

# 20160203 - February's Specification Committee Meeting

## Specification Committee Meeting Agenda

Wednesday, February 3<sup>rd</sup> @ 9:00am

Building 5, Room 122

### Approved Specification Revisions from last Committee meeting (1/6/16)

- None

### Approved Project Specific Provisions from last Committee meeting (1/6/16)

- SP 401 - RAP
- Cargo Preference Act

### Items removed from Committee Agenda

- SP 403 - Crack Sealing in Bituminous (will be back in March)
- SP 627 - ASAP Bridge (will be back in March)
- SP 642 - Temporary Pollution Control (New River Parkway)
- SP 652 - Seeding and Mulching (New River Parkway)

### Provisions to be discussed:

Anticipated Start Time	Provision	Title	Description	Approval
9:00	403	SP 403 - Crack Sealing in Bituminous Pavement	<p>Discussed in October, November, December &amp; January; 5th time to Committee. Project Specific provision for Crack/Joint Sealing in HMA.</p> <p>No updated to this provision.</p> <p>Approval expected in February.</p>	
9:05	607	607.4.1 & 607.7 - Slotted hole for guardrail	<p>Discussed in December &amp; January, 3rd time to Committee. Changes are regarding placing slotted holes in W-beam. Adds information for Cut Slope Terminal.</p> <p>Provision updated per comments at the January meeting.</p> <p>Approval expected in February.</p>	
9:10	481	SP 481 Interlayer	<p>Discussed in December &amp; January, 3rd time to Committee. Project Specific provision for Membrane Interlayer.</p> <p>No updated to this provision.</p> <p>Approval expected in February.</p>	

9:15	306	SP 306 Rubblization	<p><b>Discussed in December &amp; January, 3rd time to Committee.</b> Project Specific provision for rubblization.</p> <p>No updated to this provision.</p> <p>Approval expected in February.</p>
9:20	406	SP 406 High Friction Surface Treatment	<p><b>Discussed in January, 2nd time to Committee.</b> Update to previously approved SP. Project Specific provision for high friction surface treatment.</p> <p>No updated to this provision.</p> <p>Approval expected in February.</p>
9:25	102	102.17 Drug-Free Workplace	<p><b>Discussed in January, 2nd time to Committee.</b> Permanent Specification change, adding Drug-Free workplace.</p> <p>No updated to this provision.</p> <p>Approval expected in February.</p>
9:30	108	108.3.2 Detailed Construction Schedule	<p><b>Discussed in January, 2nd time to Committee.</b> Permanent Specification change, moving Construction Schedule requirements from 640.11 to 108.3.2.</p> <p>No updated to this provision.</p> <p>Approval expected in February.</p>
9:35	601	SP 601 - Concrete Sealer	<p><b>Discussed in January, 2nd time to Committee.</b> Project Specific provision for concrete crack sealer.</p> <p>Provision updated per comments at the January meeting.</p>
9:40	601	SP 601 - FRP Concrete Patching	<p><b>Discussed in January, 2nd time to Committee.</b> Project Specific provision for concrete patching of bridge substructure units (prior to their wrapping of FRP).</p> <p>Part of WVDOT research project - would require some calibration with WVU.</p> <p>Provision updated per comments at the January meeting.</p>
9:45	601	SP 601 - Fiber Reinforced Polymer (FRP)	<p><b>Discussed in January, 2nd time to Committee.</b> Project Specific provision for Fiber Reinforced Polymer (FRP) wrap system.</p> <p>Part of WVDOT research project - would require</p>

			<p>some calibration with WVU.</p> <p>Provision updated per comments at the January meeting.</p>
9:50	607	SP 607 - Guardrail	<p><b>Discussed in January, 2nd time to Committee.</b> Project Specific provision requiring guardrail post and block be hardwood from the Appalachian region.</p> <p>Provision updated per comments at the January meeting.</p> <p>Approval expected in February.</p>
9:55	607	SP 607 - Aesthetic Guardrail	<p><b>Discussed in January, 2nd time to Committee.</b> Project Specific provision for aesthetic treatment options to galvanized guardrail.</p> <p>Provision updated per comments at the January meeting.</p>
10:05	608	SP 608 - Right-of-way Fence	<p><b>Discussed in January, 2nd time to Committee.</b> Project Specific provision requiring farm-field fence be pressure treated wood.</p> <p>Provision updated per comments at the January meeting.</p> <p>Approval expected in February.</p>
10:10	627	SP 627 - High Load Bearings	<p><b>Discussed in January, 2nd time to Committee.</b></p> <p>Project Specific provision for high load multi-rotational bearings - Disc bearing assemblies.</p> <p>Formatting updated, no update provision contents.</p> <p>Approval expected in February.</p>
10:15	627	SP 627 - Cable Stay Repairs	<p><b>Discussed in January, 2nd time to Committee.</b></p> <p>Project Specific provision for cable stay repair</p> <p>Formatting updated, no update provision contents.</p>
10:20	627	SP 627 - Cable Stay Tape	<p><b>Discussed in January, 2nd time to Committee.</b></p> <p>Project Specific provision for cable stay taping</p> <p>Formatting updated, no update provision contents.</p>
10:25	650	SP 650 - Sodding	<p><b>Discussed in January, 2nd time to Committee.</b> Project Specific provision for sod installation.</p>

			No updated to this provision.  Approval expected in February.	
10:30	688	688 - Painting Metal Structures	<b>Discussed in January, 2nd time to Committee.</b> Permanent Specification change. Section updated, with complete re-write.  No updated to this provision.	
10:40	663	663 - Pavement Markings	<b>1st time to Committee.</b> Permanent Specification change. Section updated, with complete Re-write.	
10:50	711	711.41 - Type II	<b>1st time to Committee.</b> Permanent Specification change. Subsection updated. Change start date for installation of type II paint markings are not subject to warranty requirements from 10/1 to 11/1	
11:00	715	715.40 - Pavement Markings Material	<b>1st time to Committee.</b> Permanent Specification change. Subsection updated. Adds enhanced skid resistant material & performance requirements.	
11:10	716	716.1.1.3 - Softshale	<b>1st time to Committee.</b> Permanent Specification change. Subsection rewrite.	
11:15	425	SP 425 - Asphalt Emulsion Mineral Bond	<b>1st time to Committee.</b> Project Specific provision for Asphalt Emulsion Mineral Bond	
11:20	705	705 - Liquid Asphalt	<b>1st time to Committee.</b> Permanent Specification change. Section updated, with complete re-write.	
11:30	416	416 - Milling	<b>1st time to Committee.</b> Permanent Specification change. New addition to the Spec book	
11:40	410	410 - Percent Within Limits (PWL)	<b>1st time to Committee.</b> Permanent Specification change. New addition to the Spec book	
11:50	109	109.11 - Square yard paving adjustments	<b>1st time to Committee.</b> Permanent Specification change. Adds square yard paving adjustment.	

**Note – This meeting will not be broadcast online.**

### Next Meeting

Wednesday, March 2, 2016 at 9AM

Building 5, Room 122: *(If Available. If not available a change in venue will be attached on the door)*

### 2016 Supplemental

The 2016 Supplemental is currently located online at this location:

<http://www.transportation.wv.gov/highways/contractadmin/specifications/Pages/default.aspx>

## **2016 Specifications Committee**

The Specification Committee meets the first Wednesday of each month.

The remaining 2016 Committee dates are as follows:

March 2<sup>nd</sup>, April 6<sup>th</sup>, May 4<sup>th</sup>, June 1<sup>st</sup>, July 6<sup>th</sup>, August 3<sup>rd</sup>, September 7<sup>th</sup>, October 5<sup>th</sup>, November 2<sup>nd</sup>, and December 7<sup>th</sup>

*Calendar subject to change, updates will be given, as needed.*

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**SUPPLEMENTAL SPECIFICATION**  
**FOR**  
**STATEWIDE SEALING CONTRACT**

**STATE PROJECT NUMBER:** \_\_\_\_\_

**FEDERAL PROJECT NUMBER:** \_\_\_\_\_

**SECTION 403**

**CRACK SEALING IN ASPHALT PAVEMENT**

**403.1-DESCRIPTION:**

The work shall consist of the cleaning, sealing, and filling of cracks and joints in asphalt pavement in the manner and subject to the conditions and regulations prescribed.

**403.2-MATERIALS:**

The material shall be hot poured crack sealant and conform to the requirements of Section 708.3 of the Standard Specifications. As well as being compatible with asphalt pavement recycling.

**403.3-CONSTRUCTION:**

**403.3.1-Preparation of material for use:** Before charging the compound into the melting unit, the unit shall be free from all foreign material. If the type of heater to be used requires that the sealing material, as shipped, be cut into smaller pieces before melting, the cutting method used is subject to the approval by the Engineer.

The heating kettle used for melting sealing materials shall be of the indirect heating or double boiler type, using oil as the heat transfer medium. It shall have a thermostatically controlled heat source, a built-in automatic agitator, and thermometers installed to indicate both the temperature of the melted sealing material and that of the oil bath. Other methods of indirect heating approved by the Engineer may be used. A positive means of controlling the temperature of the heat transfer at all points in the system shall be incorporated in the heater. Sealing material shall be uniformly heated until the pouring temperature recommended by the manufacturer is reached. Should the maximum pouring temperature recommended be exceeded, the material will be rejected. The material shall be poured as soon as possible after the pouring temperature is reached. Only sufficient material for the day's operation shall be heated each day.

**403.3.2-Preparation of joints and cracks for sealing:** The cracks shall be thoroughly cleaned of all loose scale, dirt, dust, other foreign matter prior to placing hot poured crack sealant.

**403.3.3-Equipment for applying sealer:** The equipment used shall consist of heating units from which material may be discharged into the crack through the use of flexible lines and suitable shoes.

**403.3.4-Placement requirements:** Any spillage of sealing material on pavements shall be immediately removed. A neat job with good workmanship will be required at all times. At no time shall sealing material be placed in a crack which either dirty or wet. The crack shall be clean and surface dry at the time of placement. Work will be suspended when cracks are wet or damp and when the atmospheric temperature is below the minimum specified by the manufacturer. The standard overband shall be 3" centered over the crack.

**403.3.5-Equipment, personnel, and documentation requirements:** The Contractor (two (2) days prior to commencement of the project) shall submit to the Engineer a detailed list of all equipment to be used within the confines of the project. The Contractor shall also provide certification from the Sealing material manufacturer that the Contractor is qualified to apply the manufacturer's material in conformance with these specifications and the manufacture's recommendations.

The Contractor is responsible for quality control, and shall employ a Project Control Coordinator at the Contractor's expense. The coordinator shall be designated and in attendance at the Pre-Construction Conference. This coordinator shall be a member of the Sealing Crew. The coordinator shall be responsible for all communication between the Sealing Crew and the Engineer.

The coordinator shall be required to fill out all Daily Sealing Report(s) and provide these completed forms to the Engineer for payment on a daily basis. The daily sealing reports shall be submitted no later than 24 hours after the work they represent has been completed. This Sealing report shall include but not limited to the following:

1. Date
2. Location (Route # and MP)
3. Hours worked (including start and stop times)
4. Detailed listing of the Men and Equipment used
5. Amount of material used
6. Linear feet of Sealing performed
7. Detailed listing of traffic control devices used (including units and / or hours)
8. Weather information
9. Any other applicable information

Failure to deliver Sealing reports to the Engineer shall invoke daily liquidated damages as described in Section 108.7 and Table 108.7.1 of the West Virginia Division of Highway's Standard Specifications for each calendar day that the Contractor fails in delivering these sealing reports. Each week's liquidated damages are evaluated separately regarding delivery of sealing reports.

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

The Contractor shall provide a calibrated measuring device for measuring the linear feet of Sealing Joints and Cracks for his use and an additional unit for use by the Department. (This will be at the Contractor's expense and shall be integral to the contract cost).

**403.4-METHOD OF MEASUREMENT:**

The quantity of work done will be measured in linear feet of “Crack Sealing in Asphalt Pavement”.

1. For longitudinal cracking along centerline, edgeline or joints measurement is to be conducted prior to cleaning and sealing.
2. For other cracking measurement is to be conducted after cleaning and prior to the placement of the sealant.

**403.5-BASIS OF PAYMENT:**

The quantity of work, as determined 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 materials, and doing all the work prescribed in a workmanlike and acceptable manner, including all the labor, tools, equipment, supplies and incidental necessary to complete the work.

**403.6-PAY ITEM:**

<b>ITEM</b>	<b>DESCRIPTION</b>	<b>UNIT</b>
403001-001	Crack Sealing in Asphalt Pavement	Linear Foot

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**SUPPLEMENTAL SPECIFICATION**  
**FOR**  
**SECTION 607**  
**GUARDRAIL**

**607.4.1-General:**

DELETE THE CONTENTS AND SUBSTITUTE THE FOLLOWING:

**607.4.1-General:** Rail elements shall be erected in a manner resulting in a smooth, continuous installation.

All bolts, except where otherwise required, such as expansion joint bolts and adjustment bolts, shall be drawn tight. Bolts through expansion joints shall be drawn up as tight as possible without being tight enough to prevent the rail elements from slipping past one another longitudinally. Bolts shall be sufficiently long to extend at least 1/4 inch (6 mm) beyond the nuts. Except where required for adjustment, bolts shall not extend more than 1/2 inch (13 mm) beyond the nuts. Bolts through variable thickness posts shall be cut off a maximum of 1/2 inch (13 mm) beyond the nuts.

All metal guardrail elements shall be fabricated in the shop. Field punching, cutting, and drilling of all guardrail elements other than rail may be permitted after it has been demonstrated that it will not result in damage to the surrounding metal and if approved by the Engineer.

When additional slotted holes are required in W-beam to secure rail to post, slotted hole shall be per Standard Details Volume I. Slotted hole shall be field punched or shop fabricated so that they are free from tears, jagged edges and damage to the surrounding metal. Drilling to create slotted holes is prohibited.

Galvanized surfaces which have been abraded so that the base metal is exposed, any field welded surfaces, threaded portions of all fittings and fasteners, and cut ends of bolts shall be protected with zinc rich primer or by field galvanizing, when approved by the Engineer.

**607.7-BASIS OF PAYMENT:**

REMOVE THE THIRD PARAGRAPH AND REPLACE IT WITH THE FOLLOWING:

Payment for Cut Slope Terminal Type A shall include extra-length guardrail posts as required, rubrail, excavating and backfilling the trench, reshaping, seeding and mulching of the cut slope, and either concrete block or soil plate anchor complete and in place. Payment for Cut Slope Terminal Type B shall include extra-length guardrail posts as required, drilling holes into the cut slope, and furnishing and installing rock bolts (2), end shoes (2), rubrail, and all other necessary hardware to complete the installation.

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SPECIAL PROVISION**

**FOR**

**STATE PROJECT NUMBER:** \_\_\_\_\_

**FEDERAL PROJECT NUMBER:** \_\_\_\_\_

**SECTION 481**

**ASPHALT INTERLAYER MEMBRANE**

**481.1-DESCRIPTION:**

This section covers the materials, equipment, construction and application procedures for placing pavement interlayer used to mitigate reflective cracking in asphalt pavements. The pavement interlayer is a process of applying a stress absorbing membrane over existing cracks. All materials are to be properly proportioned, mixed, and installed to the paved surface in accordance with this Specification, conformity to the dimensions and typical cross sections shown on the pavement interlayer layout, and as directed by the Engineer.

**481.2-MATERIALS:**

Furnish the components of the pavement interlayer to include bond primer, interlayer membrane, and all other materials in accordance with the manufacturer's recommendation. Use materials meeting the following:

**481.2.1 Interlayer Membrane-**The interlayer membrane shall consist of an approved membrane sandwiched between two layers of geotextile fabric. The bottom geotextile shall be self-adhesive and fully bond with the existing pavement. This bond shall be capable of accommodating construction traffic without breaking its bond to existing pavement. The membrane compound shall be designed to prevent water from infiltrating the pavement base course through existing cracks or joints in the pavement, and act as a stress absorbing membrane between the new overlay and the underlying pavement. The geotextile on the top of the composite shall also be designed to fully bond with the asphalt overlay and provide high tensile stiffness reinforcement to the overlay. The interlayer membrane shall be supplied in rolls of minimum 24 inch width.

The interlayer membrane shall meet the minimum the quality standards discussed above. The Contractor shall make the materials submittals at least 30 days prior to planned initial installation. No installation will be permitted until the materials have been approved in writing by the Engineer.

The stress absorbing membrane shall have the following physical characteristics:

Property	Value	Test Method
Cold Flex	No cracking at 0° F	ASTM D 146 mod.
Tensile Strength	2,000 psi minimum	ASTM D 412 mod.
Puncture Resistance	998 lbs	E 154-93
Elongation @ peak	10% minimum	ASTM D 412 mod.
Weight	0.8 lbs/sf of membrane	ASTM D 1910
Mastic Density	70 lbs/cubic foot min.	E 12
Thickness	0.135 inches typical	ASTM D 1777
Water Absorption	1% maximum	ASTM D 517
Brittleness @77°F	Passes	ASTM D 517
Softening Point mastic	210°F-230°F	ASTM D 36
Adhesion of Fabric to compound	15 lb./in width	ASTM D 1000

**481.2.2 Bond Prime-**A bond primer shall be used in accordance with the manufacturer recommendations. Material that will be used as a bond primer must be submitted to the Engineer with the other material submittals.

### **481.3-CONSTRUCTION:**

**481.3.1 Equipment-**Provide safe, environmentally acceptable equipment that can produce a specification product. All equipment, tools, and machines used in the application of pavement interlayers shall be maintained in satisfactory working conditions at all times.

**481.3.1.1 Pneumatic Rollers-**A minimum of two self-propelled rollers shall be used on the project unless otherwise requested by the Project Manager. The rubber tired rollers shall have a gross load adjustable to apply 200-250 psi (1379-1724 kPa) of rolling width. Tire pressure shall be specified for the pneumatic tire rollers and shall not vary more than plus or minus 5.0 psi (34.5 kPa). It is recommended that the rollers travel no more than 10 miles per hour

**481.3.1.2 Sweepers-**Self-propelled four wheeled rotary mechanical brooms and or vacuum brooms capable of operating in both forward and reverse is recommended. Brooms should be checked to ensure they are in good condition and meet applicable environmental standards.

**481.3.1.3 Miscellaneous Equipment-**Provide hand squeegees, shovels, wire brushes, and other equipment as necessary to perform the work within the manufactures recommendations. Provide cleaning equipment such as power brooms, air compressors, water flushing equipment, and hand brooms for surface preparation.

**481.3.2 Application-**Pavement interlayers shall be applied in a manner to address cracks and joints in pavement that typically lead to reflective cracking in asphalt pavements. A manufactures representative shall be present on site for the initial start of the installation.

**481.3.2.1 Weather Limitations-**Membrane shall be applied when existing surface temperature is a minimum of 40 °F and rising. Surface shall be swept prior to membrane application. During installation weather must be dry, with no rain, drizzle or fog. Additionally, installation should not occur at temperatures less than the dew point due to the possibility of presence of surface moisture.

**481.3.2.2 Surface Preparation** - The surface shall be thoroughly clean and dry when the membrane is applied. The surface must be free of dirt, water, vegetation, and loose materials. The surface should be swept or blown with clean moisture and oil free compressed air. Material cleaned from the surface shall be removed and disposed of as directed by the engineer. Areas that are not adequately cleaned with sweeping or air may require scraping with shovels or other hand tools, followed by compressed air blowing. Surfaces with bonded accumulations may require more intensive cleaning procedures such as high pressure water blasting, wire brushing or abrasive cleaning.

Areas to have membrane places shall be assessed and pre treated in accordance with Table 481.3.2.2.

<b>Table 481.3.2.2-Crack Pretreatment</b>		
<b>Crack/Joints</b>	<b>Fill</b>	<b>Note:</b>
½" wide or less	NA	
greater than ½" but less than 2" wide	Pre-approved crack filler or hot mix asphalt	
Greater than 2" wide	Hot mix asphalt	
Greater than ½" vertical displacement	Wedged with compacted hot mix asphalt	
1. Hot mix asphalt used to fill cracks or to wedge vertical displacement shall be limited to a maximum aggregate size of 3/8". 2. Hot mix asphalt used to fill cracks shall conform to Section 401. 3. Hot mix asphalt used to fill cracks shall be paid at the unit price of asphalt in the contract. 4. All filler or hot mix shall be compacted and level with the existing surface.		

**481.3.2.3 Solvents**-The use of solvents (i.e., kerosene, gasoline, diesel fuel, and such) or other materials such as those used to clean paving equipment and tools is strictly prohibited. In the event that such solvents or materials come in contact with the membrane material the contaminated material shall be immediately removed from the jobsite and discarded.

**481.3.2.4 Bond Primer Application**-A properly applied layer of primer is required to adhere the interlayer membrane to the existing pavement surfaces. Surface shall be primed according to manufacturer's recommendations prior to placement of the membrane. The primer shall be placed on the surface, at a minimum rate of 0.0225 gallons per square yard (0.036 gallons per square yard on milled or distressed surfaces), at least 1 inch wider than the membrane and shall dry to be tack free before applying the membrane. Asphalt emulsions shall not be used for the bond primer.

**481.3.2.5 Membrane Placement**-The membrane shall be placed in such a manner as to leave no voids between the membrane and the pavement at faulted joints. Membrane shall be installed straight and wrinkle free with no curled or uplifted edges. Any wrinkles over 3/8" in width shall be slit and folded down.

The membrane shall be installed in widths of 24" minimum and shall be centered over the joint or crack with  $\pm 2"$ . Transverse membranes shall be extended 4" to 6" beyond the distressed pavement edge. Laps will be permitted in both the transverse and longitudinal membranes with a minimum overlap of 3". All laps shall be made in such a manner that the paver does not encounter the exposed edge of the lap first.

The membrane shall not be opened to traffic. Membrane shall not be left exposed to ultra-violet rays for over 20 days without protective cover or coating.

**481.3.2.6 Rolling the Membrane**-Immediately following the application of the membrane material, it shall be pressure rolled with a pneumatic roller to establish a tight and full continuous bond with the underlying surface.

**481.3.3 Asphalt Overlay**-After the membrane has been applied to the surface an asphalt concrete overlay having a minimum thickness of 2” is required prior to opening to traffic. The overlay process shall begin no sooner than 30 minutes after the membrane has been rolled. A tack coat meeting the requirements of Section 408 shall be applied over the membrane and the adjacent surface.

The asphalt overlay shall meet the requirements of Section 401 and conform to the contract documents. The interlay final section must have a minimum of 2 lifts of asphalt placed above the membrane.

**481.3.4 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. Equipment inspection, including transport units

**481.3.6-Traffic Control**-The interlayer membrane shall not be opened to the traveling public prior to being overlain with asphalt. Do not allow construction traffic on the membrane until it has cured sufficiently to prevent pickup by equipment tires or tracks. Protect the membrane from damage at intersections and driveways. Repair all damage to the membrane caused by construction 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, Current Edition*, or as directed by the Engineer.

**481.3.7 Quality Control**-A interlayer membrane is be installed in accordance with quality control tolerances set by the manufacture. Identify the cause of the deviation and determine the corrective action necessary to repair the membrane and prevent further damage.

For Quality Assurance purposes, all joints and edges should be inspected for adhesion and sealing. If deficiencies are noted, they are to be corrected before proceeding with additional construction. Secure the Engineer’s approval before resuming work.

**481.4-MEASUREMENT AND PAYMENT:**

Payment for interlayer membranes includes all materials, equipment, labor for preparing the surface, placing temporary pavement markings, placing the membrane and complying with all requirements 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 481.5.

**481.5-PAY ITEMS:**

ITEM NUMBER	DESCRIPTION	UNIT
481001-001	ASPHALT INTERLAYER MEMBRANE	SQUARE YARD (SY)

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SUPPLEMENTAL SPECIFICATION**

**FOR**

**STATE PROJECT NUMBER:** \_\_\_\_\_

**FEDERAL PROJECT NUMBER:** \_\_\_\_\_

**SECTION 306**

**RUBBLIZATION OF  
PORTLAND CEMENT CONCRETE PAVEMENT**

**306.1-DESCRIPTION:**

This section covers the equipment, construction and testing procedures for in place Rubblization of Portland Cement Concrete (PCC) Pavement for creating a base material for either asphalt pavement or new PCC pavement. Rubblization is the process of breaking and compacting the existing pavement. All equipment and materials shall be provided in accordance with this Specification and as directed by the Engineer.

**306.2-MATERIALS:**

As rubblization is a process materials are limited to aggregate or processed RAP that is used to fill voids, holes, or low spots in the rubblized pavement.

**306.2.1-Fill Aggregate:** The fill aggregate shall be clean, durable stone such as granite, slag, limestone or other high-quality aggregate. The quality of the fill material is important to the success of the base of the pavement. A hard, crushed, single size aggregate is recommended. Fill Aggregate shall meet the requirements listed in Section 703 of the Standard Specification. .

**306.2.3-Reclaimed Asphalt Pavement:** Reclaimed Asphalt Pavement (RAP) may be substituted for the fill aggregate material on roadways. Materials testing will be waived, however the RAP shall be processed allowing for the Top Size gradation not to exceed 3/4 inches (19 mm) or the maximum fill thickness. Approval shall be by visual inspection by the Engineer. Payment for RAP fill material substitution shall be at the same unit bid price for Fill Aggregate.

**306.3-EQUIPMENT:**

**306.3.1-Equipment:** Provide safe, environmentally acceptable equipment that can produce a specification product. All equipment, tools, and machines used in the process of rubblization shall be maintained in satisfactory working conditions at all times.

### **306.3.1-Breaker:**

**306.3.1.1-Multi-Head Breaker (MHB):** The equipment shall consist of a self-contained, self-propelled MHB. Hammer heads shall be mounted laterally in a single row or in pairs with half the hammers in a forward row, and the remainder diagonally offset in a rear row so there is continuous pavement breaking from side to side. This equipment shall have the capability of rubblizing pavement up to 13 ft. (4 m) in width, in a single pass. Hammer drop height shall have the ability to be independently controlled.

**306.3.1.2-Resonant Breaker:** The equipment shall consist of a self-contained, self-propelled resonant frequency pavement breaking unit capable of producing low amplitude, 2,000 lbs. (8,880 N) blows, at a rate of not less than 44 per second.

**306.3.2-Vibrator Roller:** Use a vibratory steel wheel roller having a total weight of not less than 10 tons. Operate the roller in the vibratory mode and at a speed not to exceed 6 feet (1.8 m) per second.

**306.3.3-Pneumatic Roller:** A self-propelled rubber tire roller shall be used on the project unless otherwise requested by the Project Manager. The rubber tired rollers shall have a gross load adjustable to apply 300-500 psi of pressure for the tire rolling width. Tire pressure shall be specified for the pneumatic tire rollers and shall not vary more than plus or minus 5.0 psi (34.5 kPa). It is recommended that the rollers travel no more than 10 miles per hour

**306.3.4-Z-Plate Roller:** The equipment shall consist of a self-contained, self-propelled vibratory steel wheel roller with a Z-pattern grid cladding mounted transversely to the surface of the drum. The vibratory roller shall have a minimum gross weight of 9 metric tons (10 tons).

**306.3.5-Miscellaneous Equipment:** Provide hand rakes, shovels and other equipment as necessary to perform the work. Provide cutting equipment to cut reinforcing steel should it become exposed.

### **306.4-CONSTRUCTION:**

**306.4.1-Quality Control Plan:** Breaking shall be accomplished a Rubblization Quality Control Plan shall be submitted to the Engineer detailing the process, equipment, and personnel to be used. Prior to the acceptance of the proposed breaking plan, the Contractor shall complete a strip for evaluation by the Engineer. To ensure the pavement is being broken to the specified dimensions. The Contractor shall excavate a broken area of 10 sq. ft. (1 sq. m), in two separate locations during the first day of breaking, as directed by the Engineer. Modifications to the breaking procedure must be made if the size requirements are not met. These excavations may be repaired with replacement material. If breaking procedures or conditions change, additional excavations to inspect the broken pavement dimensions shall be made, as directed by the Engineer.

**306.4.2-Pavement Preparation:** Prior to rubblization asphalt concrete overlays and patched larger than three square feet shall be removed from the PCC pavement. The

Engineer shall verify the removal of asphalt pavements and approve the pavement for beginning the rubblization process

Saw full depth joints and completely sever load transfer devices to isolate the rubblizing area. Saw jointed pavements at an existing joint. PCC pavement or other PCC appurtenances to remain in place shall be saw cut and severed from the pavement to be rubblized with a full-depth saw cut.

Care shall be taken to not damage adjacent pavement during rubblization. Repair damage to the adjacent pavement caused by contractor as the engineer directs, at no cost to the Division.

The Contractor shall prevent damage to underground utilities and drainage structures during rubblizing. Approved alternate breaking methods shall be used over underground utilities and drainage structures as specified on the plans or directed by the Engineer.

**306.4.3-Rubblization Process:** Break the concrete pavement uniformly across the pavement width into particles that have a maximum dimension no greater than 12 inches.

At the surface, the equipment shall break the pavement such that at least 75% of the pieces (by weight) are a maximum of 2 in. (50 mm).

Below the reinforcing steel or in the lower one-half of the pavement, at least 75% of the pieces shall be a maximum of 9 in (230 mm).

Concrete to steel bond shall be broken. Uniform breaking shall be maintained through successive passes of the breaking equipment.

**306.4.3.1-Determining Particle Size:** Determine particle size by excavating 2 test holes, of about 10 square feet each, during the first half day. Excavate at least one test hole per lane mile thereafter. Backfill, compact, and restore the stability of each test hole. The subsequent testing may be waived by the Engineer provided that the surface conditions indicate that the process is meeting the particle size requirements.

**306.4.3.1-Existing Reinforcing Steel:** Remove reinforcing steel exposed at the surface by cutting below the surface, disposing of the steel off site, and using fill aggregate to level the surface. Do not remove unexposed reinforcing steel.

**306.4.4-Compaction:** Prior to placing the asphalt overlay the complete width of the broken pavement shall be compacted by vibratory steel wheel and pneumatic tire rollers in the following sequence:

**306.4.4.1-After Breaking:** A minimum of four (4) passes with z-pattern steel gird roller, four (4) additional passes with a vibratory roller, and two (2) passes with a pneumatic tire roller.

**306.4.4.2-Immediately Prior to Overlay:** A minimum of two (2) passes with a vibratory roller.

**306.4.5-Regrading:** The contractor shall not trim the broken or rubblized pavement, or otherwise attempt to grade the broken or rubblized pavement to improve grade lines.

**306.4.6-Additional Fill Aggregate:** Fill holes and localized depressions, deeper than 2 inches, with fill aggregate and compact as the engineer directs.

**306.4.7-Opening to Traffic:** Public traffic will not be allowed on the rubblized pavement before the required asphalt overlay(s) are in place, except at crossovers and/or access points. Public traffic will not be allowed on a rubblized crossover or access point for more than 24 hours. Maintenance of crossovers and/or access points shall be as specified by the Engineer. Crossovers and/or access points shall be maintained in the same compacted state as the other areas, until the asphalt overlay is in place. Construction traffic on the rubblized base shall be limited to delivery of materials directly ahead of the paver.

Otherwise Traffic Control will be in accordance with Section 636, and the *Manual on Temporary Traffic Control For Streets and Highways, Current Edition*, or as directed by the Engineer

**306.4.8-Paving Limitations:** A tracked paver shall be used to place the first lift of hot-mix asphalt binder over the prepared rubblized pavement. During stage construction, the overlay width shall be such that it will not interfere with subsequent rubblizing operations. At a given location, the overlay shall be placed within 48 hours of the pavement breaking operation.

If rain occurs between rubblizing and paving, the rubblized pavement shall be dry and stable to the satisfaction of the Engineer before the paving operation begins.

If a material transfer device is proposed, the Contractor shall submit equipment specifications with axle loading configurations and proposed paving sequence to the Engineer three weeks prior to paving. The Engineer will provide any equipment restrictions based on device loadings and proposed paving sequence.

### **306.5-MEASUREMENT AND PAYMENT:**

Payment for rubblization includes all materials, dust control, equipment, labor for preparing the surface, breaking the existing pavement, and complying with all requirements. Rubblizing shall be measured for payment in Square Yards of existing pavement in place.

The completed work as measured will be paid for at the contract unit price for the Items detailed in Section 306.6.

### **306.6-PAY ITEMS:**

<b>ITEM NUMBER</b>	<b>DESCRIPTION</b>	<b>UNIT</b>
306001-001	RUBBLIZATION	SQUARE YARD (SY)
306002-0011	FILL AGGREGATE	TONS (TN)

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SPECIAL PROVISION**

**FOR**

**STATE PROJECT NUMBER:** \_\_\_\_\_

**FEDERAL PROJECT NUMBER:** \_\_\_\_\_

**FOR**

**SECTION 406**

**HIGH FRICTION SURFACE TREATMENT**

**406.1-DESCRIPTION:**

This work shall consist of the construction of a high friction surface treatment (HFST) material, composed of binder material and aggregate, upon an existing surface, in accordance with these Specifications and in reasonably close conformity with the lines, grades, thicknesses, and cross sections shown on the Plans or established by the Engineer.

The contractor shall notify the Engineer a minimum of two weeks prior to starting any surface treatment operation.

**406.2-MATERIALS:**

The materials shall conform to the requirements of the following:

The binder shall be a multi-component cold-applied modified exothermic polymer resin binder treatment. The binder shall cure exothermically and hold the aggregate firmly in position and meet the following requirements:

**TABLE 406.2a-MULTI-COMPONENT MODIFIED BINDER RESIN SYSTEM**

<b>Property</b>	<b>Test Method*</b>	<b>Specification Limits</b>
Viscosity	ASTM D2556	7 – 30 P
Durometer Hardness	ASTM D2240	60 - 80
Cure Rate (Dry through time)	D1640	3 hours max.
Adhesive Strength	ASTM C1583	250 PSI min. (100% substrate failure)
Compressive Strength		1000 psi (@ 3 hours 5000 psi @ 7 days
Elongation at break point	ASTM D-638	30% min.
Gel Time	ASTM C-881	10 minutes min.
Water Absorption	ASTM D-570	1 % max.
Mixing Ratio	Per Manufacturer's Recommendations	

**TABLE 406.2a-MULTI-COMPONENT MODIFIED BINDER RESIN SYSTEM**

- \*Additional testing notes for laboratory: Prepare all samples per manufacturer’s recommendation.
- Viscosity – prepare one pint sample and mix for 2 to 3 minutes before testing. Use X1.1 for spindle selection and test at a temperature of 73 ± 2°F.
  - Gel Time – Prepare a 60 g sample per manufacturer’s recommendation. Perform testing at a temperature of 73 ± 2°F.
  - Cure Rate – Prepare specimens of 50-55 wet mil thickness.
  - Cure the following test specimens for 7 days at 73 ± 2°F, and test immediately without delay.
  - Durometer Hardness – Use the type 1 precision type D method.
  - Compressive Strength – Prepare specimen according to Method “B”, 2” x 2” cube, using 2.75 parts of sand to one part mix polymer resin by volume. Sand must conform to ASTM C778, 20-30 sand.
  - Ultimate Tensile Strength Prepare Type 1 specimens in accordance to ASTM D638.
  - Elongation at break point – Prepare Type 1 specimens in accordance to ASTM D638.

The aggregate shall be bauxite material that is clean, dry and free from foreign matter and meets the following requirements:

**TABLE 406.2b-AGGREGATE**

Property	Test Method*	Specification Limits
SFC – Side Force Coefficient	ASTM E670-94 0	.70 minimum
SRV/SRT – Skid Resistance Value Test	ASTM E-274	65.0 mm min (70 mm)
AAV-Aggregate Abrasion Value	AASHTO T96	20.0 max.
Aggregate Gradation	AASHTO T27	95.0–100.0% Passing No. 6 0.0-5.0 % Passing No. 16
Aluminum Oxide Content	ASTM C-25	87% min

\* As an option, and with approval of the Engineer, the current edition of a corresponding AASHTO test may also be used in lieu of any ASTM test.

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

The contractor shall design a quality control plan in accordance with applicable section of MP307.00.50, excluding attachment 1, detailing the methods by which the quality control program will be conducted. Samples shall be obtained at a minimum frequency of one sample per day of aggregate placement.

**406.3-ACCEPTANCE TESTING:**

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

**406.3.1-Skid Testing:** The skid testing will be conducted within 90 days of the completed project installation by the Division or an independent testing firm at the discretion of the Division. Any surface application with a skid value less than 69

will be deemed unacceptable. The installed system will be tested for skid resistance 12 months after initial test, but not greater than 14 months, to determine friction compliancy to a minimum requirement of 64. Any surface application with less than 64 will be deemed unacceptable and will require reinstallation of the complete surface system at no cost to the Department.

**406.3.2-Acceptance for the Grading of Aggregate:** Acceptance for gradation shall be on the basis of test results on consecutive random samples from a lot. A lot shall be considered the quantity of material represented by an average test value, not to exceed five sublots. Generally at the beginning of the project, the average shall be started on the second sample in accordance with MP 300.00.51. A subplot is the quantity of material represented by a single gradation test. In the case where only one sample is taken, this subplot shall be considered the lot. The material shall be sampled and tested in accordance with the applicable specification. The gradation test results shall be plotted on a control chart in accordance with MP 300.00.51. When the average, or when the most recent three consecutive individual test values fall outside the guidelines for this aggregate 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 subplot shall have its price adjusted in accordance with Table 406.3.2.2. In the case where the average is nonconforming and the last subplot contained is conforming, then there would be no price adjustment. In no event, however, shall a subplot of material have its price adjusted more than once, and the first adjustment, which is determined, shall apply.

**406.3.2.1-Degree of Nonconformance:** When a subplot 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 406.3.2.1 to determine the degree of nonconformance on that sieve.

**TABLE 406.3.2.1**

<b>Nonconforming Multiplication Sieve</b>	<b>Factor</b>
4 IN (100mm) to No 16(1.18mm)	1.0
No 40 (4.25µm) to No 50 (300µm)	1.5
No 100 (150µm)	2.0
No 200 (75µm)	3.0

The total measure of nonconformance of an individual subplot is the sum of all nonconformances on the various sieve sizes of that subplot. When the total degree of nonconformance has been established and it is 12.0 or less, the material will be paid for at an adjusted contract price as specified in Table 406.3.2.2. When the degree of nonconformance is greater than 12.0, the nonconforming subplot shall be resolved on an individual basis, requiring a special investigation by the Engineer to determine the appropriate course of action to be followed.

**406.3.2.2-Price Adjustment:** Aggregates not conforming with the gradation requirements will be paid for at the adjusted contract price based on the degree of nonconformance as specified in Table 406.3.2.2.

**TABLE 406.3.2.2**

<b>Adjustment of Contract Price for Gradation Not Within Specifications</b>	
<b>Degree of Nonconformance</b>	<b>Percent of Contract Price To Be Reduced</b>
1.1 to 3.0	2
3.1 to 5.0	4
5.1 to 8.0	7
8.1 to 12.0	11
Greater than 12	*

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

**CONSTRUCTION METHODS**

**406.4-WEATHER RESTRICTIONS:**

The polymer binder material shall not be placed on a wet surface, when the ambient air or surface temperature is either \*below 50 degrees Fahrenheit or ambient temperature above 110 degrees Fahrenheit, or when the anticipated weather conditions or pavement surface temperature would prevent proper application of the surface treatment as determined by the Engineer in consultation with the manufacture’s representative.

\*Applications below 50 degrees Fahrenheit will be considered acceptable if the manufacturer can demonstrate a cure rate (dry through time) of <3 hours at representative current field conditions.

Do not place the HFST with visible moisture on the prepared surface at the time of placing. Test for moisture in the pavement by taping an 18”x18” plastic sheet to the pavement per ASTM D4263. Perform the plastic sheet test only when surface temperatures and ambient conditions are within the established parameters for application of the overlay system. In the event of rain, the pavement must be allowed to air dry prior to performing the plastic sheet test. A 2 hour minimum test duration is allowed in lieu of the 16 hours specified in ASTM D4263.

**406.5-METHODS:**

The Contractor shall ensure that a manufacturer’s representative is on site to provide technical assistance during the start up operations and as necessary during the surface preparation, material placement and during any necessary remedial work.

The contractor shall cover and protect all existing pavement markings and utilities that are left in place prior to placement. All inadequately sealed joints and cracks greater than ¼” shall be cleaned and filled with a crack sealant approved by the polymer resin manufacturer.

For applications on new asphalt pavements, install the polymer bind and high friction aggregate topping a minimum of 30 days after placement of the new pavement.

Surfaces shall be clean, dry, and free of all dust, oil, debris and any other material that might interfere with the bond between the polymer resin binder material and existing surfaces. Adequate cleaning of all surfaces will be determined by the manufacturer's representative. Utilities, drainage structures, curbs and any other structure within or adjacent to the treatment location shall be protected from the application of the surface treatment materials. Cover and protect all existing pavement markings that are adjacent to the application as directed by the Engineer. Pavement markings that conflict with the surface application shall be removed by grinding and the surface shall be swept clean prior to the polymer binder application.

Clean concrete pavement surfaces by shot blasting and vacuum sweeping. Shot blast all surfaces to remove all curing compounds, loosely bonded mortar, surface carbonation, and deleterious material. Ensure that the prepared surface complies with the International Concrete Repair Institute (ICRI) standard for surface roughness CSP 5. After shot blasting, vacuum sweep or air wash, with a minimum of 180 cfm of clean and dry compressed air, all surfaces to remove all dust, debris, and deleterious material. Maintain air lance perpendicular to the surface and the tip of the air lance within 12 inches of the surface.

**The HFST must conform to the following:**

1. Surface preparation work, surface temperature, placement of the HFST must be in conformance with the binder supplier's specifications, these special provisions and as approved by the Engineer.
2. The ~~minimum~~-spread rate range for polymer resin binder ~~is shall be~~ 25-32 sf./gal.
3. The ~~minimum~~-spread rate range of retained aggregate ~~is shall be~~ 13-20 lb/sq yd.
4. HSFT must be allowed to cure for the minimum duration as recommended by the supplier's specifications and during that time the application area must be closed to all traffic including Contractor's equipment.

**Mixing and Application Methods**

Utilize one of the following methods to apply the resin binder and aggregate wearing course, in accordance with manufacturer's recommendations. Application method 1 shall be utilized on areas greater than 250 feet in length.

**1. Automated Continuous Application**

Automated continuous application shall be performed by an applicator vehicle with a minimum aggregate capacity of 40,000lbs and a minimum of 1200 gallons of the resin binder. The applicator shall continuously mix, meter, monitor and apply the resin binder and high friction aggregate in one continuous application pass.

The applicator vehicle shall be equipped with an inbuilt data management unit which is capable of producing real time data flow showing the volume of resin, the resin mil thickness on average throughout the application width, the volume of aggregate applied throughout the application width. The automated continuous application vehicle will have continuous pumping and portioning devices that blend the polymer binder within a controlled system. The polymer binder shall be blended and mixed in the ratio per the manufacturer's specification (+/- 2% by volume); the polymer binder shall be continuously applied once blended. The application vehicle should be capable of applying the minimum polymer binder spread rate.

The high friction aggregate shall be applied by the same automated continuous application vehicle that applies the resin binder to the pavement section. The automatic aggregate spreader shall be capable of applying up to a continuous 12 foot

width application. The high friction aggregate shall be applied within 3 seconds (+/- 1 sec) of the base polymer binder application onto the pavement section, from a minimum height of 12 inches from above the pavement section surface, at the minimum spread rate.

No exposed wet spots of the polymer binder shall be visible once the aggregate is installed. The operations should proceed in such a manner that will not allow the mixed material to separate, cure, dry, be exposed or otherwise harden in such a way as to impair retention and bonding of the high friction surfacing aggregate, walking, standing or any form of contact or contamination with the wet uncured resin will result in that section of resin being removed and replaced at the contractor's expense.

## **2. Hand Mixing and Application**

For areas deemed to be low volume and areas less than 250 feet in length, hand-mix the resin binder in accordance to the manufacturer's recommendations. Uniformly spread the resin binder onto the surface using a serrated edge squeegee. Immediately broadcast the high friction surfacing aggregates until refusal.

The excess aggregate can be reused; the aggregate shall be reclaimed by a mechanical sweeper, the recovered aggregate must be clean, uncontaminated and dry.

Excess and loose aggregate must be removed from the traveled way and shoulders by street sweeping. Application of HFST on highway ramps require a second street sweeping 24-48 hours after application on the ramp.

Utilities, drainage structures, curbs, and any other structures within or adjacent to the treatment location must be protected against the application of the HFST materials.

When magnesium phosphate concrete is placed prior to the HFST bridge deck overlay, the magnesium phosphate concrete must be placed at least 72 hours prior to placing the polymer resin binder.

When modified high alumina based concrete is placed prior to the HFST bridge deck overlay, the polymer resin binder must not be placed on the concrete until at least 30 minutes after final set of the modified high alumina based concrete.

Expansion joints and deck drains must be adequately isolated prior to applying HFST.

All debris, excess aggregate, material containers, and other waste shall be disposed of off the Right-of-Way according to Section 207 by the Contractor at no direct cost to the Department.

Any roadway features disturbed by the work of the Contractor's operations shall be restored in kind by the Contractor and approved by the Engineer at no cost to the Department.

### **406.7-CLEANING AND SWEEPING:**

Excess and loose aggregate must be removed from the traveled way and shoulders by street sweeping. Application of HFST requires a second street sweeping 24-48 hours after application.

### **406.8-JOINTS:**

The longitudinal construction joints between adjacent lanes shall be kept clean of

material foreign to the type of surface being treated. The joints shall be constructed without overlaps or gaps between the materials.

The transverse joint at the end of successive sections or lanes shall be covered with paper to prevent overlapping of the binder material. Following its use, the paper shall be removed and disposed of satisfactorily.

**406.9-PROTECTION OF PAVEMENT AND TRAFFIC CONTROL:**

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

**406.11-METHOD OF MEASUREMENT:**

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

The quantities of work done will be measured as follows:

Where a surface treatment is placed upon a base constructed as an item in the same contract, the conditioning and cleaning and sweeping of the base shall be considered as a part of the construction of the base and no additional compensation will be allowed for "Cleaning and Sweeping".

The Quantity of "High Friction Surface Treatment" when specified to be paid by the square yard shall be measured by the total area the surface treatment is applied measured in place and accepted.

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

**406.15-BASIS OF PAYMENT:**

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

The Quantity of "High Friction Surface Treatment" when specified to be paid by the square yard shall include the cleaning and sweeping, binder material, aggregate and all labor and equipment required to perform the operation

**406.16-PAY ITEMS:**

ITEM	DESCRIPTION	UNIT
406001-*	High Friction Surface Treatment	Square Yard (Square meter)

\* Sequence number

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SPECIAL PROVISION**

**FOR**

**SECTION 102**

**BIDDING REQUIREMENTS AND CONDITIONS**

ADD THE FOLLOWING AS A NEW SECTION.

**102.17-CONTRACTOR'S DRUG-FREE WORKPLACE POLICY:**

Each Contractor submitting a bid must include with the bid, on a form provided by the Division, an affidavit that the Contractor implements and maintains a written drug-free workplace policy which meets the requirements of Article 1D, Chapter 21 of the Official Code of West Virginia, as amended. The successful bidder must submit a copy of its drug-free workplace policy within ten (10) days following the letting and prior to the awarding of the contract. Any successful bidder who fails to submit the policy within the specified time limit will risk forfeiture of his/her proposal guaranty bond.

The successful bidder must also insure that its subcontractors implement and maintain a written drug-free workplace policy complying with Article 1D, a copy of which must be submitted to the Division by the Contractor prior to the start of the subcontract work. The contract may be terminated if the Contractor:

1. Fails to implement its policy;
2. Fails to provide information regarding implementation of the policy at the request of the Division; or;
3. Provides to the Division false information regarding the policy.

A clearly legible copy of the written drug-free workplace policy must be kept posted in a prominent and easily accessible place at the project site by each contractor subject to the provisions of Article 1D.

Every contractor shall keep an accurate record showing the names, occupation and safety-sensitive status of all employees, in connection with the construction on the project, and showing any drug tests or alcohol tests performed and employee education and supervisor training received, which record shall be open at all reasonable hours for inspection by the Division. The Contractor must preserve these records for three years after completion and acceptance of the project.

All drug testing information specifically related to individual employee is confidential and should be treated as such by anyone authorized to review or compile program records.

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**SUPPLEMENTAL SPECIFICATION**  
**FOR**  
**SECTION 108**  
**PROSECUTION AND PROGRESS**

**108.3-PROSECUTION OF THE WORK:**

**108.3.2- Detailed Construction Schedule (Schedule):**

DELETE THE CONTENTS AND SUBSTITUTE THE FOLLOWING:

**108.3.2-Detailed Construction Schedule (Schedule):** The Schedules shall be prepared using scheduling software Primavera Project Manager P6 version 6.0 or higher. The following criteria shall apply to the development and maintenance of the schedule:

1. All Resources shall be grouped in a Project Resource Tree. This tree structure shall have one main heading name that begins with the project's specific 7 digit contract number followed by an underscore, followed by the project name.
  - a. The individual resource names shall be shown as a sublevel to the main heading name. The individual resource names shall begin with the project's specific 7 digit contract number followed by an underscore. Any additional description may follow the underscore.
2. The use of Project Codes is prohibited.
3. Global Activity Codes are prohibited. However, Project Activity Codes may be used. The Project Activity Code names shall begin with the project's specific seven (7) digit contract number followed by an underscore. Any additional description may follow the underscore.
4. Global Calendars are prohibited (except as noted below in section 6). However, Project Calendars may be used. The Project Calendar names shall begin with the project's specific seven (7) digit contract number, followed by an underscore. Any additional description may follow the underscore. In addition, the Project Default Calendar shall be assigned as a Project Calendar.

5. The use of Cost Accounts is not required. However if the Contractor elects to use them, then all Cost Account names shall be grouped in a Project Cost Accounts Tree. This tree structure shall have one main heading name that begins with the project's specific 7 digit contract number followed by an underscore, followed by the project name.
  - a. The individual cost account names shall be shown as a sublevel to the main heading name. The individual cost account names shall begin with the project's specific seven (7) digit contract number, followed by an underscore. Any additional description may follow the underscore.
6. The Contractor Resource Calendar shall be linked to the WVDOT Standard Calendar. This shall be accomplished by creating a Global Calendar named and formatted exactly as follows:
  - a. WVDOT Standard 5 Day Workweek w/holidays - This WVDOT Standard Calendar shall be assigned to each resource and shall be allowable as the only calendar for all Schedule resources.

The Schedule shall be submitted on standard D size sheets (24" x 36"). The critical path shall be distinguished from other paths on the Schedule. All back-up data used to generate the Schedule shall be submitted in digital form on acceptable media that is compatible with the computer system.

The submitted Print Out of the Schedule shall include the following data for each activity in the initial submittal and in all updates and revisions:

1. Activity number, as well as preceding and following activity numbers;
2. Activity description;
3. Duration of activity, in working days;
4. All quantities in accordance with pay items;
5. Dollar value of activity;
6. Remaining duration of activity, in working days;
7. Earliest start date, by calendar date;
8. Earliest finish date, by calendar date;
9. Actual start date, by calendar date;
10. Actual finish date, by calendar date;
11. Latest start date, by calendar date;
12. Latest finish date, by calendar date;
13. Total float for activity;
14. Free float for activity;

In addition to the above, the following information and data shall be included with the submission of the digital form to the Division:

15. Number of shifts per work day, hours per shift for activity;
16. Number of work days per week for activity;

17. Major equipment and corresponding hours for activity;
18. Manpower by Trade or entity and corresponding hours for activity;
19. Activity Usage Profile Cost of Contractor's Income.
20. The following criteria shall apply to the development and maintenance of the Schedule:
  - a. All Resources shall be grouped in a Project Resource Tree. This tree structure shall have one main heading name that begins with the Project's specific 7 digit Contract ID Number followed by an underscore, followed by the Project Name.
  - b. Individual Resource names shall be shown as a sublevel to the main heading name. The Individual Resource names shall begin with the Project's specific 7 digit Contract ID Number followed by an underscore, followed by the Project Name. Any additional description may follow the underscore.
  - c. The use of Project Codes is prohibited.
  - d. The use of Global Activity Codes are prohibited, however Project Activity Codes may be used. The Project Activity Code name's shall begin with the Project's specific 7 digit Contract ID Number followed by an underscore. Any additional description may follow the underscore.
  - e. Global Calendars are prohibited (except as noted below in bullet g). However, Project Calendars may be used. The Project Calendar names shall begin with the Project's specific seven (7) digit Contract ID Number followed by an underscore. Any additional description may follow the underscore. Additionally, the Project Default Calendar shall be assigned as a Project Calendar.
  - f. The use of Cost Accounts is not required. However if the Contractor elects to use them, then all Cost Account names shall be grouped in a Project Cost Accounts Tree. This tree structure shall have one main heading name that begins with the Project's specific seven (7) digit Contract ID Number followed by an underscore, followed by the Project Name.
    - (i) Individual cost account names shall be shown as a sublevel to the main heading name. The individual cost account names shall begin with the Project's specific seven (7) digit Contract ID Number followed by an underscore. Any additional description may follow the underscore.
  - g. The Contractor Resource Calendar shall be linked to the WVDOT Standard Calendar. The WVDOT Standard Calendar shall be assigned to each resource and shall be allowable as the only calendar for all Schedule Resources. This shall be accomplished by creating a Global Calendar named and formatted exactly as follows:

WVDOT Standard 5 Day Workweek w/holidays
  - h. The first activity on the Schedule shall be Contract letting which shall be designated as a milestone starting on the actual contract letting date.
  - i. The second activity on the Schedule shall be Project Award which shall be designated as a milestone with a 30 day lag from the Contract Letting milestone.

- j. The third activity on the Schedule shall be Notice to Proceed which shall be designated as a milestone with a 30 day lag from the Project Award milestone (or with a 7 day lag from Project Award on projects with an Incentive/Disincentive clause).
- k. Subsequent to the Notice to Proceed milestone, the logic and duration of remaining activities shall be developed and tied to the Substantial Completion milestone described in Section 108.3.1.
- l. Schedule calculation will be computed by *Retained Logic* method.
- m. Only contractual *Constraints* can be used on activities when preparing the Schedule, otherwise the use of *Constraints* is prohibited.
- n. All Actual Start Dates and Actual Finish Dates shall be reasonably captured in updated schedules.
- o. The activity costs described in Section 108.3.4 shall be incorporated into the Schedule via Resource Section. The use of Expenses for costs is prohibited.

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SPECIAL PROVISION**

**FOR**

**STATE PROJECT NUMBER:** \_\_\_\_\_

**FEDERAL PROJECT NUMBER:** \_\_\_\_\_

**FOR**

**SECTION 601**

**STRUCTURAL CONCRETE**

**601.1 – DESCRIPTION:**

**ADD THE FOLLOWING SECTION**

**601.1.1 Concrete Crack Sealer:** The work shall consist of cleaning all cracks and furnishing and placing a Concrete Crack Sealing Material at the locations indicated on the plans and any other location designated by the Engineer. The construction shall be in accordance with this Specification and in reasonably close conformity with the Plans or as established by the Engineer.

**601.2 – MATERIALS:**

**ADD THE FOLLOWING SECTIONS**

**601.2.1 – CONCRETE CRACK SEALING MATERIAL:**

**601.2.1.1:** Concrete Crack Sealing Material shall be a high penetration two part hybrid urethane material that combines with sand to form a tough instant polymer concrete. This crack sealing material is also known as Roadware 10 Minute Concrete Mender and manufactured by Roadware Incorporated. This material shall be capable of sealing vertical or horizontal cracks. Material shall have an extremely low viscosity and properties that allow deep penetration into concrete, not shrink on cure and be resistant to chemical attack.

**601.2.1.2:** All sealing materials shall be shipped in containers sealed in a manner acceptable to the Engineer. Each container shall be plainly marked with the following:

- 1) Product name
- 2) Component part
- 3) Batch number
- 4) Date of manufacture
- 5) Date of expiration of acceptance
- 6) Name & address of the manufacturer
- 7) Material safety data sheet

**601.2.1.3:** The Manufacturer of the Sealing Material shall submit documentation showing that the material submitted for construction meets the specification data listed as follows:

Mixing Ratio		1:1
Hardness @ 72° F		72D
Compressive Strength (with sand)		4500 psi
Elongation		6%
Tensile Strength		4475 psi
Bond Strength	ASTM A882	1984 psi
Viscosity (at application)		<9 cps
V.O.C. (mixed)		5.5 g/l
% Solids		98%
Cured Color		Gray
Cure Time @ 72° F		80% strength in 10 minutes

**601.2.1.4:** On vertical surfaces, a quickset reactive Gel Polymer Compound shall be placed along the surfaces of the crack to contain the sealing material during injection. The Gel Polymer Compound is also known as Multi-Bond and Seal 830 as manufactured by ASTC Polymers. The Manufacturer of the Gel Polymer Compound shall submit documentation showing that the material submitted for construction meets the specification data listed as follows:

General Physical Characteristics

Hardness	Shore D 60 to 63
Solids	100%
Mix Ratio	1:1
Tensile (lb/mil)	2300
Color	Natural or Black
Viscosity @ 72°F	Part A: 1000+/-300
CPS	Part B: 1700+/-500
Weight/gal	Part A: 10 lbs Part B: 8.8 lbs
Specific Gravity	1.08

### **601.3 – PROPORTIONING**

#### **ADD THE FOLLOWING SUBSECTION**

**601.3.1 - PREPARATION OF SURFACE:** The contractor shall remove all loose or foreign matter, dirt, grime, oil, grease, or any other materials that would diminish the bonding surface. All surfaces must be clean and dry. A wire brush or dry diamond blade attached to an electric hand grinder may be needed to achieve the necessary bonding surface.

The Contractor shall water blast the surfaces to remove any dirt, efflorescence or mineral deposits. Particular attention shall be given to removing any deposits from cracks. The Engineer will identify the cracks to be sealed. In general, any crack greater than 0.0625 inches in width will be sealed. At locations where the crack extends below the existing grade, the surface of the repair shall extend to a depth of 18” below grade. All excavation shall be included in the bid cost of the crack repair.

The bonding surface shall be dry and free of moisture. At the beginning of construction a representative of the Manufacturer of the Sealing Material shall be on site to approve of all bonding surfaces immediately prior to and during application of the Sealing Material for each application.

The Contractor shall protect from damage all concrete surfaces and previous made repairs, which are to remain in place. Materials damaged due to the Contractor's operations, as determined by the Engineer, shall be repaired or replaced at no additional cost to the Division and to the satisfaction of the Engineer.

### **601.13 PROTECTIVE SURFACE TREATMENT**

#### **ADD THE FOLLOWING SUBSECTION**

**601.13.4 Concrete Crack Sealing Installation:** The Contractor shall notify the Engineer a minimum of seven days prior to installation of the Sealing Material. Notification will include the contract number, crack sealing product name, and approximate date of installation.

An experienced technical representative of the Manufacturer of the Sealing Material shall be present during all phases of substrate preparation and material installation. All placements shall be under the direction of the manufacturer's representative.

The Manufacturer's representative shall advise both the Engineer and the Contractor regarding proper installation procedures to assure the Sealing Material is installed correctly. The material shall be installed in accordance with the recommendations of the manufacturer's representative. In the event of a conflict, the Engineer's final decision will be binding.

After installation is completed, the Manufacturer's representative shall certify to the Engineer, in writing, that the Sealing Material was installed in accordance with the Manufacturer's requirements. If the representative determines the Contractor's crew is thoroughly familiar with type of operation, he shall deliver a signed statement of competence for the crew to the Engineer for

review. Upon approval by the Engineer of the statement of competence, the presence of the representative shall not be required. The statement shall list the names of the Contractor's crew and crew leader who would be responsible for sealing operation.

#### Injection and Sealing Procedures:

On vertical or inclined surfaces, the crack should be sealed with ASTC 830 gel polymer compound. The gel polymer compound shall not be applied within 24 hours of water blasting. Once a bead is on the crack, spread the gel polymer compound across the crack and let cure. Once cured, drill holes into the crack every 12-18 inches, based upon the manufacturer's recommendations. The hole needs to be large enough to allow the sealer static mixer to be inserted into the hole about one or two inches deep and essentially seal the end. Holes will be drilled into the concrete along each vertical crack. Holes will be drilled with a hollow bit using a vacuum attached swivel chuck. It is mandatory that the drill material such as particles of sand and concrete and dust be removed from the hole as the hole is being drilled to assure that the crack remains open for injection of the sealing material.

The sealer should not be injected at temperatures less than 20 degrees F. During warmer weather, the sealer cartridges shall be kept cool (approximately 50 degrees F) to allow for superior penetration into the crack. Injection of the sealing material should start at an injection point at the end of the crack and for cracks on vertical or inclined surfaces, the injection should start at the lowest injection point and proceed upward.

Injection of the sealing material should start at the lowest point or at the injection point at the end of a crack and should continue until the sealing material flows to and out of the next injection point along the crack. When this flow is established, the injection point into which sealer is being injected will be plugged and the injection started at the second injection point along the crack. This process will be continued until the sealer flows along the entire limit of the crack and the crack is entirely sealed.

In the event that the sealer can be continued to be injected into an injection point but does not appear at an adjacent point or points, the injection of sealer will continue until no more material may be injected or a volume of 1 gallon of sealer has been injected per point, whichever comes first. In the event that the injection point will no longer accept the injection of sealer, additional holes will be drilled closer to the injection point in order to obtain flow of the sealer between points. At locations where the crack extends through the pier wall, both faces of the crack shall be injected and capped simultaneously to prevent loss of sealer on the opposite side and maintain proper flow.

Precautions to assure a continuous supply of properly blended sealer at the point of injection is important. After filling cracks and cure of the sealer, the plugs at the injection points shall be removed and the holes patched flush with the concrete surface with the gel polymer compound. The repair areas shall be ground flush with surround concrete and abraded to achieve reasonably uniform surface texture and appearance. Any runs or spills shall be removed from concrete surfaces.

At the top horizontal surfaces, drill ½ inch to 1 inch holes into the crack at 12 inch intervals horizontally. These holes will become reservoirs for the sealer to allow it to flow down into the crack and horizontally in the crack. Fill to refusal and top with medium grit or fine grit dry manufactured sand or crushed flint. Dust the top with white cement to hide the color change that occurs with sealer in UV light.

**601.13.4.1 – Concrete Crack Sealing Acceptance Criteria:**

The Engineer shall accept the Contractor's work if, in his judgment, the following criteria are met:

- The Contractor stores, handles, mixes, and installs the materials according to the Manufacturer's recommendations and as specified herein.
- Representative of the Manufacturer is on site during mixing and placing of Concrete Crack Sealing Material.
- No degradation of material properties under field conditions is detected. The Contractor shall replace any material showing degradation.
- The surface of the existing concrete is free of loose or foreign matter, dirt, grime, oil, grease, or any other materials that would diminish the bonding surface.
- All work done as a result of the acceptance criteria shall be done at no additional cost to the Division.

**601.14 - METHOD OF MEASUREMENT:**

**ADD THE FOLLOWING SUBSECTION:**

**601.14.1 – Concrete Crack Sealing:** Sealing Material will be measured in place per lineal foot (LF).

**601.15 – BASIS OF PAYMENT**

**ADD THE FOLLOWING SUBSECTION:**

**601.15.1.1 – Concrete Crack Sealing:** The cost of the concrete crack sealing, to the limits shown in the plans or as directed by the Engineer, the cleaning of the cracks, and the placement of specified materials to make the necessary repairs shall be included in the payment for the item below. The quantities, determined 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 materials and doing all the work herein prescribed, including all the Manufacturer's cost, labor, tools, equipment, supplies and incidentals necessary to complete the work.

**601.16 - PAY ITEM:**

**ADD THE FOLLOWING TO THE TABLE:**

<b>ITEM</b>	<b>DESCRIPTION</b>	<b>UNIT</b>
<b>601015-007</b>	<b>Concrete Crack Sealing</b>	<b>LF</b>

**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:

**Concrete Patching Repair in Preparation for Non-Structural FRP Wrap**  
**Application:** This work will consist of removing deteriorated concrete, cleaning and sealing the reinforcing steel with a corrosion inhibitor, applying a concrete repair material, and cleaning of area to be wrapped with water. The provision is applicable only for concrete repair in preparation for FRP wrap installation in which the FRP is designed only to protect the concrete from corrosion and prevent degradation of the cover concrete; not for concrete repair where the FRP wrap is designed for structural loads

**601.2-MATERIALS:**

ADD THE FOLLOWING SECTIONS

**601.2.1-Rapid Set Cementitious Patching Material:**

**601.2.1.1:** Rapid Set Cementitious Patching Material shall be selected from the WVDOH Materials Division list of approved repair materials for Portland cement concrete meeting requirements of section 715.4.1 of the standard specifications capable of patching deep holes, shallow feathering, and being trowelled vertically or overhead. The material shall not shrink on cure, be self-priming, and be capable of providing a strong bond to concrete and steel reinforcing bars. It shall be a nontoxic product and clean up with water.

**601.2.1.2:** All concrete components and primer materials shall be shipped in strong containers sealed in a manner acceptable to the Engineer. Each container shall be plainly marked with the following:

1. Product name
2. Component part
3. Batch number
4. Date of manufacture
5. Date of expiration of acceptance
6. Name and address of manufacturer
7. Material safety data sheet
8. Temp and time of storage

**601.2.1.3:** Clean, dry aggregates may be allowed in order to increase yield on deep placements per the Manufacturer's recommendations.

**601.2.1.4:** A retarder may be allowed in high temperature environments to improve workability per the Manufacturer's recommendations.

### **601.3-PROPORTIONING:**

ADD THE FOLLOWING SUBSECTION:

**601.3.3-Preparation of Concrete Repair Bonding Surface:** The contractor shall remove all loose, soft, honeycombed, and disintegrated concrete. The extent of deterioration has been shown in the plans, and removal of material beyond this extent is at the discretion of the Engineer. Sound concrete must NOT be removed 3" beyond damage. The surface of the existing concrete (to remain) is free of all loose or foreign matter, dirt, grime, oil, grease, or any other materials that would diminish the bonding surface via washing with 1000 to 2000 psi pressure washing.

The existing exposed reinforcing steel bars shall be cleaned by sandblasting to a SSPC-SP6 finish. After sandblasting, a rust inhibitor compatible with the concrete patching material shall be applied to all exposed steel bars.

Any cracks over 0.125 inches wide shall be filled with epoxy-resin-base crack filler that meets ASTM C881 Type IV, Grade 3 criteria. The class should be chosen based on the temperatures expected during application.

The Contractor shall protect from damage all materials which are to remain in place. Materials damaged due to the Contractor's operations, as determined by the Engineer, shall be repaired or replaced at no additional cost to the Department and to the satisfaction of the Engineer.

### **601.10-PLACING CONCRETE:**

ADD THE FOLLOWING SUBSECTION:

**601.10.5-Rapid Set Cementitious Patching Installation:** The Contractor shall notify the Engineer a minimum of seven days prior to installation of the Rapid Set Cementitious Material. Notification will include the contract number, concrete product name, manufacturer's instructions and approximate date of installation. At no time should installation occur if temperatures during installation are below 40°F or are expected to fall below 32°F during the next 24 hours.

Fill all voids over 0.5 inches wide and 0.125 inches deep. Grind away all irregularities and protrusions to provide less than 1/8 inch surface profile deviation over a 12" length. The finished surface of the repair should be troweled to a smooth finish. The repaired area shall be allowed to cure for a minimum 24 hours before FRP wrap installation or per manufacturer's material specifications.

Area to be wrapped with FRP (as shown on the plans) shall be cleaned with water at pressures of 1000 to 2000 psi starting at the top and working down no more than 72 hours prior to wrapping.

**601.10.5.1-Rapid Set Cementitious Patching Acceptance Criteria:** Representatives from the West Virginia University – Constructed Facilities Center (WVU-CFC) shall be present during material installation. The Engineer shall be responsible for contact Dr. Hota GangaRao from WVU-CFC at (304) 293-9986. The material shall be installed in accordance with the manufacturer's instructions. In the event of a conflict, the Engineer's final decision will be binding.

The Engineer shall accept the Contractor's work if, in his judgment, the following criteria are met:

1. The Contractor stores, handles, mixes, and installs the materials according to the Manufacturer's recommendations and as specified herein.
2. No degradation of material properties under field conditions is detected. The Contractor shall replace any material showing degradation.
3. Loose, soft, honeycombed, and disintegrated concrete is removed with no damage to adjacent sound concrete to limits set by the discretion of the Engineer.
4. The surface of the existing concrete to remain is free of loose or foreign matter, dirt, grime, oil, grease, or any other materials that would diminish the bonding surface.
5. Existing exposed reinforcing steel bars are free of dirt, grime, oil, grease, corrosion, or any other foreign matter that would prevent a good bonding surface or allow future corrosion of the reinforcing steel bars.
6. The finished surface is troweled smooth, with no deviations over 1/8 inch over 12 inches and no concave areas remain.
7. The entire area to be repaired with FRP is cleaned with water at pressures of 1000 to 2000 psi.

All work done as a result of the acceptance criteria shall be done at no additional cost to the Department.

**601.14-METHOD OF MEASUREMENT:**

ADD THE FOLLOWING SUBSECTION:

**601.14.1-Rapid Set Cementitious Patching:** Rapid Set Cementitious Patching Materials will be measured in place per square foot (SF).

**601.15-BASIS OF PAYMENT:**

ADD THE FOLLOWING SUBSECTION:

**601.15.1.1-Rapid Set Cementitious Patching:** The removal of existing concrete, to the limits shown in the plans or as directed by the Engineer, cleaning and sealing of exposed reinforcing bars, placement of specified materials to make the necessary repairs, and cleaning area to be wrapped with water shall be included in the payment for the items below. The quantities, determined above, will be paid for at the contract unit price bid for the items below, which price and payment shall be full compensation for furnishing all materials and doing all the work herein prescribed, including all the Manufacturer's cost, labor, tools, equipment, supplies and incidentals necessary to complete the work.

**601.16-PAY ITEM:**

ADD THE FOLLOWING TO THE TABLE:

<b>ITEM</b>	<b>DESCRIPTION</b>	<b>UNIT</b>
601030-000	Patching Concrete Structures	SF

**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:

**Fiber Reinforced Polymer (FRP) For Non-Structural Surface Protection** - This work shall consist of the repair and corrosion protection of concrete with a Fiber Reinforced Polymer (FRP) wrap system in accordance with these specifications and in reasonably close conformity with the lines, grades, dimensions and locations as shown on the plans or as established by the Engineer.

**601.2-MATERIALS:**

ADD THE FOLLOWING TO THE END OF THE SECTION:

**Fiber Reinforced Polymer (FRP):** All materials of the FRP system (fabric, resin, primer, etc.) shall be supplied by a single FRP Manufacturer (mixing of materials from different manufacturers is not approved). All materials must be approved by WVDOH.

The FRP repair system must meet the following minimum properties for the laminate:

Property	
Fabric Type	Glass or Carbon
Fabric Configuration bi-directional, equal weight in both directions	0°/90°
Minimum Tensile Strength (ASTM D3039)	30,000 psi
Modulus of Elasticity (ASTM D3039)	2,200 ksi
Minimum Thickness inches/ply for the laminate	0.04
Minimum fabric weight per square yard	26 oz. Glass 9 oz. Carbon

The Engineer shall notify Dr. Hota GangaRao of West Virginia University-Constructed Facilities Center (WVU-CFC) at (304) 293-9986 at least seven days prior to the start of wrapping.

**601.4-TESTINGS:**

ADD THE FOLLOWING TO THE END OF THE SECTION:

**601.4.6-FRP Approvals:** Material specifications, installation-construction procedures, and quality control plan must be submitted to the Engineer and approved by WVDOH prior to securing materials and beginning of installation.

**601.4.7-FRP Quality Control:** Quality assurance during installation of the FRP system components shall be described in a Quality Control plan. The quality control plan will include, but not limited to, the following:

- 1) Certification that the contractor has been trained to apply the specific FRP wrap material
- 2) Storage requirements
- 3) Procedures to inspect wrap during installation to ensure that it meets the manufacturer's instructions and those in these provisions

This plan shall also include field inspection of the FRP wrap by WVU-CFC personnel with InfraRed Thermography (IRT) and/or Digital Tap Hammer (DTH) to detect voids between the FRP wrap and the underlying concrete.

Test sections shall be made during FRP repair to permit tensile testing of the cured laminate to verify the material properties. The test section should be a section of the FRP wrap applied to a sheet of plastic to produce a laminate that is 18"x18" and the same thickness as the laminate installed on the structure. The test section should be made during the installation of the wrap on the structure and under the same application and environmental conditions. ASTM 3039 tensile tests will be conducted on this test section to verify the as-built laminate matches the minimum material specifications. Samples will be tested by WVDOT or WVU-CFC within 5 business days. If tested samples do not meet the minimum specifications listed above, additional layers of FRP wrap must be applied to bring the total laminate up to the minimum specifications at no additional cost to the Department.

**601.10-PLACING CONCRETE:**

DELETE THE SECTION AND REPALCE WITH THE FOLLOWING:

**601.10-FRP CONSTRUCITON REQUIREMENTS:**

Unless otherwise dictated by the FRP manufacturer's instructions, the following installation guidelines shall be followed for the entire FRP wrap system (primer, resin, fabric, etc.):

- 1) Area to be wrapped with FRP (as shown on the plans) shall be cleaned with water at pressures of 1000 to 2000 psi starting at the top and working down no more than 72 hours prior to wrapping.
- 2) The ambient temperature and the temperature of the resin shall be between 55oF and 95oF at the time of mixing. The composite shall be applied when the relative humidity is less than 85% and the surface temperature is more than 5oF above the dew point. Contractor should provide verification of the temperature and humidity at the application location prior to use. The concrete surface should be dry prior to wrapping.
- 3) A compatible primer as recommended shall be applied to the concrete surface.
- 4) The FRP wrap system (fabric/resin) shall be applied to the concrete surface using methods that ensure that the entire width of the fabric is in intimate contact with the underlying.
- 5) Minimum of two mutually orthogonal layers of glass FRP fabric are required.
  - a. For round column wrapping, a minimum of two layers of FRP fabric wrapped in a spiral form around the column circumference and along the column height with a minimum overlap specified by the manufacturer.
  - b. Wrapping details for other cross sections are detailed in the plans.
  - c. New rolls should overlap the previous roll by 6 inches along the length of the roll.
  - d. The wrap should be installed so that vertical seams do not allow for water intrusion (i.e. lower wraps shall not overlap upper wraps).
  - e. Successive layers of wet composite materials shall be placed before curing begins (polymerization) on the previous layer.
- 6) Adequate ventilation of the project area shall be maintained at all times.
  - a. Containment shall be provided by the Contractor to prevent the spread of fibers and/or resin residue during construction. All contained or waste material shall be properly disposed of by the Contractor.
  - b. Contractor shall read and apply all safety precautions for all FRP wrap system components.

After the wrap is installed but before protective coatings are applied, the wrap will be inspected by WVU-CFC personnel using IRT or DTH within 24 hours following wrapping. Any voids over 2 square inches between the wrap and concrete must be filled with an injectable epoxy as per ACI 440.2R-08. Filling of voids is required for completion of the work and will be at no additional cost to the WVDOH.

**601.10.1-Coating System Application Notes:** After the final wrap layer is completely polymerized, an acrylic paint or equivalent should be applied to the entire FRP wrap area (color to be chosen by WVDOH).

**601.14-METHOD OF MEASUREMENT:**

ADD THE FOLLOWING TO THE END OF THE SECTION:

The measurement for payment for Item 601015-005, FRP Wrap System, will be based on the area in square feet as determined from the lines and dimensions shown on the plans. The quantities, shall include all labor, tools, materials, equipment, supplies and incidentals necessary to complete the FRP installation as identified in this special provision and the contract documents. Cost shall include all means required to place material (lifts, etc.) and provide inspection access to WVDOH and WVU-CFC.

**601.16-PAY ITEM:**

ADD THE FOLLOWING ITEM TO THE TABLE:

<b>ITEM</b>	<b>DESCRIPTION</b>	<b>UNIT</b>
601015-005	FRP Wrap System	SF

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SPECIAL PROVISION**

**FOR**

**STATE PROJECT NUMBER:** \_\_\_\_\_

**FEDERAL PROJECT NUMBER:** \_\_\_\_\_

**FOR**

**SECTION 607**

**GUARDRAIL**

**607.2 MATERIALS:**

**ADD THE FOLLOWING:**

**607.2.1-Appalachian Lumber:** The Contractor shall utilize pressure treated wood from the Appalachian Region for all guardrail post and blocks on the project. The guardrail post shall be rectangular post. Pressure treated wood guardrail post shall be in accordance with AASHTO M 133.

The Appalachian Region includes all of West Virginia and parts of Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia. A map of the region can be found at: <http://www.arc.gov/images/appregion/AppalachianRegionCountiesMap.pdf>

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SPECIAL PROVISION**

**FOR**

**STATE PROJECT NUMBER:** \_\_\_\_\_

**FEDERAL PROJECT NUMBER:** \_\_\_\_\_

**FOR**

**SECTION 607**

**GUARDRAIL**

**AESTHETIC TREATMENT TO GALVANIZED SURFACES**

**607.1-DESCRIPTION:**

ADD THE FOLLOWING SUBSECTION TO THE SECTION:

**607.1.1-Galvanized Surface Staining:** This work consists of preparing, staining, and finishing all visible galvanized surfaces and appurtenances to achieve a rustic brown color with a matte finish.

**607.1.2-Painted Galvanized Surface:** This work shall consist of preparing and painting, as required by the paint manufacturer's requirements, galvanized surfaces with a rustic brown color surface as required by the manufacturer's requirements

**607.1.3-Powder Coated Galvanized Surface:** This work shall consist of preparing and powder coating galvanized surfaces a rustic brown color.

**607.2-MATERIALS:**

ADD THE FOLLOWING SUBSECTIONS TO THE SECTION:

**607.2.1-Galvanized Surface Staining:** The stain must consist of a clear soluble solution of natural oxidizers and soft buffered organic acids that accelerates the oxidization process without compromising the protective qualities of the galvanized surfacing. No pigment

based colorants should be added to achieve the desired color. The stain must react with the target surface over a period of 7 - 21 days to produce a rustic brown color with a matte finish. The stain must be resistant to fading in the sun.

**607.2.1.1-Submittals:**

A. Submit the following items:

1. A copy of the manufacturer's product Material Safety Data Sheet together with instructions for application of stain 5 days before application.
2. Proposed methods to control overspray, spillage and protection of adjacent surfaces for approval by the State Representative. No staining will be allowed prior to approval.
3. Independent lab tests showing that the stain material is environmentally safe.

**607.2.1.2-Quality Control and Assurance:**

A. Sample Section

1. Apply stain to a minimum 12 inch sample section of metal. Notify the Engineer not less than 7 days before staining the sample section. Prepare and stain the sample section with the same materials, tools, equipment and methods to be used in staining final surfaces. The applied stain must be allowed to cure for a minimum of 14 days before the Engineer inspection. In the event more than one sample section is required by the Engineer, each additional sample section will be paid for as change order work.
2. Use the Engineer approved sample as the standard of comparison in determining acceptability of staining.

**607.2.2-Painted Galvanized Surface:** The paint and application shall be in accordance with Subsection 688.3.4.3. All operations including cleaning, priming and painting shall be shop applied as required by the paint manufacturer. Only minor touch-up will be permitted in the field.

**607.2.3-Powder Coated Galvanized Surface:** The products provided shall be commercially powder coated materials and shall meet the requirements of Section 690.

ADD THE FOLLOWING SUBSECTION TO THE SECTION:

**607.3.4-Galvanized Surface Staining Construction:**

**607.3.4.1-Preparation:** Target surfaces to be stained must be free of excessive oils, dirt and other contaminants. All surfaces must be dry before application of stain.

**607.3.4.2-Application:**

- a. After areas to be stained have been prepared and the sample approved, apply stain to all existing galvanized surfaces and appurtenances required to be stained. Apply stain according to the manufacturer's instructions to achieve a color consistent with the approved sample. Minimize overspray. Spray application should not be performed under windy or rainy conditions
- b. Stain must be applied uniformly. Irregularities must be corrected according to the stain manufacturer's recommendations.
- c. Stained surfaces must be kept dry for a period of 5 days following the application of stain.
- d. Final approval of product samples shall be made by the Owner and/or Construction Manager.
- e. No work shall proceed until written approval is received.

**607.3.4.3-Approved Products:**

**METALS  
STAINS FOR GALVANIZED STEEL PRODUCTS**

<b>Products</b>	<b>Manufacturer's Address</b>
Natina Steel	Natina Products, LLC PO Box 4563 Palm Desert, CA 92261 (877) 762-8462  www.Natinaproducts.com
Or Approved Equal As approved by the Engineer	

**607.6-METHOD OF MEASUREMENT:**

ADD THE FOLLOWING SUBSECTION TO THE SECTION:

The aesthetic treatment applied to guardrail will be measured in linear foot (meter) of guardrail as described above. The aesthetic treatment applied to end terminals will be measured separately and will be the actual number of end terminals or attenuators with applied treatment measured per each.

**607.7-BASIS OF PAYMENT:**

ADD THE FOLLOWING BELOW THE FIRST PARAGRAPH:

The quantities of Aesthetic Treatment to Galvanized Surface shall be measured as provided above and paid for by the items listed below, which payments shall constitute full compensation for all materials, labor and incidentals necessary to complete the work of the aesthetic treatment as required.

**607.8-PAY ITEMS:**

ADD THE FOLLOWING TO THE TABLE:

ITEM NUMBER	DESCRIPTION	UNIT
607XXX-000	Aesthetic Treatment To Galvanized Surfaces	LF
607XXX-001	Aesthetic Treatment To Galvanized Surfaces	EA

{The above Item numbers could be left open as shown above or developed to with “Alternates” so that the selected system is known for historical base information.}

**DIVISION OF HIGHWAYS**

**SPECIAL PROVISION**

**FOR**

**STATE PROJECT NUMBER:** \_\_\_\_\_

**FEDERAL PROJECT NUMBER:** \_\_\_\_\_

**FOR**

**SECTION 608**

**RIGHT-OF-WAY FENCE**

**608.2-MATERIALS:**

**DELETE PARAGRAPH TWO AND REPLACE WITH THE FOLLOWING:**

Farm-field fence post and braces used throughout the Project shall be pressure treated wood. Pressure treated timber shall be in accordance with AASHTO M 133.

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SPECIAL PROVISION**

**FOR**

**STATE PROJECT NUMBER:** \_\_\_\_\_

**FEDERAL PROJECT NUMBER:** \_\_\_\_\_

**FOR**

**SECTION 627**

**SECTION HIGH LOAD MULTI-ROTATIONAL  
BEARINGS – DISC BEARING ASSEMBLIES**

**627.1-GENERAL:**

This work shall consist of fabricating, testing, furnishing, and installing High Load Multi-Rotational Bearings that are shear inhibited disc type structural bearing devices of the type shown on the plans at the location shown on the plans and in accordance with these Special Provisions. The structural bearings shall adequately provide for movements such as thermal expansion and contraction, rotation, camber changes, and creep-shrinkage of structural members where applicable. The Contractor shall state at the pre

**627.2-DEFINITION:**

**627.2.1-Shear Inhibited Disc Structural Bearing:**

The loan bearing and rotational disc shall be composed of polyether urethane material. This disc shall be contained between upper and lower steel bearing plates and equipped with an internal shear restriction mechanism.

For expansion bearings, the upper steel bearing plate shall have a PTFE sheet recessed and bonded into the top half of the plate to accommodate the horizontal movement of the structure. The PTFE surface of the upper steel bearing plate shall support an upper steel plate fitted with a continuously welded, highly polished stainless steel face. For unidirectional expansion bearings, the upper steel plate shall be fitted with guide bars or a keyway system to restrict the lateral movement of the structure. The guide bars and their opposing guided surfaces shall be faced with opposing strips of PTFE/stainless steel. The guide bars and shear restriction mechanism shall be designed to withstand a minimum force of 10% of the total vertical load. Higher horizontal forces shall be noted in the contract plans. Guiding off of the fixed base or any extension of it will not be permitted.

All materials shall be as specified in the contract documents or as recommended by the manufacturer of the bearing device. Shear inhibited disc structural bearing shall be referred to throughout this specification as the bearing device.

**627.3-QUALIFICATIONS:**

The supplier shall show previous history in the design and fabrication of disc bearings. Documentation showing a minimum of five years' experience and ten bridge installations shall be provided to the Engineer.

**627.4-CONTRACT DRAWINGS:**

The contract drawings shall indicate the following design parameters for proper sizing and detailing of structural bearings:

1. Maximum and minimum vertical load.
2. Horizontal load if it is over the minimum 10% of the total vertical load and the direction
3. Total movement for expansion bearings and the direction.
4. Amount of rotation anticipated.
5. Allowable pressure on concrete substructure.
6. Anchorage details.
7. Uplift data, if required.
8. Temporary holding clips, if required.
9. Removable bearing details, if required.
10. Self-aligning rotation in plan details, if required.
11. Jacking port details.
12. Flexible guide details, if required.
13. Type of bearing, i.e. fixed guided, non-guided.
14. Seismic details.

**627.5-MATERIALS:**

All materials shall be new and unused with no reclaimed material incorporated in the finished bearing.

The Contractor shall furnish a manufacturer's certification that the materials proposed for use on the project have been pre-tested and will meet the requirements as set forth in the manufacturer's current literature.

The material shall not be installed in the field prior to the Engineer's approval

**627.5.1-Polyether Urethane Rotational Element:** The rotational element used in the construction of the shear inhibited disc type bearings shall be molded from a polyether urethane compound. The physical properties of the polyether urethane shall conform to the following requirements:

<u>PHYSICAL PROPERTY</u>	<u>ASTM TEST METHOD</u>	<u>REQUIREMENT</u>
Hardness, Type D Durometer	D-2240	60 min 64 max
Tensile stress, psi	D-412	
@ 100% Elongation		2100 min
@ 200% Elongation		3700 min
Tensile strength, psi	D-412	5500 min
Ultimate Elongation, %	D-412	253 min
Compression Set, 22h @ 158 °F, %		40 max

**627.5.2-Steel:** All steel used in the construction of the bearings (except stainless), shall conform to AASHTO M 270 unless otherwise specified in the contract plans. All steel surfaces exposed to the atmosphere (except stainless and area in contract with the polyether urethane rotational element) shall be hot dipped galvanized in accordance with AASHTO Mill.

**627.5.3-Stainless Steel:** Stainless steel for expansion bearings shall conform to ASTM A167 Type 304 or ASTM A240 Type 304, and shall be continuously welded to upper steel plate. The face of the stainless steel in contact with PTFE shall have a No. 8 bright mirror finish (less than 5 micro inches root mean square). The minimum thickness of the stainless steel shall be 16 gauge. Bonding or mechanically fastening of stainless to upper steel plate will not be allowed.

**627.5.4-Polytetrafluoroethylene (PTFE):** PTFE shall be manufactured from pure virgin (not reprocessed) unfilled PTFE resin. The PTFE sheet shall be bonded and recessed into the upper steel bearing plate. The PTFE sheet shall have a minimum thickness of 1/8 of an inch and be recessed one-half of its thickness into its steel substrate. The PTFE sheet shall be acid-etched on the bonded side and polished on the side facing the stainless steel to insure a low coefficient of friction.

The PTFE strips for guide bars shall be 15% glass filled and a minimum of 1/32 inch thick and shall be bonded and mechanically fastened into the steel edges. The fasteners shall be recessed so as not to interfere with sliding during movement. The PTFE shall be resistant to all acids, alkalis and petroleum products, stable at temperature from -350 OF to +500 OF, non-flammable, and non-absorbing of water. The PTFE shall be bonded to grit blasted steel using an adhesive approved by the manufacturer. The unfilled PTFE shall conform to the following requirements:

<u>PHYSICAL PROPERTY</u>	<u>ASTM TEST METHOD</u>	<u>REQUIREMENT</u>
Ultimate Tensile Strength, psi	D-638	2800 min
Ultimate Elongation, %	D-638	200 min
Specific Gravity	D-292	2.13in

**627.6-FABRICATION REQUIREMENTS:**

The finish of the mold used to produce the rotational element shall conform to good machine shop practice. Each bearing shall have a project identification number and lot number marked on a side that will be visible after erection.

Gross bearing dimensions shall have a tolerance of -0, +1/8 inch. Overall thickness tolerance shall be -0, +1/8 inch. All bearing surfaces of steel plates shall be finished flat within 0.01 inch.

**627.7-TESTING:**

The bearing devices to be tested shall be selected by the design authority at random. The bearing device will be visually examined both during and after the test. Any visual effects shall be cause for rejection.

**627.7.1-Coefficient of Friction:** Sliding coefficient of friction tests will be performed by the manufacturer of one expansion bearing device from each lot. A lot will be the quantity as

defined by the designed authority with a maximum of 25 bearings per lot. The coefficient of friction will be measured at the bearing design capacity on the 5<sup>th</sup>, 15<sup>th</sup>, and 100<sup>th</sup> cycle at a speed on one inch/minute. A total of 100 cycles shall be run. The sliding coefficient of friction shall be calculated as the horizontal load required to maintain continuous sliding at a given speed divided by the bearings design capacity vertical load. The vertical load shall have been applied continuously for a minimum of one-hour prior to testing.

The measured sliding coefficient of friction shall not exceed 0.03.

**627.7.2-Rotation:** Rotation tests will be performed by the manufacturer on one bearing device from each lot. The polyether urethane element shall be capable of maintaining its initial uniform contact with the steel bearing plates through a rotation of 0.02 radians under a compressive load equal to 150% of the design capacity of the bearing device.

Any observed separation between the edge of the rotational elements and the bearing plates shall be cause for rejection.

**627.8-CONSTRUCTION REQUIREMENTS:**

The Contractor shall submit shop drawings in a timely fashion after the award of contract. At the discretion of the Engineer, the manufacturer may be required to furnish facilities for inspection of the completed device or a representative sample I his plant. The inspectors shall be allowed free access to the necessary parts of the manufacturer’s plant. The manufacturer shall provide a technical representative to be present at times while the bearing device is being installed. The Contractor shall notify the bearing device installation date.

The bearing device manufacturer’s instructions for the proper installation of the bearing shall be entered in the shop drawings. Shop drawings, which lack manufacturer’s installation instructions, may be returned without approval.

The bearing device shall be installed strict accordance with the manufacturer’s instructions, this specification and the advice of their official representative.

The manufacturer shall ship each bearing fully assembled. The bearing devices are not to be disassembled prior to installation with the knowledge of the design author and manufacturer.

**627.9-BASIS OF PAYMENT:**

The accepted quantity of bridge bearing device will be paid for at the contract unit per hearing.

**627.10-PAY ITEMS:**

ITEM	DESCRIPTION	UNIT
627006-001	Guided Bearing Disc	Each
627006-002	Non-Guided Bearing Disc	Each
627006-003	Fixed Bearing, Disc	Each

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SPECIAL PROVISION**

**FOR**

**STATE PROJECT NUMBER:** \_\_\_\_\_

**FEDERAL PROJECT NUMBER:** \_\_\_\_\_

**FOR**

**SECTION 627**

**CABLE STAYED BRIDGE, CABLE STAY REPAIRS**

**627.1-DESCRIPTION:**

The work shall consist of removing existing polyethylene pipe (PE pipe) and grout, and furnishing and placing rust inhibitor(s), grout and re-installing existing and/or installing new PE pipe at the locations indicated on the plans, and, providing access for the Engineer to the repairs during all activities. This work shall be in accordance with this Specification and in conformity with the plans.

**627.2-MATERIALS:**

**627.2.1-Polyethylene Pipe:** New PE pipe shall be PE3408 and have a minimum cell classification of 345464C per ASTM D3350 with a minimum 20 minutes of OIT. HDPE welding rod shall contain a minimum 2.5% carbon black, with MI less than 0.4 g/10 min and OIT of 20 minutes.

All PE pipe, and all material for welding PE pipe shall be stored in a clean, dry location and kept out of direct sunlight. All material shall be clearly labeled or marked with the following information:

- 1) Product name
- 2) Date of manufacture
- 3) Name & address of the manufacturer

Unless new pipe is proposed as indicated on the plans, the existing PE pipe shall be reinstalled. The Contractor may propose to use new PE pipe in additional locations if PE pipe

of suitable dimensions and meeting the requirements of this specification can be obtained by the Contractor. The Contractor shall provide material information for all proposed PE pipe and PE pipe welding material to WVDOH for approval prior to mobilizing equipment and/or personnel to the project site. The Contractor shall provide a 1-ft. sample of the new pipe and 80 grams of PE pipe welding material to the Engineer prior to mobilizing equipment and/or personnel to the project site and at least 2 weeks prior to scheduled start of the repair work. All unused new and removed PE pipe shall become the property of WVDOH and the Contractor shall make arrangements with Mr. Dave Sada, District 6, District Bridge Engineer for the delivery of the material.

**627.2.2-Grout:**

Grout mix shall conform to the requirements of the 1998 AASHTO LRFD Bridge Construction Specifications, 3rd Edition (as amended through the 2014 Interims) Section 10.9.3 “Grout Physical Properties” and as specified within these Specifications. Grout shall be Class B (Aggressive Exposure Type) per Table 10.9.3-1 and have the properties indicated in Table 10.9.3-2 of the AASHTO LRFD Bridge Construction Specifications (3rd Edition, as amended through the 2014 Interims). SIKA Grout 300PT or Engineer approved equal shall be the grout used for this project.

**Grout Physical Properties**

Grout shall contain components to achieve a thixotropic behavior.

Grouts shall contain no aluminum powder.

Water shall be potable, clean and free of injurious quantities or substances (chlorides, sulfates and nitrates) known to be harmful to Portland cement or post-tensioning steel.

All grout shall be stored in a clean, dry location, and shall be pre-bagged in plastic lined or coated bags. All material shall be clearly marked with the following information:

1. Product name
2. Date of manufacture
3. Name and address of manufacture
4. Shelf life
5. Lot number
6. Mixing instructions
7. Conformance to latest pre-qualification for testing and performance requirements

Any grout package that does not exhibit the above information, or loses that information, or has the integrity of the packaging compromised in the opinion of the Engineer, shall be rejected and shall be removed from the site and wasted to prevent reuse.

Storage of grout in the open must be on a raised platform and with adequate waterproof covering. On-site storage of grout is limited to a maximum period of one month.

**627.2.3-Cable Coatings:** The cable coatings to be used for this work shall be PreLube 19, spray penetrating oil, and SYNCAN, synthetic complex grease, both as manufactured by the Grignard Company or Engineer approved equal. The Contractor shall determine what amount

of cable coating material will be necessary to complete the work and purchase that material prior to beginning work.

**627.2.4-Cable Taping:** The cable taping material shall conform to WVDOH Special Provision 627, Cable Stay Tape.

**627.3-EXISTING POLYETHYLENE PIPE REMOVAL:**

The existing polyethylene pipe (PE pipe) shall be removed at the locations identified in the plans and to the extents as shown in the plans. The Engineer may modify the extent of the PE pipe removal and may add locations based on changed conditions and/or judgment.

The Contractor shall take those precautions necessary to ensure the removed PE pipe or the equipment or other material used in the removal of the PE pipe will not be allowed to fall to the bridge below or into the Ohio River.

The Contractor shall use equipment that can be adjusted to limit its cutting depth, and shall not cut to a depth greater than the PE pipe wall thickness at that repair location. The longitudinal cut line shall not be extended past the circumferential line and/or cut line with power equipment, but shall be completed with manual cutting tools (such as a hammer and chisel). The Contractor shall monitor all PE pipe cutting activities and adjust the cutting depths as necessary to avoid cutting past the PE pipe wall into the grout as the exact location of the cable wire strands is not known, and these wire strands must not be cut or reduced in area in any way.

The sections of PE pipe to be removed shall be marked prior to their removal to ensure they will be re-installed in their original positions. The existing PE pipe that is removed shall be re-installed at all repair locations.

The Contractor shall prevent cupping or other distortion of the removed pipe due to residual stresses while it is awaiting re-installation.

The Engineer shall inspect the removed PE pipe immediately after removal, and immediately prior to re-installation for any defects or other damage that may require additional investigation.

**627.4-EXISTING GROUT REMOVAL:**

The existing grout shall be removed at the locations identified in the plans and not less than the extent as shown in the plans. The Engineer may modify the extent of grout removal and may add locations based on changed conditions and/or judgment. The Contractor shall take those precautions necessary to ensure that at no time shall the removed grout, or the equipment or other material used in the removal of the grout or inspection of the wires, be allowed to fall onto the bridge below or into the Ohio River. The removed grout shall be collected and disposed of off-site.

A small section of grout shall be removed around the circumference of the cable in the middle of the exposed section of grout to determine the depth of grout cover on the cables' strand. Maximum 1/8-in. deep score lines shall then be cut, but at no time shall the depth of the score line be allowed to nick, cut or touch the wire strands. Steel band clamps shall be installed adjacent to the score lines and the grout then removed between the score lines. Grout removal shall be performed by hand with the lightest hammer necessary to fracture the grout. The tool or equipment used to cut the grout score lines shall be capable of being adjusted to limit the cutting depth to 1/8-in.

All grout shall be removed between the score lines. The Contractor shall take care that the hammer does not contact the strand with sufficient force to damage the wires.

The Contractor shall provide brass or bronze wire brushes to the Engineer for use in removing the final remains of the grout on the strand. The Contractor shall allot a minimum of two hours for the Engineer to inspect the strand at each repair location after the grout has been removed to the approval of the Engineer. The Contractor shall also provide brass or bronze screw drivers or other prying tools for the Engineer's use to facilitate this inspection. The Engineer may direct the Contractor to expand the repair extent should corrosion extend beyond the area initially opened and exposed for inspection. The Contractor shall then perform the same applicable operations for the expanded repair extent. The Contractor shall be paid for the total length of repair (per LF) of cable, this LF includes the original repair length and any additional length required as directed by the Engineer.

**627.5-APPLICATION OF CABLE COATINGS:**

The strand shall be coated with two corrosion inhibitors. The first shall be a spray penetrating oil and the second shall be a synthetic grease as specified in Section 627.2.3 of this Special Provision. The Contractor shall take those precautions necessary to ensure that at no time shall the cable coating materials be allowed to drip or fall off the wire strands to the cables, bridge or Ohio River below. The Contractor shall clean any cable coating material from cable and bridge surfaces should any material fall, drip or be spilled from the repair location.

The top layer of wires shall be worked with brass or bronze tools during oiling to allow the penetrating oil to be applied to the second layer of wire strands. All visible and exposed wires shall be coated with penetrating oil.

The synthetic grease shall be applied after the penetrating oil and after the penetrating oil has ceased dripping from, or collecting on the strand. The Contractor shall apply the grease to all exposed wires in a uniform coating.

The Contractor shall clean all cable coating material from the exposed grout, polyethylene pipe and Tedlar PVF tape with the appropriate cleaning material and equipment.

**627.6-INSTALLATION OF POLYETHYLENE PIPE:**

The Contractor shall prepare the removed and new polyethylene pipe (PE pipe) for installation as shown in the plans. The use of a "backer bar" or other means, may be necessary to facilitate the welding of the longitudinal cuts in the grout void region.

The Contractor shall provide a demonstration of the PE pipe welding equipment, material, and personnel capabilities for the Engineer using the new PE pipe prior to beginning the repairs. Three 1 foot sections of PE pipe shall be split and then welded back together. The welded pipe sections shall be submitted to the engineer a minimum of 2 weeks prior to the scheduled start of work. Gas temperatures at the tip of the welding gun shall be recorded. The welded samples will be tested for strength. The welds must develop a minimum of 80% of the tensile strength of the PE pipe. The Contractor shall utilize the same welding equipment, material and personnel for all PE pipe repairs. Should any factor change, the Contractor shall provide additional demonstrations to satisfy the Engineer prior to re-starting repair work.

**627.7-GROUT PLACEMENT:**

The Contractor shall follow the grout manufacturer's recommendations and provide a complete list of equipment, material, and placement procedures to Engineer prior to mobilizing equipment and/or personnel to the project site.

The Contractor shall inject new grout at all repair locations where existing grout is removed. The grout injection shall be accomplished as shown in the plans and as specified herein. The Contractor shall utilize a mechanical mixer and grout pump in the performance of this work, manually mixing the grout and hand placement of the grout shall not be allowed.

Grout placement shall not be done when the temperature of the grout exceeds 81° F, when the temperature of the cable sheathing exceeds 100° F, or when the ambient air temperature is forecast to be lower than 45° F within a 24 hour period.

Grout shall be injected into the PE pipe at the low point of the cable as shown in the plans. The pumping pressure shall be constant as the PE pipe is being filled, and as grout is forced out the grout vent hole for a minimum of 15 seconds. The 15 seconds shall be considered fulfilled when the grout has flowed from the grout vent with no visible slugs of grout, air or water for 15 seconds. Should a slug of grout, air or water be observed, the grout will continue to be injected at the constant pressure and a new 15 second period began. When the 15 second period has been fulfilled, the grout vent hole shall be plugged and the pressure held for 5 seconds. The grout injection port shall then be plugged and bleed water removed. The Contractor shall repeat the process if the grout injection port is not plugged in a timely fashion and injected grout is lost, at no extra cost to WVDOH.

The Contractor shall obtain the agreement of the Engineer for the fulfillment of this work. The Contractor shall clean all grout from the PE pipe and Tedlar PVF tape surfaces during and after the grout placement has been completed to the approval of the Engineer.

After the grout has cured according to the manufacturer's recommendations, the Contractor shall remove the plug in the grout injection port and grout vent hole and allow the Engineer to verify full grouting at those locations. The Contractor may be required to drill ¼ in. diameter "observation holes" in the cable to verify full grouting the length of the repair at the discretion of the Engineer. After the grouting procedure is finished, "observation holes" shall be filled with PE pipe weld material.

Grouting equipment shall be the same as used for the grout acceptance tests. Grouting equipment shall include a moving blade mixer capable of continuous mechanical mixing which will produce a grout free of lumps and undispersed cement. Follow the grout manufacturer's recommendation for the use of a grout mixer. The pump shall be a positive displacement type able to produce an outlet pressure of 75 psi and shall have seals which are adequate to prevent introduction of oil or other foreign substance into the grout.

A pressure gauge having a full-scale reading of no greater than 1.5 times the anticipated grouting pressure shall be installed in the grout line between the pumping outlet and the grout injection port.

A screen, which is easily accessible for inspection and cleaning with clear openings of 3/16-in. maximum size, shall be installed between the mixer and the pump.

The grouting equipment shall utilize gravity feed to the pump inlet from a hopper attached directly over it. The hopper must be kept at least 1/3 full of grout at all times during the pumping operation to prevent air from being drawn into the stay pipe. Prior to beginning grouting operations, the contractor shall demonstrate that the combination of grout materials, mixer and pump are capable of satisfactorily grouting the stays by performing a grouting acceptance test on a mock-up of a stay cable repair.

Introduction of admixtures and mixing of the grout shall be in accordance as recommended

in writing by the manufacturer of the admixtures used and in accordance with the procedures used in the grout test.

**627.8-SHOP DRAWINGS:**

The Contractor shall prepare shop drawings for the repairs as shown in the plans. Shop drawings for the repairs shall include plans and details for the fittings, valves and other that will be necessary to provide positive mechanical shut off valves. The shop drawings shall be submitted to the Engineer for review and approval prior to fabrication.

**627.10-ACCEPTANCE CRITERIA:**

The Engineer shall not accept the Contractor’s work if in his judgment, the following criteria are not met:

1. The Contractor fails to store, handle, mix, or install the materials according to the Manufacturer’s recommendations and as specified herein.
2. The Contractor fails to store, handle, mix, or install the materials according to the Manufacturer’s recommendations and as specified herein.
3. Degradation of material properties under field conditions is detected. Any material showing degradation shall be replaced by the Contractor.
4. If any PE pipe needs to be rewelded for whatever reason, it will be done by the Contractor.
5. If a repair is found not fully grouted, it will be filled by the Contractor with material and methods acceptable and approved by the Engineer.
6. All work done as a result of the acceptance criteria shall be done at no additional cost to the Department.

**627.11-METHOD OF MEASUREMENT:**

Cable stay repairs will be measured in place, in linear feet, based on the length of PE pipe removed, and shall include all material and work necessary for the PE pipe removal and installation, grout removal and injection and cable coatings within the limits of the repairs.

**627.12-BASIS OF PAYMENT:**

The preparation for the cable stay repair, testing, polyethylene pipe, polyethylene pipe welding material, grout, cable coatings, and removal and installation of all of the specified materials to affect the cable stay repair shall be included in the payment for the item. The quantities, determined above, will be paid for at the contract unit price bid for the items below, which price and payment shall be full compensation for furnishing all materials and doing all the work herein prescribed, including all the cost, labor, tools, equipment, supplies and incidentals necessary to complete the work.

**627.13-PAY ITEM:**

ITEM	DESCRIPTION	UNIT
627001-002	Cable Stay Repair	LF

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SPECIAL PROVISION**

**FOR**

**STATE PROJECT NUMBER:** \_\_\_\_\_

**FEDERAL PROJECT NUMBER:** \_\_\_\_\_

**FOR**

**SECTION 627**

**CABLE STAY TAPE**

**627.20-DESCRIPTION:**

The work shall consist of furnishing and placing Tedlar PVF tape at the locations indicated in the plans, and providing access for the Engineer to the repairs during all activities. This work shall be in accordance with this Specification and in conformity with the plans.

**627.21-MATERIALS:**

**627.21.1-Tedlar PVF Tape:**

**REQUIREMENTS**

Backing	Tedlar PVF	
Adhesive	Acrylic	
Color	White	
Width	4 in.	
Adhesion to steel	Minimum of 45 oz./in width	ASTM Test Method D-3330
Tensile Strength	Minimum of 22 lbs./in width	ASTM Test Method D-3759
Elongation at Break	Minimum of 160%	ASTM Test Method D-3759
Backing Thickness	2.1 mils +/- 0.1 mils	ASTM Test Method D-3652
Total Tape Thickness	3.4 mils +/- 0.15 mils	ASTM Test Method D-3652
Temperature Use Range	-90 deg. to 210 deg. F	

All Tedlar PVF tape shall be stored in a clean dry location and in accordance with manufacturer's recommendations. All material shall be clearly labeled or marked with the following information:

- 1) Product name
- 2) Date of manufacture
- 3) Name & address of the manufacturer
- 4) Expiration Date
- 5) Lot number

The manufacturer of the Tedlar PVF tape shall submit documentation showing that the material submitted for construction is of equal or higher quality than the material provided by WVDOH.

At the end of project, all rolls (full or partial) of tape shall become the property of the WVDOH and the Contractor shall make arrangements with Mr. Dave Sada, District 6, District Bridge Engineer for the delivery of the material.

**627.21.2-Cable Stay Tape Preparation:**

The loose, rough, or ragged edges of the Tedlar PVF tape at the repair locations shall be trimmed. The polyethylene pipe at the repair location shall be cleaned using a cloth soaked in a cleaning solvent which is acceptable to the tape and polyethylene pipe manufactures such as VM&P Naphtha and isopropyl alcohol. The use of oily or soapy solutions that might leave a film behind is prohibited.

The Contractor shall clean and dry the area to receive Tedlar PVF tape to the satisfaction of the Engineer immediately prior to Tedlar PVF tape application.

**627.21.3-Cable Stay Tape Application:**

The contractor shall apply Tedlar PVF tape at the locations indicated and to the extents shown in the plans. The application of Tedlar PVF tape shall be done in dry ambient conditions with a maximum allowable air temperature of 84°F and a minimum allowable air temperature of 36°F.

Prior to the Contractor mobilizing equipment and/or personnel to the project site, the Contractor shall provide a demonstration of the methods and personnel they intend to utilize during the repairs on a 10-ft. section of inclined polyethylene pipe. The Contractor shall demonstrate to the satisfaction of the Engineer that the tape can be applied in the helical manner without wrinkles and bumps using a taping machine or manual methods. The method approved at the demonstration stage shall be used for the actual repairs.

The Tedlar PVF tape shall be applied (wrapped) in a helical manner from bottom of repair to top, under tension with a 50% overlap. The taping process shall be started and ended with 2 wraps of 100% overlap.

Splicing of the Tedlar PVF tape is prohibited except for repairs which require a length of tape greater than a new roll of tape. If necessary, the Contractor shall splice rolls of Tedlar tape together carefully by overlapping the trailing end of one roll by 2-in. minimum onto the leading end of the new roll and continuing the wrapping process. At each splice location, 2

wraps of 100% overlap shall occur. For those circumstances which require a splice, only one splice is allowed.

**627.21.4-Acceptance Criteria:**

The Engineer shall not accept the Contractor's work if in his judgment, the following criteria are not met:

The Contractor fails to store, handle, or install the materials according to the Manufacturer's recommendation and as specified herein.

The Tedlar tape shall have a clean smooth appearance free of any wrinkles, bumps or debris between the tape and the PE pipe which would affect the performance of the tape.

If any Tedlar tape needs to be rewrapped for whatever reason, it will be done by the Contractor.

If a repair is found not fully sealed, the affected area will be rewrapped by the Contractor.

Degradation of material properties under field conditions is detected. Any material showing degradation shall be replaced by the Contractor.

All work done as a result of the acceptance criteria shall be done at no additional cost to the Department.

**627.21.5-Method of Measurement:**

Cable stay tape will be measured in place, in linear feet, based on the length of PE pipe taped, and shall include all material and work necessary for the Tedlar PVF tape preparation and installation within the limits of the repairs.

**627.21.6-Basis of Payment:**

The purchase, preparation and installation of the Tedlar PVF tape shall be included in the payment for the item. The quantities, determined as given in Section 627.21.5, Method of Measurement, will be paid for at the contract unit price bid for the items below, which price and payment shall be full compensation for furnishing all materials and doing all the work herein prescribed, including all the cost, labor, tools, equipment, supplies and incidentals necessary to complete the work.

**627.21.7-PAY ITEM:**

No direct payment will be made for this work, but shall be included under 627001-002, Cable Stay Repair, LF.

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

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**STATE PROJECT NUMBER:** \_\_\_\_\_

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**SECTION 650**

**SODDING**

**650.1-DESCRIPTION:**

This work consists of furnishing, hauling, excavating for and preparing the bed, and placing sod.

**650.2-MATERIALS:**

Furnish sod consisting of well-rooted Kentucky Blue Grass (*Poa pratensis*) or Canadian Blue Grass (*Poa compressa*) and Tall Fescue (*Festuca arundinacea*) containing a growth of not more than 5 percent of other grasses, and free from all noxious weeds such as wild mustard, thistles, quack grass, Johnson grass, dandelions, and crab grass.

Ensure that all sod is certified by the sod supplier that it complies with this item. Ensure that the sod was recently mowed to a height of not more than 3 inches (75 mm). Furnish a certificate with each shipment, and furnish the following additional information from the sod supplier:

- A. The name of the producer.
- B. The amount of sod shipped in square yards (square meters).
- C. The location of sod field.
- D. The location of job site.
- E. The date sod was cut.
- F. The thickness the sod was cut.

Furnish wood stakes that are at least 1/2 × 3/4 × 12 inches (13 × 19 × 300 mm).

Furnish T-pins that are 18-inch (450 mm) in length and 1/4 inch (6 mm) in diameter and have a 3-inch (75 mm) tee.

Furnish round pins that are 18-inch (450 mm) in length and 1/4 inch (6 mm) in diameter and have a 1.5-inch (38 mm) washer.

Furnish galvanized poultry netting 50 inches (1200 mm) wide with 2-inch (50 mm) mesh and No. 20 gage minimum wire.

Furnish fertilizer and lime according to Item 652.

### **650.3-CONSTRUCTION REQUIREMENTS:**

**650.3.1-Lifting Sod:** Furnish sod strips that are not less than 3 feet (0.9 m) and not over 6 feet (1.8 m) in length with a uniform width of not over 24 inches (0.6 m). Furnish sod strips that lay flat on skids. The Contractor may elect to deliver sod rolls of up to 25 feet (7.6 m) in length. Furnish sod rolls that are pre-rolled on skids. Furnish sod cut to a depth equal to the growth of the fibrous roots but in no case less than 1 inch (25 mm).

Deliver sod to the job within 24 hours after being cut, and install it within 48 hours after being cut.

During wet weather, allow the sod to dry sufficiently to prevent tearing during handling and placing. During dry weather, water the sod before lifting to ensure its vitality and to prevent the dropping off of the soil in handling.

**650.3.2-Preparation of Areas to be Sodded:** Before placing the sod, excavate the sod bed to a depth that when the sod is in place the top of the sod is flush with the surrounding grade and conforms to the typical cross-section. If specified, place the topsoil according to Item 651. If specified under Item 651, apply commercial fertilizer and agricultural liming material. Incorporate these materials in the areas to be sodded at the rate specified in 652.6 to a depth of not less than 1 inch (25 mm). Incorporate these materials within 48 hours prior to placing the sod. Immediately before placing the sod, rake the area or otherwise bring it to an even surface forming a proper sod bed. If the area is dry, thoroughly water the sod bed.

**650.3.3-Placing Sod:** Do not place any sod when the temperature is below 32 °F (0 °C). Do not place any frozen sod, and do not place any sod upon frozen soil. When placing sod between June 1 and October 15, cover it immediately with straw mulch 1 inch (25 mm) thick, loose measurement.

Lift sod from trucks or storage piles, and place it by hand with close joints and no overlapping. Plug all gaps between sections of sod and openings at angles with sod. After laying, thoroughly water the sod, and tamp the sod with approved sod tampers sufficiently to bring the sod into close contact with the sod-bed and to ensure tight joints between the sections or strips. Upon placing the sod, ensure that the surface of the sodded areas coincides with the finished grade.

**650.3.3.1-On Slopes Steeper Than 3:1 But Flatter Than 2:1:** Lay sod with the long edges of the strip parallel to the contour starting at the bottom of the slope. Neatly match successive strips, and stagger all joints by at least 12 inches (300mm).

For sod placed 6 feet (1.8 m) or greater in height (measured along the slope), stake each strip or roll securely along all sides with stakes not more than 2 feet (0.6 m) apart with the flat side against the slope or with pins not more than 2 feet (0.6 m) apart. Drive the wooden stakes so that the last 1 inch (25 mm) remains above the top of the sod. Drive pins 1 inch (25 mm) below the top of the grass.

**650.3.3.2-In Ditches:** Place sod in ditches with joints staggered at least 12 inches (300 mm). Stake each strip or roll securely along all sides with wooden stakes not more than 2 feet (0.6 m) apart with the flat side against the slope. Drive the wooden stakes so that the last 1 inch (25 mm) remains above the top of the sod.

**650.3.3.3-On Slopes 2:1 or Steeper:** Before placing the sod, place the galvanized poultry netting or equivalent. Stake the galvanized poultry netting or equivalent securely to the subgrade by using pins or wood stakes. Place the pins or wooden stakes at 4 foot (1.2m) intervals. Fasten the netting to the wooden stakes with staples. Where the sod width is from 8 to 10 feet (2.4 to 3 m) wide, the Engineer will allow two strands of netting for a total width of 8 feet (2.4 m). For sod, stake each strip or roll securely along all sides with wooden stakes not more than 2 feet (0.6 m) apart with the flat side against the slope or with pins not more than 2 feet (0.6 m) apart. Drive the wooden stakes so that the last 1 inch (25 mm) remains above the top of the sod. Drive pins 1 inch (25mm) below the top of the grass.

**650.3.4-Watering:** Keep all sodded areas thoroughly moist for 30 days after sodding. Repair any areas damaged following installation. Ensure that sod is in place for at least 30 days before final acceptance.

**650.4-METHOD OF MEASUREMENT:**

The quantity of work done will be measured in square yards (meter) of “Sodding” as determined from the lines and dimensions shown on the Plans.

**650.5-BASIS OF PAYMENT:**

The quantities, determined as provided above, will be paid at the contract unit process bid for the items, 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.

**650.6-PAY ITEMS:**

ITEM	DESCRIPTION	UNIT
650010-001	SODDING, “staking requirements”	Square Yard (Meter)

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**SUPPLEMENTAL SPECIFICATION**  
**FOR**  
**SECTION 688**  
**PAINTING METAL STRUCTURES**

DELETE THE CONTENTS AND SUBSTITUTE THE FOLLOWING:

**688.1-DESCRIPTION:**

The painting (coating) of metal 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.

**688.2-GENERAL:**

**688.2.1–Surface Preparation:**

**688.2.1.1–Non-Blasting:** When non-blast cleaning is specified in the contract documents, any one or any combination of the methods below shall be used. The surface and the surface profile after cleaning shall meet the requirements of the methods below. The amount of material, rust scale, and pack rust removed after non-blast cleaning, will meet the requirements of the SSPC methods listed:

1. Hand Tool Cleaning SSPC-SP2
2. Power Tool Cleaning SSPC-SP3
3. Commercial Grade Power Tool Cleaning SSPC-SP15

**688.2.1.2–Blasting:** The compressed air used for nozzle blasting shall be free of water or oil. The cleanliness of each compressed air system shall be verified at least once per shift using the blotter test in accordance with ASTM D4285, “Standard Test Method for Indicating Oil or Water in Compressed Air”.

**688.2.1.2.1–Commercial:** Shall meet the requirements of SSPC-SP 6 prior to painting. The appearance of the steel surface after blast cleaning shall correspond to the applicable and current SP 6 pictorial standards of SSPC Vis 1.

**688.2.1.2.2–Brush-Off Blast:** Shall meet the requirements of SSPC-SP 7 prior to painting. The appearance of the steel surface after brush off blast cleaning shall correspond to the applicable and current SP 7 pictorial standards of SSPC Vis 1.

**688.2.1.2.3-Near White:** Shall meet the requirements of SSPC-SP 10 prior to painting. The appearance of the steel surface after blast cleaning shall correspond to the applicable and current SP 10 pictorial standards of SSPC Vis 1.

**688.2.1.2.4–Blast Media:** The abrasives used for all blasting shall meet the guidelines set forth in SSPC AB1 for mineral and slag abrasives, and AB3 for ferrous metallic abrasives. Any additive mixed with the abrasive shall be approved by the Division prior to use. The abrasives used shall produce a height of profile between 1.0 and 3.0 mils (25 µm and 75 µm).

In addition, the container or bag of abrasive shall include the name of the abrasive, the name of the manufacturer, and the size of the abrasive. If any additive has been included with the abrasive, the name and the percentage of the additive shall be on the container or bag.

**688.2.1.3-Post-Surface Preparation:** Surface prep operations shall be performed in such a manner that no damage is done to partially or entirely completed portions of the work. After surface prep, any areas that are repaired by welding shall be prepped again. Areas repaired by grinding or other means shall have the anchor pattern restored by abrasive blasting. Visible deposits of oil, grease, or other contaminants shall be removed according to SSPC-SP1 "Solvent Cleaning" prior to painting. Dust, loose residues, and the removal of abrasives from pockets and corners shall be removed from prepared surfaces by brushing, blowing off with clean, dry air, vacuum cleaning. The prepped surface shall be checked for cleanliness by wiping a clean, dark cloth across the surface. If residue is present, the surface shall be cleaned again and rechecked. All blast cleaned surfaces shall be painted prior to any rust bloom or flash rust occurring or within 24 hours, whichever comes first.

## **688.2.2-Paint Application Requirements:**

**688.2.2.1-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. The temperature of the steel must be at least 5° F (3° C) above the dew point. 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.

**688.2.2.2-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.

**688.2.2.3-Paint Application:** The blast cleaned surface shall be painted within 24 hours. In the event rust bloom or flash rusting occurs, the effected members shall be re-cleaned by blasting. The paint shall be applied by spray methods, except those areas

inaccessible to spray application may be brushed. Brushes, when used, shall have sufficient body and length of bristle to spread a uniform coat. Small touch-up areas may be brushed, if approved by the Engineer.

Use of an agitated pot shall be mandatory in spray application of the paint. 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.

Application requirements and drying times between coats shall be in accordance with the manufacturer's written instructions. Dry film thickness requirements shall be specified in the contract documents. Exposed steel surfaces of expansion dams shall be painted as specified for structural steel.

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. This shall include pedestrian, marine, or vehicular traffic on any portion of the bridge, and any highway appurtenances that are found upon, beneath, or adjacent to the structure. 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 WVDOH Engineer to order the Contractor to cease all work on the project until corrective action has been taken. The Contractor shall be responsible for cleaning and/or replacing any property damaged by the Contractor's operations at no cost to the Department. The method of cleaning and/or replacement shall be submitted to the Engineer in advance for approval.

**688.2.2.3.1-Painting Sequence:** Shall be in accordance with the following:

**FULL PRIME COAT:**

The structure shall receive one coat of a primer meeting the requirements of Section 711 of the Standard Specifications. The full prime coat shall be applied before the stripe prime coat. The primer used for the full prime coat and the stripe prime coat shall be of the same type and shall be from the same manufacturer.

**STRIPE PRIME COAT:**

All edges, corners, crevices, bolt heads and nuts, all rivet heads, edges of flanges and plates, welds, sharp edges, in general all edges, shall receive one stripe coat, by brush application, of the same primer as the Full Prime Coat. Striping shall extend a minimum of one inch (2cm) from the edge. The prime coat shall at a minimum, be set-to-touch before the stripe coat is applied. No dry film thickness is specified for this coat. This coat shall be tinted as allowed by the manufacturer to be in contrast to the full prime coat and intermediate coat. The tinting agent shall be the paint manufacturer's approved tinting agent.

**INTERMEDIATE COAT:**

The structure shall receive one uniform coat of a paint meeting the requirements of Section 711 of the Standard Specifications. The color shall be in contrast to the prime and top coats. If tinting is required, the tinting agent shall be the paint manufacturer's approved tinting agent.

**CAULKING:**

Caulking shall be applied before the application of the topcoat. This includes all seams between diaphragm connections to stiffeners and splices; and seams between any connection that is riveted or bolted. Any welded connections that are not fully sealed by the weld shall be caulked with a paste type caulk. The caulk shall be pressed into the seams between the adjoining surfaces, by wetted finger or specialty tool, to insure bond and provide a smooth uniform surface. Caulking in a 3-coat system shall be applied after the intermediate coat has cured. Caulking on a 2-coat system shall be applied after prime coat has cured. The top coat shall not be applied until the caulking has fully cured in accordance with the manufacturer's recommendations.

The caulking material shall be compatible with the paint system being applied and shall be by written recommendation of the paint manufacturer. The caulking material shall be tested for compatibility with the paint system at the same time that the paint is tested for intercoat compatibility. Caulking operations shall be performed only when weather conditions are within the parameters as specified in section 688.2.2.1.

**TOP COAT:**

The structure shall receive one uniform coat of paint as designated in the plans meeting the requirements of Section 711 of the Standard Specifications. The color shall be as designated in the plans and shall be in accordance with current Federal Standard 595.

**688.2.2.3.2-Paint Systems:**

**3 COAT:** Primer, Intermediate, Top Coat

**2 COAT:** Primer, Top Coat

**1 COAT:** Epoxy Mastic only

**688.2.2.3.3-Painting over Galvanized Surfaces:** Painting Galvanized surfaces shall be in accordance to the paint manufacturer's recommendations. The Contractor is to exercise care while cleaning and painting around expansion joints and galvanized surfaces. Any damage to the expansion joints or galvanized surfaces found by the Engineer, as a result of the cleaning and painting operation shall be repaired and/or replaced, to the satisfaction of the Engineer, at the Contractor's expense.

**688.2.3-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 a minimum of 8X magnification. Calibration of the thickness gage and dry film thickness measurements shall be in accordance with MP 708.40.00.

**688.2.3.1-Access for Inspection:** The Contractor shall furnish suitable safe access and shall provide a time mutually agreed to for inspecting the structural steel prior to and after 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 (In particular, on the fascias where bracing is used, sufficient size support pads must be provided). Any damage that occurs from such devices shall be repaired.

**688.2.3.2-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 repairs to the applied coatings shall be from the same manufacturer. All welds from which the coating of paint has been damaged or is otherwise defective shall be blast 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 damaged areas are repainted. 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.

**688.2.4-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.

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

**688.2.4.2-Containment/Disposal Control Plan for Existing Steel Structures:** Minimum requirements shall be set forth in MP 688.03.20.

**688.2.4.3-Contractors Qualifications:** Contractors performing sand blasting and field painting operations shall be SSPC QP1, and SSPC QP2 qualified.

### **688.3-FIELD PAINTING OF SHOP PRIMED COATED STEEL:**

**688.3.1-General:** Field painting of new shop prime coated structures: Shall include, unless otherwise specified in the contract, the preparation of the primed surface for painting, the procurement of all materials to meet the necessary specifications and the application of the coatings. In addition, the Contractor shall protect pedestrian, vehicular, and other traffic on or underneath the structure from splattering, splashing, or dripping paint. Railings, curbs and all other superstructure and substructure shall be protected against spatters, splashes, and the like.

**688.3.2-Shear Studs:** Shear studs shall be applied in the field. At this time, all adjoining concrete work shall be finished and the primer repaired to the satisfaction of the Engineer.

**688.3.3-Materials:** The field coats (intermediate and/or top coats) of paint shall meet the requirements of 711.22.3 and 711.22.4. The intermediate coat shall be applied at a minimum of one mil (25  $\mu\text{m}$ ) dry. The top coat shall be applied at a minimum of 3 mils (75  $\mu\text{m}$ ) dry. The total thickness of the field coats shall be a minimum of 4 mils (100  $\mu\text{m}$ ) dry for the 711.22 system. Each coat shall be a contrasting color to the previous coat. In addition, the field intercoat adhesion shall be at least 3A when tested in accordance with MP 711.00.20.

**688.3.4-Surface Preparation:** Prior to topcoating, surface contamination such as rust, dirt, mud, oil, concrete, loose zinc, salts, or other foreign matter shall be removed. The entire structure shall be pressure washed at 2000 – 3000 psi (13800 – 20700 kpa). Touch up of the primer shall be in accordance with section 688.2.3.2.

**688.3.5-Paint Application Requirements:** Painting shall be in accordance with Section 688.2.2.3. Paint containment shall be Class 3P as specified in the current edition of SSPC Guide 6.

### **688.4-COMPLETE PAINTING AND ZONE PAINTING OF EXISTING STRUCTURES:**

**688.4.1-General:** The field coats (total system) of paint shall meet the requirements of Section 711. The applicable sections of 711, the dry film thickness and the color shall be as specified in the contract documents. Each coat shall be a contrasting color to the one previously applied.

Where Zone Painting applies, the contract documents shall specify the areas to be prepared and painted.

**688.4.2-Surface Preparation:** The surface shall be prepared as specified in the contract documents. Specific instructions will be given on the amount of surface required to be blast cleaned in accordance with the specific standards identified in 688.2.1.1. The remainder may be removed by non-blast cleaning, according to the standards identified in 688.2.1.1. All laminar and stratified rust that has formed on the existing steel surfaces shall be removed.

Pack rust formed along the perimeter of mating surfaces of connected plates or shapes shall be removed to the extent feasible without mechanically detaching the mating surface. Any rust remaining after cleaning shall be tight and intact when examined using a dull putty knife. The tools used to remove these corrosion products shall be identified in the submittals and accepted by the Engineer. If the surface preparation or removal of rust results in nicks or gouges, the work shall be suspended, and the damaged areas repaired to the satisfaction of

the Engineer, at the Contractor's expense. In general, all accessible steel surfaces not galvanized, aluminum or weathering steel shall be blast cleaned. The Contractor is to exercise care while cleaning and painting around expansion joints and galvanized surfaces. Any damage to the expansion joints or galvanized surfaces found by the Engineer, as a result of the cleaning and painting operation shall be repaired and/or replaced, to the satisfaction of the Engineer, at the Contractor's expense.

**688.4.4-Vegetation Removal:** - It is anticipated that some vegetation may need to be trimmed or removed in order to accomplish the cleaning and painting of the structure. Any such cutting and removal of vegetation shall be considered incidental to Cleaning and Painting the existing structure and shall be at the contractor's discretion and expense. Any such vegetation so cut, shall be removed from the site by the contractor at his sole expense.

**688.4.5-Utilities and Navigational Lighting:** Any damage to the existing utilities shall be repaired and/or replaced, to the satisfaction of the utility owner, at the Contractors expense.

**688.4.6-Paint Designation Label:**

**688.4.6.1-Description:** The bridge paint designation label shall consist of painting on the fascia web of the exterior girder. The following information; the paint system, month-year, and contractor will be in accordance with this special provision and attached details. This paint designation label will only be utilized during the complete removal and painting of existing or new structures. The paint designation label will be assigned to the Contractor during the Pre-Construction meeting.

**688.4.7-Location:** The paint designation label will be located at abutment number one on the fascia web of the exterior girder with a southern or eastern orientation.

**688.4.8-General:** All work performed according to this Project Note shall be considered incidental to the painting of the existing structure.

**688.5-ENVIRONMENTAL, WORKER PROTECTION, AND WASTE HANDLING:**

**688.5.1-General:** Environmental protection shall be used when cleaning, painting, welding or cutting an existing bridge that has a coating containing lead-based paint. 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. A containment/disposal control plan shall be submitted by the prime contractor to the Division according to the requirements as set forth in MP 688.03.20 - Guide for Developing the Contractor's Containment/Disposal Control Plan for Spent Material Prior to Painting Existing Steel Structures. 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. This work shall be performed in compliance with West Virginia Division of Environmental Protection (WVDEP), United States Environmental Protection Agency (EPA) Occupational Safety & Health Administration (OSHA), United States Coast

Guard (USCG), SSPC Guide 6 and Guide 7, and other agencies' rules, regulations, standards and guidelines in effect at the time the work is in progress.

**688.5.2-Permits for Disposal of Spent Material:** The Contractor shall obtain all documents and/or permits that are required for the handling and disposal of the "spent material" collected during the course of the work. All material shall be disposed of at an approved site(s) by a licensed and permitted waste transporter. The Contractor shall not begin cleaning or blasting until he has submitted final documentation that he has an approved disposal site and has all documents and/or permits for the handling, storing, and transporting of hazardous and non-hazardous waste. "Spent material" and other project waste, regardless of the presence of hazardous metals, shall be stored in roll-offs or sealed 55-gallon drums. In no case shall the material be stored directly on the ground or on tarps on the ground. The containers shall be marked and labeled in accordance with all applicable and current Federal and State regulations. 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.

**688.5.2.1-"Spent Material:** This shall include material from other waste streams and shall be sampled and tested in accordance with the current revision of SSPC Guide 7 and all applicable methods of EPA SW-846. 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 "spent material" will be transported and disposed of in accordance with all applicable and current Federal and State regulations. The waste transporter for both hazardous and non-hazardous waste will be listed on the Contractor's Containment/Disposal Control Plan.

**688.5.3-Additional requirements for all containment classes:** Ground covers will be provided 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 such as solid plywood panels or flexible materials such as tarpaulins. Provide explosion-proof lighting inside containment for all surface preparation, paint application, and inspection work. Maintain a minimum of 10 foot-candles for surface preparation and painting, and a minimum of 30 foot-candles for inspection. Water booms shall be used to contain inadvertent releases of debris unless prohibited by navigation lanes. In these cases, a boat with a skimmer shall be available to collect fugitive materials. Remove all project-related debris from the surface of the water or from the stream sediment at the end of each working day at a minimum unless directed otherwise by the Engineer.

**688.5.4-Temporary Waste Storage:** The Division (WVDOH) will obtain a provisional (temporary) EPA waste generator number for the project prior to the beginning of the work. The location of the temporary waste storage site at the project shall be noted in the Contractor's Containment/Disposal Control Plan. This location must be approved of by the Division prior to beginning work.

**688.5.5-Worker Protection:** The Contractor shall provide protection for their Workers as per the requirements of 29 CFR 1926.62 and any other applicable requirements set forth by OSHA. The Contractor shall have a Certified Industrial Hygienist (CIH) develop, review and approve their written compliance plan. The CIH shall be certified by the American Board of Industrial Hygiene. The CIH, or a technician working under the direction of the CIH, shall be present during the first three days of work and at least twice a month thereafter. The CIH shall certify in writing during the first week of work and at the end of the work that the worker protection plan fully complied with all regulations and that the plans were fully implanted. Daily inspections of the work area shall be made by the project “competent person”. The Contractor shall have identified the “competent person” by name in both the CIH’s written compliance plan and the Contractor’s Containment/Disposal Control Plan. The compliance plan shall also include the “competent person’s” qualifications and the frequency of inspections to be taken.

**688.5.6-Division Employee Worker Protection:** The Contractor shall provide respiratory protection and protective clothing and other necessary equipment for up to 2 Division employees at each site.

**688.6-METHOD OF MEASUREMENT:**

**688.6.1-The unit of measurement:** Cleaning and Painting Existing Steel Bridges “or "Cleaning and Painting Existing Steel Bridges Coated with Lead Based Paint" shall be lump sum. The unit of measurement for "Containment and Disposal of Spent Material" shall be lump sum.

**688.7-BASIS OF PAYMENT:**

**688.7.1-Basis of payment:** Cleaning and Painting Existing Steel Bridges" or "Cleaning and Painting Existing Steel Bridges Coated with Lead Based Paint”, or "Containment and Disposal of Spent Material" shall be lump sum price bid for the items listed below, which price and payment shall be full compensation for furnishing all the materials and doing all the work herein prescribed in workmanlike and acceptable manner, including all labor, tools, equipment, supplies and incidentals necessary to complete the work.

**688.7.2-PAY ITEMS:**

ITEM	DESCRIPTION	UNIT
688001-*	Clean and Paint Existing Steel Bridge	Lump Sum
688002-*	Clean and Paint Existing Steel Bridge Coated with Lead Based Paint	Lump Sum`
688003-*	Containment and Disposal of Spent Material	Lump Sum
688004-*	Zone Cleaning and Painting Steel Bridge	Sq. Ft.
688005-*	Zone Cleaning and Painting Steel Bridge With Lead-Based Paint	Sq. Ft.

\* Sequence Number

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SUPPLEMENTAL SPECIFICATION**

**FOR**

**SECTION 663**

**PAVEMENT MARKINGS**

REPLACE THE ENTIRE SECTION WITH THE FOLLOWING:

**663.1-DESCRIPTION:**

Pavement markings shall consist of furnishing and installing various types of markings. It shall include, but is not limited to, edge lines, lane lines, center lines, channelizing lines, intersection markings, stripes, curb markings, island markings, and raised markers, or combinations thereof, in accordance with Contract plans and the following specifications or as directed by the Engineer.

All details not specified or shown on the Plans shall conform to the details and requirements set forth in the following publications. These publications shall collectively be referred to as the "pavement marking standards" throughout the remainder of this Section:

1. The WVDOH Standard Details Book, Vol. II, Signing, Signals, Lighting, and Marking, latest issue date
2. The Manual on Uniform Traffic Control Devices for Streets and Highways, latest issue, as printed by the Federal Highway Administration, U.S. Department of Transportation. (Referred to as the MUTCD.)

**663.2-MATERIALS:**

Materials shall conform to the following Subsections of Division 700 of the Standard Specifications:

<b>MATERIAL</b>	<b>SUBSECTION</b>
Temporary White or Yellow Traffic Paint	711.40
White or Yellow Fast-Dry Traffic Paint, Type II	711.41
Preformed Traffic Markings, Type V	715.40.2
Interim Pavement Markings, Type VIIA	715.40.3
Temporary Pavement Marking Tape, Types VIIB and VIIC	715.40.4
Raised Pavement Markers	715.40.6

### **663.3-TYPES OF PAVEMENT MARKINGS:**

**663.3.1-Edge Lines:** Edge lines shall be continuous or dashed, white or yellow beaded stripes, six (6) inches (100 mm) or eight (8) inches (150 mm) in width, as specified on the Plans or otherwise in the pavement marking standards. Color to be specified on the Plans. Center of stripe shall be located six (6) inches (150 mm) from the edge of the pavement or as otherwise specified on the Plans.

Dashed edge lines shall be applied in lengths of two (2) feet (0.6 m), separated by gaps of six (6) feet (1.8 m), or as otherwise specified on the Plans.

**663.3.2-Lane Lines and Centerline:** Lane lines and centerlines shall be lines between contiguous lanes of pavement. They shall be continuous, broken, or dashed, white or yellow beaded stripes six (6) inches (150mm) or eight (8) inches (200mm) in width, as specified on the Plans or otherwise in the pavement marking standards.

Lane lines and broken centerline lines shall be applied in lengths of ten (10) ft. (3m), separated by gaps of thirty (30) ft. (9m). Dashed lane lines shall be applied in lengths of two (2) ft. (0.6m) separated by gaps of thirteen (13) ft. (4m), or lengths of three (3) ft. (0.9m) separated by gaps of nine (9) ft. (2.7m), as specified on the Plans or otherwise in the pavement marking standards.

When applied to bituminous surfaces, the center of single stripes shall be centered about the dividing line between the contiguous lanes. When applied to Portland cement concrete pavement, the near edge of single stripes shall be offset to the left and four (4) inches (100 mm) from the longitudinal joint. Double yellow centerlines shall be centered about the dividing line between the contiguous lanes, with the gap between the stripes being equal to the width of the stripes.

**663.3.3-Railroad Crossing Marking:** Railroad Crossing Markings shall be white beaded markings located as shown on the Plans or otherwise in the pavement marking standards. Dimensioning shall be in accordance with the pavement marking standards.

**663.3.4-Channelizing Lines:** Channelizing lines shall be continuous white beaded stripes, eight (8) inches (200mm) in width. The length of the line shall be as detailed on the Plans.

**663.3.5-Stop and Crosswalk Lines:** Stop lines shall be solid white beaded lines, twelve (12) inches (300 mm) or twenty-four (24) inches (600 mm) wide, as specified on the Plans or otherwise in the pavement marking standards. Crosswalk lines shall be solid white beaded lines, twelve (12) inches (300 mm) wide by six (6) feet (1.8 m) in length.

**663.3.6-Stripes:** These markings are transverse, diagonal or longitudinal white or yellow beaded lines, twelve (12) inches (300 mm) wide. They are used to increase the visibility of pedestrian crosswalk areas and to designate neutral traffic zones formed by channelizing lines or edge lines. Location, spacing and use of these stripes shall be shown on the Plans or otherwise in the pavement marking standards.

**663.3.7-Curb and Island Markings:** Where specified, exposed surfaces of curbs and paved islands shall be painted solid with yellow or white fast-dry traffic zone paint (Type II) and covered with glass beads. Color to be specified on the Plans.

**663.3.8-Arrows:** Arrows shall be white beaded markings located as shown on the Plans or otherwise in the pavement marking standards. Dimensioning shall be in accordance with the pavement marking standards. Arrows may be one of the following:

1. One Directional Lane Assignment Arrows
2. Multi Directional Lane Assignment Arrows
3. Ramp Wrong Way Arrows
4. Lane Drop Arrows

**663.3.9-Lane Letters:** Lane letters shall be white beaded markings located as shown on the Plans or otherwise in the pavement marking standards. Dimensioning shall be in accordance with the pavement marking standards.

**663.3.10-Raised Pavement Markers (RPM's):** RPM's include reflective Type P-2 markers and reflective Type R-4 markers. The type to be installed and general placement guidelines shall be as shown on the Plans or otherwise in the pavement marking standards.

**663.3.11-Yield Triangles:** Yield Triangles shall be white beaded markings located as shown on the Plans or otherwise in the pavement marking standards. Dimensioning shall be in accordance with the pavement marking standards.

**663.3.12-Handicapped Symbols:** Handicapped symbols shall be white beaded markings located as shown on the Plans or otherwise in the pavement marking standards. Dimensioning shall be in accordance with the pavement marking standards.

**663.3.13-Bicycle Symbols:** Bicycle symbols shall be white beaded markings located as shown on the Plans or otherwise in the pavement marking standards. Dimensioning shall be in accordance with the pavement marking standards.

## **CONSTRUCTION METHODS**

### **663.4-PAVEMENT PREPARATION-PREMARKING, CODING:**

The Contractor shall clean all debris from the surface to be marked by means of a power broom, compressed air or other mechanical means to the satisfaction of the Engineer. Markings and markers shall be applied only when the surface is clean and dry and when the ambient air temperature is 50° F (10° C) or above, unless otherwise stated in the material specification.

If pavement markings are included in the contract, they shall be applied in a timely manner and in the patterns directed by the Plans or pavement marking standards.

All materials shall be applied as recommended by the material manufacturer. This shall include surface pre-treatment, if required.

All surface cleaning, surface pre-treatment and premarking shall be performed by the Contractor prior to the installation of the proposed markings, or markers, and shall be subject to approval by the Engineer.

Coding and premarking changes in traffic flow patterns, i.e., passing, no passing zones, is very critical and should always be approved by the Engineer.

## **663.5-APPLICATION:**

**663.5.1-General:** The Contractor shall supply all of the marking material, equipment, and traffic control devices required for the completion of the project.

The Contractor shall provide and have approved by the Division a plan for traffic control and maintenance for all phases of the marking operations. The plan must be approved by the Division prior to the beginning of work. All traffic control plans shall be in conformance with provisions in the WVDOH publication "Manual on Temporary Traffic Control for Streets and Highways", latest Edition.

**663.5.1.1-Interim Traffic Control, Temporary Marking, and Permanent Marking Placement Schedule:** The Contractor shall adhere to specific guidelines provided herein for scheduling the placement of interim traffic control, temporary pavement markings, and permanent pavement markings. These guidelines are based on various factors such as facility type, ADT, and time of season. All interim, temporary, and permanent pavement markings shall be in conformance with specifications herein, the project Plans, or otherwise the pavement marking standards. The Contractor shall be responsible for maintaining both interim traffic control signs and temporary pavement markings until such time as the permanent markings are placed or for the duration of the thirty (30) calendar day warrantied performance period for the temporary markings, whichever is less. No separate payment will be made for maintenance of these items but shall be included in the applicable pay items for initial installation.

If it becomes necessary to open the roadway to traffic prior to the completion of the final paving course for longer than fourteen (14) calendar days, the Contractor shall install full compliance temporary pavement markings in conformance with Section 636 and the specifications herein.

**663.5.1.1.1-Interim Traffic Control Placement Schedule:** Interim Traffic Control includes interim pavement markings and may also include "Do Not Pass" regulatory signs. Interim markings are markings applied to freshly resurfaced roadways between lifts and after placement of the final lift prior to opening the portion of the roadway being resurfaced to traffic. These markings are intended to provide the minimum amount of delineation required for safe navigation of the roadway. Interim markings shall be Type VIIA material applied as described in Section 663.5.6 and shall meet the requirements of Material Section 715.40.3. All interim markings shall be installed by the end of the work day by placing the markings as the paving operation progresses within 1000 feet (300 meters) of the paver. Removal of interim markings shall not be required between lifts or

after placement of the subsequent markings. Payment of interim markings shall be incidental to the Paving Items. The specific interim traffic control to be placed shall be in accordance with the following.

**663.5.1.1.1.1-Two-Lane, Two-Way Roadways:** Prior to any work which will cover the centerline, the Contractor shall install twenty-four (24) inch (600mm) x thirty (30) inch (750mm) “Do Not Pass” (R4-1) signs on permanent posts at the beginning of each no passing zone throughout the length of the project. These signs shall be placed at the beginning of each no passing zone and shall be repeated every 2,500 feet (762 m) as required. Payment shall be made under the “Traffic Control Devices” item.

To delineate the centerline of the roadway, the Contractor shall install yellow interim markings measuring four (4) inches (100mm) x four (4) inches (100mm) along the centerline of the roadway on twenty (20) foot (6 m) centers.

**663.5.1.1.1.2-One-Way Multilane Roadways:** On all one-way multilane roadways, the Contractor shall install white interim markings measuring four (4) inches (100mm) x forty-eight (48) inches (1200mm) along the lane line. Interim markings shall be placed on forty (40) foot (12 m) centers.

**663.5.1.1.1.3-Two-Way Three-Lane Roadways:** Prior to any work which will cover the centerline and/or lane lines, the Contractor shall install twenty-four (24) inch (600mm) x thirty (30) inch (750mm) “Do Not Pass” (R4-1) signs on permanent posts at the beginning of each no-passing zone throughout the length of the project as required. “Do Not Pass” signs in both directions will be required when the center lane is a two way left turn lane. These signs shall be placed at the beginning of each no-passing zone and shall be repeated every 2500 feet (762 m) as required. Payment shall be made under the “Traffic Control Devices” item.

The Contractor shall install interim markings measuring four (4) inches (100mm) x forty-eight (48) inches (1200mm). On such roadways having two thru lanes in one direction, the centerline shall be marked with two parallel yellow lines separated by a four (4) inch (100mm) space placed on forty (40) foot (12 m) centers. Lane lines shall be marked with white lines placed on forty (40) foot (12 m) centers. On such roadways having a two way left turn lane, the center lane shall be marked on both sides with two parallel yellow lines separated by a four (4) inch (100mm) space, and placed on forty (40) foot (12 m) centers.

**663.5.1.1.1.4-Two-Way Four-Lane and Five-Lane Roadways:** On all two-way four-lane and five-lane roadways, the Contractor shall install interim markings measuring four (4) inches (100mm) x forty-eight (48) inches (1200mm) along the lane line and centerline where required. Centerlines shall be marked with two parallel yellow lines separated by a four (4) inch (100mm) space placed on forty (40) foot (12 m) centers. On five-lane roadways these markings shall be placed on both sides of the two way left turn lane. Lane lines shall be marked with white lines placed at forty (40) foot (12 m) centers.

**663.5.1.1.2-Temporary Pavement Marking Placement Schedule:** Interim markings are to be succeeded by temporary markings within a three (3) to fourteen (14)

day period, based on the type of roadway and ADT, as specified herein. Temporary markings are markings, typically short-lived in nature, which supplant interim markings. Temporary markings shall be applied as specified herein and in Section 636, and shall meet the requirements of Materials Section 711.40. Payment for Temporary pavement markings shall be made under the “Temporary Pavement Marking Paint” pay item.

Interim Markings shall be permitted only for a period of up to three (3) calendar days after completion of the final course. The only exception to this shall be for two-way, two-lane roadways having an ADT < 3,000, in which case fourteen (14) Calendar Days shall be permitted after completion of the final course.

Full compliance temporary centerline and edge lines in conformance with Section 636 and the specifications herein shall be installed on two-way, two-lane roadways within the time frame specified above. Two-way three-lane, two-way four-lane, and two-way five-lane roadways shall have full compliance temporary centerline, lane line, and edge lines installed in conformance with Section 636 and the specifications herein within the time frame specified above.

On one-way multilane roadways, the Contractor shall install a full compliance temporary yellow edge line after paving is first completed in the left lane and prior to the left lane being opened to traffic. Prior to the remaining lanes being opened to traffic, the Contractor shall install a full compliance temporary white lane lines and white edge line. These markings shall be installed in conformance with Section 636 and the specifications herein.

**663.5.1.1.3-Permanent Pavement Marking Placement Schedule:** Permanent markings are the final pavement marking application within a project. Permanent markings shall be placed as specified herein and shall meet the requirements of Materials Sections 711.41, 715.40.2, 715.40.6, and/or any other material specifications made part of the Contract.

The Contractor shall be required to place full compliance permanent pavement markings within sixty (60) calendar days after the placement of temporary pavement markings. In addition, there shall be a minimum thirty (30) calendar day period between the placement of temporary and permanent markings when the temporary markings are placed on or after April 15th and prior to November 1st. There shall be a minimum fifteen (15) calendar day period between the placement of temporary and permanent markings when the temporary markings are placed on or after November 1st and prior to April 15th of the following year. Full compliance markings shall consist of all centerline, lane line, channelizing line, edge line, and intersection markings.

**663.5.2-Temporary and Permanent White or Yellow Traffic Zone Paint:** Pavement marking lines shall be straight or of uniform curvature and shall conform to the tangents, curves, and transitions as specified in the Plans, the pavement marking standards, and/or as directed by the Engineer.

The finished lines shall have well-defined edges and be free of horizontal fluctuations. The lateral deviation shall not exceed 0.5 inch (13 mm) from the proposed location alignment as specified herein, on the Plans, in the pavement marking standards, and/or as directed by the Engineer.

When striping interchanges and intersections, material shall be applied for the full length of all ramps and the entire perimeter surrounding islands and gore areas. When striping at-grade intersections, yellow edge lines shall be placed completely around and shall be connected at the median ends.

The Contractor shall be responsible for removing all pavement marking materials spilled upon the roadway surface or adjoining area. The Contractor shall use methods acceptable to the Engineer for removing the spilled material.

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

Unless otherwise specified, the Contractor shall be responsible for coding and spotting per the Plans or otherwise the pavement marking standards. The Contractor's coding and spotting shall be reviewed and approved by the Engineer prior to application.

The Contractor will be responsible for cleaning any Raised Pavement Marker (RPM) lenses that are painted during this Contract. If the RPMs are not able to be cleaned, the Contractor shall replace the effected RPM lenses.

Permanent Traffic Paint shall be Type II, White or Yellow Fast-Dry Traffic Paint as described in Materials sections 711.41, unless otherwise specified in the Contract Plans.

Temporary traffic paint shall be applied at the same width as will be used for the permanent markings.

**663.5.2.1-Approved Equipment and Personnel:** The following provisions shall apply to the application of permanent traffic zone paint only:

The Contractor (prior to commencement of the project) shall submit to the Engineer a detailed list of all equipment and the resumes of all personnel within the confines of the project. The Contractor shall also provide certification from the binder manufacturer that the Contractor is qualified to apply the manufacturer's material in conformance with these specifications. Drivers and operators with less than one year of experience shall not be used on this project.

The Contractor's striper shall be equipped with electrical foot counters. The counters shall individually tabulate the amount of footage applied by each striping gun whether solid or dashed. The counters shall be six digit types with a reset feature. The Contractor shall determine the accuracy of the foot counters and establish an adjustment factor as required to determine the pay item quantities. The foot counters shall be periodically checked to assure accurate measurements. No paint shall be applied without the accurate operation of the foot counters. The Contractor shall provide the Engineer with a certified document on these calibrations.

The Contractor shall use an accurate dashing mechanism, capable of being adjusted to retrace existing lane or center line markings.

Glass beads applied to the surface of the completed marking material shall be applied by an automatic bead dispenser attached to the pavement marking equipment in such a manner that the beads are dispensed uniformly and almost instantly upon the marking as the marking is being applied to the road surface. The bead dispenser shall be equipped with an automatic cut-off control, synchronized with the cut-off of the pavement marking equipment.

**663.5.2.2-Contractor's Warranty:** The Contractor shall warranty the performance of temporary traffic zone paint for a period of thirty (30) Calendar Days after application, and shall warranty the performance of Type II permanent traffic zone paint for a period of one (1) year after application. The required performance level of the markings for the warranty periods are described in Section 711.41.

During the warranty periods, if any markings greater than 1000 feet (305 m) are found to be deficient for any reason, the Contractor will be given notification stating the locations and the type of deficiency. These notifications will be given at any time within the specified warranty periods for the markings. The Contractor shall completely replace the deficient markings, as directed by the Engineer, within twenty (20) calendar days of the written notification. Retroreflectivity and color may be checked after re-application of the pavement marking to ensure that segment meets the minimum values specified in Section 711.41.

If the Contractor does not complete the replacement of all of the deficient pavement markings by the end of the twenty (20) calendar day replacement period, and the Contract has not been finalized, the Contractor shall be subject to liquidated damages as described within Section 108.7 until replacement is completed. These liquidated damages shall not stop during the winter shut-down period. No direct payment shall be made for the replacement of any deficient pavement marking during the warranty period as such work shall be considered as incidental to the work as paid for by the various pavement marking items in the Contract.

#### **663.5.3 THROUGH 663.5.4-BLANK**

**663.5.5-Type V Preformed Intersection Traffic Markings:** Type V preformed intersection traffic markings shall be affixed to bituminous or Portland cement concrete pavements as specified in the Contract Plans, or as otherwise specified on the pavement marking details.

Care shall be taken by the Contractor to follow the installation recommendations of the material manufacturer. Preformed tapes used as Type V material are particularly sensitive to ambient air temperatures and road surface temperatures. Both preformed tapes and thermoplastics are highly sensitive to extraneous materials on the road surface and moisture contained on and within the road surface. Type V materials shall not be applied if the manufacturer's recommendations are not met.

The Contractor shall provide the Engineer with certification from the Manufacturer that they have been adequately trained through the Division of Highway's approved training seminar to apply this material. This certification shall be valid for a period of four (4) years after being issued, after which recertification shall be required.

**663.5.5.1-Contractor's Warranty:** If the material has been identified by the Division as having failed the skid resistance (when applicable), adherence, road presence, color, and/or retroreflectivity requirements described in Materials Section 715.40.2 prior to finalization of the Contract, the material shall be corrected by the Contractor in a manner acceptable to the Division and in accordance with the Manufacturer's recommendations at no additional cost to the Division, regardless of whether the material failure was caused by improper installation or defects in the manufacturer's materials. All

warranty related work required shall be completed within sixty (60) calendar days of notification. In the event that the Contractor fails to meet this time requirement, liquidated damages will be charged for each Calendar Day in the amount of \$120 per day. If the material has been identified by the Division as having failed the skid resistance (when applicable), adherence, road presence, color, and/or retroreflectivity requirements described in Materials Section 715.40.2 after finalization of the Contract, and less than one (1) year from the date of application, and the Division determines in its' sole judgement that the material failures are due to improper installation, the material shall be corrected by the Contractor in a manner acceptable to the Division and in accordance with the Manufacturer's recommendations at no additional cost to the Division. All warranty related work required shall be completed within sixty (60) calendar days of notification.

The Contractor may, but shall not be required to replace preformed thermoplastic Type V material between December 1st and March 1st of the following year. The Contractor may, but shall not be required to replace preformed marking tape Type V material between October 1st and May 1st of the following year. Calendar Days falling within the time frames specified above will not be counted against the Contractor.

In addition to any liquidated damages, non-compliance with the warranty requirements specified above may result in the Division's temporary non-recognition of the Contractor's material application manufacturer certifications, as described in Section 663.5.5 and as they pertain to other ongoing and/or future Contracts, until the failed materials are corrected.

**663.5.6-Interim Pavement Markings (Type VIIA Material):** Interim Pavement Markings shall be Type VIIA Interim Pavement Marking Tape. Type VIIA Marking shall be installed in accordance with the manufacture's recommendations.

The Contractor shall remove all dirt, debris, and loose particles from the road surface application areas immediately prior to the installation of Interim markings.

While in place, Type VIIA pavement markings shall remain adhered to the pavement, and shall meet the color and retroreflectivity requirements described in Materials Section 715.40.3. Any material that fails to meet the above provisions shall be corrected by the Contractor in a manner acceptable to the Engineer at no additional cost to the Division. If necessary, the material shall be tested and evaluated for deficiencies, with the devices described in the Materials Section, based on an adequate sampling to be determined by the Engineer.

**663.5.7-Temporary Pavement Marking Tape (Types VIIB and VIIC Material):** Temporary Pavement Marking Tape shall be either Type VIIB or VIIC, as called for in the Contract plans, and shall be installed in accordance with the manufacturer's recommendations.

The pavement surface shall be dry at the time of pavement marking application. The Contractor shall remove all dirt, debris, loose particles and heavy oil residues from the road surface application areas immediately prior to installation of pavement markings.

Care shall be taken by the Contractor to follow the installation recommendations of the material manufacturer. The Contractor shall be responsible for determining if a surface primer is necessary. Type VIIB and VIIC temporary pavement marking film shall be applied

with a mechanical applicator to provide pavement lines which are neat, accurate and uniform. The mechanical applicator shall be equipped with a film cut-off device. The pavement marking film shall be rolled or tamped to facilitate adhesion to road surface.

While in place, all temporary pavement markings shall remain adhered to the pavement and shall meet the color and retroreflectivity requirements described in Materials Section 715.40.4. These provisions shall also apply to Type VIIC materials in wet conditions, as described in the Materials Section. Any materials that fail to meet the above provisions shall be corrected by the Contractor in a manner acceptable to the Engineer at no additional cost to the Division. If necessary, the materials shall be tested and evaluated for deficiencies, with the devices described in the Materials Section, based on an adequate sampling to be determined by the Engineer.

Beginning on November 1st, the adherence, color, and retroreflectivity requirements referenced in the previous paragraph shall no longer apply to temporary tape materials which were installed prior to this date. In addition, the adherence, color, and retroreflectivity requirements shall at no point apply to temporary tapes placed on or after November 1st and prior to April 1st of the following calendar year.

When temporary pavement markings are no longer required as approved or determined by the Engineer, the plastic pavement marking film shall be neatly removed in its entirety. The cost for this work shall be included in the Contractor's bid price for installing the temporary markings.

#### **663.5.8-BLANK**

**663.5.9-Raised Pavement Markers (RPM's):** Unless otherwise directed by the Engineer, RPM's shall be placed as specified in the Plans or as otherwise specified in the pavement marking details. The proposed placement of all RPM's shall be reviewed and approved by the Engineer prior to proceeding.

In all cases, the reflective faces of RPM's shall be perpendicular to a line parallel to the roadway centerline.

Up until the time of installation, Type P-2 and R-4 markers should be stored indoors and should be protected from any source of moisture both during shipment to the jobsite and at the jobsite. The markers should be maintained at a high enough temperature as to preclude moisture condensation and, at the time of placement, both the markers and their containers shall be dry.

The color(s) of the lenses and bodies (Type R-4 only) of the markers shall be in accordance with the Plans or as otherwise specified in the pavement marking details.

Unless otherwise specified in the Plans, markers supplementing a broken line, such as a lane line, shall be placed in line with the pavement marking and within the gaps along the line at the appropriate spacing. Markers supplementing a solid line, such as a channelizing line, shall be installed immediately adjacent to the line with the edge of the marker against the edge of the line. If a Type R-4 marker is to be installed in line with the normal location of a solid line pavement marking, no painted or Type V pavement marking shall be installed at the locations where the R-4 markers are to be installed. R-4 markers shall not be placed on top of existing pavement markings.

The Contractor shall be responsible for the replacement of any markers having failed due to non-conformance with any portion of the specifications herein, and shall incur all

associated costs. The Contractor shall also be responsible for the repair of any pavement surfaces damaged and requiring repair, as determined to be necessary by the Engineer and by a method approved by the Engineer, due to non-conformance with any portion of the specifications herein, and shall incur all associated costs.

**663.5.9.1-Type P-2 Marker Installation:** At the time of installation, the exposed surfaces of Type P-2 castings shall be free of scale, dirt, rust, oil, grease, or any other contaminant which may impair adhesion. If upon inspection the Engineer determines that one or more of the markers are not sufficiently in conformance with this requirement, the Contractor shall clean each contaminated holder by sand blasting or other means acceptable to the Engineer in order to remove all such foreign matter prior to installation.

The location of placement for each Type P-2 marker shall be of a constant slope longitudinally and laterally, and homogeneous. The location shall show no visible signs of distress or failure, such as cracking or delamination. All edges of the marker shall be placed a minimum of two (2) inches (50 mm) from any portion of the road surface showing such signs of distress or failure. Type P-2 markers shall be placed such that all edges are a minimum of (2) inches (50 mm) from any lateral construction joint. In addition, Type P-2 RPM's shall not be placed within an intersection with a public street or highway where the placement of the marker creates a likelihood that the marker will be plowed in a direction other than that which the marker is designed for. If it is determined during pre-installation planning that a marker would be placed at a point with one of the aforementioned pavement surface defects, or at a lateral construction joint, or within the intersection of a public street or highway as a result of typical marker spacing, the affected marker may be relocated longitudinally a sufficient distance to be approved by the Engineer. The distance the marker may be relocated shall not exceed ten (10) % of the typical marker spacing. Where it would be necessary to relocate the marker a distance greater than ten (10) % of the typical marker spacing, the affected marker shall be deleted.

With the exception of markers installed to supplement double yellow centerline markings, all Type P-2 markers shall be installed such that the near edge of the casting is a minimum of two (2) inches (50 mm) from the nearest longitudinal construction joint. Individual markers may be shifted laterally up to two (2) inches (50 mm), and up to ten (10) % of the typical marker spacing longitudinally in order to meet this requirement. Where it would be necessary to shift the marker a greater distance laterally and/or longitudinally as allowed above, the affected marker shall be deleted.

The recesses for P-2 markers shall be machine cut fully in accordance with the marker manufacturer's specifications pertaining to, but not limited to, dimensions and blade configuration. All P-2 markers shall be installed within seven (7) days of cutting the recesses. All recesses shall be dry at the time of installation of the markers, and the pavement and ambient air temperature shall be a minimum of fifty (50) degrees Fahrenheit (10 degrees Celsius) and rising. Prior to installation of the markers, the recesses shall be brushed or blown clean of any loose material.

Epoxy adhesive recommended by the marker manufacturer and meeting the requirements of Materials Section 715.40.6 shall be used to adhere the Type P-2 marker castings in the recesses. Unless otherwise specified by the adhesive manufacturer, the epoxy adhesive shall be mixed by combining components A and B in a ratio of 1:1 by

volume. The epoxy adhesive requires that the mixing operation and placing of the pavement markers be done rapidly. Any mixed batch that becomes so viscous that it cannot be readily extruded from under the casting under light pressure shall not be used. Unless otherwise specified or allowed by the adhesive manufacturer, the adhesive shall be maintained at 60 to 80 degrees Fahrenheit (15 to 27 degrees Celsius) before mixing, and shall not be heated above 120 degrees Fahrenheit (49 degrees Celsius) once mixing starts. Any heating of the epoxy shall be by the application of indirect heat. The Contractor shall insure that the epoxy is thoroughly mixed until it is one homogeneous color. The epoxy shall be placed fully in accordance with the epoxy manufacturer's specifications. Any requirements made by the adhesive manufacturer which are more stringent than those contained herein shall take precedence.

The Contractor shall install P-2 marker castings in the recesses using the epoxy adhesive fully in accordance with the marker manufacturer's specifications. Sufficient epoxy shall be placed in the recess to ensure that all voids beneath and around the casting are filled so as to create a watertight seal around the casting. The casting shall be hand placed into the recesses. The Contractor shall insure that each of the lugs on the sides of the casting are resting on the pavement and that the tips of the casting snowplow deflecting surface(s) are below the pavement surface. The Contractor shall take reasonable steps to avoid buildup of epoxy on either the pavement surface or the casting lip in front of the lens as this buildup will affect the maximum visibility distance of the markers. There shall be no epoxy on the marker lens. If this occurs, the Contractor shall replace the marker lens in accordance with the manufacturer's recommendations and will incur all costs associated with this.

Newly installed P-2 markers shall not be exposed to traffic until the epoxy adhesive has sufficiently cured. The amount of cure time required is based on the ambient air temperature. The Contractor shall follow the recommendations of the adhesive manufacturer. In no case shall the newly installed markers be exposed to traffic within a time period less than that which is shown in the following table:

Ambient Air Temperature, °F (°C)	Minimum Protection Time (minutes)
100 (38)	15
90 (32)	20
80 (27)	25
70 (21)	30
60 (16)	35
50 (10)	45

**663.5.9.3-Type R-4 Marker Installations:** Type R-4 markers shall be placed such that all edges are a minimum of (2) inches (50 mm) from any lateral construction joint. If during pre-installation planning, it is determined that a marker would be placed at a lateral construction joint, the affected marker may be relocated longitudinally a sufficient distance to be approved by the project Engineer. The distance the marker may be relocated shall not exceed ten (10) % of the typical marker spacing. Where it would be necessary to relocate the marker a distance greater than ten (10) % of the typical marker spacing, the affected marker shall be deleted. In addition, Type R-4 markers shall not be

installed spanning a longitudinal pavement joint. Affected markers may be shifted if necessary such the edge of the marker bodies are along the edge of the joint.

All applications shall be made on dry pavement surfaces free of extraneous materials such as, but not limited to, dirt, dust, grease, oils, existing pavement markings, and excessive remnants of previous delineation or channelization device adhesives. Extraneous materials shall be removed prior to placement by means approved by the Engineer, such as sweeping, high pressure air, scraping, or grinding. The Engineer shall make the final determination as to when the existing surface has been sufficiently cleaned for placement of the markers.

Type R-4 markers shall be applied to the asphalt or concrete surface fully in accordance with the manufacturer's recommendations using an adhesive recommended by the marker manufacturer. The adhesive shall be either 1) a rapid set epoxy adhesive, 2) a standard set epoxy adhesive, or 3) a bitumen adhesive, and shall meet any applicable requirements contained in Materials Section 715.40.6. The Contractor is cautioned in regards to the application of markers to new asphalt or concrete surfaces. If the markers are to be applied to a new asphalt surface, the Contractor shall consult with the adhesive manufacturer and follow all recommendations of the adhesive manufacturer in regards to special surface preparation steps or recommended waiting periods between the completion of paving operations and adhesive application. In no case shall the markers be placed until the new asphalt surface has cured for a minimum period of fourteen (14) Calendar Days. If the markers are to be applied to a new concrete surface less than ninety (90) Calendar Days after concrete placement, any remaining curing compound on the application surface shall be removed by an Engineer approved method and procedures such as sandblasting, hydro-blasting, shot blasting, or grinding. Regardless of the type of adhesive used, type R-4 markers shall not be placed under the following conditions:

1. When either the pavement or air temperature is 32°F (0°C) or less when using rapid set epoxy, 50°F (10°C) or less when using standard set epoxy, or 40°F (4.4°C) or less when using bitumen adhesive.
2. If the relative humidity of the air is greater than 80 %
3. If the pavement is not surface dry or if there has been rainfall in the previous 24 hours

If the markers are to be applied using an epoxy adhesive, this requires that the mixing operation and placing of the markers be done rapidly. If standard set epoxy adhesive is used, the Contractor may mix this material by hand; however, not more than one (1) qt. (1 L) shall be mixed at one time and the markers shall be aligned and pressed into place within five (5) minutes after mixing operations are started. Any mixed batch which becomes so viscous that the adhesive cannot be readily extruded from under the marker on application of slight pressure shall not be used. Rapid set epoxy adhesive shall not be mixed by hand; it shall be mixed by a 2-component type automatic mixing and extrusion apparatus. Automatic mixing equipment for the epoxy adhesive shall use positive displacement pumps and shall properly meter the two components in the specified ratio. At any time requested by the Engineer, the ratio shall be checked by the Contractor in the presence of the Engineer. This check shall be made by disconnecting the mixing heads, or

using suitable bypass valves, and filling two suitable containers with the unmixed components. The mixing head shall properly mix the two components so that there is no trace of black or white streaks in the mixed material. Voids in a cured, undisturbed sample of the mixed adhesive obtained from the extrusion nozzle should not exceed four (4) %.

When machine mixing standard or rapid set epoxy adhesives, the markers shall be placed within sixty (60) seconds after the adhesive has been mixed and extruded, and no further movement of the marker shall be allowed. No more than ninety (90) seconds shall be permitted between the time the adhesive is in place on the roadway and the marker is no longer subjected to further movement. The mixed adhesive should not remain in the mixing head for more than forty-five (45) seconds. Adhesive remaining in the mixing head longer than this period shall be wasted before resuming the operation.

When applying the markers with epoxy adhesive, the adhesive shall be placed uniformly on the cleaned pavement surface or on the bottom of the marker in a quantity sufficient to result in complete coverage of the area of contact of the marker with no voids present and with a slight excess after the marker has been lightly pressed in place. Ideally there will be approximately 0.060 in. (1.5 mm) adhesive between the marker and the pavement. Excess adhesive around the edge of the marker, excess adhesive on the pavement, and adhesive on the exposed surfaces of the markers shall be immediately removed. Soft rags moistened with mineral spirits in accordance with Federal Specification TT-T-291 or kerosene may be used to remove adhesive from exposed faces of pavement markers. No other solvent shall be used. The markers should be protected against impact until the adhesive has hardened to a sufficient degree, as determined by the Engineer.

Bituminous adhesive shall be dispensed from a thermostatically controlled melter-applicator at a temperature of 375 to 425 degrees Fahrenheit (141 to 218 degrees Celsius). The material shall be stirred frequently to ensure even heating. The adhesive shall be dispensed in a puddle slightly larger than the bottom of the marker, and the marker shall be dropped onto the puddle as quickly as possible, preferably within five (5) seconds of adhesive placement. The marker shall then be pressed lightly onto the adhesive. The adhesive will set up in approximately two (2) minutes and typically no longer requires protection from traffic.

Any requirements made by the adhesive manufacturer which are more stringent than those contained herein shall take precedence.

#### **663.6-METHOD OF MEASUREMENT:**

Pavement markings shall be measured complete in place in the units designated below. Length measurements shall exclude gaps. Calibrated and verified odometer measurements will be acceptable as method of measurement on edge lines (mainline only), lane lines, and centerlines only for plan quantities in excess of 10,000 linear feet (3 000 m) or two linear miles (3.2 km).

Island marking will be measured by the square foot (meter) of island area painted.

Type P-2 markers, Type S markers, and Type R-4 markers shall be measured in units of each, completely installed as specified herein. Payment for the installation of Type P-2 and Type S markers shall include payment for the marker lens, regardless of whether the lens is factory or field installed.

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

### 663.7-BASIS OF PAYMENT:

**663.7.1-General:** The quantities, determined as provided above, will be paid for at the Contract unit prices less adjustments provided for in the Contract, which shall constitute full compensation for furnishing all materials and doing all the work prescribed in a workmanlike and acceptable manner, including the furnishing of all the auxiliary vehicles, labor, tools, equipment, supplies and incidentals necessary to complete the work.

The payment for Temporary Pavement Markings includes removal of the pavement marking film.

### 663.8-PAY ITEMS:

ITEM NUMBER	DESCRIPTION	UNIT
663001-*	EDGE LINE, TY “type”, “size” IN, “color”	LF or MI
663002-*	LANE LINE, TY “type”, “size” IN	LF or MI
663002-*	CENTER LINE, TY “type”, “size” IN	LF or MI
663004-*	CHANNELIZING LINE, TY “type”, “size” IN	LF
663005-*	STOP LINE, TY V, “size” IN	LF
663006-*	CROSSWALK LINE, TY V, 12 IN x 6 FT	LF
663007-*	STRIPE, TY V, 12 IN, “color”	LF
663008-*	YIELD TRIANGLE, TY V	EA
663009-*	HANDICAPPED SYMBOL, TY V	EA
663009-*	BICYCLE SYMBOL, TY V	EA
663010-*	ONE DIRECTION LANE ARROW, TY V**	EA
663010-*	MULTI DIRECTION LANE ARROW, TY V***	EA
663010-*	RAMP WORN WAY ARROW, TY V	EA
663010-*	LANE DROP ARROW, TY V	EA
663011-*	LANE LETTER, TY V	EA
663012-*	RAISED PVT MARKER, TY “type”	EA
663015-*	RAILROAD CROSSING MARKINGS, TY V	EA

\* = sequence number

\*\* = single headed lane assignment arrow. Typically left or right turn

\*\*\* = multi-headed lane assignment arrow with two to three arrow heads

“type” = pavement marking type

“size” = pavement marking size or width

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**SPECIAL PROVISION**  
**FOR**  
**SECTION 711**  
**PAINTS, COATINGS, OILS, AND INKS**

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

**711.41.1-General:**

DELETE THE LAST PARAGRAPH AND REPLACE WITH THE FOLLOWING:

The warranty and performance criteria of this specification shall apply to Type II markings placed on or after April 15th and prior to November 1st. Markings placed prior to April 15th, and on or after November 1st shall be exempt from the warranty and performance criteria of these specifications and shall not be considered for replacement based on the retroreflectivity and color requirements herein.

**711.41.2-Color and Retroreflectivity Requirements:**

REPLACE THE FIRST PARAGRAPH IN THE “RETROREFLECTIVITY” SECTION WITH THE FOLLOWING:

Markings installed on or after April 15th and prior to November 1st shall maintain a minimum retroreflectivity value of 200 mcd/m<sup>2</sup>/lx for white pavement markings and 150 mcd/m<sup>2</sup>/lx for yellow pavement markings for one (1) year.

REPLACE THE FIRST SENTENCE OF THE SECOND PARAGRAPH IN THE “RETROREFLECTIVITY” SECTION WITH THE FOLLOWING:

Readings shall be taken with a LTL-X, or Traffic Engineering Division approved equal, 30 meter geometry retroreflectometer.

**711.41.3-Sampling and Testing Procedures for Performance Samples:**

DELETE THE LAST TWO PARAGRAPHS.

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SPECIAL PROVISION**

**FOR**

**SECTION 715**

**MISCELLANEOUS MATERIALS**

**715.40-PAVEMENT MARKING MATERIAL:**

**715.40.2-Prefomed Traffic Markings:**

DELETE THIS SECTION AND INSERT THE FOLLOWING:

**715.40.2-Prefomed Intersection Traffic Markings (Type V Material):** The markings described are preformed, retroreflective pavement markings conforming in color, size and shape to the WVDOH Standard Details Book, Vol. II, and to the Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD)

Preformed thermoplastic traffic markings shall be fabricated to a uniform thickness of not less than 125 mils, including retroreflective beads. Preformed pavement marking tapes, applied as Type V material, shall be fabricated such that no portion of the material profile is less than 60 mils, including adhesive and retroreflective beads.

As a minimum, preformed thermoplastic traffic markings shall be capable of being applied to clean road surfaces at minimum road surface and ambient air temperatures of 35 degrees Fahrenheit (2 degrees Celsius), with a surface primer if necessary, providing moisture has been sufficiently removed from the application surface.

As a minimum, preformed pavement marking tapes applied as Type V material shall be capable of being applied to clean road surfaces, with a surface primer if necessary, when the following conditions are met:

1. Road surface is dry
2. Ambient air temperature 60 degrees Fahrenheit (16 degrees Celsius) and rising
3. Road surface temperature 70 degrees Fahrenheit (21 degrees Celsius) and rising
4. No rainfall 24 hours prior to application
5. Minimum air temperature overnight prior to application 40 degrees Fahrenheit (4 degrees Celsius)

**715.40.2.1-Enhanced Skid Resistant Prefomed Thermoplastic Traffic Markings:** Specific markings, as identified on the Plans or otherwise on the applicable

sheets in the WVDOH Standard Details Book, Vol. II, shall be applied only with preformed thermoplastic markings with enhanced skid resistant properties. The enhanced skid resistance of this material shall be achieved by utilizing surface applied abrasives with a minimum hardness of 7 (Mohs scale). The material, after application, shall have a minimum skid resistant value of 60 BPN when tested in accordance with ASTM specification E303, and shall not fall below this value for the warranty period specified in 715.40.2.2.

**715.40.2.2-Adherence, Retroreflectivity, Color, Road Presence, and Skid Resistance Warranty Requirements:** Section 663 requires that the Contractor extend the warranty of the marking manufacturer to meet the performance requirements specified herein for a period of one (1) year from the date of application. Section 663 requires that the Contractor replace failed materials during this one (1) year period regardless of whether the cause of failure is attributable to the installation of the material or the material itself. Warranty of the performance of the material for the balance of the warranty periods specified herein shall be provided directly to the WVDOH by the material manufacturer, and shall apply only to failures determined to be caused by material defects or non-conformance with the performance requirements herein.

Transverse markings shall be warranted to adhere to both asphalt and concrete, maintain road presence, and meet the retroreflectivity and color requirements described herein, for a minimum of three (3) years when applied according to the Manufacturer's recommendations. Transverse markings shall include stop bars, yield triangle markings, legend, symbols such as lane assignment arrows and lane drop arrows, railroad crossing markings, crosswalk markings, stripes inside lane shunts and gore areas, and other similar markings. When Enhanced Skid Resistant Preformed Thermoplastic material is specified, the marking shall meet the skid resistance requirement specified in 715.40.2.1 for the three year warranty period.

Longitudinal lines shall be warranted to adhere to both asphalt and concrete, maintain road presence, and to meet the retroreflectivity and color requirements described herein, for a minimum of four (4) years when applied according to the Manufacturer's recommendations. Longitudinal lines shall include lane lines, channelizing lines, edge lines, center lines, and other similar markings. When Enhanced Skid Resistant Preformed Thermoplastic material is specified, the marking shall meet the skid resistance requirement specified in 715.40.2.1 for the four year warranty period.

**RETROREFLECTIVITY:** Both white and yellow markings shall be warranted to maintain a minimum retroreflectivity level of 150 millicandelas, with beads applied, for the applicable warranty period described above.

All retroreflectivity measurements will be taken with a LTL-X or other Traffic Engineering Division approved 30-meter geometry retroreflectometer. A 5% tolerance with the stated minimum required retroreflectivity value shall be allowed when tested with a hand held retroreflectometer. Average retroreflectivity values shall be determined by following an adequate sampling plan to be determined by the Division.

Generally, conformance of markings with the retroreflectivity requirement shall be based on a well dispersed sampling, to be determined by the Division, of the retroreflectivity over the whole marking. Retroreflectivity sampling may be concentrated

on a specific area of the marking that appears to be in non-compliance with the Road Presence requirement for the purpose of determining non-compliance with quantitative data.

**COLOR:** Each color installed shall be warranted to fall within the boundaries created by the following CIE Chromaticity Coordinate Limits, with beads applied, for the applicable warranty period described above:

COLOR	CIE CHROMATICITY COORDINATE LIMITS							
	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
White	0.480	0.410	0.430	0.380	0.405	0.405	0.455	0.435
Yellow	0.575	0.425	0.508	0.415	0.473	0.453	0.510	0.490

The colormeter used shall be a LTL-Y, or other hand-held colormeter device approved by the Division. Average color coordinate values shall be determined by following an adequate sampling plan to be determined by the Division.

Generally, conformance of markings with the color requirements shall be based on a well dispersed sampling, to be determined by the Division, of the color values over the whole marking. Color sampling may be concentrated on a specific area of the marking that appears to be in non-compliance with the Road Presence requirement for the purpose of determining non-compliance with quantitative data.

**ADHERENCE AND ROAD PRESENCE:** Both white and yellow markings shall be warranted to maintain adherence and road presence for the applicable warranty period described above.

The Adherence and Road Presence requirement shall apply to materials worn uniformly, from the surface down, by normal traffic and snow-plowing. In addition, these requirements shall apply to materials at intersections subject to turning movements by normal traffic. However, these requirements shall not apply in cases of damage attributable to snow-plowing such as chiseling, cutting, chipping, or in cases of material removal from the roadway (other than removal from the surface down due to normal wearing as described above) when it can be shown that the material removal is due to snow-plowing rather than material adhesion failure. Loss due to pavement failure, unless caused by the marking material, will not be considered as a material failure.

**715.40.2.3-Approved Products Listing:** Material approvals are based on results from AASHTO’s NTPEP testing program and/or WVDOH field evaluation tests. Approvals may also be granted or rescinded based on actual performance on WVDOH projects. A list of approved materials, code numbers, and approved Contractor personnel may be obtained by contacting:

Materials Control, Soils, & Testing Division  
 190 Dry Branch Road  
 Charleston, West Virginia 25306

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SUPPLEMENTAL SPECIFICATION**

**FOR**

**SECTION 716**

**EMBANKMENT AND SUBGRADE MATERIAL**

**716.1-GENERAL:**

**716.1.1.3-Softshale:**

**DELETE THE ENTIRE CONTENTS AND REPLACE THE FOLLOWING.**

**716.1.1.3-Softshale:** Soft shale shall be considered as any of the shales, weak sandstone, weak limestone, claystones or silt stones 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.

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

**STATE PROJECT NUMBER:** \_\_\_\_\_

**FEDERAL PROJECT NUMBER:** \_\_\_\_\_

**SECTION 425**

**ASPHALT EMULSION MINERAL BOND**

**425.1-DESCRIPTION:**

This section covers the materials, equipment, construction and application procedures for placing Asphalt Emulsion Mineral Bond used to treat asphalt pavement shoulders and low volume roadways. The Asphalt Emulsion Mineral Bond shall be the process of applying a mixture of asphalt emulsion, aggregate, water, and additives as needed to the existing asphalt pavement as a preservation treatment. All ingredients are to be properly proportioned, mixed, and spread on the paved surface in accordance with this Specification and as directed by the Engineer.

**425.2-MATERIALS:**

Furnish the components of the Asphalt Emulsion Mineral Bond to include asphalt emulsion, fine aggregate, water, and additives. Use materials meeting the following:

**425.2.1 Asphalt Emulsion-**The emulsified asphalt shall contain asphalt, water, emulsifier, and polymer or other additives. It shall be pumpable and suitable for application through a distributor truck.

Emulsified asphalt shall meet the requirements listed in Section 705 of the Standard Specifications. In addition to the emulsion shall meet the requirements of either Table 425.2.1A or Table 425.2.1B.

<b>Table 425.2.1A (Non-Ionic)</b>			
<b>Criteria</b>	<b>ASTM/AASHTO METHOD</b>	<b>Value</b>	<b>Units</b>
Particle Charge	T-59 Section 8	Neutral	
Brookfield Viscosity at 77 °F (Spindle 5, 20 rpm)	D2196	11,000 – 20,000	cPs
pH	E70	5.0 – 7.5	pH
Density	T59	8.5 – 9.0	lbs/gal
Solids Content	T59	50.0 - 54.0	%, by weight
Ash Content	T111	4.0 – 6.0	%, by weight

<b>Table 425.2.1A (CSS-1H)</b>			
<b>Criteria</b>	<b>ASTM/AASHTO METHOD</b>	<b>Value</b>	<b>Units</b>
Viscosity, Saybolt Furol at 25 C	10	10-90	Seconds
Particle charge	T-59 Section 8	Positive	
Sieve test		0.50 max	%, by weight
Residue		57 min	%, by weight
Penetration (Residue from Distillation), 25 C, 100 g, 5 s,		30-150	

The sieve test may be waived if material applies without clogging nozzles and satisfactory field results are obtained.

The storage stability test may be waived provided the asphalt emulsion storage tank at the mixing site has adequate provisions for circulating the entire contents of the tank, and provided satisfactory field results are obtained.

**425.2.2 Aggregate-**The composite aggregate / mineral filler blend shall be free of cemented or conglomerated material and shall not have any detrimental material. It is recognized that high mineral filler mixture will require separate tests to be run on the aggregate and the mineral filler components. This will require verification of the stated blend percentages for the mixture.

**425.2.2.1 Gradation-**When tested in accordance with AASHTO T 27 (ASTM C 136) and AASHTO T 11 (ASTM C 117), the aggregate gradation shall be within one of the following bands.

Sieve Size	Percent Passing
#8 (2.36 mm)	100
#16 (1.19mm)	95-100
#30 (600µm)	85-100
#50 (300µm)	40-70
#100 (150µm)	30-60
#200 (75 µm)	25-65

**425.2.3 Water-**The water used shall be two parts hydrogen and one part oxygen from a potable source and free from harmful soluble salts.

**425.2.4 Additives** – Other material added to the mixture proprietary or otherwise shall be supplied by the manufacture of the mixture.

### **425.3-MIXTURE DESIGN REQUIREMENTS:**

**425.3.1 Mix Design-**Submit to the Engineer, at least five working days before the start of production, a complete mix design prepared and certified by an experienced laboratory. The mix design shall consist of:

1. Signed certificate(s) of analysis covering the specific materials to be used on the project.
2. Specify target application rates for the mixture as well as permissible operating tolerances so that adjustments may be made due to varying field conditions.
3. Test results of the tests required in Section 425.3.2.
4. List of material sources. Material sources must be on approved source lists published by the division. Materials Procedure 700.00.05, Guidelines for Establishing and Maintaining Approved Lists of Materials and Sources, outlines the requirements of these approved lists.

Once the design has been approved, no material substitution will be permitted unless approved by the Engineer. A new mix design is required for any change in aggregate or asphalt emulsion source.

**425.3.2 Mix Design Guidelines-**Mix acceptance will be subject to satisfactory field performance as determined by the engineer.

The mixture shall contain a minimum of 30% mineral aggregate by weight. This shall be determined by AASHTO T-308 Asphalt Content by Ignition Method, this method is modified to account for the high asphalt, fine aggregate mix.

The mixture shall pass the International Slurry Seal Association's Modified TB100 test for Wet-Track Abrasion Loss (3 day) Soak. There shall be a maximum of 80 g/m<sup>2</sup>.

#### **425.4-CONSTRUCTION:**

**425.4.1 Equipment-**Provide safe, environmentally acceptable equipment that can produce a specification product. All equipment, tools, and machines used in the application of asphalt emulsion mineral bond shall be maintained in satisfactory working conditions at all times.

**425.4.1.1 Emulsion and Aggregate Mixing Equipment-**The mixture shall be mixed thru a central mixing plant. Aggregate, asphalt emulsion, water and additives shall be proportioned by weight (mass) utilizing the mix design approved by the Engineer. Storage and transportation tanks shall be equipped with a full sweep agitator capable of producing a homogeneous mastic surface treatment mix.

Individual weight (mass) controls for proportioning each item to be added to the mix shall be provided. Measurement of volumes is permitted during production with the appropriate specific gravity calculations in insure that the mixture meets the weight proportions of the mix design. Each material control device shall be calibrated and properly marked. Each device shall be accessible for ready calibration and placed such that the engineer may determine the amount of each material used at the time.

**425.4.1.2 Storage Tanks-**The storage tank shall have an internal full sweep mixing system. The storage tank shall have sufficient mixing capability to assure proper suspension of fine aggregates in the mix.

**425.4.1.3 Distributor-**The distributor shall be fully self-contained and shall have a storage tank with full sweep agitation, hydraulic system, operator controls, pumping system, material filters and spray bar capable of applying a full lane width. The equipment shall have sufficient available power to operate the full spray system and the agitation system at the same time.

The distributor shall include computerized application controls, a tachometer, pressure gauges, accurate volume devices, calibrated tank, and a thermometer for

measuring temperatures of the emulsified asphalt in the tank. The distributor shall be equipped with a system allowing the measurement and calculation of application rates.

The pumps shall provide operation resulting in high volume and low potential for cavitation. The pumps shall be engineered to allow the system to handle fine aggregate filled materials. The distributor shall have computerized rate controller that automatically adjusts the distributor's pumps to the ground speed.

The applicator spray bar shall be sized with volumetric capacity to dampen any possible pressure ripples by providing even pressure to all spray tips. Attachments such as a spray shield and wind deflector shall be available.

**425.4.1.4 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.

**425.4.2 Application**-Asphalt emulsion mineral bond seals shall be applied in a manner to fill cover the area specified with at a uniform application rate to seal the asphalt pavement. If, indicated in the Contract documents, the Contractor shall apply a minimum of two applications of mixture, each applied separately to the entire pavement surface.

**425.4.2.1 Weather Limitations**-Mixture shall not be placed when either the air temperature or the temperature of the surface on which the mixture is to be placed is below 60 F, when it is raining, when there is a chance of temperatures below 32 F (0 C) within 24 hours after placement, or as directed by the engineer.

**425.4.2.2 Dilution**-Contractor shall not dilute mixture in the field with water or any other additive. Only materials mixed at the manufacturing facility will be allowed. No mixing of designed materials will be allowed in the distribution truck or on the job site.

**425.4.2.2 Surface Preparation**-The surface shall be thoroughly clean and dry when the mixture is applied. Material cleaned from the surface shall be removed and disposed of as directed by the engineer. Protect drainage structures, monument boxes, water shut-offs, etc., during application of bond coat and mixture.

**425.4.2.3 Mixture Application**-The application rate will be as shown on the plans or as directed by the engineer. The minimum application shall be 0.10 gal/yd<sup>2</sup> per pass. Placement of the mix shall be performed in two passes with a minimum coverage of 0.20 gal/yd<sup>2</sup> for the first pass and 0.16 gal/yd<sup>2</sup> for the second.

The mixture shall be uniform and homogeneous after applying on the existing surfacing and shall not show separation of the emulsion and aggregate after setting.

Placement of the material may be permitted in multiple passes at the election of the contractor. Contractor shall provide a mat ensuring total coverage and especially free of voids and pit holes. Leave no streaks, holes, bare spots, or cracks through which liquids or foreign matter could penetrate to the underlying pavement.

After application, the roadway shall remain closed until the surface is tack-free and capable of being open to traffic without tracking.

Properly sized nozzles shall be used for the material and application rate specified. Multiple series of nozzles, for spraying the mixture, shall be spaced longitudinally.

**425.4.2.6 Clean-up**-Remove spatter and mar from curb and gutter, sidewalk, guard rails and guide posts, etc. at the Contractor's expense. Remove surface treatment material from fixtures, manholes, valve covers, etc. Leave no streaks, holes, bare spots,

or cracks through which liquids or foreign matter could penetrate to the underlying pavement.

**425.4.3 Temporary Pavement Marking-**Shall be in accordance with Section 636

**425.4.4 Pre-application Meeting-**Hold an on-site pre-application 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

**425.4.5 Test strip-**Test Strip(s) are intended 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 may be used to establish the target job application rate.

**425.4.6-Traffic Control -** Do not allow traffic on the mixture until it has cured sufficiently to prevent pickup by vehicle tires. 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.

**425.4.7 Quality Control-**A mixture is to be produced that will meet the JMF and 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.

For Quality Assurance purposes, samples may be taken at the Project. The frequency of sampling and testing will be established by the Engineer based upon the Department's current acceptance program and local conditions encountered.

**425.5-MEASUREMENT AND PAYMENT:**

Payment for asphalt emulsion mineral bond includes all materials, equipment, labor for preparing the surface, placing temporary pavement markings, placing the mixture and complying with all requirements including the warranty. The placement includes application a surface course 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 425.6.

**425.6-PAY ITEMS:**

ITEM NUMBER	DESCRIPTION	UNIT
425001-001	Asphalt Emulsion Mineral Bond	Square Yard (SY)

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SUPPLEMENTAL SPECIFICATION**

**FOR**

**SECTION 705**

**ASPHALT MATERIALS**

**DELETE THE ENTIRE CONTENTS AND REPLACE THE FOLLOWING:**

Asphalts shall be made by refining of petroleum and shall be free from tar or tar products. The respective types and grades shall meet the specification requirements.

Asphalts shall be sampled in accordance with AASHTO T40. When asphalt material is furnished by a supplier who is not certified under provisions of MP 401.02.25, the supplier shall be required to have each batch or lot of material, to be furnished to the Division, sampled by a Division-approved inspection agency, in accordance with MP 700.00.01 and shall have the samples tested for compliance with the governing Specification in a Division-approved laboratory.

Measurement of the volume of asphalt materials shall be based on the volume of the materials at 60° F (15.5° C). Volumes measured at higher or lower temperatures shall be corrected to the volumes of the material at 60° F (15.5° C) using the coefficients of expansion given below:

**TEMPERATURE CONVERSION FACTORS**

<b>Material</b>	<b>Coefficient</b>
Asphalt Emulsion	0.00025 (0.00045)
Performance Graded Binder	0.00035 (0.00062)
Cut-back Emulsified Asphalt	0.0004 (0.0007)

**Application Temperatures:** Unless otherwise indicated or directed by the material manufacturer, the ranges below shall be used as guides for application temperatures. Field conditions may also require temperatures outside these ranges

**TABLE 705A- ASPHALT MATERIAL APPLICATION TEMPERATURES**

Type and Grade of Material	Application Temperature Range Degrees Fahrenheit (Celsius)	
	Spray	Mix
RS-1	70-140 (21-60)	-----
RS-2	125-185 (52-85)	-----
HFRS-2	125-185 (52-85)	-----
MS-1 and MS-2	70-160 (22-71)	70-160 (22-71)
HFMS-2	70-160 (22-71)	70-160 (22-71)
SS-1 and SS-1h	70-160 (22-71)	70-160 (22-71)
CRS-1	125-185 (52-85)	-----
CRS-2	125-185(52-85)	-----
CMS-2 and CMS-2h	70-160 (22-71)	70-160 (22-71)
CSS-1 and CSS-1h	70-160 (22-71)	70-160 (22-71)
CQS-1h	50-130 (10-54)	50-130 (10-54)
Asphalt Primer for Damp-proofing and Waterproofing	50-80 (10-27)	-----
Asphalt for Damp-proofing and Waterproofing	300-350 (149-177)	-----

**TABLE 705B- PERFORMANCE GRADED BINDER APPLICATION TEMPERATURES**

Type and Grade of Material	Application Temperature Range Degrees Fahrenheit (Celsius)	
	Spray	Mix
PG 58 – 28 / PG 58S – 28	285-350 (141-177)	250-338 (121-170)
PG 64 – 22 / PG 64S – 22	285-350 (141-177)	250-338 (121-170)
PG 70 – 22 / PG 64H – 22	285-350 (141-177)	250-338 (121-170)
PG 76 – 22 / PG 64E – 22	285-350 (141-177)	250-350 (121-177)

**705.1-WINTER GRADE CUT-BACK ASPHALT:**

This material shall conform to Cut-back asphalts as per section 705.2, 705.3, or 705.4

**705.2-LIQUID ASPHALT (RAPID CURING TYPE):**

Rapid curing liquid asphalt shall conform to the requirements of AASHTO M 81.

**705.3-LIQUID ASPHALT (MEDIUM CURING TYPE):**

Medium curing liquid asphalt shall conform to the requirements of AASHTO M 82 and in addition shall meet the requirements of AASHTO T 182

**705.4-ASPHALT EMULSION:**

Asphalt emulsion in the RS, HFRS, MS, HFMS, and SS grades shall conform to the requirements of AASHTO M 140.

**705.5-PERFORMANCE GRADED BINDERS:**

Performance graded binders shall conform to the requirements of AASHTO M-322, Table 1. Manufacturers are not required to perform Direct Tension Testing, AASHTO T-314. The naming convention for asphalt binder grades will be as followed:

Old binder Grade Designations	New Binder Grade Designations
PG 58 – 28	PG 58S – 28
PG 64 – 22	PG 64S – 22
PG 70 – 22	PG 64H – 22
PG 76 – 22	PG 64E – 22

The indication of elastic response for binders tested in accordance with AASHTO T-350 shall be determined using the appendix X1-INDICATIONS OF ELASTIC RESPONSE in AASHTO M 332.

**705.6-BLANK**

**705.7-ASPHALT FOR DAMPPROOFING AND WATER-PROOFING:**

Materials shall conform to the requirements of ASTM D449. Unless otherwise specified, Type-II shall be used.

**705.8-PRIMER FOR USE WITH ASPHALT IN DAMPPROOFING AND WATERPROOFING:**

Materials shall conform to the requirements of ASTM D41.

**705.9 THROUGH 705.10-BLANK**

**705.11-CATIONIC EMULSIFIED ASPHALT:**

Cationic emulsified asphalt shall conform to the requirements of AASHTO M 208.

**705.12-POLYMER-MODIFIED CATIONIC EMULSIFIED ASPHALT:**

Polymer-modified cationic emulsified asphalt shall conform to the requirements of AASHTO M 316.

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SUPPLEMENTAL SPECIFICATION**

**FOR**

**SECTION 416**

**FINE MILLING AND MICROMILLING OF  
ASPHALT PAVEMENT SURFACES**

**ADD AS A NEW SECTION:**

**416.1-DESCRIPTION:**

This item shall govern for the fine milling or micromilling of existing and/or new asphalt pavement at locations shown on the plans or as directed by the engineer in accordance with the requirements herein and MP 401.07.24. The work shall provide a skid resistant surface that meets smoothness requirements and provides a constant cross slope, or be used as surface preparation prior to placement of a final surface course.

**416.1.1-Fine Milling:** Item 416000-001 shall be used when the Division intends to overlay the milled surface with a thin lift asphalt course, or as otherwise shown in the plans.

**416.1.2-Micromilling:** Item 416000-002 shall be used for smoothness correction, bump and/or grade corrections on existing or newly paved surfaces where called for in the plans.

**416.2-CONSTRUCTION:**

**416.2.1-Milling Residue:** The Contractor shall establish a positive and immediate means for removal of milling residue. The machine shall have adequate loading equipment to remove solid residue from the surface and discharge them into a truck or as directed. Residue shall not be permitted to flow across lanes used by the traveling public or into gutters or drainage facilities.

**416.2.2-General:** The plans will designate the area of pavement surfaces to be milled. Milling of roadway shoulders will not be required unless indicated on the plans or required to provide drainage.

**416.2.2.1-Cross Slope:** Milling will be accomplished in a manner that eliminates crack or joint faults while providing positive lateral drainage by maintaining a constant cross-slope

between grinding extremities in each lane. Auxiliary or ramp lane grinding shall transition as required from the mainline edge to provide positive drainage and an acceptable riding surface.

The operation shall result in pavement that conforms to the typical cross-section and the requirements specified for the final surface finish. However, it is the intention of this specification that the faulting at joints and cracks be eliminated and the overall riding characteristics be restored within the limits specified. To accomplish the smoothness required, milling may not be required on 100 percent of the pavement surface. If directed by the Engineer, any spalling or dislodged unsound pavement due to milling shall be corrected by the Contractor via section 109.4.

**416.2.3-Surface Finish:** The milling process shall produce a smooth riding pavement surface that is true to the established line, grade and cross section with the milled area consisting of a longitudinal corduroy-type texture. The milling operation shall be capable of efficiently and accurately establishing profile grades along each edge of the machine within 1/8 inch (3 mm). Transverse joints and cracks shall be made flush with adjacent surfaces. Transverse joints and cracks shall be visually inspected to ensure that adjacent surfaces are in the same plane. Alignment of adjacent sides of the joints or cracks shall be within 1/8 inch (3 mm) of each other to be considered flush.

The transverse slope of the pavement shall be uniform to a degree that no depressions of misalignment of slope greater 1/4 inch (6 mm) in 12 ft. (3.65 m) are present when tested with a straightedge placed perpendicular to the centerline. Straightedge requirements do not apply outside of the milled area. The peaks of the ridges shall be approximately 1/8 inch (3 mm) higher than the grooves.

The finished, milled pavement surface shall be evaluated using MP 401.07.24 except that the volume of glass beads to be used for each test shall be 200 ml (12in<sup>3</sup>), and only one such test shall be required at each individual test location. The measured diameter for each test shall be equal to or greater than the values shown below:

416000-001 – FINE MILLING	9” Dia.
416000-002 – MICROMILLING	12” Dia.

Testing shall be performed as soon as practical behind the milling operation in order to not allow gaps to occur between sections being milled and sections being evaluated. Three tests shall be performed within the first 3,000 square yards of milling, and then at a minimum frequency of one test for every 7,500 square yards of milled surface thereafter. If the minimum diameter is not maintained, cease operations until necessary adjustments to the equipment and/or the process are made to meet this requirement. Do not resume milling operations until the Engineer is satisfied with the corrective actions.

Upon resuming operations after any adjustments are made, the first 3,000 square yards shall be evaluated as stated above. Additionally, if the equipment is replaced for any reason, or if mobilization back to the project site occurs at a later date for any reason, the first 3,000 square yards shall be evaluated as stated above.

The Engineer may reduce the testing frequency provided that a uniform texture is consistently maintained meeting the requirements shown above.

**416.3-METHOD OF MEASUREMENT:**

Pavement milling will be measured by the square yard (square meter) of pavement milled and accepted. The quantity of pavement milling will be determined by multiplying the width specified on the plans by the total length of the finished pavement surface.

**416.4-BASIS OF PAYMENT:**

The contract price per square yard (square meter) for Fine Milling or Micromilling shall be full compensation for furnishing all labor, materials, tool, equipment and incidentals and for doing all work involved in milling the existing pavement, removing residue, cleaning the pavement, and testing per MP 401.07.24 in accordance with these specifications and as shown on the plans.

**416.5-PAY ITEMS:**

ITEM	DESCRIPTION	UNIT
416000-003	Fine milling	Square Yard (Square Meter)
416000-004	Micromilling	Square Yard ( Square Meter)

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**SUPPLEMENTAL SPECIFICATION**

**FOR**

**SECTION 410**

**ASPHALT BASE AND WEARING COURSES,  
PERCENT WITHIN LIMITS (PWL)**

**ADD AS A NEW SECTION:**

**410.1-DESCRIPTION:**

**410.1.1-General:** The Contractor shall note that this Section is to be used for Square Yard Paving operations; however the proposal and / or plans may contain 401 and 402 items to be paid and measured by the Ton (TN). Instances where those items occur they shall be constructed and measured in accordance with the applicable sections of the West Virginia Division of Highways Standard Specifications Roads and Bridges, current edition, and the Supplemental Specifications current when the contract is let.

Additionally the following Materials Procedures (MP) for Square Yard Paving may be obtained by contacting the Materials Control, Soil and Testing (MCS&T) Division:

- a. MP 401.02.31 QC & Acceptance
- b. MP 401.07.20 Sampling Loose Asphalt Pavement Mixtures
- c. MP 401.07.21 Sampling Compacted Asphalt
- d. MP 401.07.22 Thickness of Asphalt Concrete Using Cores
- e. MP 401.07.23 Bond Strength
- f. MP 401.07.24 Pavement Macrotexture
- g. MP 401.07.25 Evaluation of Asphalt Pavements
- h. MP 401.13.50 Determination of PWL

**410.1.2-PWL Paving Description:** This work shall consist of constructing one or more courses of asphalt, mixed mechanically in a plant, composed of aggregate and asphalt material designed in accordance with either the Marshall or Superpave Design System as specified in the contract documents, 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 asphalt will be by the ton (megagram), square yard (square meter), or cubic yard (cubic meter).

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

**410.2-MATERIALS:**

The materials shall conform to the following requirements:

<b>MATERIAL</b>	<b>SUBSECTION</b>	<b>PG BINDER GRADE</b>
Performance Graded Binders	705.5	Standard grade shall be a PG 64-22.
Coarse Aggregate	703.1 thru 703.3 <sup>1</sup> and <sup>3</sup> (See MP 401.02.28 for exceptions and additions required for Superpave Items.)	For the top two lifts PG 70-22 <sup>2</sup> shall be used on projects specified $\geq 20$ million ESALs.
Fine Aggregate	702.3 (See MP 401.02.28 for additions required for Superpave Items)	Any deviation from the above criteria will be specified in contract documents.
Mineral Filler	702.4	

- Note 1** The total shale, coal and other lightweight deleterious material and friable particles shall not exceed 3%.
- Note 2** PG 64-22 Binder may be used in asphalt mixtures placed below the top two lifts.
- Note 3** When slag is specified in the contract, the coarse aggregate shall be slag which meets the requirements of 703.3, except as amended in this subsection.

**CONSTRUCTION METHODS**

**410.3-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.

**410.4-COMPOSITION OF MIXTURES:**

**410.4.1-General:** The aggregate for use in the designated mixture shall consist of a mixture of aggregate (coarse, fine, reclaimed asphalt pavement (RAP) if desired, or mixture

thereof) and mineral filler if required. It shall be the responsibility of the Contractor to determine the percentage of RAP to be used in the mix. The amount and grade of virgin PG Binder to be used in the RAP designs shall be determined in accordance with Materials Procedure (MP) 401.02.24 and MP 401.02.28.

**410.4.2-Job Mix Formula:** 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 (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 each asphalt mixture to be produced. Depending on the design type, the JMF gradations shall be within the tolerances set forth in either Table 410.4.2A or Table 410.4.2B. Marshall mix designs shall be developed in accordance with MP 401.02.22. Superpave mix designs shall be developed in accordance with MP 401.02.28.

Each proposed JMF must be documented on the Division Form T400 or T400SP and the entire JMF package shall be forwarded for review to the District Materials Engineer/Supervisor. After the District reviews the T400/T400SP and JMF package shall then be transmitted to the Materials Control, Soils and Testing Division for final review. If the JMF requires revision, it will be returned to the designer through the District. The T400/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 virgin asphalt binder to be blended with RAP and the total 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  $\pm 25^{\circ}$  F ( $\pm 14^{\circ}$  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 Asphalt (FA). For Marshall mixes the ratio is defined as the percentage of aggregate passing the No. 200 (75  $\mu$ m) sieve, divided by the percentage of asphalt content calculated at the percentage optimum asphalt content of the design. For Superpave mixes the ratio is defined as the percentage of aggregate passing the 75  $\mu$ m (No. 200) sieve, divided by the percentage of effective asphalt content calculated at the percentage optimum asphalt content of the design.

**TABLE 410.4.2A**  
**DESIGN AGGREGATE GRADATION REQUIREMENTS**  
**FOR MARSHALL MIX DESIGNS**

<b>TYPE OF MIX</b>	<b>Base-I</b>	<b>Base-II (Patch &amp; Level)</b>	<b>Wearing I        V</b>	<b>Wearing-I (Scratch-I)</b>	<b>Wearing-III (Scratch-III)</b>
<b>SIEVE SIZE</b>	<b>Nominal Maximum Size</b>				
	1 ½ in (37.5 mm)	¾ in (19 mm)	¾ in (19 mm)	3/8 in (9.5 mm)	No. 4 (4.75 mm)
2 in (50 mm)	100	–	–	–	–
1 ½ in (37.5 mm)	90 - 100	–	–	–	–
1 in (25 mm)	90 max	100	100	–	–
¾ in (19 mm)	–	90 – 100	90 – 100	–	–
½ in (12.5 mm)	–	90 max	90 max	100	–
3/8 in (9.5 mm)	–	–	–	85 - 100	100
No. 4 (4.75 mm)	–	–	47 min	80 max	90 - 100
No. 8 (2.36 mm)	15 – 36	20 – 50	20 – 50	30 – 55	90 max
No. 16 (1.18 mm)	–	–	–	–	40 - 65
No. 30 (600 µm)	–	–	–	–	–
No. 50 (300 µm)	–	–	–	–	–
No. 200 (75 µm)	1.0 – 6.0	2.0 – 8.0	2.0 – 8.0	2.0 – 9.0	3.0 – 11.0

**TABLE 410.4.2B**  
**DESIGN AGGREGATE GRADATION REQUIREMENTS**  
**FOR SUPERPAVE MIX DESIGNS**

Type of Mix	37.5	25	19 <sup>Note</sup> (Patch & Level)	12.5	9.5 (Scratch)	4.75 (Scratch)
Standard Sieve Size	Nominal Maximum Size					
	37.5 mm (1 1/2 inch)	25 mm (1 inch)	19 mm (3/4 inch)	12.5 mm (1/2 inch)	9.5 mm (3/8 inch)	4.75 (No. 4)
50 mm (2")	100	–	–	–	–	–
37.5 mm (1 1/2")	90 – 100	100	–	–	–	–
25 mm (1")	90 max	90 – 100	100	–	–	–
19 mm (3/4")	–	90 max	90 – 100	100	–	–
12.5 mm (1/2")	–	–	90 max	90 – 100	100	100
9.5 mm (3/8")	–	–	–	90 max	90 – 100	95 – 100
4.75 mm (No.4)	–	–	–	–	90 max	90 – 100
2.36 mm (No.8)	15 – 41	19 – 45	23 – 49	28 - 58	32 - 67	
1.18 mm (No.16)	–	–	–	–	–	30 – 60
600 µm (No.30)	–	–	–	–	–	–
300 µm (No. 50)	–	–	–	–	–	–
75 µm (No.200)	0.0 – 6.0	1.0 - 7.0	2.0 – 8.0	2.0 - 10.0	2.0 - 10.0	6.0 – 12.0

**Note:** When a 19 mm mix is specified for use as a heavy duty surface mix, it shall be designed as a fine graded mix with the additional requirement of a minimum of 47% passing the 4.75 mm (No.4) screen.

If it becomes necessary to change aggregate sources, a new mix design shall be developed and submitted for approval. When using neat (unmodified) PG Binders, the binder grade must always remain the same for each design, however the binder source may be changed without requiring a new mix design given that the replacement binder is provided from an approved source. If a source change results in the use of an additive enhanced modified binder of the same grade, a new mix design will be required.

If a modified binder source is changed or if the modification process is changed, a new mix design shall be developed and submitted for approval. A source change to a new location with the original manufacturer/supplier and the original modification process will not require a new mix design.

At no time shall different grades of PG Binders be mixed together in the same storage tank. When it is necessary to switch to a new binder grade the tank shall be drawn down as far as possible, normally to the top of heating coils, before refilling with the new binder. The new binder shall be circulated thoroughly before restarting production.

**410.4.2.1-Warm Mix Asphalt:** When the Contractor chooses to use an approved asphalt design to be produced as warm-mix asphalt (WMA) using the water injection system, the temperature of the completed mixture at the plant may be lowered to an established range that has previously been determined through trial production. The allowable temperature range specified on the approved T400 mix design form shall be adjusted accordingly when producing WMA. In addition, all references to the minimum compaction temperatures in Sections 410.10.3 and 410.10.4 of this specification, may be waived if it can be established that additional density can be obtained at lower temperatures without damaging the pavement. All testing requirements established for Hot Mix Asphalt mix designs and quality assurance/quality control testing shall also apply to WMA.

**410.5-TESTING:**

**410.5.1-Test Methods:**

MP 700.00.06	Aggregate Sampling Procedures
AASHTO T168	Sampling Hot-Mix Asphalt
AASHTO T11	Materials Finer than No. 200 (75 µm) Sieve in Mineral Aggregates by Washing
AASHTO T27	Sieve Analysis of Fine and Coarse Aggregates
AASHTO T30	Mechanical Analysis of Extracted Aggregate
AASHTO T164	Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
AASHTO T308	Asphalt Content of HMA by the Ignition Method (Test Method A)
AASHTO T245	Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D5581	Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (For Base-I Marshall designs only)
AASHTO T166	Bulk Specific Gravity of Compacted Bituminous Mixtures
AASHTO T209	Maximum Specific Gravity of Bituminous Paving Mixtures
AASHTO T312	Determining the Density of HMA Specimens by Means of the Superpave Gyrotory Compactor
AASHTO T331	Bulk Specific Gravity and Density of Compacted HMA Using Automatic Vacuum Sealing Method
ASTM D7227	Rapid Drying of Compacted Asphalt Specimens Using Vacuum Drying Apparatus
MP 401.02.31	Quality Control and Acceptance of Asphaltic Mixtures
MP 401.07.20	Sampling Loose Asphaltic Mixtures in the Field
MP 401.07.21	Sampling Compacted Asphaltic Mixtures in the Field
MP 401.07.22	Measuring Thickness of Asphalt Pavement using Drilled Cores
MP 401.07.23	Measuring Bond Strength of Cored Specimens
MP 401.07.24	Measuring Asphaltic Pavement Macrotecture
MP 401.07.25	Evaluation of Pavement with Substandard Properties
MP 401.13.50	Determination of Percent Within Limits

## **410.6-CONTRACTORS QUALITY CONTROL:**

### **410.6.1-Quality Control Testing:**

Quality control of the asphalt pavement is the responsibility of the Contractor. The Contractor shall maintain equipment and qualified personnel including at least one certified Asphalt Plant 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 asphalt within the limits of the specification.

The Contractor shall maintain necessary equipment and qualified personnel including at least one certified Asphalt Field and Compaction Technician at each project during paving operations. Additionally, a certified Asphalt Field and Compaction Technician with certification to perform nuclear density testing of asphalt pavements shall perform all testing necessary to assure compaction of the asphalt meets specification requirements. Compaction Technicians may serve as Asphalt Field and Compaction Technicians for asphalt compaction testing until December 31, 2017.

**410.6.2-Job Mix Formula Field Verification:** For each JMF, a mix design field verification shall be conducted during the first days of plant production. For Marshall and Superpave designs, the verification shall be in accordance with the guidelines established in MP 401.02.31. The field verification is for the purpose of demonstrating that the JMF can be produced within the specified tolerances set forth in the MP 401.02.31. If the mix cannot be produced within these requirements, a new mix design will be required.

**410.6.3-Quality Control Testing Requirements:** After the JMF design field verification has been successfully completed, sampling frequency and test requirements for quality control shall be as set forth in MP 401.02.31 for Marshall and Superpave designs. If the Division determines that a mix cannot be consistently produced within the tolerance limits of the specified design properties, approval of the mix may be revoked and the contractor will be required to provide a new mix design.

## **410.7-ACCEPTANCE TESTING:**

**410.7.1-Acceptance Testing of Asphalt:** Material from the paving of the traveled lanes and shoulders will be accepted in the field on a lot by lot basis. Lots will be established cumulatively and will be specific for each JMF. Each lot consists of five equal sublots (n=5). A completed subplot will have cores obtained for Pavement Density, and Bond Strength and a Loose Mixture sample for gradation and asphalt content. Samples for mat density and bond strength shall also be used to measure lift thickness prior to any preparation for density or bond strength. All field samples shall be obtained from locations determined as per MP 401.07.20 and MP 401.07.21.

A normal lot size is 2,500 tons with five, 500 ton sublots (n=5), unless operational conditions or project size dictate otherwise. If operational conditions or project size dictate, readjustment of the lot will be made as specified in Table 410.7.1. Breakdowns or stoppages

of short periods due to such causes as weather or equipment failure will not be considered as reason to adjust the lot size. The original lot will be continued when work resumes after stoppages of less than 5 days. If a lot is terminated due to a stoppage of 5 days or more, adjust the lot size and number of sublots as specified in Table 410.7.1.

**TABLE 410.7.1**

<b>Re-adjustment of Lot Size and Associated Number of Sublots Remaining Quantity* Following Last Full Lot</b>	<b>Action</b>
Less than 500 tons without a combination of one mixture acceptance sample and one density core	Quantity combined with the previous lot, (n=5)
Less than 500 tons with a combination of one mixture acceptance sample and one density core	One new subplot defined and quantity combined with the previous lot, (n=6)
500 tons to less than 1,000 tons without a combination of two mixture acceptance samples and two density cores	One new subplot defined and quantity combined with the previous lot, (n=6)
500 tons to less than 1,000 tons with a combination of two mixture acceptance samples and two density cores	Two new sublots defined and quantity combined with the previous lot, (n=7)
1,000 tons to less than 1,500 tons without a combination of three mixture acceptance samples and three density cores	Two new sublots defined and quantity combined with the previous lot, (n=7)
1,000 tons to less than 1,500 tons with a combination of three mixture acceptance samples and three density cores	New lot defined, (n=3)
1,500 tons to less than 2,000 tons without a combination of four mixture acceptance samples and four density cores	New lot defined, (n=3)
1,500 tons to less than 2,000 tons with a combination of four mixture acceptance samples and four density cores	New lot defined, (n=4)
2,000 tons to less than 2,500 tons without a combination of five mixture acceptance samples and five density cores	New lot defined, (n=4)
2,000 tons to less than 2,500 tons with a combination of five mixture acceptance samples and five density cores	New lot defined, (n=5)

Immediately after each sample is taken, it shall be identified by labeling or otherwise with the following information:

- 1) Contract ID
- 2) State Project Number
- 3) Sample Type (density, bond, loose, etc.)
- 4) Pavement Course (surface, base)
- 5) Lot Number
- 6) Sublot Number
- 7) Date
- 8) Sampled By

A sample labeling standard is shown in MP 401.07.20 Sampling of Loose Asphaltic Pavement Mixtures and MP 401.07.21. Upon fully identifying, marking or labeling, and securing, samples shall be transported to the District Materials Laboratory for testing unless otherwise indicated in the proposal.

**410.7.1.1-Mixture Acceptance Samples.** The Inspector will select sample locations in each subplot according to MP 401.07.20 Sampling of Loose Asphaltic Pavement Mixtures. The Inspector or in the presence of the Inspector, one loose mixture sample shall be obtained for each subplot. This sample is to be taken directly from the uncompacted mixture and immediately processed in accordance with the MP.

**410.7.1.2-Compaction:** Compaction testing for mat density shall be performed for all traveled lanes, ramps and shoulders. Work will be evaluated based on an Upper Specification Limit (USL) of 97.0 and a Lower Specification Limit (LSL) of 91.5 for all mats within travel lanes. Although being evaluated using the limits discussed above, constructed shoulder mats and ramps shall not be subject to compaction penalty. However, incentive criteria for payment in excess of 100% shall still apply. Acceptance of mat density shall be in accordance with 410.13.3.

Maximum density values that are supplied by the asphalt producer shall be verified by the District Materials staff by determining the theoretical maximum specific gravity in accordance with AASHTO T209 Theoretical Maximum Specific Gravity (Gmm). This verification of Gmm shall be conducted once per lot for all mixes, or one in each five reported values from the asphalt producer. This Gmm value must be within 0.024 of the asphalt producer's daily average.. Any deviation of greater shall warrant special evaluation.

Joint density testing is required. The joint density shall be evaluated based on a Lower Specification Limit (LSL) of 89% of a maximum density established by averaging the maximum densities for the paved mats adjacent to the constructed longitudinal joint. The joint density requirement shall only apply to the surface lift of the pavement structure. Lots for joint density shall also be established cumulatively and laid out as per the applicable provisions within MP 401.07.21.

A normal lot size for evaluation of joint density is 10,000 linear feet of constructed joint with five, 2000 feet long sublots unless operational conditions or project size dictate otherwise. Lots for joint density determined to be 4000 feet in length or less shall be incorporated into the previous full lot and two samples shall be taken and the lot be evaluated with seven samples (n=7). Lots for joint density that are greater than 4000 feet

in length shall have samples taken representative of each 2000 foot long subplot or portion thereof.

Lots for joint density between the outside shoulder and travel lanes shall not be subject to payment less than 100%. However, incentive criteria for payment in excess of 100% shall still apply. Acceptance for joint density shall be as per 410.13.4.

Patching-and-leveling and scratch courses shall not be included in determining the total new pavement thickness to be tested for compaction. When asphalt is placed in areas that require a non-uniform 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 compacting the mat properly. These areas shall be compacted to the satisfaction of the Engineer.

**410.7.1.3-Thickness:** Thickness testing shall be performed on all traveled lanes and shoulders.

Cores obtained for mat density and bond strength will both be measured for thickness as per MP 410.07.22 Measurement for Thickness of Asphalt Pavement Using Drilled Cores, prior to those subsequent analyses. The core measurements which represent the thickness of the sampling units shall be analyzed to determine the average value of the pavement thickness. Pavement Thickness (T), shall include all of the pavement layers as specified excluding any patch and level course and scratch courses. This value will be used to determine the degree of compliance with the provisions and to develop certain factors to be used in the derivation of equitable deductions as set forth in Section 410.13.5, in the event the provisions of this Specification are not met.

**410.7.1.4-Bond Strength:** Bond 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.

Corebond 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.

**410.7.2-Surface Tolerance:** Shall be in accordance with Section 720 on the finished mat.

**410.7.3-Pattern Segregation:** Pattern segregation is continuous or repeated areas of non-uniform distribution of coarse and fine aggregate particles in the finished mat. The Division will address pattern segregation as follows:

**410.7.3.1-Evaluating Pattern Segregation:** If the Engineer observes pattern segregation that may result in defective pavement, then:

- i. The Inspector will notify the Contractor of the observed pattern segregation.
- ii. The Contractor may continue to work at their own risk while they immediately and continually adjusts the operation to eliminate the pattern segregation from future work.
- iii. As a minimum and in the presence of the Engineer and the Contractor's Representative, Division personnel shall determine the average depth of pavement surface macrotexture according to MP 401.07.24 in areas with the pattern segregation and in areas with non-segregated pavement. The pattern segregation is unacceptable if the difference in average pavement texture depth between the non-segregated and segregated areas exceeds the following:
  - a) For 9.5 mm or Wearing I mixes – 0.012 inch (0.305 mm)
  - b) For 12.5 mm mixes – 0.016 inch (0.406 mm)
- iv. The Engineer will determine if the pavement is defective as specified in Section 410.7.3.3.

**410.7.3.2-Test Section:** If the macrotexture tests identify unacceptable pattern segregation, then:

- i. Immediately suspend placing the asphalt course. Evaluate the cause of pattern segregation according to the Paving Operation QC Plan. Provide proposed corrective actions to the Engineer and do not resume placing the asphalt course until after the Engineer reviews the proposed corrective actions and authorizes paving to continue.
- ii. Determine if the pattern segregation resulted in defective pavement as specified in Section 410.7.3.3.
- iii. After the Engineer allows paving to resume, place a test section not to exceed 200 tons. If the corrective actions do not eliminate observed pattern segregation, the Department will suspend paving, even if it is before the Contractor places the entire test section. Propose additional corrective actions, and construct another test section. Resume normal paving operations after constructing an entire test section without pattern segregation as determined by the Engineer.

**410.7.3.3-Defective Pavement:** At locations selected by the Engineer and with the Engineer present, drill three 6-inch diameter cores from the area of pattern segregation and three cores from the pavement representing a non-segregated area. Do not compress,

bend, or distort samples during cutting and handling and immediately provide the cores to the Inspector. The Inspector will transport cores to the producer's laboratory. With the Engineer present, test the cores at the plant for density, asphalt content, and gradation. Additional cores and/or additional testing as per MP 401.07.24 Measuring Pavement Macrotexture Depth can be used to further evaluate the pavement.

An area of pattern segregation contains defective pavement if:

- a) the summation of absolute deviations from any two sieves is 20% or more from the JMF
- b) the core density is defective, the mixture is defective in asphalt content
- c) or the mixture is defective for percent passing the 75  $\mu\text{m}$  (No. 200) sieve.

The core density is defective, or the cores are defective for asphalt content or gradation of the 75  $\mu\text{m}$  (No. 200) sieve if the PWL is less than 55 as determined in accordance with MP 401.13.50 and based on three samples ( $n=3$ ). Remove and replace the full width of the affected lane and a minimum of 5 feet beyond each end of the area with unacceptable pattern segregation. Construct replacement pavement conforming to the appropriate surface tolerances.

**410.7.4-Flushing:** Provide a mix that will not flush. Flushing is continuous or repeated areas of excessive asphalt on the pavement surface. The Division may recognize flushing until the Division approves the project through final inspection. The Division will address flushing as follows:

**410.7.4.1-Evaluating Flushing:** When the Engineer observes flushing, then:

- i. The Engineer will immediately notify the Contractor of the observed flushing.
- ii. The Contractor may continue work at its own risk while it immediately and continually adjusts the operation to eliminate flushing from future work.
- iii. In the presence of the Engineer, determine the average depth of pavement surface macrotexture according to MP 401.07.24 in areas of suspected flushing. If the average texture depth is less than or equal to 0.006 inches (0.152 mm), then the pavement will be considered to be flushed and is defective.

**410.7.4.2-Test Section:** If the macrotexture tests identify flushing, then:

- i. Immediately suspend placing the paving course. Evaluate the cause of flushing according to the Paving Operation QC Plan and as directed. Provide proposed corrective actions to the Engineer and do not resume placing the paving course until after the Engineer reviews the proposed corrective actions and authorizes paving to continue.
- ii. Remove and replace the defective wearing course at no cost to the Division for the full width of the affected lane and a minimum of 5 feet beyond each

end of the area of defective wearing course. Construct replacement wearing course conforming to the appropriate surface tolerances.

- iii. After the Engineer allows paving to resume, place a test section not to exceed 200TN. If the corrective actions do not eliminate observed flushing, the Division will suspend paving even if it is before the Contractor places the entire test section. Propose additional corrective actions and construct another test section. Resume normal paving operations after constructing an entire test section without flushing as determined by the Engineer.

#### **410.8-BLANK**

#### **410.9-EQUIPMENT:**

**410.9.1-Plants:** All plants shall meet the general requirements set forth in AASHTO M156 unless it can be demonstrated to the satisfaction of the Engineer that a consistent quality mix can be produced with modifications to any of these requirements.

All plants in West Virginia producing asphalt for the Division shall provide documented evidence of compliance with current requirements of the West Virginia Air Pollution Control Commission.

All plants which are not in West Virginia but producing asphalt for the West Virginia Division of Highways shall provide documented evidence of compliance with current requirements of the laws and regulations of the State in which they are producing, applicable to air pollution.

**410.9.2-Dust Collector:** An efficient dust collecting system shall be provided to prevent the loss of fine material. The material collected may be returned to the mixture at a uniform rate or discarded.

**410.9.3-Truck Scales:** Truck scales shall be provided at each Plant, except that truck scales are not required at properly calibrated automatic batching plant facilities which are equipped with digital printout equipment, and which load the trucks directly from the mixer or the weigh hopper in a surge or storage silo.

A person designated as a weigher shall be provided by the producer. The weigher shall certify that the weight of the asphalt, as determined either by the truck scales or from the digital printout of the batch weights, is correct.

Each truck shall be weighed empty prior to each load, except at automatic batch plants approved to operate without truck scales.

All truck scales shall be mounted on solid foundations which will insure them remaining plumb and level.

Approval and sealing of scales shall be conducted at the frequency determined by the West Virginia Division of Labor, Bureau of Weights and Measures, and when the plant is moved, or upon the request of the Engineer. The Engineer shall be notified of any scale malfunctions when material is being furnished to Division of Highways projects. The Division may, at its option, accept inspection and sealing by out-of-state agencies when the mixing plant is located outside West Virginia.

A digital recorder shall be required on all truck scales. The digital recorder shall produce a printed record of the gross, tare and net weights, and the time, date, truck identification, and

project number. Provision shall be made for constant zero compensation and further provision shall be made so that the scales may not be manually manipulated during the printing process. The system shall be interlocked so as to allow printing only when the scale has come to rest. In case of breakdown of the automatic equipment, the Engineer may permit manual operation for a reasonable time, normally not to exceed 48 hours, while the equipment is being repaired.

The scales shall be of sufficient size and capacity to weigh the loaded trucks that are used for delivery of asphalt from the plant.

**410.9.4-Test Weights:** As part of its standard equipment, each plant which proportions aggregate by weight shall provide a minimum of ten 50-pound (22.68 kg) test weights for the purpose of verifying the continued accuracy of its weighing equipment.

Plants which proportion asphalt material by weight shall furnish, in addition to the above, one five pound (2.268 kg) test weight.

**410.9.5-Surge and Storage Silos:** During the normal daily operation of the plant, asphalt may be stored in a surge or storage silo for a maximum of 12 hours, provided the silo has received prior evaluation and acceptance through the District plant inspection. The resulting temperature of the material at time of placement and compaction shall be sufficient to comply with 410.10.3 and 410.10.4

Longer silo storage times, up to 24 hours, may be permitted for dense graded asphalt if the storage silo is insulated and/or heated to assure that the proper mix temperature is maintained. The gates at the bottom of the storage silo shall be adequately heated and sealed when the asphalt is held for the extended period of time. When asphalt is stored for the extended time period, it shall not be used until the temperature has been checked and the asphalt has been visually inspected for hardening of the mix and stripping of the asphalt from the aggregate. Approval of the extended storage time may be revoked if it is determined through inspection and/or testing that the extended storage is having a detrimental effect on the asphalt.

**410.9.6-Inspection of Equipment and Plant Operations:** The Engineer shall have access to the plant to assure the adequacy of the equipment in use, to inspect the conditions and operation of the plant, to verify weights, to verify the proportion and character of materials, and to determine if specified temperatures are being maintained in the preparation of the mixture.

**410.9.7-Trucks for Transporting Mixture:** The use of diesel fuel, kerosene, or similar solvent-based products which can dissolve the asphalt film from the aggregate particles will not be permitted for use as a release agent. Any commercial release agent which is certified as harmless to the mix may be used; however, the Division reserves the right to restrict any release agent that is shown to cause problems during placement of the mix. All excess release agent shall be removed from the truck bed prior to loading the asphalt.

All truck beds shall be insulated with approved material. No trucks shall be used which cause segregation of the materials, which show large oil leaks, or which cause undue delays in delivery of material. All trucks shall be provided with a waterproof cover and a hole in the body for the purpose of conveniently checking the temperature of the load. Covers shall be suspended slightly above the mixture, shall extend over the sides of the truck, and shall be

securely fastened to eliminate air infiltration and to prevent water from coming in contact with the mixture.

**410.9.8-Laboratory:** A testing facility or laboratory, as described below, shall be provided within reasonable proximity of the asphalt plant. Plant operations must be visible from within the laboratory.

The laboratory shall be of sufficient size to hold all laboratory test equipment and supplies with adequate floor space to allow the technicians to test samples in an efficient manner. The laboratory shall be furnished and maintained with adequate ventilation, heat, light, water, sink and drainage, electrical or gas outlets, or both, work table, shelves, and supply cabinets.

The laboratory shall be supplied with the equipment and materials listed below and these shall be maintained to meet the applicable requirements of AASHTO or ASTM:

- i. Hot plate, gas or electric.
- ii. Large ovens (as needed for heating and drying samples), gas or electric.
- iii. Unit weight container, ½ cubic foot (0.014 cubic meter). Required for slag only.
- iv. Balances of sufficient capacity and accuracy for conducting specified tests and plant calibration.
- v. Thermometers: dial type, liquid-in-glass, and digital as required for conducting standard test procedures and monitoring mix temperatures. Digital thermometers shall be equipped with an appropriate sturdy probe that can be pushed into a sample of hot asphalt to check the temperature of the mix.
- vi. Ro-TapSieve shaker or equivalent, with 8 and/or 12 inch (200 and/or 300 mm) diameter screens.
- vii. Sample splitters for fine and coarse aggregates.
- viii. Miscellaneous items (including sample splitting trowels, scoops, square point shovel, aggregate sample pans, heat resistant gloves, measuring rules, brushes, flashlight, timing devices, and glassware as needed).
- ix. Expendable supplies necessary for performance of tests.
- x. Equipment for determining the maximum specific gravity of asphalt mixtures as specified in AASHTO T209.
- xi. Non-contact infrared thermometer accurate to  $\pm 2^{\circ}$  F ( $\pm 1^{\circ}$  C).
- xii. Equipment for determining the bulk specific gravity of asphalt mixtures using saturated surface dry specimens complying with AASHTO T166.
- xiii. Marshall equipment necessary to comply with AASHTO T245 and ASTM D5581, including a calibrated automatic testing apparatus having recording capabilities and compaction hammers. (Marshall designs only)
- xiv. Asphalt content ignition oven with built-in scale and printer meeting the requirements of AASHTO T308, Test Method A.
- xv. Calibrated Gyrotory compactor meeting requirement of AASHTO T312 with computer (including software for data acquisition and test calculations) and printer. Compactor must be calibrated to the internal angle in accordance with AASHTO TP71 with annual verification (Superpave designs only).

**410.9.9-Asphalt Paving Equipment:** Asphalt paving equipment shall be self-contained and of sufficient size, power and stability to receive, distribute and strike-off the asphalt mixture at rates and widths commensurate with the typical sections and other details shown on the plans. The paver shall be provided with an activated screed or strike-off assembly equipped to be heated. Approval of the paver by the Engineer will be based on the demonstrated capability of the equipment to place the mixture to the required cross-section, profile and alignment in an acceptable, finished condition ready for compaction.

The paver shall be equipped with means of preventing the segregation of the coarse aggregate particles when moving the mixture from the paver hopper to the paver augers. It shall also be capable of pushing a sufficient amount of the mixture under the auger gearbox to prevent streaking or tearing of the mat. Some paver models may require the installation of a manufacturer retrofit kit or equipment modification to accomplish this.

Specialized equipment or hand methods approved by the Engineer may be employed to spread the asphalt mixture where the use of standard full scale paver is impractical due to the size or irregularity of the area to be paved.

Pavers shall be equipped with mechanical or automatic grade and slope controls. The use of automatic grade and slope controls with a traveling straight edge shall be required only when specified on the Plans or in the Proposal. Both the grade and slope controls shall be in working order at all times. In the event of failure of the automatic controls, the Contractor will be permitted to finish the day's work using manual controls but will not be allowed to resume work the following day until the grade and slope controls are in proper working order.

**410.9.10-Compaction Equipment:** Compaction may be performed by self-propelled steel-wheeled, pneumatic-tired and/or vibratory rollers. Hand-held rollers or vibrating plates may be used in small inaccessible areas if approved by the Engineer. Prior to use on any project, the roller shall be inspected to see that it is in good mechanical condition. The total weight, weight per inch of width (steel-wheeled), and average ground contact pressure (pneumatic-tired) shall be documented.

## **410.10-PAVING OPERATIONS:**

### **410.10.2-Patching and Leveling and Scratch Courses:**

**410.10.2.1-Patching and Leveling:** Patching and leveling shall be placed at various locations throughout the project to remove irregularities in the existing pavement such as dips, or to raise the outside edge of the existing pavement to provide a uniform template prior to placing a base or wearing course. Patching and leveling shall not be placed as a continuous layer or course over the full width and length of the project.

~~— **410.10.2.2-Scratch Course:** The scratch course shall be placed to the limits designated on the plans. Scratch course shall be placed with a paving machine. The paving machine screed shall be set to drag on the high areas of the existing pavement, only depositing material in ruts and other depressions.~~

~~—The wearing course, or at least one lift of base course, should be placed over the scratch course prior to maintaining traffic in the lane where the scratch course has been placed. All repairs to a scratch course due to traffic damage shall be at the contractor's expense.~~

~~—Compaction of a scratch course shall be performed with a three wheel (steel) or pneumatic tire roller.~~

**410.10.3-Spreading and Finishing:** Before spreading any material, the contact surfaces of curbs, gutters, manholes, and of adjacent Portland cement concrete pavement edges shall be painted or sealed with asphalt material. Exact edge of pavement, except on concrete, shall be established by a string or chalk line for a distance of not less than 500 feet ahead of the spreading operation. For projects where the existing pavement was milled prior to the placement of new asphalt, the edge of pavement shall be the edge of milled section.

For mixes produced with neat (non-modified) asphalts (which may include PG 70-22, PG 64-22, PG 64-28, and PG 58-28) the temperature of the mixture at the time of placement shall be within the temperature requirements of the JMF. The JMF temperature range shall be the liquid asphalt supplier's specified mixing temperature  $\pm 45^{\circ}\text{F}$  ( $\pm 25^{\circ}\text{C}$ ) with a maximum mixing temperature of  $338^{\circ}\text{F}$  ( $170^{\circ}\text{C}$ ). Additional allowances will be made for water injection processes with a minimum mixing temperature of  $220^{\circ}\text{F}$  ( $105^{\circ}\text{C}$ ).

The mix temperature shall be monitored by inserting a thermometer into the mix through the hole in the truck bed.

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. 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 temperatures are within the master temperature range. Any truckload of material which exceeds the master temperature range may be rejected by the Engineer. However, 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.

When the surface temperature falls to within  $10^{\circ}\text{F}$  ( $6^{\circ}\text{C}$ ) of the weather restrictions of Table 410.8, the mix temperature may be increased up to a maximum of  $338^{\circ}\text{F}$  ( $170^{\circ}\text{C}$ ) unless otherwise specified by the asphalt supplier. The temperature of each truckload of material shall be monitored for compliance. Any truckload of material which exceeds this maximum temperature may be rejected by the Engineer.

Mixes produced with asphalts that contain modifiers for high or low temperature performance enhancement shall meet the temperature requirements recommended by the asphalt supplier, as determined using the mid-point of the mixing temperature range shown on the asphalt temperature-viscosity charts and allowing for  $\pm 25^{\circ}\text{F}$  ( $14^{\circ}\text{C}$ ).

**410.11-PROTECTION OF PAVEMENT AND TRAFFIC CONTROL:**

The Contractor shall be responsible for the protection of asphalt surfaces from damage by their equipment and personnel. When the construction of asphalt surfaces is undertaken on projects under public traffic and the road surface is 16 feet wide or greater and the ADT is 400 or greater, the Contractor shall place no passing signs, Interim pavement markings, and Temporary pavement markings to delineate the edge line, centerline, and/or lane line of the roadway as required herein and in the project plans. The provision of Section 336: Maintaining Traffic shall apply.

Interim markings are described as markings applied to freshly resurfaced roadways between lifts and after placement of the final lift prior to opening the portion of the roadway being resurfaced to traffic. These markings are intended to provide the minimum amount of delineation required for safe navigation of the roadway, and are to be succeeded by Temporary markings within a three (3) to fourteen (14) day period, based on the type of roadway and AADT, as specified herein. Interim and Temporary markings shall conform to the requirements of Section 663: Pavement Markings.

**410.12-METHOD OF MEASUREMENT:**

Asphalt will be measured by the Square Yard (SY). 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 asphalt items shall be at the expense of the Contractor. No additional compensation will be allowed for the material or any work incidental to its placement unless otherwise approved by the Engineer.

**410.13-BASIS OF PAYMENT:**

The quantities determine 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, tack coat, and incidentals necessary to complete the work and provide the performance criteria specified.

There will be no additional compensation for Interim Pavement Markings.

**410.13.1-**When a LOT of asphalt material is found not in compliance with the tolerance requirements for asphalt content and gradation as shown in MP 401.02.31, it shall be subject to a price adjustment in accordance with the criteria for Determination of Percent Within Limits established in MP 401.13.50 and pay factors in Table 410.13.3.1.

**410.13.2-BLANK**

**410.13.3-**The unit price for each LOT of asphalt pavement Mat shall be adjusted as follows in Table 410.13.3.1 in accordance with MP 401.13.50.

**Table 410.13.3.1**

<b>Percentage of Material Within Specification Limits (PWL)</b>	<b>Lot Pay Factor (Percent of Contract Unit Price)</b>
96-100 <sup>note 1</sup>	102 <sup>note 1</sup>
90-95	100
75-89	[(0.5)PWL]+55
55-74 <sup>Note 2</sup>	[(1.4)PWL]-12

**Note 1** Payment of 102% for mat density shall be subject to additional requirement of the average compaction for the lot being evaluated to be a minimum of 93% density.

**Note 2** Material with a PWL less than 55 is considered defective, and will be considered for removal and replacement of the lot. If only one lot characteristic has a percent within limits less than 55, the Engineer, may allow the Contractor to leave the defective lot in place. The decision to remove and replace the subject lot shall include evaluation of all lot characteristics for pay and surface characteristics as per guidelines set forth in MP 401.07.25. If the material is left in place, the Department will pay for the defective lot at a value not to exceed 50% of the contract unit price of asphalt per square yard.

(ie Contract unit price = \$10 sy → \$5 sy max)

**410.13.3.1-Price Adjustment:** The Division will compute the percent of the contract unit price paid as follows:

$$Lot\ Payment = CP (2PD + PB + PA) / 400$$

*CP = Contract unit price per lot (unit price times lot quantity)*

*PD = Payment Factor Percentage for mat density*

*PB = Payment Factor Percentage for asphalt content.*

*PA = Payment Factor Percentage for percent passing the 75 μm (No. 200) sieve*

**410.13.4-Joint Density Adjustments:** Joint Density PWL calculations shall be in accordance with MP 401.13.50. Joint Density bonus adjustments will be calculated for joint lots with a PWL greater than or equal to 80. Joint Density negative adjustments will be calculated for joint list with a PWL less than or equal to 60. Price adjustments shall be calculated using the formulas below. There will be no adjustment for joint lots who's PWL falls between 60 and 80.

Bonus adjustment calculated as follows:

$$\mathbf{\$T = \frac{PWL-80}{20} X 4000}$$

Negative adjustment calculated as follows:

$$\mathbf{\$T = \frac{60-PWL}{60} X 12,500}$$

Adjustments calculated for lots less than or greater than 10,000 feet in length shall be prorated directly proportional to the amount of length less than or greater than 10,000 feet.

**410.13.5-Thickness Adjustments:** No payment will be made for pavement areas deficient in thickness by more than 35% T.

Pavement which is deficient in thickness by more than 50% T is considered to be inadequate to perform satisfactorily and 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 410.13.5.1 below.

**410.13.5.1- Price Adjustments for Thickness -** When all individual measurements meet or exceed the specified thickness, there will be no adjustment for payment. If any individual values or when the average value of the pavement thickness per lot is less than the specified total thickness, the quantity of pavement represented by this average thickness will be paid by a direct calculation as defined as follows:

$$\mathbf{Price\ Adjustment\ \% = \left(\frac{t}{T}\right) x 100}$$

**T = Total Plan Thickness**

**t = avg. lot thickness + 0.04 in.**

This value is then applied to the unit price for the asphalt place in the lot, this adjustment shall remain separate from the PWL adjustments for AC, Gradation, Density, etc.

**410.13.6-Bond Strength:**

**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.

**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 410.7.1.4 , the price shall be adjusted as follows:

Negative adjustment calculated as follows:

$$\$T=(70-PWL)/70 \times 40,000$$

**410.13.7-Lot Payment Calculations:** The pay factors that are calculated with in the specification are to be applied in the following way:

**410.13.7.1-PWL Factors:** The calculated total PWL for a given lot is applied to the bid unit price for the asphalt mixture in the lot. Once the unit price has been adjusted the quantities can be calculated to arrive at the payment for the lot.

**410.13.7.2-Thickness Adjustment:** There is no adjustment for thickness greater than the thickness that is specified in the plans. If there is a Price Adjustment (Section 410.13.5) for thickness this factor (percentage) is applied to the contract bid unit price times the quantity in the lot to arrive at a dollar amount penalty. This penalty is applied to the overall payment for the lot.

**410.13.7.3-Joint Density Adjustment:** If it is determined in Section 410.13.4 of this specification that a Joint Density Adjustment is warranted the dollar amount determined in the formulas of Section 410.13.4 shall be applied to the overall payment for the lot.

**410.13.7.4-Bond Strength Adjustment:** If it is determined that a Bond Strength Adjustment is warranted by Section 410.7.1.4 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.

**410.14-PAY ITEMS:**

Item Number	Description	Unit
410001-090	MARSHALL BASE CRSE, TY I	SY
410001-095	MARSHALL BASE CRSE, TY II	SY
410001-100	SUPERPAVE BASE CRSE, TY 19	SY
410001-105	SUPERPAVE BASE CRSE, TY 25	SY
410001-110	SUPERPAVE BASE CRSE, TY 37.5	SY
410002-090	MARSHALL WEAR CRSE, TY I	SY
410002-095	MARSHALL WEAR CRSE, TY III	SY
410002-100	MARSHALL WEAR CRSE, TY IV	SY
410007-090	MARSHALL SKID PVT, TY I	SY
410007-095	MARSHALL SKID PVT, TY III	SY
410007-100	SUPERPAVE SKID PVT, TY 9.5	SY
410007-105	SUPERPAVE SKID PVT, TY 4.75	SY
410007-106	SUPERPAVE SKID PVT, TY 12.5	SY

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**STANDARD SPECIFICATION**  
**FOR**  
**SECTION 109**  
**MEASUREMENT AND PAYMENT**

ADD THE FOLLOWING:

**109.11-SQUARE YARD PAVING ADJUSTMENTS:**

For the purposes of Square Yard paving the value of Q the “As Constructed” Quantity in Sections 109.9 and 109.10 shall be calculated using the following formula.

Q = Quantity as per plan thickness calculated by:

$$Q = (L \times W \times 32.27) \times T$$

Where:      *L* = Length (mi)  
                  *W* = Width (ft)  
                  *T* = Plan Thickness (in)

**109.12 THROUGH 109.19-BLANK**