED CONCRETE PIPE:
   This pipe shall conform to the requirements of AASHTO M 175 or ASTM C 444.

714.6-POROUS CONCRETE PIPE:
   This pipe shall conform to the requirements of AASHTO M 176.

714.7-CONCRETE DRAIN TILE:
   This pipe shall conform to the requirements of AASHTO M 178 or ASTM C 412.

714.8-CLAY DRAIN TILE:
   Drain Tile shall conform to the requirements of AASHTO M 179 or ASTM C 4.

714.9- VITRIFIED CLAY-LINED REINFORCED CONCRETE PIPE: through 714.16-Blank
   Designs for fully lined or half lined pipe of the specified strength classes shall be submitted for approval. The applicable requirements of AASHTO M 170 and AASHTO M 65 or ASTM C 479 shall govern. Liner or liner elements shall be clay of first quality, sound, thoroughly and perfectly burned, without warps, cracks, or other imperfections, and they shall be fully and smoothly glazed.

714.10-CLAY PIPE:
   This pipe shall conform to the requirements of AASHTO M 65 or ASTM C 700. Extra strength clay pipe may be substituted for standard strength.

714.11 through 714.12-BLANK

714.13-PERFORATED ASBESTOS CEMENT PIPE FOR UNDERDRAINAGE:
   The pipe shall conform to the requirements of AASHTO M 189 or ASTM C 508.

714.14-BITUMINIZED FIBER PIPE FOR UNDERDRAINAGE:
   This pipe shall conform to the requirements of ASTM D 1861 or ASTM D 1862.

714.15-PERFORATED BITUMINIZED FIBER PIPE FOR UNDER-DRAINAGE:
   This pipe and fittings shall conform to the requirements of ASTM D 2311.

714.16-FIBERGLASS-REINFORCED (FRP) PIPE:
   This pipe shall conform to ASTM D 2996 or ASTM D 2997. Fittings shall be those
recommended by the manufacturer.

714.17 REINFORCED PLASTIC MORTAR (RPMP) PIPE:
   This pipe shall conform to ASTM D 3262. Fittings shall be those recommended by the manufacturer.

714.18 REINFORCED CONCRETE END SECTIONS:
   Precast reinforced concrete end sections shall conform to the requirements of the cited Specifications for the conduit pipe to the extent to which they apply and to the details shown on the Plans.

714.17 POLYPROPYLENE PIPE:
   For nominal pipe sizes of 6 inches to 30 inches (150 to 762 mm) corrugated single wall pipe and double wall shall meet the requirements of ASTM F2736.
   For nominal pipe sizes of 6 to 60 inches (150 to 1500 mm) corrugated double and triple wall pipe and fittings meet the requirements of ASTM 2764.

714.18 HIGH DENSITY POLYETHENE (STEEL REINFORCED):
   The pipe and fittings of nominal sizes 8 inch (200 mm) through 120 inches (3000 mm) shall conform to the requirements of ASTM F2562.

714.19 CORRUGATED POLYETHYLENE PIPE: HIGH DENSITY POLYETHYLENE PIPE (PROFILE WALL):
   Corrugated polyethylene pipe shall be accordance with the following:
   1. For nominal pipe sizes of 3 to 6 inches (75 to 150 mm) when perforations are required the pipe shall meet the requirements of AASHTO M 252 with class 2 perforations.
   2. For nominal pipe sizes of 3 to 10 inches (75 to 250 mm) when perforations are not required the pipe shall meet the requirements of AASHTO M 252 type “S” only.
   3. For nominal pipe sizes of 12 to 60 inches (300 to 1500 mm) the pipe shall meet the requirements of AASHTO M 294 type “S” or type “D” only.

714.20 PERFORATED PLASTIC SEMICIRCULAR PIPE:
   Perforated plastic semicircular pipe shall be extruded or molded using a high density, flexible plastic.
   The pipe shall have a smooth or corrugated top and a smooth semicircular bottom, averaging 4-5/8 inches (116 mm) in diameter, with perforations uniformly distributed along the top of the semicircular section. The perforations shall be not less than ¼ inch (6 mm) nor more than 3/8 inch (10 mm) in diameter, and shall provide a minimum intake area of one square inch per linear foot (2100 sq. mm per m). Minimum material thickness shall be 1/8 in. (3 mm). The top flange shall extend a minimum of ½ in. (13 mm) beyond the top of the semi-circular section.
   A one foot (300 mm) section of pipe shall deflect no more than 1½ at an applied load of 900 lb. (38 mm), using the Parallel Plate Load Test of ASTM D 2412. Fifteen minutes after removal of the load, the pipe section shall have recovered not less than 50 percent of its deflection at 900 lb. (4 kN).

714.21 ACRYLONITRILE-BUTADIENE-STYRENE (ABS) PIPE:
This pipe and fittings shall conform to AASHTO M 264, ASTM D 2680 or ASTM D 2751.

714.22-POLYVINYL CHLORIDE (PVC) PIPE:
The pipe and fittings shall conform to the requirements of AASHTO M278, ASTM D3034 or ASTM F949.

714.23-PRECAST REINFORCED CONCRETE BOX CULVERTS:
Precast reinforced concrete box culverts shall conform to the requirements of AASHTO M259 where depth of cover is 2 feet (600 mm) or more and AASHTO M273 where depth of cover is less than 2 feet (600 mm). Interstate live load design shall be provided for Interstate highway facilities: and HS20 live load design shall be provided for other locations.

All fabricators of precast reinforced concrete box culverts shall maintain an adequate level of quality control. Plant certification by NPCA (National Precast Concrete Association), ACPA (American Concrete Pipe Association) plant certification for box culverts, or other approved equal certification program will be required to verify this level of quality control. Plant approval must be obtained prior to the start of fabrication. All Fabricators shall then submit evidence of Plant approval to the MCS&T Division on an annual basis.

All box culverts shall be cured in accordance with section 601.12 except that curing may be discontinued once 70% of the design strength is achieved.

714.24-NON-ASBESTOS FIBER-CEMENT STORM DRAIN PIPE:
This pipe shall conform to the requirements of ASTM C 1450, and the water used in the fabrication of this pipe shall meet the requirements of section 715.7.

714.24-POLYPROPYLENE PIPE:
For nominal pipe sizes of 6 inches to 30 inches (150 to 762 mm) corrugated single wall pipe and double wall shall meet the requirements of ASTM F2736.
For nominal pipe sizes of 6 to 60 inches (150 to 1500 mm) corrugated double and triple wall pipe and fittings meet the requirements of ASTM 2764.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 606
UNDERDRAINS

606.1-DESCRIPTION:
DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

This work shall consist of constructing underdrains and free draining base trenches using pipe and granular material, blind drains, aggregate filled engineering fabric, prefabricated pavement edge drain and underdrain pipe outlets in accordance with these Specifications and in reasonably close conformity with the lines, grades, dimensions and locations shown on the Plans or established by the Engineer.

When Item 606025-*, Underdrain Pipe, is included as a pay item in the Contract, any of the following pipe types may be furnished for construction of the underdrain: bituminous asphalt coated corrugated steel underdrain pipe, corrugated aluminum alloy underdrain pipe, nonreinforced perforated concrete underdrain pipe, porous concrete pipe, standard strength perforated clay pipe, extra strength perforated clay pipe, perforated bituminous fiber underdrain pipe, corrugated stainless steel underdrain pipe, precoated, galvanized steel pipe for underdrains, corrugated polyethylene underdrainage pipe, or perforated plastic semicircular pipe.

606.1.1-Free Draining Base Trench: This work shall consist of constructing free draining base trenches and Outlet Pipes in accordance with these specifications and in reasonably close conformity with the lines, grades, dimensions, and locations shown on the plans or established by the Engineer.

606.2-MATERIALS:
DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

Material shall meet the requirements specified in the following Subsections of Division 700:

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SUBSECTION</th>
<th>TYPE OR GRADATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bituminous Coated Corrugated Aluminum</td>
<td>713.17</td>
<td>Type I, II, II or IV</td>
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<tr>
<td>MATERIAL</td>
<td>SUBSECTION</td>
<td>TYPE OR GRADATION</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>Alloy Pipe for Underdrains***</td>
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</tr>
<tr>
<td>Bituminous-Asphalt Coated Corrugated Steel Pipe for Underdrains*</td>
<td>713.12</td>
<td>Class I, II or III</td>
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<tr>
<td>Bituminous Fiber Pipe**</td>
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<td></td>
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<tr>
<td>Non Perforated</td>
<td>714.14</td>
<td></td>
</tr>
<tr>
<td>Perforated</td>
<td>714.15</td>
<td></td>
</tr>
<tr>
<td>Concrete for Miscellaneous Uses</td>
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<tr>
<td>Corrugated Aluminum Alloy Pipe for Underdrains**</td>
<td>713.16</td>
<td>Type I, II, II or IV</td>
</tr>
<tr>
<td>Corrugated Polyethylene Underdrain</td>
<td>714.19</td>
<td></td>
</tr>
<tr>
<td>Corrugated Stainless Steel Pipe for Underdrains</td>
<td>713.7</td>
<td></td>
</tr>
<tr>
<td>Cradle Invert Clay Pipe</td>
<td>714.10</td>
<td></td>
</tr>
<tr>
<td>Crushed Aggregate for Free Draining Base Trench****</td>
<td>703.1, 703.2, 703.3, 703.4</td>
<td>AASHTO 57, 67, 357, or 467</td>
</tr>
<tr>
<td>Crushed gravel for Aggregate Filled Fabric Underdrains****</td>
<td>703.2 &amp; 703.4 or 703.2.3</td>
<td>AASHTO #2 thru #57 or Pea Gravel</td>
</tr>
<tr>
<td>Crushed gravel for Underdrains****</td>
<td>703.2 &amp; 703.4</td>
<td>AASHTO Size # 57, 67, 7 or 78</td>
</tr>
<tr>
<td>Crushed Stone for Aggregate Filled Fabric Underdrains****</td>
<td>703.1 &amp; 703.4</td>
<td>AASHTO #2 thru #57 inclusive</td>
</tr>
<tr>
<td>Crushed Stone for Underdrains****</td>
<td>703.1 &amp; 703.4</td>
<td>AASHTO Size # 57, 67, 7 or 78</td>
</tr>
<tr>
<td>Engineering Fabric for Subsurface Drainage</td>
<td>715.11.8</td>
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<td></td>
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<td>Extra Quality Clay Drain Tile</td>
<td>714.8</td>
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<td>Extra Quality Concrete Drain Tile</td>
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<td></td>
</tr>
<tr>
<td>Extra Strength Perforated Clay Pipe</td>
<td>714.10</td>
<td></td>
</tr>
<tr>
<td>Heavy Duty Clay Drain Tile</td>
<td>714.8</td>
<td></td>
</tr>
<tr>
<td>Metallic Coated Corrugated Steel Pipe for underdrains</td>
<td>713.11</td>
<td>Class I, II or III</td>
</tr>
<tr>
<td>Miscellaneous Concrete</td>
<td>715.12</td>
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</tr>
<tr>
<td>Non-Reinforced Perforated Concrete Pipe for Underdrain</td>
<td>714.5</td>
<td>Class 1, 2 or 3</td>
</tr>
<tr>
<td>Perforated Plastic Semicircular Pipe***</td>
<td>714.20</td>
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<tr>
<td>Porous Concrete Pipe</td>
<td>714.6</td>
<td>Class I or II</td>
</tr>
<tr>
<td>Precoated Metallic Coated Steel Pipe for Underdrains*</td>
<td>713.23</td>
<td>Class I or II, Type B Coating</td>
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<tr>
<td>Prefabricated Pavement Edge Drain</td>
<td>715.10.1</td>
<td></td>
</tr>
<tr>
<td>Silica Sand for Underdrains</td>
<td>702.1.2, 702.1.3 &amp; 702.6</td>
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</tr>
<tr>
<td>Special Quality Concrete Drain Tile</td>
<td>714.7</td>
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</table>
### MATERIAL

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SUBSECTION</th>
<th>TYPE OR GRADATION</th>
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</thead>
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<tr>
<td>Standard Clay Drain Tile</td>
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<tr>
<td>Standard Quality Concrete Drain Tile</td>
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<td></td>
</tr>
<tr>
<td>Standard Strength Perforated Clay Pipe</td>
<td>714.10</td>
<td></td>
</tr>
</tbody>
</table>

* Unless otherwise specified, Class IV, semicircular pipe 4 5/8 inches (117 mm) in diameter, may be furnished when 6 inch (150 mm) diameter pipe is called for on the Plans.

** Unless otherwise specified. Perforated pipe shall be used.

*** Unless otherwise specified. Type V, semicircular pipe 4-5/8 inch (117 mm) in diameter, may be furnished when 6 inch diameter pipe is called for on the Plans.

**** Plastic semicircular pipe may be furnished only when six inch (150 mm) diameter is called for on the Plans.

***** Only one size may be used at any one installation.

When the locations of manufacturing plants allow, the plants may be inspected periodically for compliance with specified manufacturing methods, and material samples may be obtained for laboratory testing for compliance with material quality requirements. This may be the basis for acceptance of manufacturing lots as to quality. All materials will be subject to inspection for acceptance as to condition at the latest practicable time the Engineer has the opportunity to check for compliance prior to or during incorporation of materials in the work.

### 606.2.1 Quality Control Testing:

Quality control is the responsibility of the Contractor as specified in 106.1. The contractor shall develop a quality control plan in accordance with applicable sections of MP 307.00.50 excluding the attachment page.

Samples will be obtained at a minimum frequency of one sample per day of aggregate placement. Aggregate for underdrain shall be evaluated for specification compliance in accordance with MP 606.03.50. Aggregate for aggregate filled underdrain shall be evaluated for specification compliance in accordance with MP 606.03.50 except Section 6.0 through 6.2 are excluded.

### 606.2.2 Acceptance Testing:

Acceptance sampling and testing of aggregates used for underdrain is the responsibility of the Division, Except for furnishing the necessary materials. Quality control sampling and testing performed by the Contractor may be used by the Division for Acceptance.

### 606.2.3 Free Draining Base Trench Materials:

The perforated pipe as detailed on the plans shall meet the requirements of this Section. The Outlet pipe as detailed on the plans shall meet the requirements of Subsection 715.10.1.5.

### 606.6 Pay Items:

DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:
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<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
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<tr>
<td>606001</td>
<td>Metallic Coated Corrugated Steel Pipe For Underdrains</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>606002</td>
<td>Bituminous Coated Corrugated Steel Pipe For Underdrains</td>
<td>Linear Foot (Meter)</td>
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<tr>
<td>606003</td>
<td>Corrugated Aluminum Alloy Pipe For Underdrains</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>606004</td>
<td>Bituminous Coated Corrugated Aluminum Alloy Pipe For Underdrains</td>
<td>Linear Foot (Meter)</td>
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<td>606005</td>
<td>Non-Reinforced Perforated Concrete Underdrainage Pipe</td>
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<td>606007</td>
<td>Porous Concrete Pipe</td>
<td>Linear Foot (Meter)</td>
</tr>
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<td>606008</td>
<td>Standard Quality Concrete Drain Tile</td>
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<td>606009</td>
<td>Extra Quality Concrete Drain Tile</td>
<td>Linear Foot (Meter)</td>
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<td>606010</td>
<td>Special Quality Concrete Drain Tile</td>
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<td>606007</td>
<td>Porous Concrete Pipe</td>
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<td>Standard Quality Concrete Drain Tile</td>
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<td>Extra Quality Concrete Drain Tile</td>
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<td>Special Quality Concrete Drain Tile</td>
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<td>Standard Clay Drain Tile</td>
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<td>606012</td>
<td>Extra Quality Clay Drain Tile</td>
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<td>606013</td>
<td>Heavy Duty Clay Drain Tile</td>
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<td>Standard Strength Perforated Clay Pipe</td>
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<td>Extra Strength Perforated Clay Pipe</td>
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<td>606016</td>
<td>Cradle Invert Clay Pipe</td>
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<td>606017</td>
<td>Fiber-Cement Pipe For Underdrains</td>
<td>Linear Foot (Meter)</td>
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<td>606018</td>
<td>Prefabricated Edge Drain</td>
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<td>606019</td>
<td>Bituminized Fiber Pipe For Underdrains</td>
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<tr>
<td>606020</td>
<td>Aggregate Filled Fabric Underdrains**</td>
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<td>606021</td>
<td>Blind Drain</td>
<td>Yard (Meter)</td>
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<tr>
<td>606022</td>
<td>Crushed Stone, Crushed Gravel, Or Silica Sand For Underdrains</td>
<td>Yard (Meter)</td>
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<td>606023</td>
<td>Underdrain Junction Box</td>
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<td>Corrugated Stainless Steel Pipe For Underdrains</td>
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<td>606025</td>
<td>“size” Underdrain Pipe</td>
<td>Linear Foot (Meter)</td>
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<td>606026</td>
<td>Precoated, Galvanized Steel Pipe For Underdrains</td>
<td>Linear Foot (Meter)</td>
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<tr>
<td>606027</td>
<td>Corrugated Polyethylene Underdrainage Pipe</td>
<td>Linear Foot (Meter)</td>
</tr>
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<td>606028</td>
<td>Perforated Plastic Semicircular Pipe</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>606029</td>
<td>Free Draining Base Trench</td>
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</tr>
<tr>
<td>606030</td>
<td>Outlet Pipe, “size”</td>
<td>Linear Foot (Meter)</td>
</tr>
</tbody>
</table>

* Sequence number
** Width in inches
616.8-DETERMINATION OF BEARING VALUES:

616.8.1-Loading Test:

DELETE SUBSECTION 616.8.1 AND REPLACE WITH THE FOLLOWING:

616.8.1-Dynamic Load Tests: This item of work shall consist of applying a dynamic load by a pile hammer to a production pile being driven by the Contractor, while transducers obtain measurements for predicting the static capacity of the pile and evaluate the performance of the pile driving system. Selection of the Dynamic Testing Consultant shall be the responsibility of the Contractor. The Dynamic Testing Consultant shall install the transducers and provide all testing equipment. The dynamic load shall be applied to the pile by a pile hammer which is operating at its normal operating level. The testing work shall be conducted by the Dynamic Testing Consultant with the required assistance from the Contractor driving the pile.

This work item is required to establish/adjust driving criteria necessary to achieve the target test capacity shown on the plans without damaging the piles. The driving criteria shall include the blow count, range of stroke length and fuel setting needed for each driving condition encountered at the site.

All equipment necessary for the dynamic monitoring such as PDA, gages, cables, etc., shall be furnished by the Dynamic Testing Consultant. The equipment shall conform to the requirements of ASTM D-4945, Standard Test Method for High-Strain Dynamic Testing of Piles.

An experienced technician shall operate the Pile Driving Analyzer in the field. The technician operating the equipment shall meet one of the following requirements:

1. have documented experience in personally conducting dynamic load tests on at least 25 projects, and shall furnish written documentation describing his experience.
2. Alternatively, on-site personnel with a Certificate of Proficiency with a rank of at least Intermediate in the PDCA/PDI Dynamic Measurement and Analysis Proficiency Test may operate the equipment.

This written documentation shall be furnished to the Engineer for approval.

616.8.1.1-General: The Contractor shall conduct dynamic tests for the production piles as shown on the plans. If restrike is required, the Contractor shall conduct the dynamic tests as noted on the plans. The Contractor shall notify the Engineer of his intent to drive piling at least fourteen (14) days prior to the installation of the first pile at each foundation.

The hammer selected for driving the piles shall be used for driving all piles represented by the same site conditions. If the Contractor subsequently finds it necessary to use a different hammer, the Department will require additional dynamic load testing. Any such additional testing, delays, and mobilization costs shall be at no additional cost to the Department.

616.8.1.2-Equipment: The Contractor shall supply all personnel and equipment needed to strike the pile(s) to be tested with the pile hammer. The Contractor shall also supply a source of 115 V, 1500 VA, 60 Hz electrical power with extension power cords.

All equipment necessary for the dynamic monitoring such as sensors, cables or wireless transmitters, etc., shall be furnished by the Dynamic Testing Consultant. The equipment shall conform to the requirements of ASTM D-4945.

616.8.1.3-Test Procedures: The Dynamic Testing Consultant shall be available on the construction site for a typical eight-hour work day. While on the site, as many dynamic load tests as is practicable shall be conducted by the Dynamic Testing Consultant during the eight-hour work day.

The Dynamic Testing Consultant personnel will drill holes into the piles to be tested so that electronic transducers (at least 2 accelerometers and 2 strain gages) can be attached. When the transducers have been placed in position and the Pile Driving Analyzer has been made ready to receive the acceleration and strain measurements, the Contractor shall strike the pile with the pile hammer as many times as is required to obtain adequate measurements as determined by the Dynamic Testing Consultant personnel.

Immediately after the dynamic testing measurements have been obtained and analyzed in the field, the Dynamic Testing Consultant will provide the Engineer and the Contractor with handwritten criteria for driving the piles for the conditions anticipated. The Dynamic Consultant may need to later adjust the driving criteria based on further analysis of the data using CAPWAP or other signal matching software. Should the results indicate that a weld has broken, or that any below grade pile damage has occurred, the Contractor shall stop driving and pull that pile for examination, repair, or replacement as needed.

616.8.1.4-Dynamic Load Testing Report: Within one week after the dynamic testing, three (3) copies of a thorough type written report shall be delivered to the Engineer. One report per bridge is typical, but additional testing reports may be required per the plans or as requested by either the Contractor or the Engineer. The report shall be in accordance with ASTM D-4945. This report shall include a refined wave equation analysis and a
CAPWAP analysis (or equal) for each pile tested. The report shall state whether the required capacity (target capacity) was achieved for each pile tested and provide the recommended driving criteria to achieve the target capacity for the hammer used. The Engineer will provide the Contractor and Geotechnical Group with a copy of the report.

616.14-METHOD OF MEASUREMENT:

ADD THE FOLLOWING TO THE SUBSECTION:

Measurement shall be based on each field test performed. If restrike is required, it shall be measured based on each field test.

616.15-BASIS OF PAYMENT:

ADD THE FOLLOWING TO THE SUBSECTION:

Payment for each test will be made at the contract bid price. Payment will be made after receiving and accepting the required report(s).

616.16-PAY ITEMS:

ADD THE FOLLOWING ITEMS TO THE TABLE:

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<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>616007-001</td>
<td>Pile Load Testing – Dynamic</td>
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</tr>
<tr>
<td>616007-002</td>
<td>Pile Load Testing – Dynamic (Restrike)</td>
<td>Each</td>
</tr>
</tbody>
</table>
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 615
STEEL STRUCTURES

615.5-ASSEMBLY:
615.5.6-Connections Using High-Strength Bolts:
615.5.6.3-Installation:

DELETE THE FIRST PARAGRAPH OF SUBSECTION 615.5.6.3 AND REPLACE WITH THE FOLLOWING:

Fasteners shall be protected from dirt and moisture at the job site. Only the fasteners anticipated to be installed and tightened during a work shift shall be removed from protected storage. Fasteners not used shall be returned to protected storage at the end of the shift. Lot identification of all components shall be maintained at all times. Galvanized and zinc coated nuts shall be checked to verify that a visible lubricant is on the threads and nut faces. Fasteners shall not be cleaned of lubricant that is present in the delivered condition. Where galvanized fasteners must be tensioned by turning the bolt head, a visible lubricant that meets the requirements of AASHTO M 164 ASTM F3125, shall be applied to the washer that will be placed under the bolt head. The lubricant may be applied to the washer by the manufacturer prior to shipment, by the fabricator at the fabrication shop, or by the erector in the field. Fasteners which have accumulated rust, dirt or have been wet, shall be cleaned and relubricated, prior to installation. Bolt, nut and washer combinations as installed shall be from the same rotational-capacity lot.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 626
RETAINING WALL SYSTEMS

626.5-MATERIALS:
   626.5.1-Mechanically Stabilized Earth Components:
      626.5.1.1.5-Metal Soil Reinforcing or Attachment Devices:

DELETE ITEM E OF SUBSECTION 626.5.1.1.5 AND REPLACE WITH THE FOLLOWING:

   E. Bolts shall meet the requirements of AASHTO M-164 ASTM F3125, Grade A325. Nuts shall meet the requirements of AASHTO M-291–ASTM A563 Grade DH or AASHTO M-292–2H ASTM A194 Grade 2. Fasteners shall be galvanized in accordance with AASHTO M-232 ASTM B695.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 709
METALS

709.24-HIGH-STRENGTH BOLTS FOR STRUCTURAL STEEL JOINTS, INCLUDING
SUITABLE NUTS AND HARDENED WASHERS:

SECTION AND REPLACE WITH THE FOLLOWING:

709.24.1-Bolts, Nuts and Washers: All bolts, nuts and washers shall bear the
manufacturer's markings and all markings specified in the applicable AASHTO/ASTM
specifications. All bolts, nuts and washers supplied shall be domestic, as defined in 106.1.1.1,
and the manufacturer and identification marks shall be registered in the Industrial Fastener

709.24.2-High-Strength Bolts: High-Strength bolts, black, galvanized or zinc rich coated,
shall meet the requirements of AASHTO M 164-ASTM F3125-Grade A325 with the following
exceptions. Zinc rich coated fasteners shall also meet the requirements of 709.24.10.

709.24.2.1-BLANK

709.24.2.2: Proof load tests (ASTM F606, Method #1) are required for all bolts except
as excluded in Section 6.2-10.1.3 of AASHTO M 164-ASTM F3125. Minimum frequency
of tests shall be as specified in AASHTO M 164, paragraph 9.5.1 ASTM F3125 paragraph
9.6.1.

709.24.2.3: Wedge tests on full size bolts (ASTM F606, paragraph 3.5) are required.
If bolts are to be galvanized or zinc rich coated, tests shall be performed after galvanizing
or coating. Minimum frequency of tests shall be specified in AASHTO M 164, paragraph
9.5.1 ASTM F3125 paragraph 9.6.1.

709.24.2.4: If galvanized or zinc rich coated bolts are supplied, the thickness of the
zinc coating shall be measured. Measurements shall be taken on the wrench flats or top of
bolt head. If bolts are required to be galvanized, they shall be done so in accordance with ASTM F2329 B695.

709.24.3-Nuts: Nuts plain, galvanized or zinc rich coated shall meet the following requirements.

709.24.3.1: Nuts to be galvanized (hot dip or mechanically galvanized), or to be zinc rich coated shall be grade DH or DH3 meeting AASHTO M 291-ASTM A563 or shall be grade 2H meeting AASHTO M 292 ASTM A194. Nuts that are hot dip galvanized shall follow ASTM A153 F2329. If mechanically galvanized, they Nuts shall be done so galvanized according to ASTM B695.

709.24.3.2: Plain (black) nuts shall be grade C, D or C3 meeting AASHTO M 291 ASTM A563 or shall be grade 2 meeting AASHTO M 292 ASTM A194 and shall have a minimum Rockwell hardness of 89 HRB (or Brinell hardness 180 HB). Plain nuts may also be supplied to grades listed in paragraph 709.24.3.1 above.

709.24.3.3: Nuts that are to be galvanized shall be tapped oversize the minimum amount required for proper assembly. The amount of overtap in the nut shall be such that the nut will assemble freely on the bolt in the coated condition and shall meet the mechanical requirements of the applicable AASHTO/ASTM specification listed above and shall meet the requirements of the rotational capacity test specified (the overtapping requirements of AASHTO M 291, paragraph 7.4 shall be considered maximum values instead of minimum, as currently shown).

709.24.3.4: Galvanized and zinc rich coated nuts shall be coated with a lubricant containing a dye of any color that contrasts with the color of the coating.

709.24.3.5: Proof load tests (ASTM F606, paragraph 4.2) are required for all nuts. Minimum frequency of tests shall be as specified in AASHTO M 291 ASTM A563, paragraph 9.3 or AASHTO M 292, paragraph 7.1.2.1 ASTM A194 paragraph 8.1.2.1. If nuts are to be galvanized or zinc rich coated, tests shall be performed after coating, overtapping and lubricating.

709.24.3.6: If galvanized or zinc rich coated nuts are supplied, the thickness of the coating shall be measured. Measurements shall be taken on the wrench flats.

709.24.5-Rotational Capacity Testing: Rotational-capacity tests are required and shall be performed on all black (plain), galvanized (after galvanizing) bolt, nut and washer assemblies by the manufacturer or distributor prior to shipping. Washers are required as a part of the test. The following shall apply:

709.24.5.1: Except as modified, the rotational-capacity test shall be performed in accordance with the requirements of AASHTO M 164 ASTM F3125.
**709.24.5.2:** Each combination of bolt production lot, nut lot and washer lot shall be tested as an assembly.

**709.24.5.3:** A rotational-capacity lot number shall be assigned to each combination of lots tested.

**709.24.5.4:** The minimum frequency of testing shall be two assemblies per rotational-capacity lot.

**709.24.5.5:** The bolt, nut and washer assembly shall be assembled in a Skidmore-Wilhelm Calibrator or an acceptable equivalent device. For short bolts which are too short to be assembled in the Skidmore-Wilhelm Calibrator see Section 709.24.5.9.

**709.24.5.6:** The minimum rotation, from an initial condition (10% of the specified bolt proof load), shall be:
- \(240^\circ\) (2/3 turn) for bolt lengths up to and including 4 diameters.
- \(360^\circ\) (1 turn) for bolt lengths over 4 diameters up to and including 8 diameters.
- \(480^\circ\) (1-1/3 turn) for bolt lengths over 8 diameters.

**709.24.5.7:** The tension reached at the above rotation shall be equal to or greater than 1.15 times the required installation tension. The installation tension and the tension for the turn test are shown below:

<table>
<thead>
<tr>
<th>ENGLISH</th>
<th>ENGLISH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (Inches)</td>
<td>Required Installation Tension (kips)</td>
</tr>
<tr>
<td>⅝</td>
<td>19</td>
</tr>
<tr>
<td>¾</td>
<td>28</td>
</tr>
<tr>
<td>⅛</td>
<td>39</td>
</tr>
<tr>
<td>1</td>
<td>51</td>
</tr>
<tr>
<td>1⅛</td>
<td>56</td>
</tr>
<tr>
<td>1¼</td>
<td>71</td>
</tr>
<tr>
<td>1½</td>
<td>103</td>
</tr>
<tr>
<td>Turn Test Tension (kips)</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td></td>
</tr>
<tr>
<td>82</td>
<td></td>
</tr>
<tr>
<td>118</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>METRIC</th>
<th>METRIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (mm)</td>
<td>Required Installation Tension (kN)</td>
</tr>
<tr>
<td>16</td>
<td>91</td>
</tr>
<tr>
<td>20</td>
<td>142</td>
</tr>
<tr>
<td>22</td>
<td>176</td>
</tr>
<tr>
<td>24</td>
<td>205</td>
</tr>
<tr>
<td>27</td>
<td>276</td>
</tr>
<tr>
<td>30</td>
<td>326</td>
</tr>
<tr>
<td>36</td>
<td>475</td>
</tr>
<tr>
<td>Turn Test Tension (kN)</td>
<td></td>
</tr>
<tr>
<td>105</td>
<td></td>
</tr>
<tr>
<td>163</td>
<td></td>
</tr>
<tr>
<td>202</td>
<td></td>
</tr>
<tr>
<td>236</td>
<td></td>
</tr>
<tr>
<td>317</td>
<td></td>
</tr>
<tr>
<td>375</td>
<td></td>
</tr>
<tr>
<td>546</td>
<td></td>
</tr>
</tbody>
</table>

**709.24.5.8:** After the required installation tension listed above has been exceeded, one reading of tension and torque shall be taken and recorded. The torque value shall conform to the following:

\[
\text{Torque (T)} \leq 0.25 \text{ PD}
\]

Where:

\[
\text{Torque (T)} = \text{measured torque (foot-pounds) (kN•m)}
\]
\[
\text{P} = \text{measured bolt tension (pounds) (kN)}
\]
\[
\text{C} = \text{Contractor’s total overhead for contract period}
\]
\[
\text{D} = \text{bolt diameter (feet) (m)}
\]
709.24.5.9: Bolts that are too short to test in a Skidmore-Wilhelm Calibrator may be tested in a steel joint. The tension requirement of Section 709.24.5.7 need not apply. The maximum torque requirement of Section 709.24.5.8 shall be computed using a value $P$ equal to the turn test tension shown in the Table in Section 709.24.5.7.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: __________________________
FEDERAL PROJECT NUMBER: __________________________

SECTION 496

ASPHALT HIGH PERFORMANCE THIN OVERLAY

496.1-DESCRIPTION:

This work shall consist of constructing a single course of an asphalt high performance thin overlay (HPTO), mixed mechanically in a plant, composed of aggregate and asphalt material designed in accordance with the Superpave Design System, on a prepared foundation in accordance with these specifications and in reasonable close conformity with the lines, grades, weights or thicknesses, and cross sections shown on the Plans or established by the Engineer.

The unit of measurement for HPTO will be either by the ton (megagram) or square yard (square meter).

The work will be accepted in accordance with these Specifications and the applicable requirements of Sections 105, 106, and 109.

496.2-MATERIALS:

The materials shall conform to the following requirements:

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SUBSECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse Aggregate Note-1 &amp; 2</td>
<td>703.1 thru 703.3</td>
</tr>
<tr>
<td></td>
<td>(See MP 401.02.28 for exceptions and additions required for Superpave aggregates)</td>
</tr>
<tr>
<td>Fine Aggregate Note-2</td>
<td>702.3</td>
</tr>
<tr>
<td></td>
<td>(See MP 401.02.28 for additions required for Superpave aggregates)</td>
</tr>
<tr>
<td>Mineral Filler</td>
<td>702.4</td>
</tr>
<tr>
<td>Non-Tracking Asphalt Material</td>
<td>705.13</td>
</tr>
<tr>
<td>PG 64E-22 Performance Graded Binder</td>
<td>705.5</td>
</tr>
<tr>
<td>MATERIAL</td>
<td>SUBSECTION</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>PG 64S-22 Performance Graded Binder for Tack Coat</td>
<td>705.5</td>
</tr>
</tbody>
</table>

**Note-1:** The total coal and other lightweight deleterious material and friable particles shall not exceed 1.0%.

**Note-2:** All aggregate shall be 100% crushed and come from a source identified as approved for polish resistant aggregate meeting the requirements of Section 402

**CONSTRUCTION METHODS**

**496.3-GENERAL:**

Construction methods to be used in performing the work shall be submitted to the Engineer for review prior to the start of work. This review may require modification of the proposed methods to provide the desired end product. All equipment, tools, machinery, and plant shall be maintained in a satisfactory working condition.

**496.4-COMPOSITION OF MIXTURES:**

**496.4.1-General:** The aggregate for use in the designated mixture shall consist of a mixture of aggregate (coarse and fine) and mineral filler as required. Reclaimed asphalt pavement (RAP) shall not be used in a HPTO mix.

**496.4.2-Job Mix Formula:** The Job Mix Formula (JMF) is the specification for a single mix produced at a single plant. This mix may be specific to a single project or be used on multiple projects if the basic design criteria (aggregate gradation, design compaction level and PG Binder grade) are the same.

The Contractor shall submit a proposed JMF for each combination of aggregate and asphalt material for HPTO to be produced. The JMF gradations shall be within the tolerances set forth in Table 496.4.2A.

The HPTO design shall be developed using the guidelines of MP 401.02.28, with the exception that the volumetric properties shall meet the requirements of Table 496.4.2B. The percent voids-filled-with-asphalt (VFA) requirement of the MP shall be waived.

Each proposed JMF must be documented on the Division Form T400SP and the entire JMF package shall be forwarded for review to the District Materials Engineer/Supervisor. After review and verification of completeness the T400SP and JMF package shall then be forwarded to the Materials Control, Soils and Testing Division (MCS&T) for final review. If the JMF requires revision, it will be returned to the designer through the District. The T400SP Form shall contain the following information:

i. Identification of the source and type of materials used in the design.

ii. The aggregate blend percentages and the percentage for each sieve fraction of aggregate considered the desirable target for that fraction.

iii. The percentage of asphalt binder representing the optimum asphalt content for the JMF submitted, which is to be considered the desirable target percentage.
iv. The temperature of the completed mixture at the plant which shall be within ± 25 °F 
(± 14 °C) of the median mix temperature established by the temperature-viscosity 
chart or as recommended by the asphalt supplier.

v. The ratio (calculated to the nearest one-tenth percent) of the fines to effective asphalt.

vi. The amount and type of anti-strip agent, if used.

<table>
<thead>
<tr>
<th>Standard Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 in. (12.5 mm)</td>
<td>100</td>
</tr>
<tr>
<td>3/8 in. (9.5 mm)</td>
<td>90-100</td>
</tr>
<tr>
<td>No.4 (4.75 mm)</td>
<td>95 max</td>
</tr>
<tr>
<td>No.8 (2.36 mm)</td>
<td>30-60</td>
</tr>
<tr>
<td>No.16 (1.18 mm)</td>
<td>25-40</td>
</tr>
<tr>
<td>No.30 (600 µm)</td>
<td>15-30</td>
</tr>
<tr>
<td>No.50 (300 µm)</td>
<td>10-25</td>
</tr>
<tr>
<td>No.100 (150 µm)</td>
<td>5-15</td>
</tr>
<tr>
<td>No. 200 (75 µm)</td>
<td>4-12</td>
</tr>
<tr>
<td>Asphalt Content</td>
<td>7.0 Min</td>
</tr>
</tbody>
</table>

### TABLE 496.4.2B

<table>
<thead>
<tr>
<th>Design Volumetric Property Requirements for HPTO Mix Design Note-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Criteria</td>
</tr>
<tr>
<td>Number of Design Gyrations</td>
</tr>
<tr>
<td>Air Voids (%)</td>
</tr>
<tr>
<td>Voids-in-Mineral Aggregate (%)</td>
</tr>
<tr>
<td>Fines-to-Effective Asphalt Ratio</td>
</tr>
<tr>
<td>Tensile strength ratio (AASHTO T283) Note-3</td>
</tr>
</tbody>
</table>

**Note 3:** If the tensile strength ratio (TSR) is less than 85% without an anti-stripping agent, then an anti-stripping agent may be added and the mixture retested. If retesting with the agent still produces a TSR of less than 85% then a new mix design will be required.

If it becomes necessary to change aggregate sources, a new mix design shall be developed and submitted for approval. The source of the polymer modified binder may only be changed if the source is another facility owned and operated by the same company as the original source. The new facility shall submit verification that the binder is produced in the same manner and with the same grade and amount of polymer material as the original source. They shall also verify that the blending of the two binders in the same storage tanks will not have an adverse effect on the properties of the binder grade in use.

**496.5-TESTING:**

**496.5.1-Test Methods:** Test methods shall be those listed in Section 401.5.1.
496.6-CONTRACTORS QUALITY CONTROL:

496.6.1-Quality Control Testing: Quality control of HPTO is the responsibility of the Contractor. The Contractor shall maintain equipment and qualified personnel including at least one certified HMA asphalt technician at each plant. The technician shall be in charge of all plant quality control activities such as mix proportioning and adjustment and all sampling and testing activities necessary to maintain the various properties of HPTO within the limits of the specification.

The Contractor shall maintain equipment and qualified personnel including at least one certified Compaction Technician at each project. A certified Compaction Technician shall perform all testing necessary to assure compaction of the HPTO meets specification requirements. The Contractor, or Contractor-Producer, shall design a workable Quality Control Plan, detailing the type and frequency of sampling and testing deemed necessary to measure and control the magnitude of the various properties of the HPTO governed by these Specifications. This plan, prepared in accordance with MP 401.03.50 shall be submitted to the Engineer for review prior to production of material under this Specification.

496.6.2-Quality Control Testing Requirements: Test requirements for quality control shall be as set forth in MP 401.02.29, with the exception that the job mix formula field design verification and quality control testing for HPTO shall be monitored for conformance to the mix property requirements of Table 496.6.2. Additionally, the minimum quality control sampling frequency shall be one random sample per every 750 tons of HPTO mixture delivered to the project. In order to evaluate conformance to the specifications using MP 401.02.29, all job mix formula field design verification and quality control samples obtained for the project shall be used in the moving average calculations and the final evaluation of all test data shall be project specific.

<table>
<thead>
<tr>
<th>Property</th>
<th>Production Tolerances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt Content (%)</td>
<td>JMF ± 0.3 %</td>
</tr>
<tr>
<td>Air Voids (%)</td>
<td>2.0 to 4.0 %</td>
</tr>
<tr>
<td>Voids in Mineral Aggregate (VMA) %</td>
<td>≥ 18.0%</td>
</tr>
<tr>
<td>% Passing No. 8 (2.36 mm) Sieve</td>
<td>JMF ± 4</td>
</tr>
<tr>
<td>% Passing No. 200 (75 µm) Sieve</td>
<td>JMF ± 2.0</td>
</tr>
</tbody>
</table>

496.7-ACCEPTANCE TESTING:

496.7.1-Acceptance Testing of HMA: Acceptance testing of HPTO is the responsibility of the Division. The acceptance sampling and testing requirements for the mixture shall be as set forth in MP 401.02.29, with the exception that the HPTO shall be monitored for conformance to the mix property requirements of Table 496.6.2.

496.7.2-Compaction: Acceptance testing for compaction shall be performed in accordance with the Lot-by-Lot method described in Section 496.7.2.1. Any patching-and-leveling and scratch courses placed prior to the placement of the HPTO shall be compacted to the satisfaction of the Engineer. When HPTO is placed in areas that require a nonuniform
thickness or is tapered to a thin edge, the method of acceptance testing shall be determined by
the Engineer. Acceptance testing is not required on areas in which a full-size roller is restricted
from properly compacting the mat. These areas shall be compacted to the satisfaction of the
Engineer.

496.7.2.1-Lot-By-Lot Testing: Randomly located nuclear density tests will be
performed in accordance with the Lot by Lot test procedure as described in MP 401.05.20,
including the Control Strip testing described in that MP. The pavement shall be divided
into Lots not exceeding 1000 feet (300 meters) of paving lane. A randomly located density
test shall be conducted in each Lot. The density shall be monitored for conformance to the
range of 94% to 97% of the maximum density of the approved mix design. If the density
is outside the range, an additional five tests shall be conducted for the Lot and the average
of these five tests used to judge acceptance of the Lot in accordance with Table 496.13.3A.

496.8-WEATHER RESTRICTIONS:
HPTO shall not be placed on a wet surface or when the surface temperature of the
underlying course is less than 50 °F (10 °C).

496.9-EQUIPMENT:
496.9.1-Plants: Shall meet the requirements of Sections 401.9.1.

496.9.2-Dust Collector: Shall meet the requirements of Sections 401.9.2.

496.9.3-Truck Scales: Shall meet the requirements of Sections 401.9.3.

496.9.4-Test Weights: Shall meet the requirements of Sections 401.9.4.

496.9.5-Surge and Storage Bins: During the normal daily operation of the plant, HPTO
may be stored in a surge or storage bin for a maximum of 4 hours, provided the bin has received
prior evaluation and acceptance through the District plant inspection. The temperature of the
material at time of placement and compaction shall be sufficient to properly perform these
activities.

Loading of trucks through the storage bin will only be permitted when a minimum 25 ton
(23 Mg) buffer of material is being maintained or an amount as recommended by the bin
manufacturer. Means shall be provided for loading the trucks directly from the mixer when
the storage bin is not in operation.

496.9.6-Inspection of Equipment and Plant Operations: Shall meet the requirements of
Sections 401.9.6.

496.9.7-Trucks for Transporting Mixture: Shall meet the requirements of Sections
401.9.7.

496.9.8-Laboratory: Shall meet the requirements of Sections 401.9.8.
496.9.9-Spreading Equipment: Shall meet the requirements of Sections 401.9.9.

496.9.10-Compaction Equipment: Shall meet the requirements of Sections 401.9.10.

496.9.11-Materials Transfer Vehicle: Provide and use a Material Transfer Vehicle (MTV) to place asphalt mixtures. The MTV shall include a system in the storage bin to continuously blend the asphalt mixture prior to discharge, and a system to independently deliver asphalt mixtures from the hauling equipment to the paving equipment. It shall also have a high capacity truck unloading system, capable of 600 tons per hour, that will receive asphalt mixtures from the hauling equipment, and have a minimum combined capacity, including the MTV storage bin and paver hopper, of 15 tons of asphalt mixture. Additionally, the MTV should have a discharge conveyor, with the ability to swivel and deliver the mixture to the paving spreader while allowing the MTV to operate from an adjacent lane.

496.10-PAVING OPERATIONS:
  496.10.1-Cleaning and Sweeping: Shall meet the requirements of Sections 401.10.1.

  496.10.2-Patching and Leveling and Scratch Courses:
    496.10.2.1-Patching and Leveling: Shall meet the requirements of Sections 401.10.2.1. When patching and leveling is used, a PG 64S-22 tack coat or approved Non-Tracking Asphalt Material shall be applied to the existing pavement sections being patched in accordance with Section 496.10.3 prior to placement.

    496.10.2.2-Scratch Course: Scratch course should not be used on most projects, but if it is used, it shall meet the requirements of Sections 401.10.2.2. When scratch course is used, a PG 64S-22 tack coat or NTSS-1HM shall be applied to the existing pavement in accordance with Section 496.10.3 prior to placement.

  496.10.3-Spreading and Finishing: Before spreading any HPTO, a hot tack coat of PG 64S-22 or Non-Tracking Asphalt Material shall be applied to the existing surface according to Section 408. The contact surfaces of curbs, gutters, manholes, and of adjacent Portland cement concrete pavement edges shall be painted or sealed with the same tack coat material. When precipitation has occurred during the previous 24 hours, the engineer will determine if the tack coat may be applied or if the work will be delayed until the surface is completely dry. No more tack coat shall be applied than can be covered in the same day. Traffic control shall be provided to prevent vehicles from riding on surfaces upon which tack coat has been applied. The PG 64S-22 tack coat shall be applied at a rate of 0.05 – 0.12 gal/yd² (0.23 – 0.54 L/m²) and at a spraying temperature of approximately 325 °F (163 °C). Non-Tracking Asphalt Material shall be applied at a rate to produce a residual rate of 0.05 - 0.12 gal/yd² (0.23 – 0.54 L/m²) and shall be applied at a temperature of approximately 170 °F (77 °C). The spraying temperature and application rate will be adjusted by the Engineer as required to produce a uniform coating so that every part of the surface is covered, with no excess material. All uncoated or lightly coated areas shall be corrected. All areas showing an excess of asphalt binder shall be corrected by removing the excess material. The application is not acceptable if the material is streaked or ribboned.
The HPTO mixture shall meet the temperature requirements recommended by the asphalt supplier which will be referenced on the JMF. The mix temperature shall be monitored by inserting a dial type thermometer into the mix through a hole in the truck bed. The mixture shall not be placed if the temperature is below 265 °F (130 °C).

The temperature of the completed mix, when measured at the plant, shall be within the tolerance as established by the JMF. The first load, which demonstrates temperatures outside of that range shall be accepted provided that the temperature is still within the master temperature range. Any truckload of material which exceeds the master temperature range may be rejected by the Engineer. No additional loads of material shall be run out until necessary steps are taken to reestablish the temperature of the mix within the plant tolerance. When measured at the project site, the temperature of the mix shall be within the tolerance established by the JMF. The first truck load of material which demonstrates temperatures outside of that range or any trucks in transit at that time shall be accepted provided the temperature is not below 265 °F (130 °C). Any truckload of material which exceeds the JMF temperature range and/or is below 265 °F (130 °C) shall be rejected by the Engineer. The plant shall immediately be notified that no additional loads of material are to be dispatched until necessary action is taken to reestablish temperature within JMF specification limits.

The Contractor shall monitor the surface temperature at a minimum of once every hour. When the surface temperature begins dropping toward the 50 °F (10 °C) minimum temperature for placement, temperature monitoring shall increase to a minimum of once every ½ hour. Placement shall be halted when the surface temperature drops below 50 °F (10 °C).

The placement of all HPTO material at the job site shall be accomplished using a Materials Transfer Vehicle as discussed in 496.9.11.

496.10.4-Rolling Procedure: Shoulders, ramps, and similar areas shall be compacted in the same method as the mainline.

During rolling, roller wheels shall be kept moist with only enough water to avoid picking up material. Fuel oil or other petroleum products are not allowed on roller wheels or pneumatic tires. Rollers shall move at a slow but uniform speed with the drive roll or wheels nearest the paver. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. A sufficient number of rollers shall be furnished to handle the output of the plant.

If rolling causes material displacement, the affected area shall be loosened at once with lutes or rakes and restored to their original grade with loose material before being re-rolled. Heavy equipment, including rollers, should not be permitted to stand on the finished surface before it has thoroughly cooled or set.

Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh HPTO mixture and immediately compacted to conform to the surrounding area at the Contractor’s expense.

496.10.5-Joints: The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All contact surfaces shall be given a tack coat of asphalt binder prior to placing any fresh mixture against the joint.

The longitudinal joint in any layer shall offset that in the layer immediately below by approximately six inches; however, the joint in the top layer shall be at the centerline of the pavement if the roadway comprises two lanes of the width, or at lane lines if the roadway is
more than two lanes in width. The transverse joint in any layer shall offset that in the layer immediately below by approximately six feet.

All transverse joints between existing and new pavement shall be “heeled-in” to the existing surface at the beginning and at the end of the project and at all other locations where the new pavement terminates against an existing pavement. Transverse joints between one day's production and the next shall be carefully constructed and shall be formed by cutting back into the existing section to expose the full depth of the course. All joints shall be squared up to the full vertical depth of the course to be placed, and a tack coat of asphalt material shall be applied. Joints adjacent to curbs, gutters, or adjoining pavement shall be formed by transporting back sufficient hot material to fill any space left uncovered by the paver.

Longitudinal joints which are irregular, damaged, un-compacted, or otherwise defective shall be cut back to expose a clean, sound surface for the full depth of the course. The longitudinal joint between adjacent mats shall be set up to a sufficient height to receive the full compactive effort from the rollers and shall be tacked prior to placing adjacent material. Transverse joints shall be checked for smoothness with a ten foot straight edge provided by the Contractor. All surface irregularities shall be corrected prior to proceeding with paving operations.

**496.11-PROTECTION OF PAVEMENT AND TRAFFIC CONTROL:** Shall meet the requirements of Sections 401.11.

**496.12-METHOD OF MEASUREMENT:**

HPTO will be measured by the ton (Mg), or square yard (square meter). If the project is to be paid by the ton, the quantity will be determined by the Contractor from the total weight slips for each vehicle load weighed upon an approved standard scale or from digital printout slips from an automatic batching plant, and certified by the Contractor as correct. If the project is to be paid by the square yard, the quantity will be determined by the Plan Quantity as provided for in the proposal unless otherwise directed by the Engineer.

Any patching or leveling mixture placed on a subbase or base course constructed in the same Contract with the HPTO item shall be at the expense of the Contractor. No additional compensation will be allowed for the material or any work incidental to its placement.
496.13-BASIS OF PAYMENT:

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

When a Lot of HMA pavement does not meet the density requirements of 496.7.2, the price shall be adjusted as follows:

**Formula 1:** Projects requiring only mat density testing:

\[
\text{Lot Price Adjustment (Mat only)} = (\text{unit price}) \times (\text{Lot quantity}) \times (\text{mat density price adjustment \% from Table 496.13.3A})
\]

**Formula 2:** Projects requiring both mat and joint density testing:

\[
\text{Lot Price Adjustment (Mat + Joint)} = (\text{unit price}) \times (\text{Lot quantity}) \times [(\text{mat density price adjustment \% from Table 496.13.3A}) + (\text{joint density price adjustment \% from Table 496.13.3B})]
\]

**TABLE 496.13.3A**

<table>
<thead>
<tr>
<th>Percent of Mat Density</th>
<th>Percent of Contract Price To Be Paid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 97 %</td>
<td>Note 1</td>
</tr>
<tr>
<td>96% to 97%</td>
<td>102</td>
</tr>
<tr>
<td>94% to 96 %</td>
<td>100</td>
</tr>
<tr>
<td>93 %</td>
<td>98</td>
</tr>
<tr>
<td>92 %</td>
<td>96</td>
</tr>
<tr>
<td>91 %</td>
<td>92</td>
</tr>
<tr>
<td>90 %</td>
<td>88</td>
</tr>
<tr>
<td>Less Than 90 %</td>
<td>Note 2</td>
</tr>
</tbody>
</table>

**Note 1:** Mat density slightly above 97% is normally only a problem if it leads to asphalt flushing on the surface of the mat or rutting due to an unstable mix. The Division will make a special evaluation of the material and determine the appropriate action.

**Note 2:** For price adjustments on mat densities less than 90%, the percent of Contract Bid Price will be decreased by 10% per percentage of mat density less than 90%, unless a special evaluation performed by the Division determines a more appropriate action.
TABLE 496.13.3B
Adjustment of Contract Price
For Pavement Joint Density Not Within Tolerance

<table>
<thead>
<tr>
<th>Percent of Joint Density</th>
<th>Percent Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 97%</td>
<td>Note 3</td>
</tr>
<tr>
<td>96% to 97%</td>
<td>+2.0%</td>
</tr>
<tr>
<td>94% to 96%</td>
<td>+1.0</td>
</tr>
<tr>
<td>92% to 94%</td>
<td>0%</td>
</tr>
<tr>
<td>91%</td>
<td>-1.0%</td>
</tr>
<tr>
<td>90%</td>
<td>-10.0%</td>
</tr>
</tbody>
</table>

**Note 3:** Density greater than 97% is normally only a problem if it leads to asphalt flushing on the surface of the mat or rutting due to an unstable mix. The Division will make a special evaluation of the material and determine the appropriate action.

**Note 4:** If the longitudinal joint density is determined to be less than 94% on at least 20% of the total project Lots, then the Contractor shall be required to seal the joint a minimum of 3” on each side of the joint with a heated PG 64S-22 binder (or approved equivalent) on the entire project at no additional cost to the Division.

**Note 5:** Density values less than the minimum specified 92% will be more susceptible to accelerated deterioration of both the joint and the surrounding pavement. Less than 90% will require the Division to make a special evaluation of the material and determine the appropriate action.

**Note 6:** Note 6: Any joint densities determined to be below 92% the Contractor shall be required to seal the joint a minimum of 3” on each side of the joint on the entire project with a heated PG 64S-22 binder (or approved equivalent) at no additional cost to the Division.

The conditioning, cleaning, and sweeping of the existing base or underlying surface shall be considered as part of the construction of the appropriate items listed in 496.14, and no additional compensation will be allowed for "Cleaning and Sweeping".

There will be no additional compensation for tack coat material used for minor (spot) areas to be patched and leveled; the cost of this tack coat material will be included in the unit bid price for Item 401003.

There will be no additional compensation for Interim Pavement Markings.

**496.14-PAY ITEMS:**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>496001-001</td>
<td>Asphalt High Performance Thin Overlay, “aggregate type”</td>
<td>Ton (MG)</td>
</tr>
<tr>
<td>496001-003</td>
<td>Asphalt High Performance Thin Overlay, “aggregate type”</td>
<td>Square Yard (Meter)</td>
</tr>
<tr>
<td>496002-001</td>
<td>Performance Graded Binder for Tack Coat, Type 64S-22</td>
<td>Gallon (Liter)</td>
</tr>
</tbody>
</table>

“aggregate type” shall be either stone and gravel or slag.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION
FOR

STATE PROJECT NUMBER: ________________________________
FEDERAL PROJECT NUMBER: ________________________________

SECTION 212
STRUCTURE, ROCK, AND WET EXCAVATION

212.1-DESCRIPTION:

ADD THE FOLLOWING SUBSECTION:

212.1.1-Shoring: This work consists of providing shoring to support structure excavation at specific areas designated in the Contract.

213.3-GENERAL:

ADD THE FOLLOWING SUBSECTION:

212.3.1-Shoring Materials and Construction Requirements: The Contractor shall locate, size, design and construct shoring which provides all necessary rigidity, and supports the loads imposed to facilitate construction as at the locations designated on the plans.

If the height of shoring exceeds 5-4 feet above the base of the excavation, within the designated locations; shoring drawings shall be provided by the Contractor to the Engineer for information only. The drawings shall be prepared, signed and sealed by the Contractor's Engineer, a West Virginia licensed Professional Engineer. These drawings shall be approved and signed by the Contractor and provided to the Engineer at least 10 days prior to start of work.

Shoring drawings shall include the following information as applicable:
1. The size and grade of all structural materials.
2. Design notes, including design assumptions and construction details.
3. Where applicable, restrictions on heavy equipment placement at specific locations adjacent to the shoring.

4. Areas determined by the Contractor's Engineer where de-watering of the shored excavation will be required, and a description of the requirements (i.e., head added by the pump, flow rate, minimum pump size, etc.) and methods to be used for de-watering.

5. All other information determined by the Contractor's Engineer to be pertinent to the design and successful construction of the shoring.

Shoring shall be constructed in conformity with the shoring drawings provided to the Engineer. Prior to placing construction or traffic loads on the supported earth, the Contractor's Engineer shall certify in writing that shoring materials and construction have been inspected and that all shoring materials and construction are in conformity with the drawings. A copy of this certification shall be submitted in an appropriate form for the Engineer's records.

If the embankment, construction, traffic or any other surcharge is in excess of what the original shoring was designed for, the Contractor shall provide a signed letter from the Contractor's Engineer prior to the load placement stating that the shoring will support the additional load.

212.11-METHOD OF MEASUREMENT:

ADD THE FOLLOWING SUBSECTION:

212.11.1-Shoring: Shoring will not be measured, but will be paid for as a single lump sum for all shoring locations designated on the plans.

212.12-BASIS OF PAYMENT:

ADD THE FOLLOWING SUBSECTION:

212.12.1-Price Adjustment: Payment for shoring will be full compensation for all labor, materials, equipment required to design, construct and remove the shoring.

212.13-PAY ITEMS:

ADD THE FOLLOWING ITEM:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>212010-003</td>
<td>Shoring</td>
<td>Lump Sum</td>
</tr>
</tbody>
</table>
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 405
CHIP SEALS

405.4-EQUIPMENT:

DELETE SUBSECTION 405.4.2 ADD REPLACE WITH THE FOLLOWING:

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. Aggregate spreader calibration according to ASTM D5624 shall be done within the current construction season. Verification of this calibration shall be provided during the pre-construction meeting, or if agreed upon during the pre-construction meeting, the Engineer may request calibration be performed according to ASTM D5624 prior to beginning work.

405.13-FOG SEAL:

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

Unless otherwise specified, a fog seal shall be applied on the final surface according to Section 407. This shall be done no less than 3 but no more than 7 calendar days after the application of the Chip Seal. The surface must be dry before application, and the surface shall be swept to remove loose material. An asphalt emulsion shall be applied uniformly at a rate of 0.09 ± 0.03 gallons per square yard to the surface. Any raveled areas, flushed areas, or other defects in the chip seal shall be repaired prior to the application of the fog seal.

405.14-TESTING AND ACCEPTANCE:

DELETE SUBSECTION 405.4.2 ADD REPLACE WITH THE FOLLOWING:

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. Samples shall be taken according to ASTM D5624. Samples may be split with the contractor. Sampling frequency shall be one sample for every lane mile per layer. This sample shall be the lot. 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, Cu, as defined in ASTM D2487. Adjustments per sublot will be as follows.

<table>
<thead>
<tr>
<th>Cu</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>

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>

405.17-PAY ITEMS:

DELETE ITEM 405011 FROM THE TABLE:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>405007-*</td>
<td>Chip Seal Aggregate, Type **</td>
<td>Square Yards (Square Meters)</td>
</tr>
<tr>
<td>405010-*</td>
<td>Asphalt Emulsion Material</td>
<td>Gallon (Liter)</td>
</tr>
<tr>
<td>405011-*</td>
<td>Asphalt Emulsion Material, Fog Seal</td>
<td>Gallon (Liter)</td>
</tr>
</tbody>
</table>

* Sequence number

** Type of Aggregate Gradation from Section 405.2.1, either A, B, or C
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
SUPPLEMENTAL SPECIFICATION  

FOR

ADD THE FOLLOWING SECTION:

SECTION 407  
FOG SEAL

407.1-DESCRIPTION:  
This work shall consist of preparing and fog sealing an existing roadway surface with asphalt material in accordance with these Specifications and in reasonably close conformity with the lines shown on the Plans or established by the Engineer.

407.2-MATERIALS:  
Materials shall be from an approved source and conform to the requirements of the following Subsections:

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>SUBSECTION</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt Emulsion</td>
<td>705.4</td>
<td>SS-1 or SS-1h or RS Grades</td>
</tr>
<tr>
<td>Cationic Emulsified Asphalt</td>
<td>705.11</td>
<td>CSS-1 or CSS-1h or CRS Grades</td>
</tr>
<tr>
<td>Non-Tracking Asphalt Material</td>
<td>705.13</td>
<td>NTSS-1HM or similar*</td>
</tr>
</tbody>
</table>

*Refer to MP 401.02.25 for a list of Certified Bituminous Materials

407.2.1-Quality Control:  Quality control is the responsibility of the Contractor as specified in 106.1.  Quality control shall consist of calibrating the distributor to the proper application rate, verifying the volume and temperature measuring devices, and when performed, assuring and documenting that the proper dilution rate is maintained.

407.2.1.1-Acceptance Testing: Approval of asphalt emulsions used for fog seal material will be handled by the Materials Control, Soils and Testing (MCS&T) Division. MCS&T maintains a list of all approved asphalt emulsion sources and grades. The local District Materials Section can provide a copy of the latest list. The list is also posted on the MCS&T web page under the heading Approved Source/Product Listing. The use of non-approved material without prior testing by MCS&T may result in nonpayment of the item.
CONSTRUCTION METHODS

407.3-WEATHER RESTRICTION:
Fog seal shall be applied only when the weather and existing surface are satisfactory to the Engineer and when the temperature of the surface is 40°F (4°C) or above. When the surface temperature is less than 50°F (10°C), care must be exercised to assure that the fog seal sets prior to resuming traffic.

407.4-EQUIPMENT:
Equipment for Surface Preparation may include a power broom and power blower, and a broom drag. Equipment may also include scrapers, hand brooms, shovels, and other equipment as may be necessary to thoroughly clean the base or surface.

Equipment for distribution of asphalt material shall include equipment for heating asphalt material, and a self-powered asphalt material pressure distributor. Equipment for heating asphalt material to the required temperature shall consist of a retort coil so designed that steam will not be introduced into the material and shall not degrade the emulsion. The distributor shall be so designed, equipped, maintained and operated that asphalt material at even heat may be applied uniformly on variable widths of surface up to 15 ft. (4.6 m) at readily determined and controlled rates from 0.05 to 2.0 gal/sq yd (0.2 to 0.9 liters/m²) with uniform pressure and with an allowable variation from any specified rate not to exceed 0.02 gal/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.

407.5-PREPARING AND REPAIRING EXISTING SURFACES:
No fog seal shall be applied until breaks, holes, depressions, and other irregularities in the existing surface have been repaired and cured sufficiently to permit the fog seal to be placed in a uniform application.

407.6-CLEANING AND SWEEPING:
Immediately before application, the existing surface shall be swept and thoroughly cleaned by the use of tools or machinery as may be required to remove all loose aggregate, mud, dirt, dust, 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 treated including the shoulder.

407.7-APPLICATION OF ASPHALT MATERIAL:
Except when required to maintain traffic, the work shall be done on the full width of the section. Joints shall overlap by 2 to 6 inches.

After the surface has been cleaned, when called for, and is in a dry condition, the asphalt
material shall be applied by means of a 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 as recommended in 407.11, or as determined by the Engineer. Application temperatures of the asphalt material shall be within the range specified in Subsection 705 for the particular material being used. Anionic asphalt emulsion grades SS-1 and SS-1h, and cationic emulsion grades CSS-1 and CSS-1h, may be diluted at a 1:1 ratio by addition of water to the emulsion. **Dilution shall occur before the distributor truck is loaded.** The surfaces of sidewalks, curbs, other structures, and trees adjacent to the area being treated shall be protected in such a manner as to prevent being spattered or marred. Material used for such protection shall be removed and disposed of in an appropriate manner. The distributor shall not be cleaned or discharged within the right-of-way, into borrow pits, or so as to pollute or block water courses.

**407.8-APPLICATION OF COVER AGGREGATE:**
Any fog seal material applied in excess of the requirements shall be removed or covered with a blotter course of dry sand or stone chips as directed by the Engineer.

**407.9-PROTECTION OF THE 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 picking up under traffic. The applicable provisions of 636 shall apply for regulating traffic.

**407.10-QUANTITIES OF MATERIALS:**
The application rates referenced in Table 407.11 shall be used as guide to assure the proper amount of asphalt is distributed over the pavement surface under various pavement conditions. The undiluted application rate refers to the unmodified emulsion that meets all standard specifications of the specified grade. When an SS or CSS grade emulsion is diluted with water at the allowable 1:1 ratio, the residual asphalt content is defined as the amount of asphalt remaining on the pavement surface after all water has evaporated from the emulsion.

**Note 2:** Application rates are for slow setting emulsions grades (SS and CSS) that contain approximately 60% asphalt material. Rapid setting emulsion grades may contain slightly higher or lower asphalt contents, but can usually be applied within the same application range. Non-Tracking Emulsions may contain different asphalt contents. Refer to manufacturer’s recommendations for application rates.

**407.11-METHOD OF MEASUREMENT:**

<table>
<thead>
<tr>
<th>Condition of Existing Pavement</th>
<th>Application Rate (gal/sq yd) / (L/m²) (Note 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Undiluted</td>
</tr>
<tr>
<td>Oxidized HMA</td>
<td>0.06 – 0.08 / (0.27 – 0.36)</td>
</tr>
<tr>
<td>Chip Seals</td>
<td>See Specification 405</td>
</tr>
</tbody>
</table>
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 quantity of “Asphalt Material” for fog seal shall be the number of gallons (liters), prior to dilution, incorporated into the completed work. Any applicable dilution rates, shall be supplied to the Engineer by the Contractor on the material delivery ticket.

Dry sand or stone chips used as a blotter course due to excessive use of fog seal shall be considered incidental to the work.

407.12-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, included all labor, tools, equipment, supplies, and incidentals necessary to complete the work.

407.13-PAY ITEM:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>407001-*</td>
<td>Non-Tracking Fog Seal</td>
<td>Gallon (Liter)</td>
</tr>
<tr>
<td>407002-*</td>
<td>Fog Seal</td>
<td>Gallon (Liter)</td>
</tr>
</tbody>
</table>

*Sequence number
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 408
TACK COAT

408.2-MATERIALS:

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

Materials shall conform to the requirements of the following Subsections of Division 700:

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>SUBSECTION</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt Emulsion</td>
<td>705.4</td>
<td>SS or RS Grades</td>
</tr>
<tr>
<td>Cationic Emulsified Asphalt</td>
<td>705.11</td>
<td>CSS or CRS Grades</td>
</tr>
<tr>
<td>Non-Tracking Asphalt Material</td>
<td>705.13</td>
<td>NTSS-1HM or similar*</td>
</tr>
</tbody>
</table>

*Refer to MP 401.02.25 for a list of Certified Bituminous Materials

408.14-PAY ITEM:

ADD THE FOLLOWING ITEM TO THE TABLE:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>408001-*</td>
<td>Non-Tracking Asphalt Material</td>
<td>Gallon (Liter)</td>
</tr>
</tbody>
</table>

*Sequence number
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 410
ASPHALT BASE AND WEARING COURSES,
PERCENT WITHIN LIMITS (PWL)

410.7-ACCEPTANCE TESTING:
   410.7.1-Acceptance Testing of Asphalt:
   410.7.1.5-Bond Strength:

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

410.7.1.5-Bond Strength: Bond Strength Testing shall be conducted to ensure the creation of a monolithic layered pavement, this is typically achieved by the application of a tack coat between pavement layers. Any tack coats applied by the Contractor shall be applied in accordance with Section 408.

Bond Testing shall be performed on all surface layers beginning with the existing pavement layer and then all intermediate pavement layers called for in the proposal and plans, this testing shall be performed on all traveled lanes and shoulders. Additionally, Bond Tests will be performed for all surface layers beginning with the Existing Pavement layer and then all intermediate pavement layers called for in the Proposal and Plans. However if a scratch course is called for in the plans, then a bond test will be performed at the scratch course layer and the first new surface pavement layer, not between the existing pavement layer and the scratch course layer. Bond Testing is not required for pavement layers placed on top of a granular type layer (aggregate base, rubbleized concrete, macadam, etc.).

If an asphalt pavement layer is to be placed atop a concrete surface, Bond Strength testing is not required however, a tack coat shall be applied in accordance with Section 408 to ensure complete coverage of the surface and to the satisfaction of the Engineer.

Core bond strength shall exceed a minimum of 100 psi when tested in accordance to MP 410.07.23 Guide to Determining Interface Bond Shear Strength. If all samples obtained within a lot exceed the minimum requirement, there will be no adjustment for pay. If any of the specimens result in strength below the required amount, the values shall then be evaluated for payment as per 410.13.50 Guide to Statistical Analysis of Material.
Using Quality Level Analysis Percent within Limits. For the purpose of relieving large standard deviations from abnormally strong samples, any sample with a strength exceeding 150 psi will be evaluated as 150 psi instead of the actual strength. The actual strength should still be recorded as such on the reporting form.

### 410.13-BASIS OF PAYMENT:

#### 410.13.6-Bond Strength:

DELETE THE CONTENTS OF THE SUBSECTIONS 410.13.6, 410.13.6.1, AND 410.13.6.2, AND REPLACE WITH THE FOLLOWING:

#### 410.13.6-Bond Strength Adjustment:

Bond Strength PWL calculations shall be in accordance with 410.13.50, Guide to Statistical Analysis of Material Using Quality Level Analysis Percent within Limits. However, for the purpose of relieving large standard deviations from abnormally strong samples, any sample with a strength exceeding 150 psi will be evaluated as 150 psi instead of the actual strength. The actual strength should still be recorded as such on the reporting form.

Bond Strength positive adjustments will be calculated for lots with PWL greater than or equal to 90. Bond Strength Negative adjustment will be calculated for lots with PWL less than or equal to 70. There is no adjustment for bond Strength lots who’s PWL falls between 70 and 90.

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#### 410.13.6.1 Tack Coats:

Any tack coats applied by the contractor shall be applied in accordance with section 408. It is the intent of the Sections 410.13.6, 410.13.6.1 and Section 408.7 to provide one tack coat application on the existing surface including any milled surfaces.

However, any new intermediate asphalt layers installed shall receive an additional tack coat when such layers have been used for maintaining traffic for two or more weeks prior to placement of any final or intermediate layers. If the contractor chooses not to tack any intermediate layers as described above, then the Bond Strength Pay adjustment factor described in section 410.13.6.2 shall apply.

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#### 410.13.6.2 Bond Strength Calculations:

If no tack coat is applied in accordance with Section 408, then the following price adjustment will be applied for Bond Strength.

When a lot of Asphalt does not meet the Bond Strength requirements as specified in Section 410.7.1.5, the price shall be adjusted as follows:

Positive adjustment calculated as follows:

\[ T = \frac{PWL - 90}{10} \times 2,000 \]

Negative adjustment calculated as follows:
Adjustments calculate for lots less than or greater than the standard 2,500 tons shall be prorated directly proportional to the amount of tonnage less than or greater than 2,500 tons.

410.13.7-Lot Payment Calculations:

410.13.7.4-Bond Strength Adjustment:

DELETE THE CONTENTS OF SUBSECTION 410.13.7.4 AND REPLACE WITH THE FOLLOWING:

410.13.7.4-Bond Strength Adjustment:  If it is determined that a Bond Strength Adjustment is warranted by Section 410.7.1.4.5 of this specification, the formulas in Section 410.13.6.2 shall be used to calculate the adjustment. This adjustment shall be applied to the overall payment for the lot.
DELETE THE ENTIRE CONTENTS AND REPLACE THE FOLLOWING:

614.1-DESCRIPTION:
This work shall consist of furnishing and placing steel piles in predrilled holes, concrete or grout, backfill and lagging, of the kinds and dimensions designated, in accordance with these provisions and in reasonably close conformity with the lines, grades, dimensions, and locations shown on the Plans or established by the Engineer. Painting of the exposed steel is included required.

Careful attention shall be given to assuring the pile wall be embedded will tie directly into an existing stable slope ground or bedrock. Prior to ordering any materials, the contractor in conjunction with the Engineer shall conduct a project site review in order to verify the limits of the pile wall.

614.2-MATERIALS:
Materials shall conform to the requirements specified in the following Subsections of Division 700:

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SUBSECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine Aggregate</td>
<td>702.1</td>
</tr>
<tr>
<td>Fly Ash</td>
<td>707.4</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>701.1</td>
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<tr>
<td>Prestressing Steel</td>
<td>709.2</td>
</tr>
<tr>
<td>Reinforcing Steel</td>
<td>709.1</td>
</tr>
<tr>
<td>Steel Lagging and Wales</td>
<td>709.12</td>
</tr>
<tr>
<td>Steel Piles and Splices</td>
<td>709.12</td>
</tr>
<tr>
<td>Treated Timber Lagging</td>
<td>710</td>
</tr>
</tbody>
</table>

614.3-DRILLING:
A drilled hole is required for the buried length of the pile.
A minimum of 1/3 the total pile length or 10 feet (3 m) of the pile, whichever is greater, is to be placed in bedrock/shale. Deviation from this requirement will be controlled by a Plan note. The total estimated pile lengths and the depths to the estimated bedrock/shale line are shown on
the piling profile in the plans. Should the elevation of the actual bedrock/shale vary from the estimated elevation by more than 2.5 feet (0.8 m), the Engineer must approve the hole prior to placement of the pile. The material from the drilled hole shall be removed and disposed of by the Contractor in an approved site.

Particular care must be taken in the drilling operation to avoid deflecting the bit along a sloping bedrock/shale line. To verify proper alignment, the Contractor shall measure and record the vertical alignment of the hole using a plumb bob or other acceptable method. **Pile alignment shall allow direct welding of wale to piles.**

Preferably, the diameter of the drilled hole shall be a size that will allow the pile, while being slowly lowered into the hole, to reach the bottom of the hole under the impetus of the pile weight. The minimum hole diameter shall be 2 inches (50 mm) larger than the diagonal distance across the pile cross section.

Light tapping (ten blows with at least 3 inches (75 mm) of penetration per blow) with a pile hammer exerting no more than 12,000 ft-lbs (16 32 kJ) of energy is permitted at the direction of the Engineer to advance the pile past minor obstacles in the hole.

Temporary casing of holes may be needed to maintain an open clean hole through the soil overburden. There will be no additional compensation for temporary casing. The cost of any casing used shall be included in the unit price bid for piling.

### 614.4-INSTALLATION OF PILES:

Piles shall be located as shown on the Plans or as directed by the Engineer. Piles shall be installed with the pile center within 1 inch (25 mm) of the Plan location. The piles must be prevented from rotating, so that the pile axis is within five (5) degrees of the position shown on the Plans.

Light tapping (ten blows with at least 3 inches (75 mm) of penetration per blow) with a pile hammer exerting no more than 24,000 ft-lbs (32 kJ) of energy is permitted at the direction of the Engineer to advance the pile past minor obstacles in the hole. The maximum permissible vertical deviation for piles shall be one percent of the total pile length, as measured at the actual pile location. Boreholes that have collapsed shall be re-drilled or cleaned to the satisfaction of the Engineer. Obstacles that impede the placement of the piles shall be removed. Tapping on the pile(s) to reach its intended tip elevation(s) is prohibited. Driving piles with a hammer is prohibited unless required in the Plans.

It is desirable that piles be installed without splicing; however, at the direction of the Engineer splices may be made. Splice lengths at the top of the piles may be butt welded provided the splice lengths are less than the required splice plates. No payment will be made for cut-offs. Welding shall be in accordance with 615.5.7.

The drilled hole shall be pumped free of water and shall be reasonably free of fall-in soil or other debris prior to the placement of the concrete or grout. When unable to remove the water, the concrete or grout shall be pumped or tremied through a pipe beginning at the bottom of the drilled hole. The pipe shall be slowly raised ensuring the pipe end remains at least 2 feet (600 mm) below the surface of the concrete or grout. A means of positively measuring the elevation of the concrete or grout as it is placed shall be provided by the Contractor. After placing the concrete or grout below water table, the Contractor has the option of either pumping or pouring directly into the hole the remainder of the concrete or grout provided the hole can be pumped to remove remaining water. Placing the concrete or grout from the bottom of the hole to the bottom of the lagging shall be accomplished in one continuous operation.
Accurate records shall be maintained by the Contractor showing the depth to which each pile was placed, the plumbness, the amount of material used, elevation depth of bedrock/shale, and any unusual conditions encountered during the pile installation. These records shall be given to the Engineer at the completion of the project, incorporated into the permanent records of the project.

614.5 CORROSION PROTECTION

Concrete or Grout:

Piles will be protected from corrosion and sealed by the placement of concrete or grout, from the bottom of the hole to the bottom of the lagging or as directed by the Engineer. Vibration of the concrete or grout is not required. The Contractor shall complete all concrete or grout operations for holes drilled during the work day within 24 hours of drilling each hole.

The drilled hole shall be pumped free of water and shall be reasonably free of fall in soil or other debris prior to the placement of the concrete or grout. When unable to remove the water, the concrete or grout shall be pumped or tremied through a pipe beginning at the bottom of the drilled hole. The pipe shall be slowly raised ensuring the pipe end remains at least 2 feet (600 mm) below the surface of the concrete or grout. A means of positively measuring the elevation of the concrete or grout as it is placed shall be provided by the Contractor. After placing the concrete or grout below water table, the Contractor has the option of either pumping or pouring directly into the hole. The remainder of the concrete or grout provided the hole can be pumped to remove remaining water. Placing the concrete or grout from the bottom of the hole to the bottom of the lagging shall be accomplished in one continuous operation.

The Contractor will inform the Engineer, at the preconstruction conference, as to the type of corrosion protection that whether grout or concrete will be used. Intermixing of concrete and grout will not be allowed, unless approved by the Engineer.

Concrete shall be in accordance with Section 601, Class B. The job site testing is waived.

Grout shall be furnished, tested and placed in accordance with the requirements specified herein.

The acceptance sampling and testing of the grout is the responsibility of the Division.

Quality Control of the concrete or grout is the responsibility of the Contractor as designated in Materials Procedure MP 601.03.50. The Contractor shall maintain equipment and qualified personnel, who shall direct all field inspection, sampling, and testing necessary to determine the magnitude of the various properties of the concrete and grout governed by the Specifications and shall maintain these properties within the limits of this Specification. The Quality Control Plan designated in MP 601.03.50 shall be submitted to the Engineer at the pre-construction conference. Work shall not begin until the Plan is reviewed for conformance with the contract documents.

The required 7-day compressive strength of the grout shall be a minimum of 1,600 psi (11 MPa). Piling which has been installed with grout which does not attain the 1,600 psi (11 MPa) strength in 7 days shall be paid for at a reduced unit price equal to 80% of the unit bid price for steel pile. The penalty would include the entire length of each pile which has been installed with failing grout. Grout with compressive strength of less than 1,000 psi (7 MPa) shall be evaluated by the Engineer as to the adequacy for the use intended. All grout evaluated as unsatisfactory for the use intended shall be removed and replaced or otherwise corrected by the Contractor as required in 105.3.
A grout strength test shall consist of testing three 6 in x 12 in (150 mm x 300 mm) cylindrical specimens. The test results shall be the average of the three specimens. A minimum of one set of three specimens shall be made for each day’s operations.

614.6-PAINTING:

All surfaces from the top of the steel pile, down to and including 2.0 feet (600 mm) below the top of the anticipated concrete or grout line shall be cleaned and painted prior to installation. The method of surface preparation shall be hand tool cleaning to SSPC-SP-2. The paint system shall consist of one-coat of aluminum epoxy mastic meeting the requirements of 711.12 applied at a minimum dry film thickness of 5 mils (125 μm). Unless otherwise approved by the Engineer, if no concrete or grout is required in the plans, the entire pile shall be painted.

614.7-LAGGING AND BACKFILLING:

Lagging of the type and size as specified on the Plans shall be installed between the piles. Timber or steel lagging shall not be use unless otherwise shown in the plans. Backfilling and restoration of the roadway template shall be as shown on the Plans. Precast concrete lagging shall be fabricated in accordance with the requirements of MP 604.02.40. Precast concrete lagging shall be used to the maximum exposed height as follows:

For exposed heights of up to 8 feet, 6-inch (minimum) lagging thickness shall be used. For exposed heights greater than 10 feet and less than 16 feet, 8-inch (minimum) lagging thickness shall be used. These minimum thicknesses are applicable up to a maximum center to center piles spacing of 6 feet.

Other spacings, exposed heights, and minimum thicknesses shall be allowed as shown on the plans.

Timber lagging shall be Grade # 3 or better treated rough cut oak, treated southern yellow pine, 3 6 in (75/150 mm) wide by 8 in (200 mm) deep for heights up to 11 ft (3.4 m); and for wall heights exceeding 11 ft (3.4 m) the timber lagging shall be double 3 6 in (75/150 mm) wide by 8 in (200 mm) deep. The boards shall be cut to their required length prior to preservative treatment.

The timber lagging shall conform to Sections 710.3 and 710.4 of the West Virginia Division of Highways Standard Specifications.

614.8-METHOD OF MEASUREMENT:

The quantity of piles will be measured in linear feet (meters) of piles installed and accepted for the wall.

The quantity of lagging will be measured in square feet (meters) installed and accepted as measured by the total area of wall lagging as measured through all wall elements, without deductions for gaps between lagging, piles, etc.

614.9-BASIS OF PAYMENT:

The quantities 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 herein prescribed in a workmanlike and acceptable manner, including all labor, tools, equipment, supplies, and incidentals necessary to complete the work. The cost of drilling, concrete, grout, wales, and painting shall be included in the price bid for the piles. The cost of painting and welding steel lagging shall be included in the price bid for steel lagging.
will be made after receiving and accepting the record of piling installation as described in Section 614.4.

614.10-PAY ITEMS:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
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<tbody>
<tr>
<td>614001-*</td>
<td>“size” Steel Pile</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>614002-*</td>
<td>Steel Lagging, Thickness “thickness”</td>
<td>Square Foot (Meter)</td>
</tr>
<tr>
<td>614003-*</td>
<td>Concrete Lagging, Thickness “thickness”</td>
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</tr>
<tr>
<td>614004-*</td>
<td>Timber Lagging</td>
<td>Square Foot (Meter)</td>
</tr>
</tbody>
</table>

* Sequence number
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
SUPPLEMENTAL SPECIFICATION  
FOR  
SECTION 616  
PILING  

DELETE THE ENTIRE CONTENTS AND HEADING AND REPLACE WITH THE FOLLOWING:  

SECTION 616  
STEEL BEARING PILING  

616.1-DESCRIPTION:  
This work shall consist of furnishing and driving concrete or steel bearing piles, of the kind and dimensions designated, to the required bearing or penetration in accordance with these Specifications and in reasonably close conformity with the lines and spacing shown on the Plans or established by the Engineer.  

616.2-MATERIALS:  
Materials shall conform to the requirements specified in the following sections/subsections:  

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SUBSECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precast Concrete Piles</td>
<td>601</td>
</tr>
<tr>
<td>Prestressed Concrete Piles</td>
<td>603</td>
</tr>
<tr>
<td>Steel Bearing Piles and Splices*</td>
<td>709.12</td>
</tr>
<tr>
<td>Steel Pile Points</td>
<td>709.50</td>
</tr>
</tbody>
</table>

* The piling section shall be of the H form and with total flange width substantially equal to the depth of the section. No section shall have a thickness of metal less than 0.4 inches (10 mm), nor a depth less than 8 inches (200 mm).  

CONSTRUCTION METHODS  

616.3-PREPARATION FOR DRIVING:  

616.3.1-General: Unless the Contractor demonstrates to the Engineer for site access reason, piles shall not be driven until required excavation or embankment is completed. Pre-drilled boreholes shall be drill and backfilled with sand prior to placement of the pile and driving. Material forced up between the piles shall be removed to correct elevation, without cost to the
Division, before concrete for the foundation is placed. Piling driven within 75 feet of any privately owned structure, that is not being dismantled during the project, shall require pre-construction and post-construction survey to assure damages are not caused by the selected driving method.

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616.3.2-Caps: The heads of all concrete piles shall be protected by caps of approved design, preferably having a rope or other suitable cushion net to the pile head, and fitting into a casting which, in turn, supports a timber shock block when the nature of the driving is such as to unduly injure them. A cast or structural steel cap or driving head shall be used for driving steel piles, if required, to keep the pile heads from upsetting excessively under hard driving conditions.

616.4-EQUIPMENT FOR DRIVING:

616.4.1-General: When a steam or air hammer diesel hammer is used for driving any type of piles, both the volume and pressure of steam or air recommended by the manufacturer fuel setting and stoke height of the hammer, as well as the rated number of strokes per minute, shall be maintained at all times at refusal to insure full energy of the driving blows and the target capacity as noted on the Plans is achieved. All hammers shall be in good working order, in the opinion of the Engineer, and be warmed up prior to refusing any pile.

Before pile driving is started, the Contractor shall provide written certification to the Engineer that of the pile hammer type(s) and rated energy, and that the hammer air compressors, and air valves have been inspected and found to be in good working condition.

In case the required penetration is not obtained using a hammer complying with the minimum requirements in 616.4.2 and 616.4.3, the Contractor shall provide a heavier hammer or resort to jetting predrilling at their own expense, unless jetting is specifically prohibited.

616.4.2-Hammers for Steel Piles: Open and closed end diesel hammers are commonly required to drive steel piles. Vibratory hammers can be used to extract piles. Vibratory hammers shall not be used to set the piles to the tip elevations and target capacity, unless specified in the Plans. External combustion hammers shall not be used to set the piles to the tip elevations and target capacity, unless specified in the Plans. All hammers used to drive steel piles shall have a minimum equivalent energy rating of 34,000–25,000 ft-lbs or as specified on the Plans. Gravity hammers for driving steel piles shall not be allowed weigh not less than 2,000 and 3,000 lb. (907 to 1,360 kg) respectively, and in no case shall the weight of the hammer be less than the combined weight of the driving head and pile, unless noted otherwise on the Plans. The fall shall be so regulated as to avoid injury to the piles and in no case shall exceed 15 ft. (4.5 m).

Steam or air hammers used for driving steel piles shall develop an energy per blow, at each full stroke of the piston, of not less than 12,000 ft. lb. (16.3 kJ) unless noted otherwise on the Plans.

616.4.3-Hammers for Concrete Piles: Steam or air hammers used for driving precast concrete piles with a mandrel shall develop an energy per blow, at each full stroke of the piston, of not less than 15,000 ft. lb. (20.3 kJ) or not less than one foot-pound for each pound of weight driven.
616.4.4 Leads, Cushion Material, and Helmet: Pile driver leads, cushion material, and helmet shall be in accordance with the hammer manufacture’s specifications. Substitute materials will only be allowed at the Engineer’s discretion. Constructed in such a manner as to afford freedom of movement to the hammer, and they shall be held in position by guys or still braces to insure firm support to the pile during driving to the lowest point the hammer must reach.

616.4.5 Water Jets: When water jets are used, the numbers of jets and the volume and pressure of water at the jet nozzles shall be sufficient to freely erode the material adjacent to the piles. The plant shall have sufficient capacity to deliver at all times at least 100 psi (689 kPa) pressure at two ¾ inch (19 mm) jet nozzles.

616.5 Method of Driving:

Drive the piles at the locations and to the vertical or battered lines shown in the Plans. Use full-length piles where practicable. Unless otherwise approved by the Engineer, driven piles shall reach the required tip elevations and blows per inch at refusal. Harden steel pile points shall be used for all piles driven to refusal on bedrock. Pile points shall be welded as required in these specifications. Unless the Contractor demonstrates to the Engineer for site access reasons, piles shall not be driven until the required excavation or embankment is complete. Do not drive piles until the footing, webwall or abutment excavation is completed. Piling driven within 20 feet of freshly placed concrete shall not be allowed until after the minimum compressive strength has been achieved per Table 601.8.7 for Superimposed Concrete Elements. When required, pre-drilled borehole diameters shall be as specified on the Plans. Drill the holes accurately so that the piles are set at the locations as shown in the Plans. Place clean, dry sand in all borehole before placing and driving the piles, unless otherwise noted on the Plans.

Precast concrete piles shall be driven by means of a combination of steam or air hammer and water jet, but the water jet may be omitted if approved by the Engineer. Other piles shall preferably be driven with an approved steam or air hammer, an approved diesel hammer, or a combination of these hammers, and water jet, except that jetting of steel piles will not be permitted unless special written permission of the Engineer is obtained. The jets, if used, shall be withdrawn before the desired penetration is reached, and the piles shall be driven with the hammer to secure the final penetration.

Pile driver leads shall be used in driving unless otherwise directed by the Engineer in writing. Underwater hammers may be used only when held in rigid leads extending to the full depth.

616.6 Accuracy of Driving:

All piles shall be driven with a variation of not more than 2% from the vertical or from the batter line indicated. The plan elevation for cut off shall be measured from the lowest point of the pile head with a maximum deviation of 2 inches (50 mm) above plan cut off providing this deviation does not interfere with other construction requirements. The cut off shall be made at right angles to the pile. The concrete cover from the face of the concrete to any face of the pile shall not be less than 9 inches (225 mm) except on the side the pile penetrates the structure. Additional concrete cover may be monolithically added to the structure to maintain the minimum 9 inches (225 mm) cover at no cost to the Division.
616.6.1-Foundations: The location in plan for piles in foundations may have a maximum deviation of 6 inches (150 mm) from that shown in the contract documents except as provided in 616.6.2.

616.6.2-Abutments with Single Lines of Piles: The location in plan for piles in an abutment with a single line of piles may have a maximum deviation of 3 inches (75 mm) from that shown in the contract documents.

616.6.3-Combination Pile and Trestle Bents: The location of the top of a combination pile and trestle bent may have a maximum plan deviation of 1 1/2 inches (38 mm).

616.7-DEFECTIVE PILES:

The procedure incident to the driving of piles shall not subject them to excessive and undue abuse producing crushing and spalling of concrete or deformation of the steel. Any pile driven out of its proper location the tolerances required in 616.6, or any pile damaged by reason of internal defects or by improper driving shall be removed or, at the option of the Engineer, a second pile may be driven adjacent thereto if this can be done without detriment to the structure. All piles so driven shall be at the expense of the Contractor.

616.8-DETERMINATION OF BEARING VALUES:

616.8.1-Loading Tests: When required, the size and number of piles shall be determined by actual loading tests. In general, these tests shall consist of the application of a test load placed upon a suitable platform supported by the pile, together with suitable apparatus for accurately measuring the load and the settlement of the pile under each increment of load. The safe allowable load shall be considered at 50% of that load which produces a permanent settlement not greater than 3 inches (75 mm), measured at the top of the pile, after 48 hours of application. This maximum settlement shall not be increased by a continuous application of the test load for a period of 60 hours. In general, one pile for each group of 100 piles shall be tested.

616.8.12-From Blow Count at Refusal: The size of piles, energy rating of hammer, fuel setting, stoke height, and design load target capacity will be designated on the Plans. All piles shall be driven to refusal into the foundation strata bedrock as indicated by the estimated pile lengths or pile tip elevations. Refusal is defined as the equivalent of 20 blows for 1 inch (25 mm) of penetration for the hammers as listed on the Plans. with a power hammer developing the minimum designated foot pounds per blow. The minimum number of blows in the last inch of penetration shall be as specified on the Plans. If a different larger hammer or fuel setting is used, the Contractor shall submit driving criteria using a wave equation analysis, such as that provided by GRLWEAP. The driving criteria shall be submitted to the engineer at least 14 days prior to installation of the first pile. The driving criteria shall include the fuel setting(s), stoke height(s), and required blows per 1 inch to achieve the target capacity. The maximum compressive driving stress shall be submitted and shall not exceed 45 ksi at the target capacity. A minimum of 6 blows per 1 inch may be allowed by the Engineer based on the wave equation analysis. As an alternate to blow count at refusal to control pile driving, the Contractor, or the Engineer, may allow the use of a Saximeter to determine the refusal stoke height. Any wave
equation analysis performed by the Contractor and associated costs due to delays and driving equipment mobilization shall be at the Contractor’s expense. The Engineer will specify the blow count to determine refusal.

616.9-PRECAST CONCRETE PILES:

616.9.1-General: Precast concrete piles shall be constructed in accordance with the size, shape, and reinforcement, shown on the Plans.

Class B concrete shall be used, and the applicable provisions of 601 shall govern.

616.9.2-Formwork: Forms for precast concrete piles shall conform to the general requirements for concrete form work as provided in 601. Forms shall be accessible for tamping and consolidation of the concrete. Under good weather conditions, side forms may be removed 24 hours after placing concrete, but the entire pile shall remain supported for at least seven days and shall not be subjected to any handling stress until the concrete has set for at least 14 days or for a longer period in cold weather, according to the judgment of the Engineer. Where control cylinders are made, bottom forms may be removed when the concrete has developed a compressive strength of 2,000 psi (14 MPa).

616.9.3-Placing and Finishing: Piling may be cast in either a vertical or horizontal position. Special care shall be taken to consolidate the concrete around the reinforcement and to avoid the formation of stone pockets, honeycomb, or other such defects. To secure uniformity and remove surplus water, the concrete in each pile shall be placed continuously and shall be compacted by vibrating or by other means satisfactory to the Engineer. The forms shall be overfilled, the surplus concrete screeded off, and the top surfaces finished to uniform, even texture similar to that produced by the forms.

As soon as the forms are removed, concrete piles shall be pointed with a 1 to 2 mortar and finished. Trestle piling exposed to view shall be finished above the ground line in accordance with the provisions governing the finishing of concrete columns. Foundation piling and that portion of the trestle piling which will be below the ground surface shall not be finished except by pointing as specified.

616.9.4-Curing: Concrete piles shall be cured in accordance with the general provisions governing the curing of concrete as specified in 601. As soon as the piles have hardened sufficiently, they shall be removed from the forms and placed in a curing pile, separated from each other by wood spacing blocks. No pile shall be driven until it has cured for at least 21 days and in cold weather for a longer period as determined by the Engineer.

616.9.5-Handling: Removal of forms, curing, storing, transporting, and handling precast concrete piles shall be done in such a manner as to avoid excessive bending stresses, cracking, spalling, or other injurious results. Piles shall be lifted by means of suitable bridles or slings attached to the pile along its length. The arrangement shall be such that no stresses in excess of 12,000 (82.7 MPa) psi are developed in the reinforcement, and the maximum compressive stress in the concrete is not over 600 psi (4 Mpa) allowing 100 % of the calculated load for impact and shock.

616.10-PRESTRESSED CONCRETE PILES:
Prestressed concrete piles shall conform to the requirements of 603.

616.149 STEEL PILING:

616.149.1 General: Steel piles shall consist of structural steel shapes of the kind and size specified. Only new piles shall be furnished and used by the Contractor. Full-length steel piles shall be used where practicable. Splicing of piles is permitted subject to the approval of the Engineer and shall be in accordance with this Specification. The number of welded connections in the length of a pile shall be preferably as few as practicable.

616.149.2 Splicing Steel Piles: If splices are made in steel piles by welding, the abutting surfaces must be true planes. The top surface of the lower pile shall be straightened if bent during the driving process or cut off (flame cutting permitted, 615.4.3.2.2) below the bent portion if it cannot be satisfactorily straightened. The bottom surface of the upper pile shall be beveled on the inside edges of the flanges and along one edge of the web. The bevel shall be made at an angle of approximately 40° with the horizontal. A surface of 1/8 inch (3 mm) may be left unbeveled. The upper pile shall be securely clamped to the lower pile and separated there from 1/8 inch (3 mm), care being taken to make the axis of the two piles coincide. The entire periphery of the pile joint shall then be butt welded, by properly certified welders, with sufficient passes to completely fill the joint, the slag of each pass being removed before beginning the next pass.

616.11.3 Cutting off Steel Piles: Steel piles shall be cut off at the required elevation. If capping is required, the connection shall be made according to details shown on the Plans.

616.1210 PREDRILLED PILING:

Holes shall be drilled or bored through the fill material to original ground or into the rock strata, to the diameter and depth as when specified on the Plans, before driving the piles. The predrilled holes for H-piling shall have a diameter of approximately 85% of the depth of the pile section when the piling is not required to penetrate into rock and shall be a minimum of 100% of the diagonal dimension of the pile section when the piling is required to be socketed into rock. Holes for round piles may vary from 2 inches (50 mm) less to 4 inches (100 mm) more than the diameter of the pile, the exact diameter to be approved by the Engineer to produce satisfactory pile driving results.

All voids remaining after Prior to placement of the pile or the driving operations, the Contractor shall be filled the open borehole with concrete sand or other aggregate of a size no larger than No. 8. Test requirements for this material are waived, except that the material shall be dry and free flowing. After driving, the Contractor shall in order to fill the voids around the piles with additional concrete sand to the satisfaction of the Engineer.

616.13 EXTENSIONS OR “BUILD-UPS”:

Extensions, splices or build ups on concrete piles, when necessary and permitted by the Engineer, shall be made as follows:

After the driving is completed, the concrete at the end of the pile shall be cut away, leaving the reinforcement steel exposed for a length of 40 diameters. The final cut of the concrete shall be perpendicular to the axis of the pile. Reinforcement similar to that used in the pile shall be securely fastened to the projecting steel and the necessary formwork shall be placed, care being taken to
prevent leakage along the pile. The concrete shall be of the same quality as that used in the pile. Just prior to placing concrete, the top of the pile shall be thoroughly wetted and covered with a thin coating of neat cement, retempered mortar or other suitable bonding material. The forms shall remain in place not less than seven days and shall then be carefully removed and the entire exposed surface of the pile finished as specified in 616.9.3.

616.1411-METHOD OF MEASUREMENT:

The number of linear feet (meters) 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.

Extension, splices, or “build-ups” will not be measured for payment as such, but, they will be included as footage in the length of piling remaining in the finished structure. In determining the amount to be included, no allowance will be made for cut-offs necessary to accomplish the extensions, splices, or “build-ups”.

“Pile Loading Tests” will be measured separately and will be the actual number of tested piles in place.

616.1512-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, tools, equipment, supplies, and incidentals necessary to complete the work. The cost of pre-drilling boring, filling of borehole and voids with sand, splicing, and metal shoes or hardened steel pile points shall be included in the price bid for the piles.

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

616.1613-PAY ITEMS:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>616003-*</td>
<td>Concrete Piles</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>616004-*</td>
<td>“size” Steel Bearing Piles, Driven</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>616005-*</td>
<td>Steel Bearing Piles, Pre-Drilled and Driven</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>616007-*</td>
<td>Pile Loading Tests</td>
<td>Per Pile</td>
</tr>
<tr>
<td>616016-*</td>
<td>Sheet Piling Left In Place</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>616017-*</td>
<td>Sheet Piling, Driven</td>
<td>Linear Foot (Meter)</td>
</tr>
</tbody>
</table>

* Sequence Number
709.12-STRUCTURAL AND EYEBAR STEEL:

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

— All structural steel for bridges shall conform to the applicable grade of AASHTO M270 that is specified in the Plans. When no specific grade is called for, AASHTO M270, Grade 36 shall be used. Non-designated structural steel in all other sections of the Specifications shall conform to ASTM A36.

All structural and eyebar steel shall conform to AASHTO M270, Grade 50.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 618
CAST BRONZE AND ROLLED COPPER-ALLOY EXPANSION PLATES

DELETE THE ENTIRE SECTION:

618.1-DESCRIPTION:

This work shall consist of furnishing and erecting cast bronze or rolled copper-alloy expansion plates, to be used as friction type expansion or bearing plates, in accordance with the details and dimensions shown on the Plans and in accordance with this Specification.

618.2-MATERIALS:

Materials shall conform to the requirements specified in the following Subsections of Division 700:

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SUBSECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronze Castings for expansion Plates</td>
<td>709.18</td>
</tr>
<tr>
<td>Rolled Copper-Alloy Expansion Plates</td>
<td>709.19</td>
</tr>
</tbody>
</table>

CONSTRUCTION METHODS

618.3-GENERAL:

Plates shall be accurately set in position as shown on the Plans and shall have a uniform bearing over the entire area. Provisions shall be made to keep the plates in position while masonry is being placed. When finishing is indicated on the Plans or directed, the surfaces shall comply with the American Standards Association surface roughness requirements as defined in ASA B46, 1-55, ASA 125.

618.4-CAST BRONZE PLATES:

Cast bronze plates shall be cast according to details shown on the Plans. Sliding surfaces shall be planed parallel to the movement of the span and polished unless otherwise detailed. When self-lubricated bronze plates are specified, they shall conform to 709.18 unless otherwise provided. They shall be trepanned in a geometric pattern of recesses to receive a lubricating material suitable for long-life service of the bearing face. The lubricated area shall comprise a minimum of 25 percent of the bearing face to provide a coefficient of friction for bronze on steel of approximately 10 percent for loads of 1,000 to 2,000 psi (7 to 14 MPa). Only the sliding
surfaces shall be lubricated.

618.5 ROLLED COPPER-ALLOY EXPANSION PLATES:
— Rolled copper-alloy expansion plates shall be furnished according to the details shown on the Plans. Finishing of rolled plates will not be required if they have a plane true and smooth surface. If finishing is indicated on the Plans or directed, it shall be in the direction of the movement of the span.

618.6 METHOD OF MEASUREMENT:
— The quantity of work done will be measured by the pound (kilogram). Unless otherwise provided, the weight to be paid for shall be the certified scale weight in pounds (kilograms) of the plates placed in the structure but not to exceed the weight as computed from the net dimensions shown on the Plans. The weight per cubic foot of cast bronze or copper-alloy plates shall be considered as 536 lb. (8.6 Mg per cubic meter).

618.7 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 materials, labor, tools, equipment, supplies, and incidentals necessary to complete the work.

618.8 PAY ITEMS:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
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</thead>
<tbody>
<tr>
<td>618001</td>
<td>Cast Bronze Expansion Plates</td>
<td>Pound (Kilogram)</td>
</tr>
<tr>
<td>618002</td>
<td>Rolled Copper-Alloy Expansion Plates</td>
<td>Pound (Kilogram)</td>
</tr>
</tbody>
</table>

* Sequence number
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 625
DRILLED CAISSON

625.4-MATERIALS:

625.4.3-Casing:

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

Metal casing shall be used whenever required to prevent caving of the soil material or to exclude ground water. Casing shall be metal, of unit or sectional construction, be strong enough to withstand handling stresses, withstand the pressures of concrete and of the surrounding earth and ground water, and prevent seepage of water. Also, the casing used shall be selected by the Contractor to control dimensions and alignment of excavations within tolerances, to seal the casing into impervious materials, and to execute all other construction operations.

Casing pipe used for permanent applications shall be new material and conform to ASTM A 252/A 252M, Grade 2. Casing pipe when used for temporary applications only, will initially be required to meet the requirements of permanent pipe but when removed can be transferred to the contractors stock and reused on subsequent projects.

Any required casing splices shall be welded in accordance with Section 625.2.3 e) of this specification—with no interior splice plates, producing true and straight casing. All welding shall be in accordance with ANSI/AWS D1.1.

Permanent casing is required in all caissons where noted on the plans. All temporary casing shall be removed during placement of concrete unless otherwise noted on the plans. Should the Contractor be unable to remove the temporary casing or if conditions require the temporary casing remain in place, the Contractor shall pressure grout the annular space between the casing and soil. Materials and methods for grouting operation shall be submitted to the Engineer for approval for the grouting operation. There shall be no additional cost to the Division for the grouting operation.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 634
CONCRETE CRIBBING

DELETE THE ENTIRE SECTION:

634.1-DESCRIPTION:
This work shall consist of the furnishing and installing of precast concrete units to form a crib wall or similar structure, including the placing of interior and backfill material, in accordance with these Specifications and in reasonably close conformity to the lines, grades, dimensions, locations, and sections shown on the Plans.

634.2-MATERIALS:
Concrete shall be Class A, meeting the requirement of 601.
Joint mortar shall conform to 708.8.
Interior filling material shall conform to the requirements of select borrow as specified in 211. Shale or cinders shall not be used.
Reinforcing steel shall conform to 709.1 or 709.3.
The details of the crib members and their arrangements shall be as shown on the Plans. If manufactured on the Project, crib members shall be cured in accordance with 601. All members shall be free from depressions and spalled, patched, or plastered surfaces or edges, or any other defects which may impair their strength or durability. Cracked, untrue, or otherwise defective members will be rejected.

CONSTRUCTION METHODS

634.3-PLACING CRIB MEMBERS:
The prepared foundation bed for the cribbing shall be firm and normal to the face of the cribbing and will be approved by the Engineer before any of the crib work is placed. The crib members shall be erected as shown on the Plans. Care shall be taken to insure the correct alignment and batter on the crib wall. If a slight adjustment is needed, a shim made of shingles may be used. Asphalt bearing pads having a thickness of 1/4 inch (6 mm), and having a dimension of 1/4 inch (12 mm) greater than the bearing width in any direction, shall be placed between all bearing surfaces. When concrete cribbing is placed without batter, the asphalt bearing pads shall be eliminated and the cribbing members laid with a 1 to 2 cement mortar joint. The crib members
shall be handled carefully, and members that become cracked or otherwise damaged shall be removed and new members substituted without extra compensation.

634.4 FILLING CRIB:
—— The filling of the interior and backfilling behind the crib shall progress simultaneously with the erection of the cribbing. The interior shall be filled with approved granular material. The space back of the cribbing shall be filled with suitable random material. All material shall be free of particles larger than 3 inches (75 mm), frozen lumps, wood or other extraneous material. All material shall be placed in layers not exceeding 4 inches (100 mm) after compaction. This method of filling and compacting the interior and backfilling shall be continued until the embankment is level with the top of the structure, except, where the backfill is accessible to a roller, the backfill shall be compacted in accordance with 212.10. In any event, the greatest care shall be exercised in the placing and compacting of material between and back of the crib cells so that damage will not occur to the crib members.
—— The quality control testing and acceptance of the interior and backfill material will be according to the applicable sections of 207 and 716 or 717 with the following exceptions:
—— A lot will normally consist of the quantity of material required to fill the interior of the cribbing and backfill, except where the filling material and backfill material are different and in this case, each type of material would constitute a lot. For large installations, a lot should not exceed the quantity of material to fill or backfill 100 linear feet horizontal and 20 feet vertical. If either of these dimensions is exceeded, a new lot should be established.
—— The target percentage of density will be 95 percent, and each lot will have 5 density tests performed for quality control.

634.5 METHOD OF MEASUREMENT:
—— The quality of work done will be measured in cubic feet (meters) of "Concrete Cribbing", complete in place and accepted, determined by a tabulation of the number of pieces of each size and variety of separate members used, times the volume of the respective members calculated from their dimensions.
—— "Structure Excavation" will be limited to a plane 18 inches (450 mm) from and parallel to the faces of the cribbing.

634.6 BASIS OF PAYMENT:
—— The quantity, determined as provided above, will be paid for at the contract unit price bid for the item below, which price and payment shall be full compensation for furnishing all the material 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, except that the necessary structure excavation with limitations as specified above, will be paid for as Item 212001-*, "Structure Excavation". The cost of asphalt bearing pads or joint mortar, granular filling of the interior, and backfilling behind the crib shall be included in the bid price for "Concrete Cribbing".

634.7 PAY ITEM:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>634001-*</td>
<td>Concrete Cribbing</td>
<td>Cubic Foot (Meter)</td>
</tr>
</tbody>
</table>

* Sequence number
DELETE THE ENTIRE SECTION:

635.1-DESCRIPTION:
This work shall consist of the furnishing and installing of metal crib members, including the placing of the interior and backfill material, in accordance with these Specifications and in reasonably close conformity with the lines, grades, dimensions, locations, and sections shown on the Plans.

635.2-MATERIALS:
The crib members shall consist of metallic headers and stretchers with the appurtenances necessary for complete assembly in the field. Each header and stretcher shall be fabricated completely in the plant prior to shipment to the site. If indicated on the Plans, fillers for placing between the stretchers on the face of the wall and end caps for the outside ends of the headers shall be furnished.
The sheets from which all headers and stretchers are manufactured shall be made of material meeting the requirements for chemical composition and spelter coating specified under 713.2 for corrugated iron or steel pipe.
The various members of the crib shall be constructed of metal having a minimum thickness of 0.064 inch (1.6 mm).
The details of the crib members and their arrangements shall be as shown on the Plans. Interior filling material shall conform to the requirements of select borrow in 211.

CONSTRUCTION METHODS

635.3-PLACING CRIB MEMBERS:
The prepared foundation bed for the cribbing shall be firm and normal to the face of the cribbing and will be approved by the Engineer before any of the crib work is placed.
The crib members shall be erected as shown on the Plans. The members shall be handled carefully, and members that are damaged shall be removed and new members substituted in their place without extra compensation.

635.4-FILLING CRIB:
The filling of the interior and backfilling of the crib shall progress simultaneously with the erection of the cribbing and shall be as specified in 634.

635.5 METHOD OF MEASUREMENT:
—— The quantity of work done will be measured in square feet (meters) of "Metal Cribbing", complete in place and accepted, determined by actual overall measurements of the outside face of the structure.
—— "Structure Excavation" will be limited to a plane 18 inches (450 mm) from and parallel to the faces of the cribbing.

635.6 BASIS OF PAYMENT:
—— The quantity, determined as provided above, will be paid for at the contract unit price bid for the item below, which price and payment will 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, except that the necessary structure excavation, with limitations as specified above, will be paid for as Item 212001 *, "Structural Excavation". The cost of granular filling of the interior and backfilling behind the crib shall be included in the unit price bid for "Metal Cribbing".

635.7 PAY ITEM:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>635001</td>
<td>Metal Cribbing</td>
<td>Square Foot (Meter)</td>
</tr>
</tbody>
</table>

* Sequence number
636.4-WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 636
MAINTAINING TRAFFIC

636.1-DESCRIPTION:

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

This work shall consist of all necessary measures to maintain and to protect vehicular and pedestrian traffic, to protect the work in process, to protect adjacent property from excess dust resulting from the construction area and to maintain traffic through, around or adjacent to the construction area, in accordance with these Specifications or as directed. The work shall include the furnishing and maintaining of all traffic control devices, flaggers and pilot truck; construction of temporary structures when required; labor, equipment and materials to keep the traveled road smooth, passable, and safe; and the furnishing and application of dust palliatives.

636.2-MATERIALS:

DELETE CALCIUM CHLORIDE FROM THE TABLE

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SUBSECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium-Chloride</td>
<td>715.4</td>
</tr>
</tbody>
</table>

636.4-AGGREGATES AND DUST PALLIATIVES:

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

Aggregates required for the maintenance of traffic, water, liquid asphalt, asphalt emulsion, cationic emulsified asphalt or calcium chloride for use as dust palliatives, shall be furnished and applied as directed by the Engineer. Water or other dust palliative shall be used on haul roads and any location on the project to minimize pollution from dust, when dust is creating a nuisance to the traveling public or adjacent property owners. No payment will be made for other dust control.
Temporary roads shall be constructed when called for, and such roads, as well as the road under construction, shall be surfaced and maintained with aggregates, as shown on the Plans or as directed by the Engineer.

636.6-PILOT TRUCK AND DRIVER OR SHADOW VEHICLE:

636.6.2-Shadow Vehicle:

DELETE SUBSECTION 636.6.2 AND REPLACE WITH THE FOLLOWING:

636.6.2-Shadow Vehicle: A shadow vehicle shall be furnished by the Contractor when called for on the Plans or directed by the Engineer. This vehicle shall be a standard truck weighing between 10,000 GVW (4536 kg) and 24,000 GVW (10880 kg) maximum, and shall be equipped with a flashing or rotary yellow beacon which can be seen in all directions and a truck-mounted attenuator mounted on the rear.

The shadow vehicle shall be used at the locations shown on the Plans where a lane is closed and work is in progress. When work is completed for the day, lane closure is no longer needed, the shadow vehicle shall be relocated behind a positive barrier or off the job site in a safe location.

636.23-METHOD OF MEASUREMENT:

DELETE SUBSECTION 636.23.2, 636.23.3, 636.23.26 AND REPLACE WITH THE FOLLOWING:

636.23.2-Bituminous Material: The quantity of "Bituminous Material for Dust Palliative" shall be the number of gallons (liters), prior to dilution in the field, incorporated into the completed work and will be measured as prescribed in 109.1.

636.23.3-Calcium Chloride: The quantity of "Calcium Chloride for Dust Palliative" shall be the number of tons (megagrams) actually used for the work, determined by the total of the weights of the individual units when shipped in packages.

636.23.26-Shadow Vehicle: A shadow vehicle “Shadow Vehicle” shall be on a per-day/month basis and shall include the flashing beacon, fuel, crew and truck-mounted attenuator used in conjunction with the vehicle.

The Department will measure the item by actual number of months the vehicle is used on the project. Partial months at the beginning and ending of the project will be paid for as a full month. The Contractor will not be paid units when there is a break in work larger than one month.

636.24-BASES OF PAYMENT:

The quantities, determined as provided above, will be paid for at the contract unit price bid for the items listed below, which prices and payment 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. When aggregate for maintaining traffic, dust palliatives, flagger, traffic director, cleaning of traffic control devices or the electric arrow are contained in the contract as pay items, payment for such pay items will not be made subsequent to the date of required completion of the project.

When a portable message sign or speed monitoring trailer is to become the property of the Division, each unit shall be delivered with the following items:

i. Operator's manual for sign-raising mechanism and sign operations.
ii. Schematic wiring diagram of the sign, remote control console and the control unit.
iii. Service manual for the sign, sign-raising mechanism control unit and the remote control console.
iv. Record of Serial Numbers, Model Numbers, and Model Types for the Portable message sign and any attendant diesel engine.
v. Warranty on the sign-raising mechanism, sign remote control console and control unit.
vi. Inspection and operational tests.

If during the prosecution of the work, additional items under this Section, not included in the contract, are found to be necessary as determined by the Engineer, payment for such additional items will be made under the provisions of 104.3.

636.25-PAY ITEMS:

DELETE ITEM 636003 AND 636004 FROM THE TABLE AND REPLACE ITEM 636028 WITH THE FOLLOWING:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>636003</td>
<td>Bituminous Material For Dust Palliative</td>
<td>Gallon (Liter)</td>
</tr>
<tr>
<td>636004</td>
<td>Calcium Chloride For Dust Palliative</td>
<td>Ton (Megagram)</td>
</tr>
<tr>
<td>636028</td>
<td>Shadow Vehicle</td>
<td>DayMonth</td>
</tr>
</tbody>
</table>
DETERMINE CONTROL STABILIZING ADMIXTURES FOR CONCRETE:

707.15.2.1 - The effects of using hydration control stabilizing admixtures may vary widely with different types of cement, cement from different mills, aggregate proportions, aggregates from different sources and of different gradation, and changes in water-cement ratio. Therefore, no hydration control stabilizing admixture shall be used until the concrete of the specified class, designed in accordance with these Specifications and made with the ingredients proposed for use by the Contractor, including hydration control stabilizing admixtures as specified or permitted under this Specification, is shown to meet the requirements of AASHTO M 194 for water reduction and compressive strength increases at ages 3, 7, and 28 days.

707.15.2.2 - In order for a concrete mix design, containing a hydration control stabilizing admixture, to be considered for the allowable concrete discharge time extension for excessive haul time, as outlined in Section 601.7, the additional following testing is required in that subject mix design.

Upon completion of the mixing of this batch, at least one of the trial batches at the minimum cement factor, for the subject mix design, as required in MP 711.03.23, air content and slump tests in accordance with Section 601.4.1 shall be performed on the that trial batch of plastic concrete containing the hydration control stabilizing admixture. A test to establish the initial and final times of setting of the concrete mix shall also be performed, in accordance with ASTM C403. The air content and slump tests shall then be repeated at 45-minute intervals, until a period of 3-hours after the completion of mixing has elapsed.

The value obtained by any of the air content tests during the 3-hour period shall not vary, from the value obtained by the initial air content test, by more than 2.5 percentage points.

The value obtained by any of the slump tests during the 3-hour period shall not vary, from the value obtained by the initial slump test, by more than 1.75 inches (445 mm).
The results of all these tests shall be included, along with all the other information required in MP 711.03.23, when the subject mix design is submitted for approval.

707.15.2.23 The subject concrete mix design, and the concrete mix used during construction, shall contain the quantity of admixture recommended by the manufacturer at the prevailing temperature.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 102
BIDDING REQUIREMENTS AND CONDITIONS

DELETE SUBSECTION 102.3 AND REPLACE WITH THE FOLLOWING:

102.3-ISSUANCE OF PROPOSAL FORMS:

Proposal forms, will be issued to Prequalified Contractors only or to their authorized representatives, or to Contractors who have filed on a Division standard form an application for prequalification 15 calendar days prior to the date set for receiving bids on projects on which the applicant desires to bid.

The Division may at its discretion issue to a Contractor a Proposal requiring prequalification in excess of the amount allotted the Contractor provided it considers that this Contractor is particularly fitted by reason of their experience or equipment, or both, to perform work of this type involved in an amount exceeding their prequalification limits and further provided that the prospective bidder furnish the Division with a letter from a reputable Surety advising of their willingness to furnish bond to the Contractor for the project. No letter from a reputable Surety will be accepted after 4:00 PM Eastern Time, seven (7) calendar days before the letting. Lettings must be submitted to DOHContractProcure@wv.gov. The Surety letter should include the following information: call number, project name, project number, and letting date for each project the Contractor requests to exceed their prequalification limits on. Failure to submit this information by the specified time may result in a Contractor’s proposal(s) being irregular.

When more than one project is advertised, Proposals will be issued on as many projects as the Contractor requests, providing the Contractor is qualified as above for each individual project, but no contracts will be awarded exceeding the permissible limit of the Contractor's prequalification rating except as otherwise provided in 103.1.

DELETE SUBSECTION 102.7 AND REPLACE WITH THE FOLLOWING:

102.7-IRREGULAR PROPOSALS:

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

i. When the Proposal is on a form other than that furnished by the Division or if the form is altered. Use of a Division approved computer generated Schedule of Items
shall not be considered an alteration of form or format within the meaning of these Specifications.

ii. When there are unauthorized additions, conditional or alternate bids, or irregularities of any kind which may tend to make the Proposal incomplete, indefinite, or ambiguous as to its meaning. Also, when Division approved computer generated Schedule of Items show any alteration of format, additions or amendments not called for, errors or omissions in units of measure, or erasures.

iii. When the bidder adds any provisions reserving the right to accept or reject an award, or to enter into a Contract pursuant to an award. This does not exclude a bid limiting the maximum gross amount of awards acceptable to any one bidder at any one bid letting, providing that any selection of awards will be made by the Division.

iv. Failure to sign or properly execute the Proposal.

v. Failure to indicate a proposed goal in Section C, Item 3 of the Notice contained in the Proposal, when a Division determined goal is indicated in paragraph 5 of the Special Provision for Disadvantaged Business Enterprise Utilization.

vi. Failure to properly acknowledge receipt of amendment(s) in accordance with Section J of the notice contained in the proposal.

vii. Failure to show the West Virginia Contractor’s License Number when required in Section H of the notice contained in the proposal.

viii. Contractor’s failure to submit a letter from a reputable Surety at least seven (7) calendar days prior to a letting, advising of the Surety’s willingness to furnish a bond in an amount exceeding the Contractor’s prequalification limits.
218.1-DESCRIPTION:

ADD THE FOLLOWING SUBSECTION:

**218.1.1-Tied Concrete Block Erosion Mat:** This work shall consist of furnishing and placing the Tied Concrete Block Erosion Control Mat (TCBM) in accordance with this Special Provision and in reasonably close conformity with the lines, grades, design, and dimensions shown on the plans.

The TCBM shall be manufactured or field fabricated from integrally formed individual concrete blocks tied together with high strength geogrid or pre-approved cable system.

218.2-MATERIALS:

ADD THE FOLLOWING SUB-SECTIONS:

**218.2.1-Panel:** The concrete blocks, cables, geogrid, fittings and other applicable elements shall be manufactured or fabricated into mats.

**218.2.2-Concrete Blocks:** Concrete block shall be tapered, beveled, and interlocked. The blocks shall incorporate interlocking surfaces or connections that prevent lateral displacement of the blocks within the mats when they are lifted for placement. Blocks shall exhibit resistance to mild concentrations of acids, alkalis, and solvents.

Blocks shall be wet-cast and conform to the requirements of Class K concrete, as outlined in Section 601. The concrete mix design, used to produce the concrete from which these blocks are fabricated, shall be approved by the Engineer and shall meet the requirements of MP 711.03.23. The concrete, used to fabricate these blocks, shall be supplied by a WVDOH approved concrete plant.
The block fabricator shall fabricate and test compressive strength specimens, each day that blocks are fabricated, to verify that the compressive strength of the concrete used to fabricate these blocks, meets the requirements of Table 218.2.2. The block Fabricator shall test the air content and the slump of the plastic concrete, once for every 50 yd³ (38 m³) of concrete that is produced or once per half-day of production, whichever is less, to verify that they meet the requirements of Table 218.2.2. The POA shall be measured and documented by the block Fabricator, on one random panel per day of production to ensure that it meets the requirements of Table 218.2.2. The Fabricator shall perform an absorption test on one random block per five days of production, after that block has cured for 28-days, the ensure that the absorption of the concrete used to fabricate these blocks, meets the requirements of Table 218.2.2.

<table>
<thead>
<tr>
<th>TABLE 218.2.2: Physical Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum 28-day Compressive Strength (AASHTO T22 and T23)</td>
</tr>
<tr>
<td>4,000 psi (28 Mpa)</td>
</tr>
</tbody>
</table>

218.2.3-Polypropylene Geogrid: The TCBM shall be constructed of a high strength, rough service, low elongating, and continuous filament polypropylene geogrid with an acrylic coating. Interlocking geogrid shall have the following physical properties:

| Mass/Unit Area | ASTM D-5261 7.0 oz./yd2 (240 g/m2) |
| Aperture Size | ASTM D-5261 7.0 oz./yd2 (240 g/m2) |
| Wide Width Tensile Strength | Machine Direction (MD) ASTM D-6637 2,055 lb./ft. (30 kN/m) |
| | Cross Machine Direction (CMD) ASTM D-6637 2,055 lb./ft. (30 kN/m) |
| Elongation at Break | ASTM D-6637 6% (6%) |
| Tensile Strength @ 2% | Machine Direction (MD) ASTM D-6637 822 lb./ft. (12 kN/m) |
| | Cross Machine Direction (CMD) ASTM D-6637 822 lb./ft. (12 kN/m) |
| Tensile Strength @ 5% | Machine Direction (MD) ASTM D-6637 1,640 lb./ft. (24 kN/m) |
| | Cross Machine Direction (CMD) ASTM D-6637 1,640 lb./ft. (24 kN/m) |
| Tensile Modulus @ 2% | Machine Direction (MD) ASTM D-6637 41,100 lb./ft. (600 kN/m) |
| | Cross Machine Direction (CMD) ASTM D-6637 41,100 lb./ft. (600 kN/m) |
| Tensile Modulus @ 5% | Machine Direction (MD) ASTM D-6637 32,900 lb./ft. (480 kN/m) |
| | Cross Machine Direction (CMD) ASTM D-6637 32,900 lb./ft. (480 kN/m) |

218.2.4-Underlayment: The backing material shall be rolled up with the TCBM and shall include the minimum of a double-net excelsior (wood fiber) blanket so when the system is unrolled the backing becomes the underlayment to stabilize the soils and promote growth of vegetation, unless otherwise specified on the plans. Alternate underlayment options include permanent erosion control matting per 715.24.2 type A and engineering fabric for erosion control per 715.11.6.
218.2.5 - Transportation, Handling, and Storage: Upon delivery to the project, the Contractor shall inspect the TCBM for type, size, quantity, quality, and condition, to ensure that the proper material has been delivered and no damage occurred during transportation. Defects or damage will be cause for rejection, and immediate steps shall be taken to replace, at no additional cost. TCBM with excelsior fiber backing may be left exposed for up to 30 days. If exposure will exceed 30 days, the rolls must be tarped or otherwise covered to minimize UV exposure.

218.2.6 - Visual Inspection: All units shall be free of defects that would interfere with the proper placing of the unit or impair the strength and permanence of the overall system. Surface cracks incidental to the normal manufacture of concrete shall not be deemed grounds for rejection. Cracks exceeding 0.25 inches in width and/or 1.0 inch in depth shall be deemed grounds for rejection and unit replacement. Surface chipping resulting from customary methods of manufacture, shipping, handling and installation shall not be grounds for rejection. Chipping resulting in a weight loss exceeding 15% of the average weight of a concrete unit shall be deemed grounds for rejection and unit replacement.

CONSTRUCTION METHODS

218.3 - SLOPE PROTECTION:

ADD THE FOLLOWING SUB-SECTIONS:

218.3.8 - Tied Concrete Block Erosion Mat:

218.3.8.1 - Subgrade Preparation: The prepared subgrade shall provide a firm, unyielding foundation for the mats. The subgrade shall be prepared as detailed on the plans. Subgrade surface shall be free of any debris, protrusions, rocks, sticks, roots or other hindrances which would result in an individual block being raised more than ¾” above the adjoining blocks. Undulations, rolls, knolls and rises in the subgrade to which the TCBM is able to contour over and maintain intimate contact with the subgrade will be allowed. Apply seed directly to the prepared soil prior to installation of mats. Use seed and/or topsoil per project specifications. Install mats to the line and grade shown on the plans and according to the manufacturer’s installation guidelines. The manufacturer or authorized representative will provide technical assistance during installation as needed.

218.3.8.2 - Anchoring: The upstream end of the TCBM is to be embedded 18 inches to prevent undermining of the mat. This also provides anchorage when the mats are installed on steeper slopes. Edges exposed to concentrated flows, such as side channels, shall also be embedded 18 inches. Edges exposed to sheet flow shall have the row of blocks along that edge embedded into the soil.

In instances where the TCBM cannot be embedded into the soil, such as when it is placed on a rock foundation, mechanical anchorage may be required. The polypropylene grid cast into the concrete blocks shall be attached to the anchoring system as indicated on the Contract Drawings. An engineered anchoring system, such as a percussion anchor that
loops around lengths of rebar placed over the grid and in between the blocks, may be used. The design and layout of the anchoring system shall be by the Engineer, or a party designated by the Engineer.

The site should allow for manipulation of the mat during installation to achieve proper positioning and placement through the use of standard construction equipment including, but not limited to; excavator, forklift, skid-steer, or other under supervision of approved manufacturer representative.

218.3.8-Panel Seaming: Panel seams (Channel and Slopes) perpendicular to the hydraulic flow must be overlapped. The downstream panel will be terminated and properly anchored according to Contract Drawings. The upstream panel will then overlap the downstream panel by 18 to 24 inches. If no hydraulic or overland flow is expected, butting the seams together is acceptable. A 4 foot section of erosion control matting is used with 2 foot being placed under the mats on each side of the seam.

218.3.8.4-Maintenance: The Contractor shall inspect TCBM at regular intervals and after storm events. Contractor shall remove sediment buildup and mow/fertilize to promote vegetation’s long-term establishment. Grass killing chemicals are not permitted in area of TCBM.

218.7-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>2180011-001</td>
<td>Tied Concrete Block Mattress</td>
<td>Square Feet (Meter)</td>
</tr>
</tbody>
</table>
311.5-TESTING:
   311.5.1-Quality Control Testing:

DELETE SUBSECTION 311.5.1 AND REPLACE WITH THE FOLLOWING:

   311.5.1-Quality Control Testing: Quality control is the responsibility of the Contractor as specified in 106.1.

   The contractor shall design a quality control plan detailing the methods by which the quality program will be conducted. The Contractor shall conduct one test daily to determine mix properties in accordance with 311.4. Frequency will be one test per day. Acceptance for gradation will be in accordance with section 703.6. If gravel is used for the coarse aggregate a crushed particle analysis, in accordance with Section 311.2 will be conducted before placement and every 10,000-ton (9000-mg) thereafter. Unless otherwise specified compaction testing shall be waived.
ADD THE FOLLOWING SECTION:

SECTION 495420
SINGLE / MULTIPLE COURSE MICRO-SURFACING

420.1-DESCRIPTION:
This section covers the materials, equipment, construction and application procedures for placing Micro Surfacing material for filling ruts and for surfacing existing paved surfaces. The Micro Surfacing is a mixture of a latex-modified asphalt emulsion, crushed mineral aggregate screenings, mineral filler, water and other additives for control of set time in the field. All ingredients are to be properly proportioned, mixed and spread on the paved surface in accordance with this Specification and as directed by Engineer.

420.2-MATERIALS:
Furnish a Micro Surfacing mixture consisting of a properly designed and proportioned blend of polymerized asphalt emulsion, fine aggregate, Portland cement, water and other additives. Use materials meeting the following:

420.2.1-Mineral Filler: Portland cement, hydrated lime, limestone dust, fly ash, or other approved filler meeting the requirements of ASTM D 242 shall be used if required by the mix design.

420.2.2-Fine Aggregates, 2FA and 3FA: The fine aggregate used shall be suitable for the particular application and shall be a crushed stone such as granite, slag, limestone, chat, or other high-quality aggregate, or combination thereof and shall meet the requirements of the Division of Transportation Highways and grading requirements as stated. In addition, aggregates used for surface courses on projects with an ADT greater than 3000 shall be from an approved source identified as having polish-resistant aggregates and considered potential skid-resistant aggregate sources.

<table>
<thead>
<tr>
<th>Tests</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand Equivalent Value of Soils and Fine Aggregate</td>
<td>ASTM D 2419 65 minimum</td>
</tr>
<tr>
<td>Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate</td>
<td>C 88 15% max. w/NA2SO4 25% max. w/MgSO4</td>
</tr>
</tbody>
</table>
Material | Percent Passing
--- | ---
2FA | 3/8 in | No. 4 | No. 8 | No. 16 | No. 30 | No. 50 | No. 100 | No. 200
(a) | 100 | 85-100 | 50-80 | 40-65 | 25-45 | 13-25 | 5-15 |
3FA | 100 | 70-90 | 45-70 | 28-50 | 19-34 | 12-25 | 7-18 | 5-15 |

(a) Gradation represents the final blended product.

420.2.3-Asphalt Emulsion-CSS-1hM or CQS-1hM: Polymer Modified Asphalt Emulsion shall be a quick-set, CSS-1hM or CQS-1hM emulsion in accordance with AASHTO M 208 except the cement-mixing test is waived. The polymer material shall be processed into the asphalt cement or milled into the asphalt emulsion. Post adding to the asphalt emulsion is not permitted. The minimum polymer solids content will be 3.0% based on the residual of the emulsion.

Tests ASTM D 244, Unless Otherwise Designated
- Viscosity, Saybolt Furol, ASTM D 88, @ 25 °C, sec: 20 – 100
- Storage Stability Tests, 24-hr, % Difference, max: 1
- Particle Charge Tests: Positive
- Sieve Tests, % max (Distilled Water): 0.10
- Distillation to 260 °C, % by Weight, min.: 60

Tests on Distillation Residue
- Penetration, 25 °C, 100 g, 5 sec, dmm, ASTM D 5: 40 – 90
- Ductility, 25 °C, 5 cm/min, cm, min, ASTM D 113: 40
- Solubility in Trichloroethylene, % min, ASTM D 2042: 97.5

Polymer Modified Asphalt Emulsion shall be a quick-set, CSS-1hM or CQS-1hM emulsion in accordance with AASHTO M 208 except the cement-mixing test is waived. The polymer material shall be processed into the asphalt cement or milled into the asphalt emulsion. Post adding to the asphalt emulsion is not permitted. The minimum polymer solids content will be 3.0% based on the residual of the emulsion.

420.2.4-Water: Water shall potable and be free of harmful salts and contaminants.

420.2.5-Additives: Chemical additives may be used to accelerate or retard the break/set of the Micro Surfacing mixture if required by the mix design.

420.3-MIXTURE REQUIREMENTS:

420.3.1-Mix Design: Submit to the Engineer, at least five working, fourteen calendar days before the start of production, a complete mix design prepared and certified by an experienced laboratory. Provide a job mix formula (JMF) to the Engineer at the pre-paving meeting showing individual proportions of each material, that when combined, will meet the following mix design criteria. A new mix design is required for any change in aggregate or asphalt emulsion source.
Micro Surfacing Mix Design Criteria

**ISSA TB-139 Wet Cohesion***
- 30 minutes minimum (set time) 12 kg-cm min
- 60 minutes minimum (traffic) 20 kg-cm min or near spin

**ISSA TB-114 Wet Stripping**
- 90% min

**ISSA TB-100 Wet Track Abrasion Loss**
- One Hour Soak 50 g/ft2 max
- Six Day Soak 75 g/ft2 max

**ISSA TB-144 Saturated Abrasion Compatibility**
- 3 g loss, max

**ISSA TB-113**
- Mix Time at 77 °F* Controllable to 120 sec, min
- Mix Time at 104 °F* Controllable to 35 sec, min

* Check the ISSA TB-139 (set time) and ISSA TB-113 (mix time) tests at the highest temperature expected during construction. For ISSA TB-113 test at 104°F, preheat all ingredients and containers.

The JMF must be within the following limits:

<table>
<thead>
<tr>
<th>Material</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt Binder Content (Residual)</td>
<td>7.0%-8.5%, dry weight, 2FA aggregate 6.5%-8.0%, dry weight, 3FA aggregate</td>
</tr>
<tr>
<td>Mineral Filler</td>
<td>0.25%-3.0%, dry weight, of aggregate</td>
</tr>
</tbody>
</table>

420.3.2-Mix Design Format: Provide the following information in the final mix design:

a. Sources of each material
b. Aggregate
   1. Type
   2. Gradation
   3. Sand equivalence
c. Field Simulation Tests
   1. Wet stripping test
   2. Wet track abrasion loss
   3. Saturated abrasion compatibility
   4.Trial mix time at 77 °F and 100 °F
d. Interpretation of results and the determination of a JMF
   1. Mineral filler (minimum & maximum), percent
   2. Water, including aggregate moisture (minimum & maximum), percent
   3. Quantitative effects of moisture content on the unit weight of the aggregate
   4. Mix set additive (if required), percent
   5. Modified emulsion, percent
   6. Residual content of modified emulsion
   7. Residual, percent
e. Mix designer’s signature and date
420.4-CONSTRUCTION:

420.4.1-Equipment: Provide safe, environmentally acceptable equipment that can produce a specification product.

420.4.1.1-Mixing Machine: Provide one or more self propelled, front feed, continuous loading mixing machines equipped and operated as follows:

a. A positive connection conveyer belt aggregate delivery system and an interconnected positive displacement, water-jacketed gear pump to accurately proportion aggregate and asphalt emulsion.

b. Continuous flow, twin shaft, multi-blade type pugmill a minimum of 50 inches long.

c. Blade sizes and side clearances that meet the equipment manufacturer’s recommendation.

d. Mineral filler feed located to ensure that the proper quantity of mineral filler drops on the aggregate before discharging into the pugmill.

e. Asphalt emulsion introduced within the first one-third of the mixer length to ensure proper mixing of all materials before they exit from the pugmill.

f. Computerized material monitoring system with integrated material control devices that are readily accessible and positioned so the amount of each material used can be determined at any time. The mixer shall be equipped with a back-up electronic materials counter that is capable of recording running count totals for each material being monitored. The mixer shall be equipped with a radar ground measuring device. Each material control device shall be calibrated prior to each mix application and as often thereafter as deemed necessary by the Engineer. The computer system shall have the capability to record, display and print the following information:

1. Individual sensor counts for emulsion, aggregate, cement, water and additive
2. Aggregate, emulsion, and cement output in lbs.(kgs) per minute
3. Ground travel distance. The mixer shall be equipped with a Radar Ground metering device
4. Spread rate in lbs./s.y.(kgs/m2)
5. Percentages of emulsion, cement, water and additive
6. Cumulative totals of aggregate, emulsion, cement, water and additive
7. Scale factor for all materials

g. Equipped with a water pressure system and nozzle type spray bar to provide water spray ahead of and outside the spreader box when required. Apply water to dampen the surface without resulting in free flowing water ahead of the spreader box.

h. Opposite side driving stations on the front to optimize longitudinal alignment during placement. Remote forward speed control at the back mixing platform so that the back operator can control forward speed and level of mixture in the spreader box.

Use a sufficient number of transports to assure a continuous operation during mix production and application. Use transport units with belt type aggregate delivery systems,
emulsion and water storage tanks of adequate size to proportionally mix aggregate delivered by each transport.

Unless otherwise noted in the plans or as approved by the Engineer, truck-mounted batch type machines will only be allowed on small projects (15,000 square yards or less).

Provide a minimum of two units at all times. Schedule these truck-mounted machines so that mixture production is never delayed more than 15 minutes. Stop production anytime there is noncompliance with this requirement.

Calibrate the mixing machines before use. Maintain documentation of calibration of each material metering device at various settings. Supply all materials and equipment, including scales and containers, necessary for calibration. Recalibrate after all changes in aggregate or asphalt emulsion sources.

420.4.1.2-Spreader Box: Attached to the machine shall be hydraulically adjustable (adjustable while applying mixture) type spreader box with a positive screed adjustment for yield control and a positive adjustment for the joint matcher.

Equipped with paddles or augers mounted on adjustable shafts to continually agitate and distribute the mixture to prevent stagnation, excessive build-up, or lumps. Equip spreader boxes with front and rear flexible seals to maintain direct contact with the road.

Use a secondary strike off attached to the spreader box to provide a finished smooth surface texture on the final pass or surface pass. Use a drag that produces a uniform finish.

420.4.1.3-Rut Box: Use a steel V configuration screed rut box specifically designed and commercially manufactured to fill ruts to perform all Micro Surface, rut-filling applications. Ensure a mixture spread width of 5 to 6 feet and use a secondary strike off to control crown on the rut box. The rut box must be equipped with a third strike off that may be used to control texture.

420.4.1.4-Miscellaneous Equipment: Provide hand squeegees, shovels and other equipment as necessary to perform the work. Provide cleaning equipment such as power brooms, air compressors, water flushing equipment, and hand brooms for surface preparation.

420.4.1.5-Lights on Equipment: Equip power brooms, distributors and truck mount spreaders with at least one approved, flashing, rotating or oscillating amber light that is visible in all directions. Equip continuous spreader units with one such light on each side.

420.4.2-Application: Micro Surfacing mixtures shall be applied in a manner to fill ruts, minor cracks and leave a uniform surface with straight longitudinal joints, transverse joints and edges.

If, indicated in the Contract documents, the Contractor shall apply a minimum of two courses of mixture, each applied separately to the entire pavement surface including the shoulder if indicated in the contract documents. When performing multiple course Micro Surfacing, the total application rate shall be a minimum of 30 pounds per square yard with the final surface course not less than 16 pounds per square yard.

a. Restored Cross-Section: The construction of the leveling course of Micro Surface, Multiple Course will restore the cross section of the driving lane within 1/4 inch as
measured transversely across the pavement with a 7-foot straight edge. The preceding will not apply to any pavement segment that is designed with a quarter crown cross slope or any area of the segment within 6 inches of the edge line, lane line, or centerline.

b. Rutfilling: Rutfilling is required when the rut depth is ½ inch or greater and the pay item is Micro Surface. Rutfilling shall use a Micro Surfacing mix with fine aggregate 3FA applied with an approved rut box for each designated wheel track. A clean overlap and straight edges shall be required between wheel tracks. Each pass of rutfilling shall be limited to a maximum depth of 1 inch. For each 1 inch of applied mix, an additional 1/8 inch crown is required for traffic consolidation. All rutfilling material should cure under traffic for at least twenty four (24) hours before additional material is placed.

Micro Surface, Single Course: A single course shall be applied full lane width in one course to the entire pavement surface including the shoulder if indicated in the contract documents at a minimum of 20 pounds per square yard by weight of dry aggregate.

420.4.3-Temporary Pavement Marking: Shall be in accordance with Section 636

420.4.4-Pre-paving Meeting: Hold an on-site pre-paving meeting with the Engineer before beginning work to review and discuss the following.
1. Detailed work schedule
2. Traffic control plan
3. Calibration of equipment
4. Mix design previously submitted to the Engineer
5. Equipment inspection, including transport units

420.4.5-Test strip: Test Strip(s) to demonstrate the mixing of materials and placement procedures of each mixing machine to be used on the project. Test strip shall be performed at the beginning of the first day production and on the roadway to be treated. The completed test strip (minimum 500 feet length) shall be reviewed to detect and correct any variances in surface texture, material ratio(s) and finished surface appearance. Additionally, the test strip will be used to establish the target job application rate.

420.4.6-Surface Preparation: Remove all plastic pavement markings using an abrasion method. Remove markings just before the surfacing operation.

Micro Surfacing shall not be placed on top of patches, Base Repairs, Edge Repairs, or any other asphalt pavement repairs for at least 14 calendar days.

Thoroughly clean the existing surface of all loose materials, vegetation, dirt, dust, mud and other objectionable materials at the time of placing the mixture. Remove animal remains and thoroughly wash the surface before placing the mixture.

Protect drainage structures, monument boxes, water shut-offs, etc., during application of bond coat, tack coat and mixture.

Apply bond coat according to section 408, except for the following on concrete surfaces, or as directed by the Engineer. Mix bond coat with one part emulsion to two-three parts water. Use the same emulsion as used in the production mixture. Apply the bond coat uniformly, at an application rate of 0.035-0.0700.05-0.12 gallons per square
yard and without excessive run off. Allow the bond coat to cure before placement of mixture.

Establish 1,000-foot intervals for the entire project, before placing the mixture. Clearly identify and maintain these intervals until project completion.

420.4.7-Surface Quality: Provide a finished surface free from excessive scratch marks, tears, rippling, and other surface irregularities. Do not leave ripples greater than 1/8 inch measured by a 10-foot straight edge. Do not leave tear marks greater than 1/2 inch wide and 4 inches long, or other marks greater than 1 inch wide and 1 inch long. If the finished surface exceeds the described tolerance, stop work immediately and determine appropriate correct action. Review corrective action with the Engineer before resuming production.

Place longitudinal construction joints and lane edges to coincide with the proposed painted lane lines. Construct longitudinal joints with less than 3 inches overlap on adjacent passes and no more than 3/8 inch overlap thickness as measured with a 10-foot straight edge. Place successive passes to prevent ponding of water on the up-slope side of the overlap. Construct neat and uniform transverse joints with less than a 1/8 inch difference in elevation across the joint as measured with a 10-foot straight edge. Provide neat and uniform lane edges with no more than 2 inches of horizontal variance in 100 feet. If defective joints or edges are placed, stop work and take corrective action and reviewed by the Engineer.

420.4.8-Traffic Control: Do not allow traffic on the mixture until it has cured sufficiently to prevent pickup by vehicle tires. The new surface must be able to carry normal traffic without damage within one hour of application. Protect the new surface from damage at intersections and driveways. Repair all damage to the mixture caused by traffic. All costs associated with this repair work will be borne by the Contractor. Otherwise Traffic Control will be in accordance with Section 636, and the Manual on Temporary Traffic Control for Streets and Highways, 2006 Edition, or as directed by the Engineer.

420.4.9-Weather and Seasonal Limitations:
1. Place the mixture when the air and pavement temperatures are at least 45 °F.
2. Do not place mixture in rain or inclement weather or when temperatures are forecast to be below 32 °F within 24 hours of completion of the work.

420.4.10-Quality Control: Produce a mixture that will meet the JMF and the quality control tolerances. Notify the Engineer immediately if the quality control test results exceed any of the tolerances and stop mixture production. Identify the cause of the excess deviation and determine the corrective action necessary to bring the mixture into compliance. Secure the Engineer’s approval before resuming work.

**Micro Surfacing Quality Control Tolerances**

| Aggregate Gradation Tolerances (±) from JMF |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Sieve Size      | # 4             | # 8             | # 16            | # 30            | # 50            | # 100           | # 200           |
| Tolerance       | 5.0%            | 5.0%            | 5.0%            | 5.0%            | 4.0%            | 3.0%            | 2.0%            |

General Quality Control Tolerances (±)

Parameter Tolerance
Micro Surfacing Quality Control Tolerances

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt Cement Content Single Test</td>
<td>0.5 % from JMF</td>
<td></td>
</tr>
<tr>
<td>Asphalt Cement Content Daily Average</td>
<td>0.2 % from JMF</td>
<td></td>
</tr>
<tr>
<td>Application Rate:</td>
<td>2 lb/sq yd (as determined by 1000 ft yield checks)</td>
<td></td>
</tr>
<tr>
<td>Sand Equivalent Test (ASTM D2419)</td>
<td>7% from JMF</td>
<td></td>
</tr>
</tbody>
</table>

Verify and document quality control with the following minimum measures:

1. **Fine Aggregate**: Sample from the project stockpile and test for gradation at one test per 500 tons of aggregate or one test per day of mixture production, whichever is greater.

2. **Sand Equivalent Test (ASTM D 2419)**: Perform a minimum of one test for each project aggregate stockpile gradation used in producing micro surface mixture for the project.

3. **Asphalt Content**: At least three times per day, on a random basis, calculate the percent asphalt content of the mixture using the equipment counter readings.

4. **Application Rate**: At least three times per day, on a random basis, calculate the yield of the course being placed using the equipment counter readings.

5. **Documentation**: Complete a daily report that includes the following information. Complete a separate daily report for each truck mounted machine:
   a. Control section, job number, route, Engineer
   b. Date, air temperature
   c. Control settings, calibration values
   d. Unit weight of emulsion (lbs/gal), percent residue in emulsion
   e. Beginning and ending intervals
   f. Counter readings (beginning, ending, and total)
   g. Length, width, total area (sq yd), weight of aggregate, gallons of emulsion
   h. Percent of each material including asphalt cement
   i. Application rate, (lbs/sq yd), combined application rate, (lbs/sq yd)
   j. JMF (percent Portland cement, percent emulsion, gradations, percent asphalt cement)
   k. Contractor’s authorized signature
   m. Calibration forms
   n. QC aggregate gradations
   o. Aggregate certification
   p. Asphalt emulsion bill of lading
   q. QC sand equivalent test results

For Quality Assurance purposes, samples for gradation will be taken from aggregate stockpiles designated by the Contractor for use. Additionally, samples for asphalt content will be taken from the completed mixture. The frequency of sampling and testing will be established by the Engineer based upon the Department’s current acceptance program and local conditions encountered.

**420.5- MEASUREMENT AND PAYMENT:**
Payment for Micro Surface, **Multiple Course** includes all materials, equipment, labor for preparing the surface, placing temporary pavement markings, placing the micro surfacing mixture and complying with all requirements, including the warranty. The placement includes application of a rut-filling and/or leveling course and a surface course for full width coverage as specified in the contract documents.

Payment for Micro Surface, **Single Course**, includes all materials, equipment, labor for preparing the surface, placing temporary pavement markings, placing the Micro Surfacing mixture and complying with all requirements, including the warranty. The placement includes application of a single course of mixture for full width coverage as specified in the contract documents.

The completed work as measured will be paid for at the contract unit price for the Items detailed in Section 420.6.

Materials placed in stockpiles or on the road not meeting the required tolerances may be accepted at a reduced price if it is not considered detrimental to the life of the treatment by the Engineer in accordance with ISSA A-143, Section 3. The following price adjustment schedule will be used when appropriate and applied accordingly to representative material:

(i.) One percent reduction in the bid price per square yard for each one-tenth percent the asphalt content is out of tolerance.

(ii.) One-quarter percent price adjustment in the bid price per square yard for each one percent that the aggregate gradation is out of the job mix range.

(iii.) One and a half percent reduction in the bid price per square yard for application rate dropping below the established rate by more than 2 lb/sq yd. If the application rate drops below the established rate by more than 3 lb/sq yd, the material will not be accepted and measures will need to be taken by the contractor to correct for such deficiency.

Price adjustments under 1, 2, and 3 above shall apply concurrently; however, price adjustment will not apply in the event the material is rejected. The disposition of rejected material will be subject to the approval of the Engineer.

### 420.6-PAY ITEMS:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>420001.*</td>
<td>Micro Surface Multiple Course</td>
<td>Square Yard (Meter)</td>
</tr>
<tr>
<td>420002.*</td>
<td>Micro Surface Single Course</td>
<td>Square Yard (Meter)</td>
</tr>
<tr>
<td>420003.*</td>
<td>Micro Surface Rut Fill</td>
<td>Ton (TN)</td>
</tr>
<tr>
<td>Micro Surface 2FA</td>
<td></td>
<td>Square Yard (Meter)</td>
</tr>
<tr>
<td>Micro Surface 3FA</td>
<td></td>
<td>Square Yard (Meter)</td>
</tr>
<tr>
<td>Micro Surface Leveling Course</td>
<td></td>
<td>Square Yard (Meter)</td>
</tr>
<tr>
<td>Micro Surface Wearing Course</td>
<td></td>
<td>Square Yard (Meter)</td>
</tr>
</tbody>
</table>

*Sequence number*
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 501
PORTLAND CEMENT CONCRETE PAVEMENT

501.23-BASIS OF PAYMENT:

DELETE SUBSECTION 501.23.1.1 AND REPLACE WITH THE FOLLOWING:

501.23.1.1-The core measurements which represent the thickness of the sampling units shall be analyzed to determine the average value of the pavement thickness. This value will be used to determine the degree of compliance with the provisions set forth in 501.19 and to develop certain factors to be used in the derivation of equitable deductions as set forth in 501.23.1.2 and 501.23.1.3, in the event the provisions of this Specification are not met.

No payment will be made for pavement areas deficient in thickness by more than 7.8%T, that are 0.922T or less in thickness, the area being defined in the manner set forth in 501.19.2. Any area of pavement which is deficient in thickness by more than 0.7 inches (18 mm) and is considered by the Engineer to be inadequate to perform satisfactorily shall be removed and replaced at no added cost to the Division. The balance of the item, the portion of the item not treated in the manner set forth above, will be treated in the manner set forth in 501.23.1.2 or 501.23.1.3.
615.3-MATERIALS:

615.3.2-High-Strength Fasteners:

615.3.2.1-Weathering Steel Bridges:

DELETE THE CONTENTS OF SUBSECTION 615.3.2.1 AND REPLACE WITH THE FOLLOWING:

615.3.2.1-Weathering Steel Bridges: High strength fasteners shall meet Section 709.24 and shall be Type 3 (weathering steel), per ASTM A325 F3125 Grade A325. High strength fasteners used in regions of the structure that require painting shall be Type 1 or 3, per ASTM A325 F3125 Grade A325, and mechanically galvanized in accordance with ASTM B695.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 622
TIMBER BRIDGE STRUCTURES

622.2-MATERIALS:

DELETE THE CONTENTS OF SUBSECTION 622.2.4 AND 622.2.6, AND REPLACE WITH THE FOLLOWING:

622.2.4-Preservative Treatment: Treatment of all sawn timber and lumber shall be by the Empty Cell process in accordance with the American Wood Preserver's Protection Association (AWPA) Standard C2 U1, UC4B. Treating solution shall be Coal Tar Creosote conforming to AWPA Standard P1. Treatment retention shall be 7.0 pcf (112.1 kilogram per cubic meter (kg/m³)) minimum and shall be determined by the gauge or weight method.

To the extent practical, all lumber and timber members shall be dimensioned, cut, machined and drilled fabricated prior to preservative treatment, except stress laminated deck lumber 2 inches (50 mm) or less in thickness, which can be drilled or cut to length after treatment. Deck lumber cut to length after pressure treatment Items that are field fabricated shall have the saw cut ends be treated in accordance with AWPA Standard M4. Holes in deck boards drilled to accept steel thread bars, to provide for void drains, or to attach guardrail and curbs do not require treatment of holes.

All surfaces shall be free of excess treatment solutions at the time of delivery to the job site.

622.2.6-Structural Glued-Laminated Timber (Glulam): All Structural Glued-Laminated Timber members shall be visually graded Southern Pine or visually graded Douglas Fir-Larch as shown on the drawings and specified below.

Materials, manufacture and quality control shall be in accordance with American National Standards Institute/American Institute of Timber Construction (ANSI/AITC) Standard A 190.1, Structural Glued-Laminated Timber, and shall provide allowable design values as shown on the Plans. All design values are based on wet condition of service. Adhesives shall meet the requirements of wet-use for wet conditions of service. Appearance of the members shall be industrial grade. Surfaces of members shall be not sealed and members shall not be wrapped. Members shall be marked with a Quality Mark and, in addition, a Certificate of
Conformance shall be provided to the Engineer to indicate conformance with ANSI/AITC A190.1, Structural Glued-Laminated Timber.

All Structural Glued-Laminated Timber members shall be preservative treated in accordance with AITC Standard 109, Standard for Preservative Treatment of Structural Glued-Laminated Timber and AWPA Standard U1, UC4B, Commodity Specification F,C28, Standard for Preservative Treatment of Structural Glued-Laminated Timber. Treating solution shall be Coal Tar Creosote conforming to AWPA Standard P1. Treatment retention shall be 12.0 pcf (192.2 kilogram per cubic meter (kg/m$^3$)) minimum, and shall be determined by the assay method. Incising is required prior to treatment for members manufactured from Douglas Fir Larch.

At the completion of the treating cycle, all structural glued-laminated material shall be cleaned by final steaming for three (3) hours at a temperature between 220˚ F (105˚ C) and 240˚ F (115˚ C).

All surfaces shall be free of excess treatment solution at the time of delivery to the job site.

To the extent practical, all Structural Glued-Laminated Timber members shall be dimensioned, machined, have holes bored and cut to proper length fabricated prior to preservative treatment, except diaphragms for Type B and C bridges may be trimmed to length for up to 1 inch (25 mm) after treatment provided the trimming is followed by re-treatment. Items that are field fabricated shall be treated in accordance with AWPA Standard M4. Holes bored for lag screws for Type B and C bridges may be done after preservative treatment provided all holes are treated in accordance with AWPA Standard M4.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 642
TEMPORARY POLLUTION

642.6-TEMPORARY PIPE, CONTOUR DITCHES, BERMS, SLOPE DRAINS, DITCH CHECKS, SILT FENCE, PREMANUFACTURED DITCH CHECKS AND SUPER SILT FENCE:

DELETE SUBSECTION 642.6.4 AND REPLACE WITH THE FOLLOWING:

642.6.4-Ditch Checks: Silt fence or bales of hay or straw shall be used to control erosion and trap sediment as required. Ditch checks shall be constructed in cut or median ditches by installing silt fence or by using wood, plywood, logs, rocks, steel, or other devices to control velocity and to aid in sediment control. A barrier constructed of clean, non-erodible rock or other manufactured devices (i.e. – triangular silt dikes, core logs, etc.) across a cut or median ditch. Ditch checks shall be constructed to control velocities, reduce erosion, and aid in sediment control.

642.7-METHOD OF MEASUREMENT:

DELETE THE 5TH PARAGRAPH AND REPLACE WITH THE FOLLOWING:

Inlet Protection and Dewatering Device will be paid per each device used.

642.9-PAY ITEMS:

DELETE ITEM 642011 FROM THE TABLE AND ADD ITEM 642040:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>642011</td>
<td>Hay or Straw Bale</td>
<td>Each</td>
</tr>
<tr>
<td>642040</td>
<td>Inlet Protection</td>
<td>Each</td>
</tr>
</tbody>
</table>

* Sequence number
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 660
TRAFFIC SIGNALS

660.19-METHOD OF MEASUREMENT:

660.19.2-Traffic Detectors:

DELETE SECTION AND REPLACE WITH THE FOLLOWING:

660.19.2-Traffic Detectors:

660.19.2.1-Traffic Detectors: Traffic detectors shall be measured per unit complete and in place, mounted in a cabinet or enclosure as required. This item shall consist of the detector tuning unit only. The roadway traffic sensors, such as loops, probes, etc., and associated cables outside of cabinet, shall be considered included in "Miscellaneous Signal" items. Any supplementary cabinets or other enclosures as required for the detector tuning units shall also be included in "Miscellaneous Signal".

660.19.2.2-Pedestrian Detector: Audible Pedestrian Detector Push Buttons will be measured as a complete unit in place in accordance with the Plans and these Specifications. The item shall include but not limited to power service, electrical conduit, audible pedestrian detector push button, and all wiring, appurtenances and work.

660.19.7-Miscellaneous Signal:

DELETE SECTION AND REPLACE WITH THE FOLLOWING:

660.19.7-Miscellaneous Signal: Miscellaneous signal items as required to complete a traffic signal system in accordance with the Plans or these Specifications shall be measured complete in place by intersection or control location. This item shall include but not be limited to power services, electrical conduit, vehicle sensors (loops, probes, etc.), pedestrian push buttons, and all wiring, appurtenances and work not included in other Contract items.
660.20-BASIS OF PAYMENT:

660.20.2-Traffic Detectors:

DELETE SUBSECTION 660.20.2 & 660.20.3 AND REPLACE WITH THE FOLLOWING:

660.20.2-Traffic Detectors: Pay item codes shall be as follows:

660.20.2.1-Traffic Detectors:

(LPS)-Loops
(PBS)-Probes
(VTDS)-Video Detection
(PAS)-CCTV (Closed Circuit Television)
(RADD)-Radar Advance Digital Detection

660.20.2.2-Pedestrian Detector:

(APS)-Accessible Pedestrian Stations

660.20.3-Signal Sections: Pay item codes shall be as follows:

(V-8)--8” ((V-203) -- 203 mm) Vehicle Signal Sections (R, Y or G)
(V-12)--12” ((V-305) -- 305 mm) Vehicle Signal Sections (R, Y, G or ARROW)
(V-8P)--8” ((V-203) -- 203 mm) Programmed Vehicle Signal Sections (R, Y or G)
(V-12P)--12” ((V-305) -- 305 mm) Programmed Vehicle Signal Sections (R, Y, G or Arrow)
(P-9)--9” ((P-229) -- 229 mm) Pedestrian Signal Sections (W-DW)
(P-12)--12” ((V-305) -- 305 mm) Pedestrian Signal Sections (W-DW)
(G-16)--16” ((G-405) – 405 mm) Pedestrian Control Signal Heads (W-DW)
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 707
CONCRETE ADMIXTURES, CURING AND COATING MATERIALS

707.4-POZZOLANIC ADDITIVES FOR USE IN PORTLAND CEMENT CONCRETE:
707.4.1

ADD THE FOLLOWING SUB-SECTION:

707.4.1.1-Fly ash with an amount retained on the No. 325 (45 µm) sieve >34% but ≤40% shall be considered as meeting specification requirements provided the following criteria are met:

i. 50% minimum reduction in mortar bar expansion when tested in accordance with ASTM C441. The alkali content of test mix shall be equal to or greater than the control mix.

ii. 0.1% maximum mortar bar expansion, at 16 days after casting, when tested in accordance with ASTM C1567. Graded Pyrex Glass shall be used as fine aggregate.
ADD THE FOLLOWING SUBSECTION:

707.18-FOAMING AGENT ADMIXTURES:
The foaming agent admixtures shall meet the requirements of ASTM C869.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 710
WOOD MATERIALS

DELETE THE CONTENTS OF SUBSECTIONS 710.3, 710.5, 710.7, AND 710.8, AND REPLACE WITH THE FOLLOWING:

710.3-PRESERVATIVE TREATMENT:
All wood products and preservative treatments used for highway and commercial use shall meet the requirements of AWPA Standard U1 and AASHTO M133.

The quantity retention of preservative shall be as required above, unless modified by the Plans or purchase order or as otherwise defined in these specifications, the plans or purchase order.

710.5-WOOD POSTS:
Wood posts shall meet the requirements of AASHTO M168 and AASHTO M133, and AWPA UC4B.

710.5.1- Blank.

710.5.2- Rectangular posts for guardrail shall be No. 1 major or minor species of Southern Pine as defined in Section 400 of the SPIB grading rules.

710.5.3- Dimensions of all guardrail posts except as noted on the Plans shall be as follows:

<table>
<thead>
<tr>
<th>Rectangular Guardrail Posts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size: 6” ±½” X 8”±¼” (152 mm ±6 mm by 203 mm ±6 mm) throughout the length except as noted on Plans</td>
</tr>
<tr>
<td>Length: 6’ ±½” (1 828 mm ±13 mm)</td>
</tr>
</tbody>
</table>

710.5.4- Dimensions of wood posts for fence and signs shall be as shown on the Plans.

710.7-COMMON LUMBER:

710.7.1- Common lumber is untreated and suitable for general construction and utility purposes. Common lumber is from 2 inches (50 mm) to, but not including, 5 inches (125 mm)
thick and is 2 inches (50 mm) or more in width. Common lumber shall be grade 2 or better, unless otherwise specified in the plans, when graded by the Board of Review of the American Lumber Standards Committee.

710.8-SERVICE AND LIGHTING POLES:

710.8.1- Wood Service or lighting poles shall be ANSI Class 5, or larger, or as called for on the contract plans. Lighting poles shall be southern yellow pine and service poles shall be either southern yellow pine or Douglas fir. The poles shall be pressure-treated) to meet the requirements of AWPA U1 UC4C (Commodities Specification D: Poles).
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 715
MISCELLAENOUS MATERIALS

715.42-TRAFFIC SIGNAL MATERIALS AND EQUIPMENT:
715.42.2-Solid State Traffic Actuated Signal Controllers:
  715.42.2.1-Definition of Terms:

ADD THE FOLLOWING:

  **Audible Pedestrian Detector:** A detector, usually of the push button type installed near the roadway, capable of being operated by hand, and having audible and vibratory features for both the purposes of location of the device and notification of the operations of the device.

DELETE THE FOLLOWING:

  **Pedestrian Detector:** A detector, usually of the push button type installed near the roadway and capable of being operated by hand.

715.42.5-Traffic Detectors:
  715.42.5.1-General Design Requirements:

DELETE THE NOTE AT THE END OF THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

  **NOTE:** The above general design requirements do not apply to **audible** pedestrian detectors. **Audible** pedestrian push buttons are covered in 715.42.5.4.

ADD THE FOLLOWING SUBSECTIONS:

  **715.42.5.3-Blank**
**715.42.5.4-Audible Pedestrian Push Buttons:** A solid-state digital, pole-mounted, pedestrian push button detector and appurtenances with audible and vibratory features to assist disabled users who have hearing and/or sight impairments. Appurtenances are to include the associated signal power interface or control board assembly to be mounted in the corresponding pedestrian signal head with the associated cabling.

The push button detector is to be MUTCD 2009, NEMA TS2 and ADA compliant, made of sturdy construction consisting of a base housing with a removable cover, a pushbutton with normally open contacts and include all electrical and mechanical parts required for operation. The detector shall include an adjustable automatic gain control with the associated microphone to keep audio output from 0 to 5 dB above ambient conditions.

The push button detector and its associated contacts and housing are to be resistant to mechanical shocks and abuse. The unit shall be able to withstand a concentrated force of 50 pounds (225 Newtons) applied to the button or any exposed portion without damage. Furnish a housing with geometry and/or hardware suitable for mounting on poles of various diameters. The removable cover assembly is to be fastened to the base housing with stainless steel machine screws resulting in a weatherproof and shockproof assembly.

The maximum force required to operate the pushbutton is 5 pounds (22.5 Newtons). Furnish a raised or flush pushbutton with a minimum of 2 inches (51 mm) at its smallest dimension.

Furnish pedestrian pushbutton signs that are a minimum thickness of 0.07-inch (1.8 mm) for steel or 0.10-inch (2.5 mm) for aluminum with baked enamel paint for steel signs and baked enamel paint or non-reflective sheeting for aluminum signs.
DELETE SUBSECTION 716.1.1 AND REPLACE WITH THE FOLLOWING:

716.1-GENERAL:
Material for embankment shall be suitable soil, granular material, shale, rock, random material, or borrow material. The material shall have dimension limitations in accordance with the contract documents.
Material for subgrade shall be granular material free of particles larger than 3 inches (75 mm).

716.1.1-Random Material: Random material shall be considered as a mixture of any or all of soil, granular material, or soft shale as described which are permitted by the Engineer to be used in embankment. These are materials that can be incorporated in a 6 inch (150 mm) compacted layer.

716.1.1.1-Soil: Soil material shall be considered as layers or deposits of disintegrated rock, lying on or near the surface of the earth; which has resulted from natural processes, such as weathering, decay or chemical action or a combination of these processes. Material shall be considered as soil when more than 25-50 percent by weight of the grains or particles pass the No. 200 (75 μm) sieve and the Liquid Limit shall not be more than 50 (determined by AASHTO T 89). Soil shall not contain particles larger than 3 inches.

716.1.1.2-Granular Material: Granular material shall be considered as natural or synthetic mineral aggregate, such as broken or crushed rock, gravel, sand, or slag. Shale or fly ash shall not be considered granular material. Granular material shall have not more than 25-50 percent by weight of grains or particles passing the No. 200 (75 μm) sieve (determined by AASHTO T-27) and the plasticity index shall not be more than 6 (determined by AASHTO T-90). Granular material shall not contain particles larger than 3 inches.

716.1.1.3-Soft Shale: Soft shale shall be considered as any of the shales, weak sandstone, weak limestone, claystones or siltstones that break down using the following roller test. Rock which break down under three complete coverages with a steel drum
roller, meeting the following requirement, shall be classified as soft shale to be placed as specified in 207.7.3.2.1. Smooth drum rollers shall provide a minimum 1.5 tons per linear foot of roller width and drum rollers with any type of feet (sheep’s foot, tamping foot, and etc.) shall provide the same minimum of 1.5 tons per linear foot of roller drum width. This criteria applies to single and multiple drum rollers as well as vibratory rollers with the vibration set to maximum. This criteria shall be calculated for each roller and test combination by dividing the operating weight of the roller in tons by the total measured width of the drum in feet, or the total of all drums if more than one drum. This calculation shall be provided to the Engineer in writing prior to the test. The contractor shall provide the roller or rollers and any other necessary equipment for this test without additional compensation.

716.1.2-Rock: Rock is defined as sandstone, limestone, or concrete that cannot be incorporated in a 6 inch (150 mm) compacted lift and shall be medium hard or harder.

716.1.3-Hard Shale: Material that meets the description of shale in 716.1.1.3 except that it does not break down under the hardness test shall be considered as hard shale and placed as specified in 207.7.3.2.2 when used as embankment material.

716.1.4-Borrow Material: Borrow shall consist of approved material required for the construction of embankments and other portions of the work and shall be subject to the applicable provisions of 211.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPPLEMENTAL SPECIFICATION
FOR
SECTION 716
EMBANKMENT AND SUBGRADE MATERIAL

716.1-GENERAL:
716.1.1-Random Material:

DELETE SUBSECTION 716.1.1.2 AND REPLACE WITH THE FOLLOWING:

716.1.1.2-Granular Material: Granular material shall be considered as natural or synthetic mineral aggregate, such as broken or crushed rock, gravel, sand, or slag. Shale or fly ash shall not be considered granular material. Granular material shall have not more than 25 percent by weight of grains or particles passing the No. 200 (75 µm) sieve (determined by AASHTO T-27) and the plasticity index shall not be more than 6 (determined by AASHTO T-90). Granular material may have a maximum of 50 percent of reclaimed asphalt pavement (RAP), and shall be uniformly blended with the percent of RAP determined visually.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION
FOR
STATE PROJECT NUMBER: __________________________
FEDERAL PROJECT NUMBER: __________________________

SECTION 601
STRUCTURAL CONCRETE

601.1-DESCRIPTION:

ADD THE FOLLOWING TO THE END OF THE SECTION:

This specification describes additional requirements for the Shotcrete method of performing Patching Concrete Structures. Coordinate the work described with the requirements for installing galvanic anodes as required. The maximum depth of repair for which shotcrete can be utilized is 6 inches.

601.2–MATERIALS:

ADD THE FOLLOWING TO THE END OF THE SECTION:

(a) Cement. Section 701.1
(a) Fine Aggregate. Section 702.1
(b) Water. Section 715.7
(c) Reinforcement Bars. Section 709.1
(d) Fabric Reinforcement. Section 709.4. Use fabric reinforcement, consisting of galvanized, welded straight-line fabric, conforming to one of the following:
   1. No. 12 gage wire, spread 2 inches in each direction;
   2. No. 10 gage wire, spaced 3 inches in each direction;
   3. or approved alternative.
(e) Burlap. Section 707.7
(f) Liquid Membrane-Forming Curing Compound, Clear. Section 707.9
(g) Expansion Bolts. Submit manufacturer and type for approval.
601.10–PLACING CONCRETE:

ADD THE FOLLOWING TO THE END OF THE SECTION:

(a) Preparation of Structure. Thoroughly clean the surfaces and voids of rust, scale, grease, loose and disintegrated particles, and material that might impair the bond between the surfaces to be covered and the shotcrete mortar mixture. Remove unsound concrete, as directed. Clean by means of compressed air and waterblasting, by handscraping, and by sandblasting, if necessary.

(a) Placing Reinforcement. Lap adjacent sheets of fabric at least 4 inches for 2-inch mesh and at least 6 inches for 3-inch mesh. Fasten fabric together with wire ties at intervals of not more than 18 inches. In areas of buildup for the replacement of disintegrated material, unless otherwise indicated or directed, place a layer of fabric for each 3-inch layer of shotcrete mortar or fraction thereof. More than one layer of fabric may be attached to an anchor bolt, provided the bolt is long enough. Hold the fabric in place by means of lead-collared expansion bolts, either 1/4 inch by 3 inches, or 3/8 inch by 4 inches. Use longer bolts, where necessary. Space 1/4-inch diameter bolts approximately 20 inches center-to-center in each direction, starting 3 inches from the outside edges of the areas to be shotcreted. Space 3/8-inch diameter bolts approximately 30 inches center-to-center in each direction, starting 6 inches from the outside edges of the areas to be shotcreted. Fasten the fabric to the expansion bolts away from the prepared surface, with 1 inch clear below the finished surface of the repair. Where existing reinforcement is exposed due to removal of deteriorated concrete, fabric may be tied to this reinforcement at 18-inch intervals, to form a cage to position and support the fabric within 1 inch of the finished surface of repair. Avoid excessive fabric layers, which may create planes of weakness or internal stresses.

(b) Mixing Shotcrete Mortar (Mortar). Mix the mortar of one part cement and 3 1/2 parts fine aggregate. Thoroughly dry-mix the mortar in a batch mixer. Screen the dry-mix and remove material retained on a No. 4 sieve, before placing the mixture in the hopper of the mortar pressure gun. Do not mix more than 1 hour’s supply of mortar at a time. Keep the mixture in the gun bin thoroughly stirred.

(c) Pressures. At the gun, supply air pressure of at least 35 pounds per square inch when shooting the mixture. Increase the air pressure, as necessary, when the lift is greater than 25 feet, or when using more than 100 feet of hose. Maintain uniform air pressure. At the nozzle, maintain a uniform water pressure of at least 15 pounds per square inch greater than the air pressure at the gun. Supply pressure in the lower gun chamber to produce a nozzle velocity of 375 feet per second to 450 feet per second, with a 1 1/4-inch tip opening. Vary these pressures and velocities only when directed. Determine the nozzle pressure and velocity from the nozzle velocity meter attached to the gun.

(d) Moisture Content of Mortar. Use approximately 8% to 10% moisture, by weight, when shooting, of approximately 3 1/2 gallons of water per bag of cement. Do not use a greater quantity of water than necessary to produce a proper mixture. When using reinforcement fabric, supply a moisture content of approximately 8%, for mortar below the fabric, and approximately 9% to 10% above the fabric.
(e) Application. Perform work under the continuous supervision of an experienced pressure gun foreperson, using only experienced personnel as gun and nozzle operators. Saturate the surfaces with clean water before applying mortar. Use guide strips at corners and other places, where necessary, to ensure true lines, corners, and the placement of specified thickness, dimensions, and designs. Bring mortared surfaces to a reasonably true plane, then finish the entire mortared area with a pressure-gun finish. Apply the main body of the mortar in at least two coats. Apply bottom surfaces in at least two coats to obtain proper adhesion and to avoid sagging. Bring the last main coat to within 1/8 inch of the proposed surface, then correct irregularities and remove high spots with trowels. Give the entire surface a thin coat of mortar, but do not trowel or float. If directed, give the final surfaces a finish using a long-bristled brush, saturated with clean water, then dragged over the surfaces. Do not work the surfaces with the brush. Fill voids with mortar, making the surface flush with the adjacent face of the structure. Shoot mortar at right angles to the surface, holding the gun nozzle approximately 3 feet from the surface, when using a 3/4-inch or a 1-inch nozzle, or 4 feet from the surface, when using a 1 1/4-inch nozzle. Use a shorter distance only where working space requires closer shooting. Remove deposits of loose fine aggregate. If any deposit of loose, fine aggregate is covered by succeeding layers of mortar, remove the surfacing and replace with suitable mortar. At the end of a day’s work or at other required stopping periods, slope off the mortar to a thin edge. Do not use square joints. Before shooting the adjacent section, joining new work to old work, or placing additional coats, clean this sloped portion, old work, or previous coat. Saturate the previous coat by a combination of air and water blasting. Do not place mortar unless the air temperature or the surface on which it is placed is 50 degrees F or higher.

(f) Curing. Immediately after initial hardening, saturate mortar and keep wet for a period of at least 96 hours. Protect placed surfaces with burlap. Keep burlap wet during this curing period. If allowed as an alternative to burlap curing, apply Liquid Membrane Forming Curing Compound. Cure in cool and cold weather, as specified in Section 601.9.1.

(g) Backfilling. For spaces excavated around areas being surfaced, backfill with acceptable embankment material in layers no more than 4 inches in depth. Thoroughly compact mechanically.

601.14–METHOD OF MEASUREMENT:

ADD THE FOLLOWING TO THE END OF THE SECTION:

This work is a method of performing concrete placement for Item 601030-001 Patching Concrete Structures. This work is included in that item which is measured by square feet.

601.15–BASIS OF PAYMENT:

This work is a method of performing concrete placement for Item 601030-001 Patching Concrete Structures, and payment will be included in that item.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION
FOR

STATE PROJECT NUMBER: __________________________
FEDERAL PROJECT NUMBER: __________________________

SECTION 601
STRUCTURAL CONCRETE

601.1-DESCRIPTION:

ADD THE FOLLOWING TO THE END OF THE SECTION:

This work consists of installing embedded galvanic anodes in conjunction with Patching Concrete Structures (removing all loose, disintegrated and delaminated concrete; preparing the surface; furnishing and placing reinforcing steel as required; placing forms; and placing concrete patches, including curing of same).

601.2–MATERIALS:

ADD THE FOLLOWING TO THE END OF THE SECTION:

Furnish pre-manufactured galvanic anodes designed for cathodic protection when embedded in concrete and tied to steel reinforcing. The core of the anode shall consist of a minimum of 100 grams of electrolytic high grade zinc in compliance with ASTM B 418 Type II cast around a pair of steel tie wires and encased in a highly alkaline cementitious shell with a pH of 14, or encased in a material that uses activation methods to assure performance. The anodes shall have one side that is less than 1½-inches in height.

Furnish galvanic anodes in accordance with these specifications. Supply a certification of compliance to the engineer before starting work. Deliver, store, and handle all materials according to the manufacturer’s instructions.

Repair concrete shall be hydraulic cement-based material with a 28-day moist cured electrical resistivity less than 15,000 ohm-cm according to ASTM C 1760. Concrete mixes containing high levels of supplementary cementitious materials such as silica fume, ground-granulated blast furnace slag, fly ash or metakaolin may not meet the resistivity requirement.
601.10–PLACING CONCRETE:

DELETE THE SECTION AND REPLACE WITH THE FOLLOWING:

601.10–GALVANIC ANODE INSTALLATION:

Install embedded galvanic anodes in accordance with manufacturer’s recommendations, as shown on the plans, and as listed in this specification.

1. Install galvanic anodes to existing reinforcement along the perimeter of the repair at spacing as specified on the plans. In no case shall the distance between anodes exceed 30 inches nor shall the distance between the anode and the edge of the repair exceed 6 inches.

2. Provide a 1-inch clearance between anodes and substrate to allow repair material to encase anode. If necessary, increase the size of the repair cavity to accommodate the anodes.

3. Secure the galvanic anodes as close as possible to the patch edge using the anode tie wires (bare wire). Wrap tie wires around the cleaned and uncoated reinforcing steel at least one full turn in opposite directions and then tighten the tie wires to allow little or no free movement. If the anode is to be tied onto a single bar, or if less than 1½-inch of concrete cover is expected, place anode beneath the uncoated bar and secure to reinforcing steel. If 1½-inch concrete cover will exist over the anode, the anode may be placed at the intersection between two bars and secured to each bar.

Confirm electrical connection between every anode tie wire and uncoated reinforcing steel with a multi-meter. The maximum DC resistance shall be 1 Ohm. Confirm electrical continuity of every exposed uncoated reinforcing steel within the repair area. Steel reinforcement shall be considered continuous when the DC resistance is 1 Ohm or less. If necessary, establish the electrical continuity with uncoated steel tie wire.

Provide the Engineer a report documenting the resistance measurement for every reinforcing bar in each repair area. The report shall be signed by the contractor’s employee responsible for supervision of the repair work.

601.14–METHOD OF MEASUREMENT:

ADD THE FOLLOWING TO THE END OF THE SECTION:

There will be no separate pay item for this work.

601.15–BASIS OF PAYMENT:

ADD THE FOLLOWING TO THE END OF THE SECTION:

This work is incidental to Item 601030-001 Patching Concrete Structures.
No additional payment shall be made for furnishing and installing the Galvanic Anodes. Payment for furnishing and installing Galvanic Anodes shall be included in the price bid for the concrete patching.

NOTE:
Do not use this specification for patch areas less than 5 ft². Anode spacing shall be specified by the designer. Anode spacing is dependent upon the reinforcing steel density; chloride content; and amount of zinc per anode. The density of the reinforcing steel is the total surface area of the bar (ft²) within a square foot of concrete (regardless of depth). Corrosion levels in the concrete can be broken into three measurable categories based on ASTM C 1152 Acid-Soluble Chloride of Mortar and Concrete: Light corrosion levels: < 4 lb/yd³, Moderate corrosion levels 4 to 8 lb/yd³ and High corrosion levels: > 8 lb/yd³. In lieu of coring to determine chloride thresholds, the following general guidelines may be considered: Light corrosion for concrete aged 0-15 years and exposed to deicing salt or concrete of any age not directly exposed to deicing salt; Moderate corrosion for concrete aged 16-30 years and exposed to deicing salt; High corrosion for concrete 31 years and older and exposed to deicing salt. The following anode spacing guidelines are based a minimum zinc content of 100 grams per anode and to mitigate the initiation of new corrosion activity:

<table>
<thead>
<tr>
<th>Steel Density Ratio</th>
<th>Light Corrosion Levels</th>
<th>Moderate Corrosion Levels</th>
<th>High Corrosion Levels</th>
</tr>
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<tr>
<td>&lt; 0.3</td>
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<td>30</td>
<td>30</td>
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<td>0.31 – 0.6</td>
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<td>0.61 – 0.9</td>
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<td>20</td>
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<td>0.91 – 1.2</td>
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<td>1.21 – 1.5</td>
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<td>16</td>
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<tr>
<td>1.51 – 1.8</td>
<td>18</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>1.81 – 2.1</td>
<td>17</td>
<td>14</td>
<td>12</td>
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</tbody>
</table>
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION
FOR

STATE PROJECT NUMBER: ____________________________
FEDERAL PROJECT NUMBER: ____________________________

SECTION 601
SECTION STRUCTURAL CONCRETE

601.1-DESCRIPTION:

ADD THE FOLLOWING TO THE END OF THE SECTION:

This specification describes the Epoxy Bonding Compound to be used for this contract as required when Patching Concrete Structures is necessary prior to FRP Wrap System installation.

601.2–MATERIALS:

ADD THE FOLLOWING TO THE END OF THE SECTION:

Provide an Epoxy Bonding Compound conforming to ASTM C881 Type V, Grade 2 and of a class chosen based on the temperatures expected during application. Submit a copy of the manufacturer’s recommendations for proper application to the Engineer. Apply the compound according to the manufacturer’s recommendations.

Epoxy Bonding Compound shall be used neat with no aggregate added.

601.10–PLACING CONCRETE:

DELETE SUBSECTION 601.10 AND REPLACE WITH THE FOLLOWING:

601.10–EPOXY BONDING COMPOUND CONSTRUCTION REQUIREMENTS:

Surfaces to which the compound is to bond shall be clean and sound. They may be dry, damp or wet (without standing water). Dust, laitance, grease, curing compounds, impregnations, waxes, foreign particles and disintegrated material shall be removed. Temperature of concrete surfaces shall be 40°F or higher.
When the work requiring the Epoxy Bonding Compound is to be accomplished during periods of temperatures below 40°F, the proposed material to be used shall be submitted to the Engineer for approval.

The mix proportions of the epoxy system shall be as specified by the manufacturer. To insure intimate blending of the components, the Contractor shall use a 1/2 inch low-speed portable electric drill (400-600 rpm) fitted with a suitable mixing paddle. The mixing time shall be not less than three minutes and not more than five minutes. These times shall be carefully adhered to since a period shorter than the minimum can result in inadequate mixing; while a prolonged mixing time may result in premature gelation of the material.

Epoxy Bonding Compound shall be applied by spray with approved spray equipment. New concrete must be placed while bonding compound is still tacky. If bonding compound becomes glossy and loses tackiness, it shall be recoated.

601.14–METHOD OF MEASUREMENT:

ADD THE FOLLOWING TO THE END OF THE SECTION:

There will be no separate pay item for this work. The epoxy bonding compound will be applied to existing concrete surfaces where new patching material will be applied.

601.15–BASIS OF PAYMENT:

ADD THE FOLLOWING TO THE END OF THE SECTION:

This work is incidental to Item 601030-001 Patching Concrete Structures. No additional payment shall be made for furnishing and installing the Epoxy Bonding Compound. Payment for furnishing and installing Epoxy Bonding Compound shall be included in the price bid for the concrete patching.
601.1-DESCRIPTION:

ADD THE FOLLOWING TO THE END OF THE SECTION:

This work shall consist of sealing cracks in the existing concrete members as required with a pressure injected epoxy resin, prior to FRP wrap installation.

601.2–MATERIALS:

ADD THE FOLLOWING TO THE END OF THE SECTION:

Material to be injected shall be a high-modulus, low viscosity, high-strength epoxy conforming to ASTM C881 Type IV, Grade 1 and of a class chosen based on temperatures expected during installation. Submit a copy of the manufacturer’s recommendations for proper installation to the Engineer. Perform injection in accordance with the manufacturer’s recommendations.

Other materials such as crack surface sealing material and injection entry ports shall be as recommended by the manufacturer and approved by the Engineer. Such material shall be compatible with the material to be used for crack injection.

601.10–PLACING CONCRETE:

DELETE SUBSECTION 601.10 AND REPLACE WITH THE FOLLOWING:

601.10–EPOXY INJECTION CRACK REPAIR CONSTRUCTION REQUIREMENTS:
1. **Delineation**—All cracks to be sealed shall be delineated by the Engineer. Approximate locations and crack lengths are shown on the contract drawings.

2. **Preparation for Repairs**—The surfaces shall be prepared before application of epoxy injection resin. The adjacent areas surrounding the cracks shall be cleaned of efflorescence, deteriorated concrete, petroleum, rubber deposits and other contaminants considered detrimental to adhesion. Large cracks may be rutted or "veed" to accommodate insertion of injection ports of entry. All cracks may be slotted to facilitate installation of injection ports. Injection ports shall be glued in place at spacings recommended by the manufacturer. The surface of the crack and the areas surrounding the entry ports shall be sealed with a compatible epoxy mortar or gel. The seal shall be applied in such a manner that the epoxy injection resin shall be sealed until initial cure.

3. **Making Epoxy Resin System**—The epoxy resin system shall be mixed as per manufacturer's instruction with a minimum three (3) minute mixing time using a low speed (400-600 RPM) electric drill with an approved mixing paddle. The mixing may also be accomplished by an injection machine capable of metering and mixing the specific proportions of components within a tolerance of ±5 percent.

4. **Injection Procedure**—The crack shall not be injected until after the surface sealer had hardened. The epoxy may be injected by means of a hand gun, pressure pot or injection machine or as recommended by the manufacturer. Injection should start at the lowest point on the crack. When material begins to flow from the next higher entry port, the nozzle is removed, the port plugged, and the nozzle inserted in the next higher entry port. The operation is continued until the crack is completely filled. After the epoxy material has achieved an initial cure the entry ports shall be removed and, if required, the area patched with the same material used to seal the rest of the crack surface.

5. **Application Limitations**—Epoxy materials shall not be applied or injected if the ambient temperatures are below 40°F.

6. **Disposal**—All packaging debris, injection ports, etc. used during the crack repair procedure shall be properly disposed of by the Contractor.

**601.14—METHOD OF MEASUREMENT:**

ADD THE FOLLOWING TO THE END OF THE SECTION:

The designated cracks to be repaired by this procedure will be measured in place in linear feet.

**601.15—BASIS OF PAYMENT:**

ADD THE FOLLOWING TO THE END OF THE SECTION:

Epoxy injection crack repair will be paid for at the contract unit price per linear foot, complete in place, which price shall include all preparation; furnishing, mixing and injecting the epoxy resin; and doing all the work herein prescribed in a workmanlike and acceptable manner, including all labor, tools, equipment, scaffolding, supplies, and incidentals necessary to complete the work.
601.16–PAY ITEM:

ADD THE FOLLOWING ITEM TO THE TABLE:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>601031-001</td>
<td>Epoxy Injection Crack Repair</td>
<td>Linear Foot (Meter)</td>
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WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: ________________________________

FEDERAL PROJECT NUMBER: ________________________________

SECTION 601
STRUCTURAL CONCRETE

601.13-PROTECTIVE SURFACE TREATMENT:

601.13.3-Concrete Protective Coating:

DELETE THE CONTENTS OF SUBSECTION 601.13.3, 601.13.3.1, 601.13.3.2 AND REPLACE WITH THE FOLLOWING:

601.13.3-Concrete Protective Coating: This section covers requirements for materials to be used as surface finishes for designated surfaces of concrete structures. The masonry coatings must hide form marks, patches, and other minor irregularities and prevent deterioration, spalling, and other damage to the concrete due to the action of the weather and deicing chemicals. These materials must have protective and corrosion resistance properties. The storage life will be based on manufacturer recommendations. The Engineer will inspect all concrete surfaces to be coated as stated in the plans and/or contract documents. The field painting (coating) of concrete structures shall follow the provided requirements set forth in this specification unless otherwise noted in the Contract. This specification shall apply to surface preparation, coating application, contractor responsibilities, environmental and worker protection, and waste handling/disposal. All structures shall be pre-cleaned and washed in accordance with Section 685 of the Standard Specifications. The Engineer will ensure a satisfactory ordinary surface finish prior to coating operations. This section shall apply only when the pay item for concrete protective coating is included in the plans.

601.13.3.1-Physical Requirements of Coating: An independent testing laboratory acceptable to the Department shall perform the tests described herein on representative samples of the material. Tests listed herein are the minimum testing requirements to be met. When requested in writing, the Engineer may accept materials based on conformance to the same type of test but differing on minor procedural points. Attach copies of test procedures which differ from those stated herein.
i. **Freeze-Thaw Test.** Cast and cure 3 concrete specimens no less than 4 by 6 by 6 inches (100 by 150 by 150 mm). Moist cure specimens for 14 days and then dry in room air at 60° to 80° F (15° to 27° C) for 24 hours before applying protective coating. Ensure that there is no excessive oil on specimen forms. Coat sides of specimens (brush permitted) according to the manufacturer’s directions at a rate of 50± 10ft2/gal (1.75± 0.35 m2/L) and cure at room temperature for 48 hours, after which:

1. Immerse in water at room temperature 60° to 80° F (15° to 27° C) for 3 hours and remove.
2. Place in cold storage at 5° F (-15° C) for one hour and remove.
3. Thaw at room temperature, 60° to 80° F (15° to 27° C) for one hour.
4. Repeat steps 1), 2) and 3) to complete a total of 50 cycles. At the end of 50 cycles of the Freeze/Thaw Test, ensure that the coated specimens show no visible defects.

ii. **Salt Fog:** Apply the masonry coating to concrete at a rate of 50± 10ft2/gal (1.75± 0.35 m2/L), and test the coating according to ASTM B 117. Expose the coating to a 5 percent sodium (salt) solution for 300 hours, and maintain it at 194° ± 4° F (90± 2° C) during the period of exposure. Ensure that it shows no loss of adhesion or deterioration at the end of the 300 hours.

iii. **Fungus Growth:** Ensure that like protective coatings passes a fungus resistance test as described by federal specifications TT-P-29. After a minimum incubation period of 21 days, ensure that no growth is exhibited on the coatings.

iv. **Color:** The color choices permissible are from SAE International AMS-STD-595 A. The color difference, ΔE, of the acceptance samples shall not be more than five units from the Standard Numbers- 37925, 36650, 37925, 36622.

### 601.13.3.2-Concrete Surface Preparation:
All concrete surfaces to receive a protective coating shall be prepared in accordance with SSPC-SP 13, Surface Preparation of Concrete, SSPC-The Fundamentals of Cleaning and Coating Concrete, ASTM D4258-Standard Practice for Surface Cleaning Concrete for Coating. All surfaces to receive a protective coating shall be thoroughly cleaned and kept free of oil, form oil, grease, dust, dirt, mud, curing compound, release agents, loose patching mortar, or any other substances that may prevent bonding.

### 601.13.3.3-Paint Application Requirements:
The following surfaces shall be coated, including all beveled edges

1) Bridge Abutments and Wingwalls – Every exposed surface above a point six inches below ground or fill line. Exclude where epoxy coating is applied.
2) Bridge Pier Caps – The tops (including exposed surfaces of pads, pedestals, and keys), sides and ends. Do not apply the coating to bearing areas. Exclude where epoxy coating is applied.
3) Bridge Superstructure – The tops, inside and outside faces, and ends of all barrier walls, parapets, curbs, and points that will be exposed. Do not apply the coating to the riding surface of the bridge deck.
4) Exposed Surfaces of Substructure and the Superstructure – all surfaces identified in 1), 2), and 3) above and the underneath surfaces of slab overhangs
that are outside of exterior girders and the exterior side and bottom of exterior beams or girders, the interior windows of barriers, and all exposed surfaces of piers and abutments. Extend the masonry coating from a point six inches below ground line to the top of the exposed surface.

5) Any other area as designated within the contract plans not mentioned above

601.13.3.3.1-Weather Conditions: Painting shall not be done when the ambient temperature is below 40° F (5° C) or above 100° F (38° C), or the relative humidity above 90 percent. Painting shall not be performed when the surface to be coated is sufficiently hot to cause blistering of the film or too rapid solvent release. Painting will only be permitted between the dates of April 15th through October 15th. There will be no painting permitted to occur in a heated containment.

601.13.3.3.2-Paint Storage: Paint and thinners shall be stored in a temperature-controlled environment between 40° F (5° C) and 100° F (38° C). At no time will paint be used beyond the manufacturer’s shelf life.

601.13.3.3.3-Paint Application: The cleaned surface shall be painted within 24 hours. The paint shall be applied by spray, brush or roller methods. Brushes or rollers, when used, shall have sufficient body and length of bristle or roller nap to spread a uniform coat. Small touch-up areas may be brushed or rolled, if approved by the Engineer.

Use of an agitated pot shall be mandatory in spray application. The agitator or stirring rod shall reach within 1 inch (25 mm), of the bottom of the pot and shall be in motion at all times during paint application. Coatings shall be mixed in strict accordance with the coating manufacturer’s written instructions. Under certain conditions, it may be necessary to thin or adjust the solvent balance of the paint. The type and amount of solvent to be used shall be that listed on the coating manufacturer’s product data sheet for that material. Upon thinning, the dry film thickness requirement shall still be met by appropriately increasing the wet film thickness.

Application requirements and drying times between coats shall be in accordance with the manufacturer’s recommendations.

Spray guns must be equipped with the recommended size tip for the paint product being applied and shall be held perpendicular (90 degrees) to, and at, the proper distance from the receiving surface. Complete protection shall be provided by the contractor against paint spatter, spillage, overspray, wind-blown paint, or similar releases.

Appropriate containment shall be placed around the work area to protect public and private property. Staging must be adequate to provide access to all areas being painted. Violation of these requirements causing excessive paint waste will be justification for the WVDOD Engineer to order the Contractor to cease all work on the project until corrective action has been taken. The method of cleaning and/or replacement shall be submitted to the Engineer in advance for approval.

Coating application shall be suspended any time the ambient temperature or the temperature of the concrete does not comply with the coating manufacturer’s recommendations.

Prior to application of the materials, furnish the Engineer with copies of the coating material manufacturer’s brochures or booklets. Apply protective coating materials in strict
conformity with the manufacturer’s written instructions and apply the material at a uniform rate of at least 50± 10 ft²/gal (1.75± 0.35 m²/L).

Satisfactorily repair or remove any portions of the coating that are not clean, uniform in color, texture, thickness, tightly bonded, or that are damaged before final acceptance of the project and replace them with an acceptable finish and coating. Provide a neat uniform appearance, and prevent the coating from being dripped, sprayed, or otherwise deposited upon concrete and surfaces not designated to receive the coating. Remove any objectionable deposits or material and repair the surfaces to the Engineer’s satisfaction.

601.13.3.4-Environmental, Worker Protection, and Waste Handling:

601.13.3.4.1-General: Environmental protection shall be used when cleaning, painting, welding or cutting an existing bridge. The containment class, emission assessment methods and levels as defined by the current revision of SSPC Guide 6 shall be as stated in the contract documents. The specific pollution control system which is proposed for the complete capture, containment, collection, and disposal of the “spent material” generated by the work shall be included in the plan.

601.13.3.4.2–Permits for Disposal of “Spent Material”: Shall be in accordance with Section 107.2, Permits, Licenses, and Taxes or any other applicable sections of Section 107. The “spent material” shall not be disposed of until authorized by the Engineer and in no case shall “spent material” be allowed to accumulate longer than 90 days prior to transport.

601.13.3.4.3-“Spent Material”: This shall include material generated by surface preparation operations and shall be sampled and tested in accordance with the current revision of SSPC Guide 7 The Contractor shall, at the Contractor’s expense, select a laboratory that will sample and analyze the “spent materials”. The laboratory must be certified by the WVDEP, EPA or by another state’s DEP-equivalent. Certification will be provided to the Engineer prior to the beginning of work. The waste transporter for both hazardous and non-hazardous waste will be listed on the Contractor’s Containment/Disposal Control Plan.

601.13.3.4.4-Additional Requirements for All Classes of Containment: Contractor will provide ground covers beneath the containment area and all equipment where spills are possible to capture inadvertent spills or leaks of debris. Extend the covers a minimum of 5 feet beyond the area to be covered. Debris shall be removed from the covers at least once per shift, or as directed by the Engineer. If the ground beneath the structure serves as the base of the containment, install and maintain air and dust impenetrable materials such as solid plywood panels or flexible materials such as tarpaulins. Provide explosion-proof lighting inside containment for all paint application. Maintain a minimum of 10 foot-candles for surface.

601.13.3.5-Concrete Protective Coating Materials: Select masonry coatings from the Department’s List of Approved Materials. Use a material that is readily recognizable by its name, trademark, container, or other feature. For materials not currently on the
Department’s List of Approved Materials, the manufacturer shall submit copies of certified test reports to Materials Control, Soils and Testing (MCS&T) Division for review and approval. An independent testing laboratory acceptable to the Division shall perform the tests described herein on representative samples of the material. Tests listed herein are the minimum testing requirements to be met. Attach copies of test procedures which differ from those stated herein. In addition, provide brochures or booklets containing detailed instructions and explanatory remarks about surface preparation, application procedures, and other pertinent operations.

**601.13.3.6-Inspection Requirements:**

**601.13.3.6.1-Inspection of Applied Paint:** If in the opinion of the Engineer the coating has flaws other than deficiencies in the prescribed dry film thickness, the material shall be repaired or shall be removed and replaced. Defects in the film, including but not limited to runs, sags, mud-cracking, lifting, overspray, dry spray, pinholes, and holidays shall be corrected until a continuous uniform film has been applied.

Excessive film thickness shall be reduced and insufficient film thickness shall be increased. If the thickness of the finish coat is reduced, a thin coat of the finish shall be reapplied to seal the surface and to blend the area into the surrounding coating. Depending on the defect, total removal and replacement of the effected coating may be required. No unsightly runs or sags shall be visible. All "mud-cracking" and/or "dry overspray" in the paint film shall be removed. Excessive bubbles or pinholes shall not be visible in the coat after examination under 8X magnification. Calibration of the thickness gage and dry film thickness measurements shall be in accordance with MP 708.40.00.

**601.13.3.6.2-Access for Inspection:** The Contractor shall furnish suitable safe access and shall provide a time mutually agreed to for inspecting the structural concrete prior to and after each coating. The Division’s inspector shall approve all repairs. When providing suitable safe access, rubber rollers or other protective devices shall be used. Metal rollers or clamps and other types of fastenings that will mar or damage freshly coated surfaces shall not be used. No temporary attachments, supports for access, or forms, shall damage the coating system. Any damage that occurs from such devices shall be repaired to the satisfaction of the Engineer at the Contractors expense.

**601.13.3.6.3-Repair Procedures for Field Paint Deficiencies:** All field repairs to the coating shall be made in strict accordance with the coating manufacturer's recommendations, except where the requirements listed in this specification are more stringent. Any products used during repairs to the coating deficiencies shall be from the same manufacturer as the coating being repaired. All welds from which the coating of paint has been damaged or is otherwise defective shall be cleaned and repaired. Surfaces that will be inaccessible for coating after erection shall be repaired and/or recoated prior to erection. The Engineer is to review and accept a repair plan before deficient areas are repaired. The requirements specified herein for provisions for inspection, mixing, thinning, temperature and humidity, and application shall govern the coating of the repaired areas. In order to avoid abrupt changes in paint thickness, the area adjacent to repair areas shall transition from zero paint thickness to full system thickness within not less than 3 inches (75 mm) of the repair area by means of sanding the transition area. The requirements for
the dry film thickness of the repair coats are the same as those specified for the paint system.

601.13.3.7-Submittals: Submittals shall be forwarded through the Prime Contractor and be accepted by the Engineer prior to commencement of the subject work. This is the responsibility of both the Fabricator and the Field Contractor. Electronic submittals will be accepted.

601.13.3.7.1-Quality Control Plan for Painting: Minimum requirements and document form are set forth in MP 688.02.20.

601.13.3.7.2-Containment/Disposal Control Plan for Existing Steel Structures: Minimum requirements and document form are set forth in MP 688.03.20.

601.16–PAY ITEM:

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<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
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<tr>
<td>601019-001</td>
<td>Concrete Protective Coating</td>
<td>Square Foot (Meter)</td>
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</table>
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION
FOR

STATE PROJECT NUMBER: __________________________
FEDERAL PROJECT NUMBER: _______________________

SECTION 668
PORTABLE VIDEO CAMERA CCTV (CLOSED CIRCUIT TELEVISION) TRAILER

This work shall consist of furnishing, maintaining, relocating (as required) and removing a fully-installed and operational portable video camera (CCTV) trailer system. The Contractor shall furnish and assemble all necessary materials and equipment for each CCTV as described below to provide a complete operational system that can be viewed and operated by those with appropriate permissions.

1. The CCTV trailer shall include a Pan-Tilt-Zoom (PTZ) CCTV Camera, autonomous (24/7/365) Solar Power System and Trailer per the specifications below. This item shall also include furnishing software and interfaces required to provide streaming video with PTZ controls to the WV DOH TMC as well as include a public web page for the CCTV units on this project for the general public to view streaming video in a format approved.

2. All cellular communications (SIM cards) will be provided by the Department along with all associated cellular costs. The CCTV trailers, video interfaces, all appurtenances, software and documentation, training of Department and Project personnel and the acceptance testing of all equipment and interfaces shall be included.

3. The CCTV shall be individually mounted on a trailer unit with solar power system consisting of solar panels, solar-charged batteries, solar charge controller (with low voltage disconnect), and associated wiring and fuses. Backup batteries should be included to insure 24/7/365 streaming video.

4. The CCTV shall be able to autonomously restart to normal operations once the solar charge controller comes out of the low voltage disconnect state.

5. The CCTV shall be equipped with a 4G/LTE digital cellular modem operational on a commercial cellular communication network that accepts Department provided SIM cards and provides reliable statewide broadband connectivity.
6. The Contractor shall provide a CCTV that includes all software required to provide communications with the TMC, provide remote configuration of the CCTV from the TMC, and permits full IP PTZ camera control and viewing at the TMC.

7. The Contractor shall set up the IP addressable CCTV camera to stream at a minimum of 1 frames per second and shall work with WV DOH TMC and IT Departments to integrate the camera into their current systems and to provide the highest image resolution achievable utilizing the wireless link.

8. The Contractor shall warranty CCTV equipment including all component parts for the duration of this contract.

9. The minimum specifications for the following components of the CCTV are provided below:
   a. CCTV network (IP) camera with Pan-Tilt-Zoom
   b. Camera dome
   c. Camera software

10. The camera shall provide the ability to control and monitor CCTV video over wireless IP networks.

11. The zoom ratio shall be 12x Optical Minimum.

12. The camera shall have an auto focus with manual override capability.

13. The CCTV camera shall display up to four preset zones, each with a unique and descriptive title.

14. The Contractor shall program each CCTV camera with a minimum of two preset zones: Upstream and Downstream Traffic.

15. The CCTV camera shall display a minimum of 20 programmable characters for on-screen camera ID, location & titles.

16. The camera PT unit shall provide a proportional speed Pan/Tilt capability, where the speed decreases automatically as the zoom level increases.

17. The camera PT unit shall provide a 360° continuous pan rotation without cable interference or tangling.

18. The camera shall provide a minimum of 720H x 480V High Definition pixels.

19. The camera shall provide compressed video output compliant with H.264 (MPEG-4 Part10/AVC) and Motion JPEG standards.

20. The camera shall have Color and Black & White video image display modes with both automatic and manual selection. The camera shall transition automatically to a Black & White mode (when in automatic mode) when the luminance reaches a predefined threshold (used during evening hours or periods of low luminance).

21. The CCTV camera image display shall vary between day and night by reverting to quasi-monochrome operation at night for increased sensitivity. At all times the camera shall provide a full motion video output with controllable frame rate of up to 30 frames per second for both H.264 and Motion JPEG. Long-term image integration is not acceptable.

22. The CCTV camera shall incorporate electronic image stabilization to reduce the effects of vibration and wind gusts on the displayed video image.

23. The camera shall include both automatic iris control and an override for manual iris adjustments.

24. The camera shall have password protection, IP address filtering, HTTPS encryption, IEEE 802.1X network access control, digest authentication, user access log.
25. The camera shall provide video access using a standard web browser to view live camera video.

26. The camera dome housing shall be provided by the camera manufacturer as an integrated product.

27. The power input requirements for the IP CCTV camera and dome may be 24 VAC, PoE or PoE+, selectable.

28. The camera shall provide a RJ-45 Ethernet 10BASE-T/100BASE-TX connector that is IP66 rated.

29. The camera manufacturer shall have a minimum of 12 installed units of dome type CCTV cameras at outdoor installations for ITS applications, operational for at least six (6) months. Qualification list of installations for the camera vendor shall be submitted with the bid.

30. Unless otherwise specified, the equipment inside the dome shall remain functional with outside temperatures ranging from -34°C to 74°C (-29°F to 165°F).

31. Unless otherwise specified, the equipment inside the dome shall remain functional with an outside relative humidity from 0-100%.

32. The maximum total weight for the combined CCTV camera and dome assembly shall be 19 lbs. or less.

33. The outer dome shall be constructed of rust-free components.

34. The dome shall have a UV light resistant outer sunshield.

35. The lower dome cover shall be distortion free, cell-cast acrylic plastic or free blown, UV Coated, with no fastening holes.

36. The CCTV camera dome assembly shall be rated NEMA 4X.

37. The dome shall accommodate mounting on the CCTV Trailer Tower assembly.

38. The power input requirements for the CCTV camera and dome shall be sufficient to power the IP CCTV camera and heater to permit camera operation throughout the temperature range defined above.

39. The Contractor shall furnish all necessary software to permit WV DOH to configure the IP CCTV camera. All software installed shall be licensed for use throughout WV DOH.

40. The Contractor shall setup the CCTV cameras to allow real-time viewing of the camera video, pan/tilt/zoom control, camera control, and camera configuration and setup using the latest version of Internet Explorer. The Department will provide and setup the IP address (or host name) of the camera as well as provide usernames and passwords for the Contractor to configure each trailer/CCTV. The Contractor shall provide video for the WV DOH TMC web page per the requirements below unless directed otherwise by the WV DOH ITS Engineer.

41. The video from the cameras shall be provided in a format able to be displayed at the WV DOH TMC and on the project web page at a rate of at least 1 frame per second.

42. The system shall allow WV DOH authorized personnel to control the camera through a web- based interface to the camera’s pan-tilt-zoom controls.

43. The video shall be viewable through the web page and shall have a minimum viewing size of 720x480 pixels.

44. The video format shall provide a stream to permit the video to be posted to the WV DOH TMC.

45. The Cellular 4G/LTE Gateway Modem shall provide full duplex data communications between the CCTV installation sites and the WV DOH TMC over WV DOH’s cellular carrier. The Department shall make all provisions for setting up cellular service and
configuring all equipment for end-to-end communications and provide that to the Contractor and assist with any questions related to this effort.

46. The 4G/LTE Gateway Cellular Modem shall be compatible with the data communications equipment installed at the CCTV installation sites and at the WV DOH TMC.

47. The 4G/LTE Gateway Cellular Modem shall include the following data communications security features:
   a. IP Sec VPN encryption technology; 3DES and AES encryption, typical
   b. An integrated application inspection firewall
   c. GRE tunneling
   d. HTTPS

48. The 4G/LTE Gateway Cellular Modem shall include an antenna input for reception of GPS positioning and timing information.

49. The 4G/LTE Gateway Cellular Modem may include an integrated 4-Port Hardened Ethernet Switch for future use.

50. The 4G/LTE Gateway Cellular Modem shall meet or exceed the following power and environmental requirements:

51. The modem shall be powered using the solar power system with backup batteries available at the CCTV Trailer.

52. The modem shall have an operating temperature range of -13°F to 140°F and a humidity range of 5% to 95% non-condensing.

53. Antenna and Antenna Cabling Requirements for the 4G/LTE Gateway Cellular Modem:

54. The Contractor shall provide and install an external omni-directional 4G/LTE antenna and an external GPS antenna for the 4G/LTE Gateway Cellular Modem.

55. The antennas shall be mounted on the CCTV Trailer in a manner to provide continuous cellular communications and good reception of cellular signals.

56. The Department shall be responsible for all SIM cards and monthly charges.

57. The CCTV shall include solar panels, battery enclosure with batteries including all necessary accessories and wiring, and mounting hardware required to furnish a fully-operational 12 Volt solar power system to provide 24/7/365 operation for all areas in West Virginia.

58. The solar charge controller shall be UL listed, rated at a minimum 15A with solid state, with low voltage disconnect. The solar charge controller shall be sealed with internal temperature compensation, lighting protection, reverse polarity protection and LCD indications of solar panel voltage, solar charge current, and battery voltage.

59. The portable trailer shall meet the following minimum requirements:
   a. Have the ability to be towed at 65 mph.
   b. Support a weight of all materials on board.
   c. Provided with a 2” ball and rated for hauling 7,500 lb. load.
   d. The outside dimensions of the trailer shall be no more than 242” long x 86” wide.
   e. Enclosures shall be lockable.
   f. Shall include a complete lighting package that meets all West Virginia roadway vehicle lighting and signaling requirements.
   g. Shall include 6-pin electrical interface cabling for towing vehicles.
   h. The trailer shall be painted orange.

60. The mast shall meet the following minimum requirements:
a. The mast and trailer shall result in a minimum height above the adjacent ground of at least 30 feet to the focal point of the camera.
b. It shall be sized appropriately to allow for powering and mounting of the IP CCTV Camera.
c. It shall allow for mounting a pod on top of the tower to hold camera(s), radio/wireless communications equipment and antennas.
d. The lifting mechanism may be a hand crank rated for the associated loads or an electro-hydraulic powered lift

61. The Contractor shall provide one (1) training session for personnel from WV DOH. The training session shall be up to two (2) hours duration and shall cover the use, deployment of both the physical field hardware and the equipment software. It is the responsibility of the Contractor to provide all user manuals, training information and other instructional materials for up to ten (10) attendees. Each session shall include, but not be limited to:
   a. Description and installation of the CCTV for this project
   b. Software and communication related to the CCTV to allow real-time viewing of multiple cameras and control of the Pan-Tilt-Zoom capabilities.
   c. Public website interface and demonstration.

62. Prior to delivery of the equipment and after receipt of the Department furnished and activated SIM cards, it is expected that the Contractor will conduct in-house factory testing of all the individual components as well as an end-to-end testing of the entire system including hardware, communication and software. The Contractor shall provide appropriate proof of testing prior to the delivery of the equipment.

63. The operational testing phase is intended to provide WV DOH personnel the opportunity to independently operate the CCTV based upon procedures provided at the training session by the Contractor. The operational testing phase shall be completed within five (5) calendar days upon completion of the training sessions. During this period, the Contractor shall provide technical support to address any questions or concerns encountered by WV DOH while operating the equipment. Any equipment issues and/or malfunction identified by WV DOH, either with the hardware, communication or software, shall be resolved by the Contractor to the satisfaction of WV DOH within 10 business days. Any equipment malfunction identified by WV DOH not resolved by the Contractor may result in that equipment being identified as being “not accepted” by WV DOH.

64. The Department will measure each CCTV trailer as each unit deployed and accepted on a monthly basis. If at the end of the project, the last month shall be pro-rated based on the number of days of use compared to an average month of 30 days. Measurement and payment shall include all testing, training, furnishing, maintaining, relocating (which is incidental) and removal of the trailers for this project.
   a. Portable CCTV Trailer  (Unit Month)