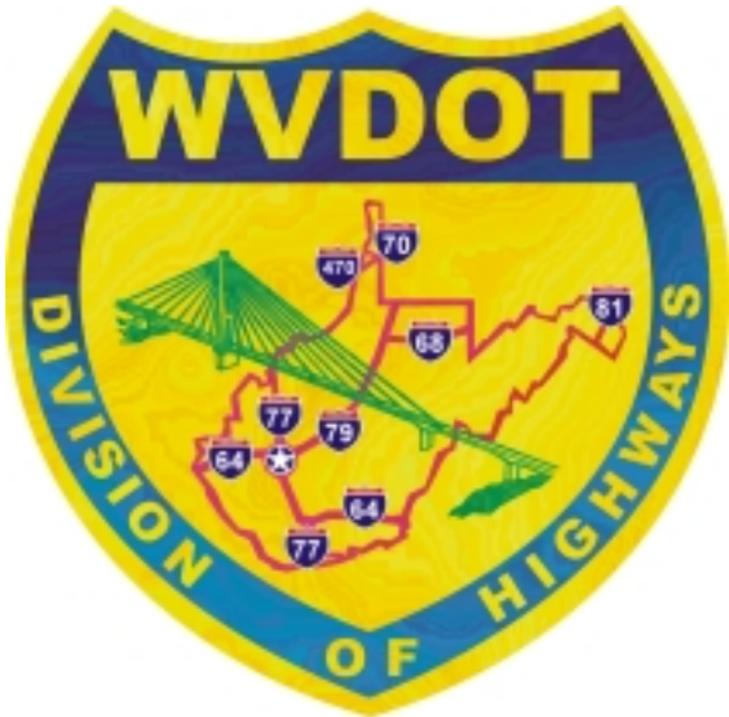


# WEST VIRGINIA DIVISION OF HIGHWAYS



## SUPPLEMENTAL SPECIFICATIONS

*TO ACCOMPANY THE 2000 EDITION  
OF THE STANDARD SPECIFICATIONS*

ISSUED JULY 1, 2001

# TABLE OF CONTENTS

<b>SECTION</b>	<b>DESCRIPTION</b>	<b>PAGE #</b>
<b><u>DIVISION 100</u></b>		
105.2	PLANS AND WORKING DRAWINGS	1
107.26	NOTIFICATION OF ABATEMENT, DEMOLITION OR RENOVATION	1
107.27	CONSTRUCTION ACCESS AND ENVIRONMENTAL PERMITS:	2
<b><u>DIVISION 200</u></b>		
202	BUILDING DEMOLITION, WELL AND SEPTIC TANK ABANDONMENT	5
204.4	METHOD OF MEASUREMENT	10
<b><u>DIVISION 300</u></b>		
307	CRUSHED AGGREGATE BASE COURSE	11
<b><u>DIVISION 400</u></b>		
401	HOT-MIX ASPHALT BASE, WEARING, AND PATCHING-AND-LEVELING COURSES	19
402	HOT-MIX ASPHALT SKID RESISTANT PAVEMENT	41
408.6	CLEANING AND SWEEPING	42
<b><u>DIVISION 500</u></b>		
501.4.1	TEST METHODS	43
506	CONCRETE PAVEMENT REPAIR	44

<b>SECTION</b>	<b>DESCRIPTION</b>	<b>PAGE #</b>
<b><u>DIVISION 600</u></b>		
601.1	DESCRIPTION	47
601.3	PROPORTIONING	47
601.4.1	SAMPLING AND TESTING METHODS	49
601.4.2	CONTRACTOR'S QUALITY CONTROL	49
601.8	FORMS	49
601.11.5	FINISHING CONCRETE DECKS FOR THE PLACEMENT OF SPECIALIZED OVERLAY	55
601.14	METHOD OF MEASUREMENT	56
601.15	BASIS OF PAYMENT	56
601.16	PAY ITEMS	56
602.9	METHOD OF MEASUREMENT	57
604.14	PAY ITEMS	58
607.1	DESCRIPTION	60
609.2	MATERIALS	60
615	STEEL STRUCTURES	60
616	PILING	61
625	DRILLED CAISSON FOUNDATIONS	68
626	RETAINING WALL SYSTEMS	85
636	MAINTAINING TRAFFIC	105
637.4	METHOD OF MEASUREMENT	109
640	FIELD OFFICE AND STORAGE BUILDING	109
642	TEMPORARY POLLUTION CONTROL	115
651.2	MATERIALS	115
653.9	PAY ITEMS	116
654.17	PAY ITEMS	116
656.8	PAY ITEMS	116
657	ROADSIDE SIGN SUPPORTS	116
658	OVERHEAD SIGN STRUCTURES	117
662	ROADWAY LIGHTING	117
663	PAVEMENT MARKINGS	118
679	OVERLAYING OF PORTLAND CEMENT CONCRETE BRIDGE DECKS	118
688	PAINTING STEEL STRUCTURES	141
689	METALIZING STEEL	142
<b><u>DIVISION 700</u></b>		
702	FINE AGGREGATE	143
704	STONE AND CRUSHED AGGREGATE	143
705.5	PERFORMANCE GRADED BINDERS	144
707	CONCRETE ADMIXTURES, CURING AND COATING MATERIALS	145
709	METALS	146
711	PAINTS, COATINGS, OILS, AND INKS	147
712	GUARDRAIL AND FENCE	150
713	METAL PIPE	151
715	MISCELLANEOUS MATERIALS	151
717	COMPACTION CONTROL OF BASE COURSE MATERIAL	156
718	SEWER AND WATERLINE MATERIAL	157



## DIVISION 100 GENERAL PROVISIONS

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### SECTION 105 CONTROL OF WORK

#### 105.2 - PLANS AND WORKING DRAWINGS:

DELETE THE 5<sup>TH</sup> PARAGRAPH AND REPLACE WITH THE FOLLOWING:

Working drawings for steel and timber structures shall consist of shop detail, erection and other working plans, showing details, dimensions, sizes of material, and other information necessary for complete fabrication and erection of the work. The Division will require shop lists for structural steel to be submitted in a format as set forth by the Engineer.

### SECTION 107 LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

ADD THE FOLLOWING SECTION:

#### 107.26 - NOTIFICATION OF ABATEMENT, DEMOLITION OR RENOVATION:

In accordance with state and federal regulations, the Contractor shall submit a "Notification of Abatement, Demolition or Renovation" to the address shown below prior to the commencement of demolition or renovation of any building or bridge. This notification is required regardless of the presence of asbestos.

If a building or bridge contains asbestos, the notification process as outlined in the Special Provision for Section 681, Asbestos Abatement shall be followed.

For buildings or bridges that do not contain asbestos, *only the notification form* must be submitted to the West Virginia Division of Environmental Protection (DEP) and the United States Environmental Protection Agency (EPA) at the address given below. All notifications must be made a minimum of 10 working days prior to the commencement of demolition or renovation operations. Particular attention is to be made to the "Schedule" section of the form. If for any reason, demolition or renovation cannot begin on the date as submitted, the DEP, Office of Air Quality must be notified at the address below:

West Virginia Division of Environmental Protection  
Office of Air Quality  
7012 MacCorkle Avenue, S.E.  
Charleston, West Virginia 25304-2943  
Attn: Mr. W. Leonard Womble  
Asbestos Program Manager  
Telephone: (304) 926-3647  
Fax: (304) 926-3739  
e-mail: LWOMBLE@MAIL.DEP.STATE.WV.US

United States Environmental Protection Agency  
1650 Arch Street  
Philadelphia, Pennsylvania 19103-2029  
Attn: Asbestos Coordinator  
Telephone: (215) 814-2100

The Project Engineer will have a copy of all asbestos inspection reports available at the field office. The Contractor shall provide copies of all notifications and correspondence to the Project Engineer.

If an asbestos inspection report indicates that there is no asbestos present on a bridge scheduled for demolition or renovation, the need for a trained individual to be on site during either process is waived.

However, the Contractor shall have an individual trained in accordance with the provisions as set forth in 40 CFR Part 61, Subpart M on site to observe building demolition and file a report with the Project Engineer indicating if any suspect (asbestos containing) material was encountered during demolition. A copy of the individuals current training certification must be attached to this report.

ADD THE FOLLOWING SUBSECTION:

**107.27 - CONSTRUCTION ACCESS AND ENVIRONMENTAL PERMITS:**

The Division has obtained permits for activities shown in the contract documents. The anticipated *Temporary Construction Access (TCA)* methods are included, if a TCA is not shown in the plans, or the permit, it has been determined that at least one TCA method exists that does not require a permit. A copy of these permits is in the contract documents.

The contractor must comply with the approved permits and exercise best environmental management practices at no additional cost to the Division.

The permits do not cover waste or borrow sites, haul roads, storage sites, staging areas or activity not shown in the contract documents or permits. These permits are to be handled in accordance with Section **107.2**.

**107.27.1-TEMPORARY CONSTRUCTION ACCESSES:**

A Temporary Construction Access is any road, cofferdam, causeway and/or stream crossing, access fill, dike, channel retaining structure, etc that may be required to access the work. This work shall consist of the construction of all temporary construction access required for the project and shall include, but is not limited to, all culverts, structures, excavation, rock borrow and incidental construction as required to construct the access. This work shall also include all necessary work required to maintain and remove the temporary construction access and to restore the area to its original condition. All of the work shall be in accordance with these Specifications and in reasonably close conformity with the contract documents, approved permits, or as established by the Engineer.

No payments shall be made for the Temporary Construction Access unless otherwise stated in the plans.

**107.27.1.1-Changing Temporary Construction Accesses:** The Contractor may elect to utilize alternate temporary construction access methods from those shown in the contract documents. If the Contractor proposes alternate temporary construction access methods, he shall obtain written approval from all affected landowners and shall provide to the Engineer all of the permit documents required to obtain additional or revised permits. The Division will submit the permit documents to the appropriate agencies for approval. Acceptance of the permit documents by the Engineer or forwarding them to the permitting agency does not guarantee or constitute approval of the permit. No work shall be performed on a permissible activity until a copy of all the appropriate approvals and permits are received by the Engineer. No time extensions or additional payments will be made for the contractor to obtain additional approvals or permits or for changes to the design of the temporary construction access.

**107.27.1.2- Excavated Material:** The excavated material, unless otherwise directed by the Engineer, shall be utilized for backfill or embankments. Surplus material shall be disposed in accordance with section 207.6 and in such a manner that the efficiency or appearance of the structure shall not be impaired, and the stream shall not be obstructed or excess sediment introduced into the stream.

**107.27.2 - CORPS OF ENGINEERS PERMIT:** If this project has been determined to involve activities, which are regulated by the Department of the Army, Corps of Engineers a permit has been included in the contract documents. These activities involve the discharge of dredge or fill materials into the Waters of the United States as regulated by Section 404 of the Clean Water Act or the obstruction or alteration of Navigable Waters of the United States regulated by Section 10 of the River and Harbor Act of 1899.

The Engineer will decide all questions that may arise as to the interpretation or violation of these conditions. The Contractor shall comply with the conditions of the Permits and the following:

1. Material will not be stockpiled in the watercourse.
2. Bilge, ballast or wash water pumped from barges or out of cofferdams will not be discharged into the watercourse without acceptable removal of solids, oils and/or toxic compounds.
3. Discharges shall be avoided during fish spawning seasons to the maximum extent practicable unless a note prohibiting such discharge is included in the construction plans.

# DIVISION 200

## EARTHWORK

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### SECTION 202 & SECTION 665

DELETE SECTIONS 202 AND 665 AND REPLACE WITH THE FOLLOWING:

#### SECTION 202

### BUILDING DEMOLITION, WELL AND SEPTIC TANK ABANDONMENT

#### 202.1-DESCRIPTION:

This work shall consist of the demolition of buildings and the abandonment of Septic Tanks, Water Wells, Gas Wells, Oil Wells and appurtenances as are specifically designated on the Plans. It shall include rodent control, disconnecting utilities, salvaging and disposing of the resulting materials in the manner and subject to the conditions and regulations prescribed.

The Contractor shall obtain all necessary permits, bonds and licenses required for this work and must provide them to the Engineer prior to commencing the work

#### 202.2-UTILITIES:

The Contractor shall be solely responsible for making all necessary arrangements and for performing any necessary work to the satisfaction of the utility companies and municipal departments involved in connection with the discontinuance or interruption of all public utilities or services, such as gas, water, sewage, electricity, and telephone, which may be affected by the work to be done under the demolition specified.

#### 202.3-DISPOSAL OF MATERIALS:

Materials resulting from demolition shall be disposed of by the Contractor at a West Virginia Division of Natural Resources approved landfill. Any material that is considered hazardous material must be disposed of at an approved site.

#### 202.4-BUILDINGS:

The demolition shall conform to the schedule of construction set up for the project.

Buildings and appurtenances shall be removed to the existing ground level, which operation shall include removal of concrete slabs or any other type of floor resting upon the ground. Basements shall be cleared of all debris, appliances, wood or metal partition walls, wood floors, etc., so that only the foundation walls and basement floor remain. The basement floors

## 202.4.1

shall be shattered. If pits, trenches, holes, or basements are not to be eliminated in subsequent excavation operation, they shall be backfilled. All backfill within the roadway prism shall be accomplished in accordance with the requirements of Section 207. Compaction of backfill outside the roadway prism shall be performed so as to obtain a minimum density equal to that of the surrounding ground.

### 202.4.1-RODENT CONTROL:

When specified in the Contract, the following rodent control provisions shall apply.

**202.4.1.1-General:** The Contractor shall furnish and place suitably prepared bait containing rodenticide in and around buildings to be demolished and shall also furnish and place insecticide for control of ectoparasites. Two rodenticide treated baits differing in content and method of placement will be required within 24 hours after receipt of notification to proceed. The Contractor shall place rodenticide treated bait within the building demolition area.

If the rodent control measures are not promptly furnished by the Contractor, the Division may provide the measures as required and deduct the cost from the money due the Contractor.

**202.4.1.2-Materials:** The rodenticide treated bait shall consist of the following:

**Type I Bait**-An anticoagulant, 0.5% concentrate, such as warfarin, pival, fumarin, PMP, etc., mixed with cereals and other rodent attractants in the following proportions by weight:

One part anticoagulant to seven parts coarse yellow corn meal; five parts rolled oats; one part granulated sugar; one part corn oil.

In the event rodents do not accept this formula chopped fruit may be substituted for the rolled oats in the same proportion.

**Type II Bait**-Zinc phosphide, 100% concentrate (94 % minimum assay), mixed in the proportion of 1:96 (one ounce to six pounds) of ground meat or canned dog food.

All rodenticides shall be handled and mixed in the bait in accordance with the manufacturers' instructions.

**Insecticide**-Two percent Diazinon Dust, or five percent Malathion Dust, or ten percent Carbaryl Dust, or two to five percent Chlordane Dust.

**202.4.1.3-Rodent Control Operations:** Type I bait containing anticoagulant shall be placed in shallow bait containers fastened to the floor surface of buildings or in shallow containers heavy enough to prevent overturning or removal to burrows. The containers shall be protected from domestic animals and weather and shall be distinctly labeled with the word

### 202.4.1.3

Poison and symbol thereof. The initial rate of application shall not be less than four pounds of bait per 1,000 sq. ft. (2 kg per 100 square meters) of building area.

Type II bait containing zinc phosphide shall be wrapped in paper squares approximately 4 in. by 4 in. (100 by 100 mm) in size to form baits about the size of a candy "Kiss". Bait should be placed out of reach of children or pets and should be tossed in otherwise inaccessible places. Initial rate of application shall be a minimum of 20 baits per residential building and 40 baits per commercial building.

Bait shall be placed near burrows, runways, or other areas showing rodent signs. A shallow pan containing water shall be placed in each building.

At the time the bait is set out, the Contractor shall treat all runways, burrow entrances, nests and vertical surfaces against which the rodents may brush with the insecticide dust at a rate of 2 pounds (1 kg) per residential building and 4 pounds (2 kg) per commercial building.

Location of all bait, bait containers and water containers shall be noted and bi-weekly inspection and replacement of bait and water shall be made. In the event bait is not touched for several days, the bait shall be moved to other areas in the building. Moldy, wet, caked or insect infested bait shall be replaced. Insecticide dusting shall be repeated once per month.

Baiting and insecticide dusting shall continue until all buildings and rubble are removed from the building demolition area.

A sign shall be posted at the front and rear of each building treated for rodent control. The sign shall be a minimum size of 30 in. by 30 in. (750 by 750 mm) with red lettering and poison symbols on a contrasting background.

Wording of the sign shall be as follows:

**THIS BUILDING  
TREATED  
FOR RODENT CONTROL  
POISON  
NO ADMITTANCE**

Minimum size lettering of the word POISON and symbols thereof shall be 6 inches (150 mm). All other lettering shall be a minimum of 4 inches (100 mm). The sign shall be made of weather resistant materials such as plastic or exterior plywood and shall be securely fastened to the building.

Where buildings to be demolished have had exterior poison warning signs placed upon them during the Division's phase of the rodent control program, the signs remaining on the buildings to be demolished will serve as adequate warning and the signing requirement of this Section is waived.

Exterior poison warning signs previously placed by the Division shall, upon demolition of the buildings, remain Division property and shall be stored on the project for removal by the Division.

**202.4.2**

Dead rodents shall be removed from the building demolition area daily and shall be buried at a minimum depth of 2 ft. (600 mm). The disposal area shall be provided by the Contractor and shall be subject to approval by the Engineer.

**202.4.2-INSURANCE REQUIREMENTS:**

In addition to the insurance required of the Contractor on all Division Contracts, the Contractor is required to maintain Liability Insurance for this work in the amounts and form as set forth below for the duration of the work:

- i. Public Liability \_\_\_\_\_ \$ 1,000,000.00
- ii. Products Liability \_\_\_\_\_ \$ 1,000,000.00
- iii. Owner Liability \_\_\_\_\_ \$ 1,000,000.00

The above insurance shall be purchased by the Contractor on behalf of the Division from a company authorized to do business in the State of West Virginia.

**202.5-WELLS:**

The Contractor shall plug the well prior to starting any other construction in the vicinity of the well.

**202.5.1-Materials:** Materials for plugging water wells shall meet the requirements of Division 700 as follows:

<b>MATERIAL</b>	<b>SUBSECTION</b>
Bentonite	715.45
** Concrete	601

\*\*Class D with or without air entrainment at the option of the Contractor.

**202.5.2-Gas And Oil Wells:** The well shall be plugged using bentonite and cement as provided for by law, and the work shall be accomplished by a qualified service company meeting the approval of the Department of Environmental Protection office of Oil and Gas. All work pertaining to plugging the well must be performed under the supervision of the representative of the DEP office of Oil and Gas. The Contractor shall notify the Project Engineer and the DEP office of Oil and Gas at least 14 days in advance of the date on which the Contractor intends to begin work.

The Division will make available upon request copies of regulation Title 35 Series 4 and Article 6, Chapter 22 of the Gas and Oil Laws. The Contractor shall obtain a permit from DEP office of Oil and Gas and must follow all procedures prescribed in the permit.

**202.5.3-Water Wells:** The Contractor shall plug all drilled water wells within the right-of-way limits prior to starting any other work in the vicinity of the wells. The well casing shall be pulled as much as practical and then filled from the bottom to the top with bentonite, concrete or a mixture of concrete and 5% bentonite to the ground surface. This operation shall be continuous.

The Contractor shall obtain a permit to abandon a water well from the County Sanitarian or State Health Department and must follow all procedures prescribed in the permit.

**202.6-SEPTIC TANKS:**

A septic tank that serves a building that is being demolished shall be abandoned as follows:

The contents of the septic tank shall be removed by a licensed septic tank cleaner and the tank removed and disposed of at an approved landfill. The excavation made to remove the tank shall be backfilled with material free of sod, trash, organic substances and muck. The backfill shall be compacted as outlined in 202.4.

**202.7-METHOD OF MEASUREMENT:**

The unit of measurement will be lump sum value as determined for each building to be demolished and removed, each water well abandonment, each septic tank abandonment, each gas well abandonment, or each oil well abandonment.

**202.10-BASIS OF PAYMENT:**

The Building Demolition shall constitute full compensation for performing all of the requirements of this item, including furnishing all material, labor, tools, equipment, supplies, rodent control and incidentals thereto. Salvageable materials shall become the property of the Contractor, unless otherwise indicated on the Plans or in the Proposal.

The water wells, gas wells, oil wells, or septic tanks abandoned as provided above will be paid for at the contract price per each and shall be full compensation for performing all of the requirements of the item, including furnishing all material, labor, tools, equipment, supplies, permits, and incidentals thereto.

**202.11-PAY ITEMS:**

ITEM	DESCRIPTION	UNIT
202001-*	BUILDING DEMOLITION NUMBER, "x" / "y"	LUMP SUM
202002-*	WATER WELL ABANDONMENT NUMBER, "x" / "y"	LUMP SUM
202003-*	SEPTIC TANK ABANDONMENT NUMBER, "x" / "y"	LUMP SUM
202004-*	GAS WELL ABANDONMENT NUMBER, "x" / "y"	LUMP SUM
202005-*	OIL WELL ABANDONMENT NUMBER, "x" / "y"	LUMP SUM

\* Sequence number

x = parcel number

y = building, well, or septic tank number

**SECTION 204  
MOBILIZATION**

**204.4-METHOD OF MEASUREMENT:**

DELETE THE CONTENTS AND INSERT THE FOLLOWING:

The method of measurement will be a lump sum.

**204.5-BASIS OF PAYMENT:**

DELETE THE CONTENTS AND INSERT THE FOLLOWING:

Partial payments will be made as the work progresses.

Partial payment amounts will be the lesser of the following:

- a) 1.5% of the entire contract amount including mobilization
- b) 50% of the amount bid for mobilization

The first partial payment shall be made on the first estimate payable, not less than 15 days after the start of work at the project site.

The second partial payment shall be made with the estimate payable 30 days after the first estimate.

Upon completion of the project payment of the amount bid less partial payments for mobilization shall be paid.

Nothing herein shall be construed to limit or preclude partial payments otherwise provided for by the contract.

No deductions or increases will be made in the lump sum mobilization item amount regardless of decreases or increases in the final total contract amount or for any other cause.

# DIVISION 300 BASES

## SECTIONS 307 & 308

DELETE AND REPLACE WITH THE FOLLOWING

### SECTION 307 CRUSHED AGGREGATE BASE COURSE

#### **307.1-DESCRIPTION:**

This work shall consist of furnishing, spreading, and compacting one or more courses of crushed aggregate on a prepared surface in accordance with these Specifications and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the Plans or established by the Engineer.

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

#### **307.2-MATERIALS:**

The crushed aggregate base course shall be composed of materials meeting the requirements of 704.6 for the class shown on the Plans except that 704.6.3 shall not apply.

Class 3 material shall be used on all shoulders and surface courses.

**307.2.1-Quality Control Testing:** Quality control of the crushed aggregate base course is the responsibility of the Contractor as specified in 106.1.

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

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

**307.2.2-Acceptance Testing:** Acceptance sampling and testing of crushed aggregate base course 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.

### 307.2.3

**307.2.3-Sampling and Testing:** Frequency of sampling and testing shall be in accordance with the Contractor's quality control plan. The minimum frequencies shall be as indicated in applicable portions of MP 307.00.50. Crushed aggregate shall be sampled in accordance with MP 700.00.06, Aggregate Sampling Procedures.

When Sampling shoulder material for resurfacing projects that has a depth of less than 3 inches (75 mm) gradation samples may be taken from the stockpile prior to placement.

**307.2.4-Acceptance Procedure:** Material conforming to the specification requirements will be accepted at full contract price. Material failing to comply with the quality requirements of Table 704.6.2 shall not be incorporated into the work.

Acceptance of crushed aggregate base course for compaction and for gradation shall be in accordance with appropriate portions of 307.2.4.1.

#### 307.2.4.1-Acceptance Plan:

**307.2.4.1.1-For Compaction:** Acceptance for compaction shall be on a lot by lot basis. A lot shall consist of a single layer of not more than 2,000 linear ft. (600 meters) per width being placed. A lot shall be divided into five approximately equal sized sublots. One nuclear moisture and density measurement in accordance with applicable portions of 717 shall be made at a random location within each of the five sublots. The random locations shall be determined in accordance with MP 712.21.26. If the result of five density tests on a lot indicates that at least 80 percent of the material, in accordance with 106.3.1 (West Virginia AP-A), has been compacted to the specified target percentage of dry density, the lot will be accepted. If less than 80 percent has been compacted to the specified target percentage of dry density, no additional material shall be placed on that layer until it has been reworked to meet the specified requirements. Reworking and retesting shall be at the expense of the Contractor. When the Division performs the testing in the evaluation of reworked lots, the testing will be at the expense of the Contractor at the unit cost specified in 109.2.2.

Compaction of shoulder aggregate on resurfacing projects adjacent to asphalt or concrete pavement shall be based on visual inspection to assure that the surface of the shoulder has been compacted to the level of the finished pavement surface.

Compaction of Class 7 aggregate shall be based on visual inspection to assure that the aggregate particles are arranged in a stable manner.

**307.2.4.1.2-For Gradation:** Acceptance for gradation shall be on the basis of test results on consecutive random samples from a lot. A lot shall be considered the quantity of material represented by an average test value, not to exceed five sublots. Generally at the beginning of the project, the average shall be started on the second sample in accordance with MP 300.00.51. A subplot is the quantity of material represented by a single gradation test. In the case where only one sample is taken, this subplot shall

### 307.2.4.2

be considered the lot. The material shall be sampled and tested in accordance with 307.2.3. The gradation test results shall be plotted on a control chart in accordance with MP 300.00.51. When the average, or when the most recent three consecutive individual test values fall outside the limits of Table 704.6.2 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 307.9.1. 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.

Acceptance for Gradation of Class 7 aggregate shall be on the basis of the Contractor's written certification that the material meets the gradation requirements. Certification shall include a description of the crushing operation indicating the screens used.

**307.2.4.2-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 307.2.4.2 to determine the degree of nonconformance on that sieve.

**TABLE 307.2.4.2**

<b>NONCONFORMING SIEVE SIZE</b>	<b>MULTIPLICATION FACTOR</b>
2 in. (50 mm)	1.0
1 ½ in. (37.5 mm)	1.0
¾ in. (19 mm)	1.0
No. 4 (4.75 mm)	1.0
No. 40 (425 µm)	1.5
No. 100 (150 µm)	2.0
No. 200 (75 µm)	2.5

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 307.9.1.

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

### **307.3**

action to be followed. Pending resolution of the matter, additional lifts of base or pavement shall not be placed over the nonconforming material.

## **CONSTRUCTION METHODS**

### **307.3-EQUIPMENT:**

Any machine, combination of machines, or equipment which will handle the material without undue segregation and produce the completed base course meeting these Specifications for handling, spreading, moistening, mixing and compacting may be used when approved by the Engineer.

### **307.4-PLACING:**

Prior to the placing of any base course material on the subgrade, the subgrade shall meet the applicable requirements of 207.9 or 228. The profile grade of the subgrade shall be such that the specified thickness of the base course may be obtained. No base shall be placed when the subgrade is frozen or when it is sufficiently wet that its surface can be marred by construction equipment.

The base course shall be placed and shaped on the prepared surface in layers to achieve the compacted thickness shown on the Plans. When more than one layer is required, each layer shall be shaped and compacted to the required density before the succeeding layer is placed. Each layer shall be kept at least 500 ft. (150 meters) ahead of the succeeding layer. Tailgating will not be permitted. If power graders are used for spreading, the material shall be placed in windrows and uniformly and thoroughly mixed prior to final spreading and compaction.

Aggregate for shoulders on resurfacing projects shall be spread over the prepared surface to a width as specified in the Plans and to a depth sufficient to bring the uncompacted surface to a height of at least 1 in. (25 mm) above the finished pavement edge elevation. For compacted shoulder thicknesses exceeding 3 inches (75 mm), the differential from the pavement edge elevation must be increased to assure that the loose aggregate thickness is approximately equal to 1 1/3 times the compacted thickness. The loose aggregate is then to be shaped to proper grade and cross section maintaining the height differential.

### **307.5-COMPACTING:**

Each layer shall be compacted. The moisture content shall be maintained at a level sufficient to facilitate compaction. Required density and testing shall be in accordance with the provisions of the appropriate portions of 717. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture is produced and the aggregates firmly keyed. The surface of the top layer of the base course shall be carefully trued by blading if necessary.

Shoulder aggregate adjacent to concrete or asphalt pavement shall be compacted by pneumatic tire rollers when the drum roller is wider than the shoulder width or as directed by the engineer.

**307.6-TOLERANCE:**

**307.6.1-Surface Tolerance:** The completed surface shall not vary more than 3/8 in. (10 mm) above or below Plan grade, nor more than 3/8 in. (10 mm) from a straightedge 10 ft. (3.048 m) long applied parallel to the centerline of the pavement. Deviations shall be corrected by scarifying, adding additional approved aggregate if necessary, reshaping, and recompacting.

Shoulder surfaces on resurfacing projects adjacent to concrete or asphalt pavement do not need to be checked with a straightedge.

**307.6.2-Thickness Tolerance:** The base course shall be checked for proper thickness after final compaction. The Contractor shall refill all test holes with approved base course material and adequately recompact the material.

Any deficiency in total thickness of the base course in excess of 1/2 in. (13 mm) shall be corrected.

**307.7-MAINTENANCE:**

The surface of the completed base shall be protected against the loss of fine material by the addition of moisture when necessary, and it shall be maintained in a satisfactory and smooth condition until such time that it is surfaced or finally accepted.

**307.8-METHOD OF MEASUREMENT:****307.8.1-Cubic Yard (Meter) Measurement:**

The quantity of work done will be the number of cubic yards (meters) as established in the Proposal. Any additional work beyond the scope of the original Plans but authorized by the Engineer will be measured in cubic yards (meters) in place and paid for at the unit bid price for this item, subject to the provisions of 104.2 and 109.2.

Base course constructed outside the lines, dimensions, and cross sections shown on the Plans or designated will not be measured for payment.

**307.8.2-Ton (MG) Measurement:**

The quantity of work done will be the number of tons (Mg) of material complete in place and accepted.

The number of tons (Mg) shall be determined by the total of the weights shown on receipted railroad freight bills when materials are shipped by rail; by actual measured displacement of barges certified by the producer when water shipments are made, providing materials delivered by the methods are not stockpiled or stored; or determined by the Contractor from the total of weigh slips for each vehicle load weighed on an approved standard scale or from digital printout slips from an automatic batching plant, and certified by the Contractor to be correct.

### **307.9**

Truck scales shall be provided by the producer or Contractor, except that truck scales are not required where the material is weighed at properly calibrated automatic batching plant facilities which are equipped with digital print-out equipment. The scales shall be of sufficient size and capacity to weigh the heaviest loaded trucks that are used for delivery of the material.

All truck scales shall be mounted on solid foundations, which will insure their remaining plumb and level. All truck scales shall be inspected and sealed by the West Virginia Division of Labor, Bureau of Weights and Measures, or other appropriate agencies of the State or its political subdivisions. The Division may, at its option, accept inspection and sealing by out of state agencies when the material is weighed outside West Virginia.

The producer shall provide a weigh person. The weigh person shall certify that the weight of the material, as determined either by the truck scales or from the digital printout of the weights, is correct.

Each truck shall be weighed empty prior to each load, except at automatic batch plants approved to operate without truck scales. A digital recorder shall be required on all truck scales. The digital recorder shall produce a printed record of the gross, tare and net weights, and the time, date, truck identification and project number. Provision shall be made for constant zero compensation and further provision shall be made so that the scales may not be manually manipulated during the printing process. The system shall be interlocked so as to allow printing only when the scale has come to rest.

In case of a breakdown of the automatic equipment, the Engineer may permit manual operation for a reasonable time, normally not to exceed 48 hours, while the equipment is being repaired.

When reconditioning surface with aggregate is specified it shall include the cost of all surface reconditioning work.

### **307.9-BASIS OF PAYMENT:**

The quantities, determined as provided above, will be paid for at the contract unit price bid for the items listed below, which price and payment shall be full compensation for furnishing all the materials including water for compaction, scarification and manipulation of existing surface, 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.

**307.9.1-Price Adjustment:** Aggregates not conforming with the gradation requirements as described in 307.2.4.1 will be paid for at the adjusted contract price based on the degree of nonconformance as specified in Table 307.9.1.

TABLE 307.9.1

ADJUSTMENT OF CONTRACT PRICE FOR GRADATION NOT WITHIN SPECIFICATIONS	
DEGREE OF NONCONFORMANCE	PERCENT OF CONTRACT PRICE TO BE REDUCED
1.0 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.

**307.10-PAY ITEMS:**

ITEM	DESCRIPTION	UNIT
307001-*	AGGREGATE BASE COURSE, CLASS "class"	CUBIC YARD (METER)
307005-*	AGGREGATE BASE COURSE, "aggregate type", CLASS "class"	TON (MEGAGRAM)

\* Sequence number

"aggregate type" shall be either stone and gravel, slag or steel slag  
 "class" From Table 704.6.2A and B

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# DIVISION 400

## BITUMINOUS PAVEMENTS

### SECTION 401

#### HOT-MIX ASPHALT BASE, WEARING, AND PATCHING AND LEVELING COURSES

DELETE THE ENTIRE SECTION AND INSERT THE FOLLOWING:

### SECTION 401

#### HOT-MIX ASPHALT BASE, WEARING, AND PATCHING-AND-LEVELING COURSES

#### 401.1 - DESCRIPTION:

This work shall consist of constructing one or more courses of hot-mix asphalt (HMA), 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 HMA 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.

#### 401.2 - MATERIALS:

The materials shall conform to the following requirements:

MATERIAL	SUBSECTION	PG BINDER GRADE
Performance Graded Binders	705.5	Standard grade shall be a PG 64-22.
Coarse Aggregate	703.1 thru 703.3 * (See MP 401.02.28 for exceptions and additions required for Superpave Items.)	PG 70-22** shall be used on projects specified with over 20 million ESALs. Any deviation from the above criteria will be specified in contract documents.
Fine Aggregate	702.3 (See MP 401.02.28 for additions required for Superpave Items)	
Mineral Filler	702.4	

\* The total shale, coal and other lightweight deleterious material and friable particles shall not exceed 3%.

### **401.3**

\*\* PG 64-22 Binder may be used in HMA placed below the top two lifts. Scratch course and patching-and-leveling are not identified as lifts.

## **CONSTRUCTION METHODS**

### **401.3 - 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.

### **401.4 - COMPOSITION OF MIXTURES:**

**401.4.1 - 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.

**401.4.2 - 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 type of HMA to be produced. Depending on the design type, the JMF gradations shall be within the tolerances set forth in either Table 401.4.2A or Table 401.4.2B. 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. 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 asphalt binder representing the optimum asphalt content for the JMF submitted, which is to be considered the desirable target percentage.

**401.4.2**

- iv. The temperature of the completed mixture at the plant which shall be within  $\pm 25$  °F ( $\pm 14$  °C) of the median mix temperature established by the temperature-viscosity chart or as recommended by the asphalt supplier.
- v. The ratio (calculated to the nearest one-tenth percent) of the Fines to 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 401.4.2A  
DESIGN AGGREGATE GRADATION REQUIREMENTS  
FOR MARSHALL MIX DESIGNS**

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

**TABLE 401.4.2B**  
**DESIGN AGGREGATE GRADATION REQUIREMENTS**  
**FOR SUPERPAVE MIX DESIGNS**

Type of Mix	37.5	25	19	12.5	9.5
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)
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
9.5 mm (3/8")				90 max	90 - 100
4.75 mm (No.4)					90 max
2.36 mm (No.8)	15 - 41	19 - 45	23 - 49	28 - 58	32 - 67
1.18 mm (No.16)					
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

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 source may be changed without requiring a new mix design, but the binder grade must always remain the same for each design. 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.

#### **401.5 -TESTING:**

##### **401.5.1 - 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 T287 - Asphalt Content of Bituminous Mixtures by the Nuclear Method
- 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 T269 - Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
- AASHTO TP4 - Determining the Density of HMA Specimens by Means of the Superpave Gyrotory Compactor

#### **401.6 - CONTRACTORS QUALITY CONTROL:**

**401.6.1 - Quality Control Testing:** Quality control of HMA is the responsibility of the Contractor. The Contractor shall maintain equipment and qualified personnel including at least one certified HMA 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 HMA within the limits of the specification. A certified HMA inspector may handle sampling and testing activities under the supervision of the plant technician.

The Contractor shall maintain equipment and qualified personnel including at least one certified Compaction Technician at each project. A

## **401.6.2**

certified Compaction Technician shall perform all testing necessary to assure compaction of the HMA meets specification requirements. The Contractor, or Contractor-Producer, shall design a workable Quality Control Plan, detailing the type and frequency of sampling and testing deemed necessary to measure and control the magnitude of the various properties of the HMA governed by these specifications. This plan, prepared in accordance with MP 401.03.50 shall be submitted to the Engineer for review prior to production of material under this specification.

**401.6.2 - 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 designs, the verification shall be in accordance with the guidelines established in MP 401.02.27. For Superpave, designs it shall be in accordance with MP 401.02.29. The field verification is for the purpose of demonstrating that the JMF can be produced within the specified tolerances set forth in the MP. If the mix cannot be produce within these requirements, a new mix design will be required.

**401.6.3 – 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 401.02.27 for Marshall designs and MP 401.02.29 for 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.

## **401.7 - ACCEPTANCE TESTING:**

**401.7.1 - Acceptance Testing of HMA:** Acceptance testing of HMA is the responsibility of the Division. For Superpave mixes, the acceptance sampling and testing requirements for the mixture shall be as set forth in MP 401.02.29.

**401.7.2 – Surface Tolerance:** It is the intent of these specifications that projects with a total new pavement thickness of 3 inches (75 mm) or more and minimum length of two lots (1100 ft = 340 m) shall be constructed to provide a smooth riding surface. The smoothness of the riding surface will be determined by the Engineer using an inertial profilometer or Mays Ride Meter. The smoothness testing will generally be accomplished within 30 days after the project is complete. On urban projects with numerous side streets where traffic must cross through the paving operation, the Engineer shall determine if it is practical to evaluate the pavement for smoothness.

The pavement will be divided into sampling LOTS of one-tenth (0.1) lane-mile (0.16 km) each. Each LOT shall exhibit a smoothness measurement, expressed in inches per mile (millimeters per kilometer) equal to or less than that shown in the appropriate Table 401.7.2E or

401.7.2M. When a LOT is represented by a smoothness number greater than that shown in Tables 401.7.2E or 401.7.2M, the unit price shall be adjusted as in 401.13.2.

<b>TABLE 401.7.2E</b>	
<b>Total New Pavement Thickness</b>	<b>Smoothness</b>
3 inches to 4 inches	81 inches per mile or less
4 inches or greater	65 inches per mile or less

<b>TABLE 401.7.2M</b>	
<b>Total New Pavement Thickness</b>	<b>Smoothness</b>
75 mm to 100mm	1250 mm/km or less
100mm or greater	1000 mm/km or less

When compaction is completed on the course, it shall present a uniform surface, true line and grade, conforming to the cross section shown on the Plans. When tested with a straightedge of approximately 10 feet (3 meters) in length and a template of the specified dimensions, the finished base course shall not show a deviation greater than ¼ inch (6 mm) and the finished wearing course shall not show a deviation from the required surface greater than 3/16 inch (5 mm).

The Contractor shall provide the straightedge and template for checking the surfaces and an employee to use them under the direction of the Engineer. Any irregularity of the surface exceeding the limits specified shall be corrected. Depressions which develop after the initial rolling shall be corrected by loosening the mixture and adding new material. High places shall be corrected by removing excess material.

Areas of completed courses found to be defective shall be removed and replaced with approved mixtures laid in accordance with these specifications, and no additional compensation will be allowed for materials used or work involved in replacing defective areas.

**401.7.3 - Compaction:** Acceptance testing for compaction shall be performed in accordance with either the Lot-by-Lot method described in Section 401.7.3.1 or the rollerpass procedure described in MP 401.05.20, based on the total new pavement thickness and the lift thickness provided in Table 401.7.3A. Patching-and-leveling and scratch courses shall not be included in determining the total new pavement thickness. When HMA is

**401.7**

placed in areas that require a nonuniform thickness or is tapered to a thin edge, the method of acceptance testing shall be determined by the Engineer. Acceptance testing is not required on areas in which a full-size roller is restricted from properly compacting the mat. These areas shall be compacted to the satisfaction of the Engineer.

<b>Table 401.7.3A Mainline Compaction Methods</b>				
<b>Traffic Type</b>	<b>Total New Pavement Thickness</b>	<b>Marshall Lift Thickness</b>	<b>Superpave Lift Thickness</b>	<b>Compaction Method *</b>
Heavy ≥ 3 million ESALs	≥ 2.5 inches (63 mm)	≥ 1 inch (25 mm)	≥ 1.25 inch (32 mm)	Lot-by-Lot
		< 1 inch (25 mm)	< 1.25 inch (32 mm)	Rollerpass
Heavy ≥ 3 million ESALs	< 2.5 inches (63 mm)	> 1 inch (25 mm)	> 1.25 inch (32 mm)	Lot-by-Lot
		≤ 1 inch (25 mm)	≤ 1.25 inch (32 mm)	Rollerpass
Medium < 3 million ESALs	≥ 3.0 inches (75 mm)	> 1 inch (25 mm)	> 1.25 inch (32 mm)	Lot-by-Lot
		≤ 1 inch (25 mm)	≤ 1.25 inch (32 mm)	Rollerpass
Medium < 3 million ESALs	< 3.0 inches (75 mm)	All lifts	All lifts	Rollerpass

\* Any lift that is placed at a thickness of less than two times the nominal maximum aggregate size, as specified in either Table 401.4.2A or Table 401.4.2B, shall be compacted using the rollerpass method.

<b>Table 401.7.3B Other Compaction Situations</b>		
<b>Procedure</b>	<b>Construction Situation</b>	<b>Compaction Method</b>
Shoulders	New Construction	Lot-by-Lot
	Overlay Projects	Rollerpass
Shoulders With Rolled-In Rumble Strips	Surface Course Only	See Section 401.7.3.2
Trench Paving	All	Rollerpass or Satisfaction of the Engineer
Pavement Widening	All	Rollerpass or Satisfaction of the Engineer
Pavement Repairs	All	Rollerpass or Satisfaction of the Engineer

**401.7.3.1 – LOT-By-LOT Testing:** Randomly located nuclear density tests will be performed in accordance with the LOT-By-LOT test procedure described in MP 401.05.20. The pavement shall be divided into LOTS not exceeding 1000 feet (300 meters) of paving lane. A randomly located density test shall be conducted in each LOT. The density shall be within the range of 92 to 96% of the maximum density of the approved mix design or the maximum density established under Section 401.6.2, Job Mix Formula Verification. If the density is outside the range, an additional five tests shall be conducted for the LOT and the average of these five tests used to judge acceptance of the LOT in accordance with Table 401.13.3.

**401.7.3.2 – Shoulders With Rolled-In Rumble Strips:** On both new construction and overlay projects, the compaction requirement for the surface course of the shoulder shall be in accordance with the rollerpass procedure described in MP 401.05.20. However, the number of roller passes may be reduced in the area of the rolled-in rumble strip to allow for the proper placement of the rumble strip.

**401.7.4 – Thickness:** When a uniform thickness of three inches (75 mm) or more is specified, excluding resurfacing, cores shall be taken to verify the thickness of the compacted pavement.

Cores will be taken by the Division at random locations. The sampling frequency shall be approximately five cores per 2000 feet (600 meters) of two-lane construction, except that the sampling frequency shall normally be limited to a minimum of five and a maximum of 50 cores per project. The Division may elect to waive coring for short projects of less than 1000 feet (300 meters) in length or for projects where a paving mat of uniform thickness cannot be expected (for example: tapered paving mats or pavement widening projects). The Division may also elect to take additional cores when needed to resolve problems related to pavement thickness.

The thickness shall be considered acceptable if one or both of the following criteria are met.

- (A) The average thickness equals or exceeds the specified thickness.
- (B) The average thickness is less than the specified thickness, but the difference is not statistically significant at the 95% confidence level. (Standard one tail “t” test at 0.05 significance).

The calculated ‘t’ value shall be less than or equal to the standard ‘t’ value at the 95% confidence level. The method for calculating Criteria ‘B’, shall be as follows:

**401.8**

$t \leq t_{95}$  Where:

$t_{95}$  = value from standard “t” table for 95% confidence level.

$$t = \frac{x_s - \bar{x}}{s} \sqrt{n-1}$$

$x_s$  = specified thickness

$\bar{x}$  = average thickness

$n$  = number of samples

$$s = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$$

$x$  = individual core thickness

If the average thickness is less than specified and is determined to be significant as determined by criteria ‘B’, the Division shall decide on a course of action as described in Section 401.13.4.

**401.8 - WEATHER RESTRICTIONS:**

HMA shall only be placed when the surface is dry and when weather conditions are such that proper handling, finishing, and compaction can be accomplished. In no case however, shall HMA be placed when the surface temperature is below the minimum established in Table 401.8.

<b>Course Thickness</b>	<b>Minimum Surface</b>
3 inches (75 mm) and over	35 °F (2 °C) *
1.5 to 2.9 inches (38 to 74 mm)	40 °F (4 °C)
Less than 1.5 inches (38 mm)	50 °F (10 °C)

\* In lieu of 35 °F (2 °C), a minimum air temperature of 40 °F (4 °C) shall be used when paving directly on an aggregate base, subbase, or subgrade.

In addition to the above surface temperature requirements, no wearing courses shall be placed when the air temperature is less than 40 °F (4 °C).

**401.8.1 - Cold Weather Paving:** When the air temperature falls below 50 °F (10 °C) or the surface temperature falls below 60 °F (15 °C) the provisions for cold weather paving shall apply.

Paving shall be performed so that the transverse joints in adjacent lanes shall be no more than 50 feet (15 meters) apart at the end of each days paving operations.

The surface temperature shall be taken a minimum of once every hour and shall be taken in all shaded areas. The temperature requirements as listed in Table 401.8 shall apply.

It shall be the Contractor's responsibility to monitor the declining surface temperature to insure that material delivery from the plant be terminated so as to allow that all material can be placed prior to the surface temperature falling below the surface temperatures listed in Table 401.8.

The temperature of the delivered material and the mat temperature at the time final density is obtained shall be taken for every truck load. These temperatures shall be in accordance with Section 401.10.3 for delivered material and 401.10.4 for the mat temperature at the time final density is obtained.

#### **401.9 - EQUIPMENT:**

**401.9.1 - Plants:** All plants in West Virginia producing HMA 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 HMA 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. 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.

**401.9.2 - 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.

**401.9.3 - 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 bin.

A person designated as a weigher shall be provided by the producer. The weigher shall certify that the weight of the HMA, as determined either by the truck scales or from the digital printout of the batch weights, is correct.

#### 401.9.4

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 HMA from the plant.

**401.9.4 - 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 maintaining 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.

**401.9.5 - Surge and Storage Bins:** During the normal daily operation of the plant, HMA may be stored in a surge or storage bin for a maximum of 12 hours, provided the bin 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 401.10.3 and 401.10.4

Longer silo storage times, up to 24 hours, may be permitted for dense graded HMA 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 HMA is held for the extended period of time. An inert gas system may be used to purge the silo of oxygen to prevent oxidation of the asphalt. The HMA delivered from the storage silo shall meet all of the specification requirements.

When HMA is stored for the extended time period, it shall not be used until the temperature has been checked and the HMA has been

#### 401.9.8

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 HMA.

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

**401.9.6 - 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.

**401.9.7 - Trucks for Transporting Mixture:** The inside surfaces of trucks shall be thinly coated with a soapy water or a mixture with not more than ten percent lubricating oil. 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. Any commercial release agent which can be 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. In the case of mixtures composed of PG Binders which contain polymer modification, truck surfaces should be coated with a release agent recommended by the binder supplier. All excess coating material shall be removed from the truck bed prior to loading the HMA.

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.

**401.9.8 - Laboratory:** A testing facility or laboratory, as described below, shall be provided within reasonable proximity of the HMA 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.

#### 401.9.8

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 and glass, as required for conducting standard test procedures and monitoring mix temperatures.
- vi. Standard Gilson shaker or equivalent, with screens.
- vii. Ro-Tap shaker or equivalent, with 8 and/or 12 inch (200 and/or 300 mm) diameter screens.
- viii. Sample splitters for fine and coarse aggregates.
- ix. Miscellaneous items (including sample splitting trowels, scoops, square point shovel, aggregate sample pans, heat resistant gloves, measuring rules, brushes, flashlight, and glassware as needed).
- x. Expendable supplies necessary for performance of tests.
- xi. Equipment for determining the maximum specific gravity of asphalt mixtures as specified in AASHTO T209.
- xii. Equipment for determining the in-place density of asphalt mixtures meeting the requirements of MP 401.05.20.
- xiii. Non-contact infrared thermometer accurate to  $\pm 2$  °F ( $\pm 1$  °C).
- xiv. Equipment for determining the bulk specific gravity of HMA using saturated surface dry specimens complying with AASHTO T166.
- xv. 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)
- xvi. Asphalt content ignition oven with built-in scale and printer meeting the requirements of AASHTO T308, Test Method A. (Optional for Marshall designs – Mandatory for Superpave designs)
- xvii. Calibrated Gyrotory compactor meeting requirements of AASHTO TP4 with computer (including software for data acquisition and test calculations) and printer. Compactor must be a model which has been evaluated and approved for use by either the National Asphalt Training Center or one of the Superpave Regional Centers using the standard protocol developed by the Federal Highway Administration Superpave Mixture Expert Task Group. Proof of calibration within last six months shall be presented to the District before testing can

begin on the first project of the paving season. (Superpave designs only)

**401.9.9 - Spreading Equipment:** Spreading 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 spreading equipment shall be provided with an activated screed or strike-off assembly equipped to be heated. Approval of spreading equipment 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. Specialized equipment or hand methods approved by the Engineer may be employed to spread the asphalt mixture where the use of standard full scale spreading equipment is impractical due to the size or irregularity of the area to be paved.

Paving machines 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.

**401.9.10 - 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.

#### **401.10 - PAVING OPERATIONS:**

**401.10.1 - Cleaning and Sweeping:** Immediately prior to the arrival of the paving mixture, the existing base or surface shall be thoroughly cleaned by the use of tools and equipment as may be required to remove all mud, dirt, dust, and other caked or loose material foreign to the type of treatment or surface being placed. The cleaning shall be done to a minimum width of one foot on each side beyond the width of the surface being placed.

#### **401.10.2 - Patching and Leveling and Scratch Courses:**

**401.10.2.1 - Patching and Leveling:** A tack coat shall be applied to the existing pavement prior to placing patching and leveling.

#### **401.10.2.2**

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.

Compaction of patching and leveling shall be performed with three-wheel (steel) or pneumatic-tire rollers.

**401.10.2.2 - Scratch Course:** A tack coat shall be applied to the existing pavement prior to placing a 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.

**401.10.3 - 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 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 within the master temperature range of 250 and 338 °F (121 and 170 °C) unless otherwise specified by the asphalt supplier. The mix temperature shall be monitored by inserting a dial type 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

#### 401.10.5

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 °F (6 °C) of the weather restrictions of Table 401.8, the mix temperature may be increased up to a maximum of 338 °F (170 °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, which will be referenced on the JMF.

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

During rolling, roller wheels shall be kept moist with only enough water to avoid picking up material. Fuel oil on roller wheels or pneumatic tires is not allowed. Rollers shall move at a slow but uniform speed with the drive roll or wheels nearest the paver.

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

Mat temperature shall be measured using a non-contact infrared thermometer. The required density shall be obtained prior to the mat temperature reaching 175 °F (80 °C). The Contractor shall be allowed to lower this temperature to 165 °F (74 °C) if they can demonstrate during the first day of placement of each lift on each project that additional densification can be achieved without causing any pavement distress.

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

Joints between the existing and new HMA pavement shall be "heeled in" to the existing surface at the beginning and at the end of the project and at all other locations where the new pavement terminates against an existing HMA pavement.

These joints, as well as the transverse joints between one day's production and the next shall be carefully constructed and shall be formed by cutting back into the existing section to expose the full depth of the course. All joints shall be squared up to the full vertical depth of the course to be placed, and a tack coat of asphalt material shall be applied if called for

#### **401.11**

by the Engineer. Joints adjacent to curbs, gutters, or adjoining pavement shall be formed by transporting back sufficient hot material to fill any space left uncovered by the paver. The joint shall be set up with lutes to a sufficient height to receive the full compactive effort from the rollers. After rolling, joints shall be at the same elevation as the adjacent lanes or sections and shall be free from ridges or depressions.

Transverse joints shall be checked for smoothness with a ten foot straight edge provided by the Contractor. All surface irregularities shall be corrected prior to proceeding with paving operations.

#### **401.11 - PROTECTION OF PAVEMENT AND TRAFFIC CONTROL:**

The Contractor shall be responsible for the protection of HMA surfaces from damage by their equipment and personnel. When the construction of HMA surfaces is undertaken on projects under public traffic and the road surface is 16 feet (4.9 meters) wide or greater and the ADT is 400 or greater, the Contractor shall place no passing signs and interim pavement markings to delineate the centerline or lane line of the roadway as required herein. The Contractor shall be responsible for maintaining both signs and markings until such time as the permanent markings are placed or thirty calendar days after completion of the final course, 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. All Interim Markings shall be in conformance with the Manual on Uniform Traffic Control Devices (MUTCD), and 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. Interim Markings shall be Type VII A pavement markings meeting the requirements of Section 715.40.4.1. Payment of Interim Pavement Markings shall be incidental to the 401 Items. Removal of Interim Markings shall not be required between lifts or after placement of the final markings.

#### **401.11.1 - Interim Traffic Control for Two-Lane, Two-Way Roadways:**

Prior to any work which will cover the centerline, the Contractor shall install 24-inch x 30-inch (600 mm x 750 mm) "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 2500 feet (750 meters) 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 Pavement Markings measuring 4 inches x 4 inches (100 mm x 100 mm) along the centerline of the roadway on 20 foot (6 meter) centers.

**401.11.1.1 - Temporary Pavement Markings with ADT of 3,000 or Greater:** The Interim Pavement Markings described in Section 401.11.1 shall be permitted only for a period up to three calendar days after

#### 401.11.4

completion of the final course. Within this time the Contractor shall install full compliance centerline Temporary Pavement Markings (i.e. passing and no passing zones delineated) in conformance with Sections 636 and 663. Payment shall be made under the “Temporary Pavement Marking Paint” item.

#### **401.11.2 - Interim Traffic Control for One-Way Multilane Roadways:**

On all one-way multilane roadways, the Contractor shall install white Interim Pavement Markings measuring 4 inches x 48 inches (100 mm x 1200 mm) along the lane line. Interim Pavement Markings shall be placed on 40-foot (12-meter) centers.

#### **401.11.2.1 - Temporary Pavement Markings:**

Prior to the left lane being open to traffic, the Contractor shall install a four inch yellow edge line. These markings shall be in conformance with Sections 636 and 663. Payment shall be made the “Temporary Pavement Marking Paint” item.

#### **401.11.3 - Interim Traffic Control for Two-Way Three-Lane Roadways:**

Prior to any work which will cover the centerline and/or lane lines, the Contractor shall install 24-inch x 30-inch (600 mm x 750 mm) “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 for Center Left Turn Lanes. These signs shall be placed at the beginning of each no-passing zone and shall be repeated every 2500 feet (750 meters) as required. Signs shall be maintained by the Contractor until temporary or permanent markings are installed. Payment shall be made under the “Traffic Control Devices” item.

The Contractor shall install Interim Pavement Markings measuring 4 inches x 48 inches (100 mm x 1200 mm). Where truck-climbing lanes exist, the centerline shall be marked with two parallel yellow lines separated by a four-inch (100-mm) space placed on 40-foot (12-meter) centers. Lane lines shall be marked with white lines placed on 40-foot (12-meter) centers. Where center left-turn lanes exist, the center lane shall be marked with two parallel yellow lines separated by four inches (100-mm) space, and placed on 40-foot (12 meter) centers on both sides of the center lane.

#### **401.11.3.1 - Temporary Pavement Markings:**

The Interim Pavement Markings described in Section 401.11.3 shall be permitted only for a period of up to three calendar days after completion of the final course. Within this time the Contractor shall install full compliance centerline and lane line Temporary Pavement Markings in conformance with Sections 636 and 663. Payment shall be made under the “Temporary Pavement Marking Paint” item.

#### **401.11.4 - Interim Traffic Control for Two-Way Four-Lane and Five-Lane Roadways:**

On all two-way four-lane and five-lane highways, the

#### **401.11.4.1**

Contractor shall install Interim Pavement Markings measuring 4 inch x 48 inch (100 mm x 1200 mm) along the lane line and centerline where required. Centerlines shall be marked with two parallel yellow lines separated by a four inch (100 mm) space placed on 40 foot (12 meter) centers. On five-lane roadways these markings shall be placed on both sides of the center left turn lane. Lane lines shall be marked with white lines placed at 40 foot (12 meter) centers.

**401.11.4.1 - Temporary Pavement Markings:** The Interim Pavement Markings described in Section 401.11.4 shall be permitted only for a period of up to three calendar days after completion of the final course. Within this time the Contractor shall install full compliance lane line and centerline or left edge line Temporary Pavement Markings in conformance with Sections 636 and 663. Payment shall be made under the "Temporary Pavement Marking Paint" item.

**401.11.5 - Seasonal Temporary Markings:** Unless otherwise described above, if it becomes necessary to open the roadway to traffic whether on the base or final course, for longer than 14 calendar days, the Contractor shall install full compliance Temporary Pavement Markings in conformance with Section 636 and 663. Payment shall be made under the "Temporary Pavement Marking Paint" item.

#### **401.12 - METHOD OF MEASUREMENT:**

HMA will be measured by the ton (Mg). The quantity will be determined by the Contractor from the total weigh slips for each vehicle load weighed upon an approved standard scale or from digital printout slips from an automatic batching plant, and certified by the Contractor as correct.

Any patching or leveling mixture placed on a subbase or base course constructed in the same Contract with the HMA 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.

#### **401.13 - 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, and incidentals necessary to complete the work.

The conditioning, cleaning, and sweeping of the existing base or underlying surface shall be considered as part of the construction of the appropriate items listed in 401.14, and no additional compensation will be allowed for "Cleaning and Sweeping".

There will be no additional compensation for tack coat material used for minor (spot) areas to be patched and leveled; the cost of this tack coat

### 401.13.3

material will be included in the unit bid price for the “patching and leveling” Item.

There will be no additional compensation for Interim Pavement Markings.

**401.13.1** - When a LOT of Superpave HMA material is found not in compliance with the tolerance requirements of MP 401.02.29, it shall be subject to a price adjustment in accordance with the criteria established in this MP.

**401.13.2** – When a LOT of HMA pavement is represented by a smoothness value larger than that shown in Tables 401.7.2E or 401.7.2M, the unit price of the LOT (surface course only) shall be determined as follows:

#### **ENGLISH VERSION:**

Reduced Unit Price = Unit Bid Price X [(127.86 – As)/100]

Where A = 0.429 when specified smoothness is 65 in/mi

Where A = 0.341 when specified smoothness is 81 in/mi

Where s = Smoothness value measured as per 401.7.2

#### **METRIC VERSION:**

Reduced Unit Price = Unit Bid Price X [(127 – As)/100]

Where A = 0.0274 when specified smoothness is 1000mm/km

Where A = 0.0218 when specified smoothness is 1250 mm/km

Where s = smoothness value measured as per 401.7.2

When the measured smoothness value exceeds the specified value by 50% or more, the LOT so measured shall be corrected, at the Contractor’s expense, to comply with Tables 401.7.2E or Table 401.7.2M.

**401.13.3** - When a LOT of HMA pavement does not meet the density requirements of 401.7.3, the price shall be adjusted as follows:

### 401.13.3

<b>TABLE 401.13.3 ADJUSTMENT OF CONTRACT PRICE FOR PAVEMENT DENSITY NOT WITHIN TOLERANCE OF DENSITY</b>	
<b>Percent of Density</b>	<b>Percent of Contract Price to be Paid</b>
Greater than 96 %	*
92 % to 96 %	100
91 %	98
90 %	96
89 %	92
88 %	88
Less Than 88 %	*

\* The Division will make a special evaluation of the material and determine the appropriate action.

**401.13.4** - When a LOT of HMA pavement is determined to be statistically non-conforming in accordance with criteria 'B' of Section 401.7.4, the Division will review the plans and project records to determine if there is an acceptable explanation for this deficiency. If it is determined that a deficiency does exist, one of the following adjustments may be used. If the deficiency is less than  $\frac{3}{4}$  inch (19 mm), the Division may choose to accept the material at a price equal to the bid price times the ratio of the average thickness divided by the specified thickness. If the deficiency is  $\frac{3}{4}$  inch (19 mm) or greater, the Division may require that an additional lift of material [specified to the nearest  $\frac{1}{4}$  inch (6 mm) of the deficiency] be placed at the Contractor's expense. Retesting of the overlay will be at the expense of the Contractor in accordance with MP 109.00.20.

### 401.14 - PAY ITEMS:

<b>ITEM</b>	<b>DESCRIPTION</b>	<b>UNIT</b>
401001-*	"design method" HOT-MIX ASPHALT BASE COURSE, "aggregate type", TYPE "mix type"	TON (MG)
401002-*	"design method" HOT-MIX ASPHALT WEARING COURSE, "aggregate type", TYPE "mix type"	TON (MG)
401003-*	"design method" HOT-MIX ASPHALT PATCHING AND LEVELING COURSE, "aggregate type", TYPE "mix type"	TON (MG)
401007-*	"design method" SCRATCH COURSE, "aggregate type", TYPE "mix type"	TON (MG)

"design method" shall be either Marshall or Superpave  
 "aggregate type" shall be either stone and gravel or slag  
 "mix type" from Table 401.4.2A or 401.4.2B

\* Sequence number

## SECTION 402 HOT-MIX ASPHALT SKID RESISTANT PAVEMENT

### 402.1 - DESCRIPTION:

This work shall consist of constructing a Hot-Mix Asphalt (HMA) Skid Resistant Wearing Coarse or a Superpave HMA Skid Resistant Wearing Coarse in accordance with the requirements of the Section 401 Asphalt Specification with the following exceptions and additions:

### 402.2 - MATERIALS:

The coarse aggregate shall consist of gravel, slag, or other acceptable polish resistant aggregate, or combinations thereof, meeting the requirement of Subsections 703.1 through 703.3, except as amended in this subsection.

When stone or gravel is specified in the contract, the coarse aggregate shall consist of gravel or other acceptable polish resistant aggregate, or combination thereof meeting the requirements of 703.1 through 703.3, except as amended in this subsection. 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.

Acceptable dolomite may be used alone or as a part of a coarse aggregate blend on roadways with an ADT of 10,000 or less. On roadways exceeding 10,000 ADT, acceptable dolomite may be used only as a part of the coarse aggregate blend and shall not exceed 50% of that blend.

The total of shale (determined by MP 703.00.27), coal and other lightweight deleterious material (determined by ASTM C123) and friable particles (determined by MP 703.01.20) shall not exceed three percent.

**402.2.1 - Marshall Mix Designs:** For Marshall mix designs, the coarse aggregate or blends thereof shall have a minimum of 80 percent two-face fracture, and, except for those carbonate rocks which may be designated as acceptable polish resistant aggregate, the portion obtained on the No. 4 (4.75 mm) sieve shall contain no more than 15 percent carbonate particles.

The total thin and elongated pieces, when tested as per MP 703.00.25, shall not exceed five percent.

**402.2.2 - Superpave Mix Designs:** For Superpave mix designs, the coarse aggregate or blends thereof shall have a minimum angularity requirement as specified in MP 401.02.28, Table 401.02.28C and, except for those carbonate rocks which may be designated as acceptable polish resistant aggregate, the portion obtained on the No. 4 (4.75 mm) sieve shall contain no more than 15 percent carbonate particles.

Flat and elongated particles shall be tested in accordance with ASTM D4791 and the procedure modification referenced in AASHTO MP2. The total flat and elongated particles, measured at a 5:1 ratio, shall not exceed

### 402.3

ten percent by weight for all pavements where the estimated traffic level is greater than or equal to 0.3 million ESALs.

### 402.3 - FINE AGGREGATE:

**402.3.1 - Marshall Mix Designs:** Fine aggregate shall meet the requirements of 702.3.

**402.3.2 - Superpave Mix Designs:** Fine aggregate shall meet the requirements of 702.3 along with the addition of the fine aggregate angularity and sand equivalent requirements noted in MP 401.02.28, Table 401.02.28C.

### 402.4 - MIXING:

The skid resistant paving mix shall be type designated on the plans.

### 402.5 - PAY ITEMS:

Method of measurement and basis of payment will be in accordance with the applicable sections of Section 401.

ITEM	DESCRIPTION	UNIT
402001-*	"design method" HOT-MIX ASPHALT SKID RESISTANT PAVEMENT, "aggregate type", TYPE "mix type"	TON (MG)

"design method" shall be either Marshall or Superpave  
"aggregate type" shall be either stone and gravel or slag  
"mix type" from Table 401.4.2A or 401.4.2B

\* Sequence number

## SECTION 408 TACK COAT

### 408.6-CLEANING AND SWEEPING:

DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

Immediately before starting construction, the existing surface shall be swept and thoroughly cleaned by the use of tools or machinery as may be required to remove all mud, dirt, dust, and other caked or loose material foreign to the type of surface to be placed. Cleaning shall be done to a minimum width of one-foot (300 mm) on each side beyond the width of the surface to be placed.

# DIVISION 500

## RIGID PAVEMENT

### SECTION 501

#### PORTLAND CEMENT CONCRETE PAVEMENT

#### 501.4.1-Test Methods:

DELETE THE CONTENTS AND SUBSTITUTE THE FOLLOWING:

Slump of Portland Cement Concrete	AASHTO T 119
Air Content of Freshly Mixed Concrete	AASHTO T 152 AASHTO T 196
Unit Weight/Yield of Concrete	AASHTO T 121
Making and Curing Concrete Test Specimens	AASHTO T 23 with MP 601.04.20
Compressive Strength of Cylindrical Concrete Specimens	AASHTO T 22
Flexural Strength of Concrete	AASHTO T 97
Obtaining and Testing Drilled Core Specimens	AASHTO T 24
Measuring Length of Drilled Concrete Cores	AASHTO T 148
Total Moisture Content of Aggregate by Drying	AASHTO T 255
Sampling Fresh Concrete	AASHTO T 141
Sieve Analysis of Fine and Coarse Aggregates	AASHTO T 27 and T 11
Determination of Free Moisture in Fine Aggregate Using 20 Gram or 26 Gram "Speedy Moisture Tester"	MP 702.00.20
Sampling Aggregates	MP 700.00.06
Determination of Total Solids in Concrete	MP 601.03.51

## SECTION 506 CONCRETE PAVEMENT REPAIR

DELETE ENTIRE SECTION AND SUBSTITUTE THE FOLLOWING:

### 506.1 - DESCRIPTION:

This work shall consist of the removal and replacement of deteriorated concrete pavement and patches at locations as shown on plans or as specified by the Engineer.

### 506.2 - MATERIALS:

Materials shall meet the requirements of Division 501 or 601, and as follows:

#### Joint sealer      708.3

An accelerating admixture meeting the requirements of AASHTO M 194 may be used.

An approved epoxy grout shall be used to firmly anchor dowel bars in 30 minutes. Bond breaker material shall be supplied from approved sources.

### 506.3 – PROPORTIONING:

The concrete produced shall meet the requirements of 501, except that the design compressive strength for Concrete Pavement Repair shall be 2000 psi (13.8 Mpa) prior to opening traffic. When concrete is to be overlaid with asphalt the requirements of 601 may be substituted. The Contractor shall submit the mix proportions and recent test data for compressive strength at specified age for the concrete to be used.

### 506.4 - TESTING:

When the strength of concrete specimens representing the concrete placed indicate that the concrete has attained the design strength, that concrete represented by the specimens may be put into service.

### 506.5 - CONDITIONING EXISTING SUBBASE:

Prior to placing the concrete for the rigid replacement, any subbase material that is disturbed below the desired level of cleanout shall be removed and the patch area compacted to the satisfaction of the Engineer. The Contractor shall replace the removed subbase material with concrete integral to pavement replacement up to a maximum 1-inch (25 mm) depth. In event soft areas are encountered in the subbase or subgrade, the Engineer may require replacement of subbase and subgrade with 307001-\* subbase material and installation of underdrains. The cost of replacing the subbase

and subgrade shall be paid for as item 506003-\*. The cost of installation and method of installation of underdrains shall be as a per section 606.

#### **506.6 - PLACING CONCRETE:**

The concrete shall be placed in the patch using a metal chute; the free fall shall not be more than 3 ft. (1 m.). If the concrete does not fall into its final position in the patch, it shall be moved by means of shovels; raking is prohibited. The concrete shall be worked with tampers, spades or other tools to completely fill the patch area. Maximum effort will be used to ensure that the area beneath the existing concrete pavement is completely filled, internal vibration will be used.

Following the placing of the concrete, the surface will be struck off to finished grade by means of an adjustable steel or wooden template and floated to a smooth finish.

#### **506.7 - CURING:**

In accordance with section 501.14. Where early opening to traffic is required, insulation mats may be used over the repairs during curing will be used to accelerate strength gain.

#### **506.8 - RIDE ACCEPTANCE:**

During finishing operations deviations in adjacent lanes which are also to be repaired shall not be transferred to the new construction. The Contractor shall furnish and use straightedges to check the surface tolerance. For patches 10 ft. (3 m) or more in length, a 10 ft. (3 m) straightedge shall be used. Shorter straightedges shall be used for patches less than 10 ft. (3 m) in length.

The minimum length straight edge shall be 6 ft. (1.8 m). Section 501.12.6 shall govern except the shorter straightedges shall be used for shorter patches. The concrete pavement should be finished to match existing texture.

Surface tests on patches shall be performed as follows:

As soon as the concrete has hardened sufficiently, the pavement surface shall be tested with a 10 ft. (3 m) straightedge. The straightedge shall be placed in successive positions parallel to the road centerline matching existing wheel paths. Areas showing high spots of more than ¼ inch (7 mm), but not exceeding ½ inch (14 mm) in 10 ft. (3 m) shall be marked and ground down with an approved grinding tool to an elevation where the surface deviations will not be more than ¼ inch (7 mm) in 10 ft. (3 m). Where the deviations exceeds ½ inch (14 mm), either high or low, the areas shall be removed and replaced at the discretion of the Engineer and at the Contractor's expense. All areas or sections so removed shall not be less than 6 ft. (1.8 m) in length nor less than full width of the traffic lane involved. Any remaining portion of the slab adjacent to the joints that is less than 6 ft. (1.8 m) in length shall also be removed and replaced. Where concrete repairs are made that are to be overlaid the smoothness criteria is waived for the concrete repair.

## 506.9

### 506.9 - METHOD OF MEASUREMENT:

The quantity of concrete pavement repair to be paid for will be the number of square yards (meters) complete in place and accepted.

### 506.10 -BASIS OF PAYMENT:

The quantity of special concrete pavement repair, determined as provided above, will be paid for at the contract unit price which shall constitute full compensation for the furnishing, hauling and placing of all materials, including admixtures, the removal and disposal of old concrete, all labor, tools, equipment, and incidentals necessary to complete the item.

### 506.11 - PAY ITEM:

ITEM	DESCRIPTION	UNIT
506001-*	CONCRETE PAVEMENT REPAIR	SQUARE YARD (METER)
506003-*	REMOVE AND REPLACE EXISTING AGGREGATE BASE COURSE	CUBIC YARD (METER)

\* Sequence Number

# DIVISION 600

## INCIDENTAL CONSTRUCTION

### SECTION 601

#### STRUCTURAL CONCRETE

#### 601.1 - DESCRIPTION:

ADD THE FOLLOWING:

All classes of concrete shall be designated as *modified* when using increased design strengths.

All classes of concrete shall be designated as *architectural* when using additional formwork as shown in Section 601.8.10.

#### 601.3- PROPORTIONING:

ADD THE FOLLOWING:

The proportions for any concrete designated as *modified* shall be submitted by the Contractor to the Engineer for approval. The Design 28-Day Compressive Strength shall be as shown in the plans. The contractor's mix design shall utilize Table 601.3.1, except the Target Cement Factor may be revised to obtain the modified strength.

#### 601.3.2.1:

ADD THE FOLLOWING AT THE END OF THE SECTION:

An approved Type F or Type G admixture may be used to increase the consistency and improve the workability of the concrete as long as the requirements of section 707.2.2.1 or section 707.3.2.1 are met. When an admixture is used for this purpose, it may be referred to as a superplasticizer.

No more than a total of two additions of a superplasticizer shall be permitted in any one batch of concrete. If a superplasticizer is used at the batch plant, then only one field addition is permitted. The total quantity of the superplasticizer shall not exceed the manufacturer's recommended dosage rate.

Upon addition of a superplasticizer at the job site, the mixing drum shall be turned for a minimum of 60 revolutions or 5 minutes at mixing speed to establish a workable mixture of uniform composition and consistency. If a second job site addition of superplasticizer is used; the mixing drum shall be turned a minimum of 30 additional revolutions at mixing speed. All additions and mixing of the superplasticizer shall be completed before

placement of the concrete is started. The total number of revolutions shall not exceed 300, and the concrete shall be discharged within the time limits in section 601.7.

When a superplasticizer is used, the optimum consistency target value may be increased by 4 inches (100 mm), but under no circumstances shall the slump exceed 8 inches (200 mm).

Acceptance tests for consistency (slump), air content, compressive strength, etc. shall be made after all additions and mixing of the superplasticizer. Slump tests shall be performed on every batch of concrete to which superplasticizer is added (one test before and one test after the addition of superplasticizer).

The Contractor shall obtain a written statement from the manufacturer of the superplasticizer stating:

- i. The manufacturer is satisfied with the compatibility of the combination of materials and the sequence in which they are combined.
- ii. The recommended maximum admixture dosage rate.
- iii. The names of the designated technical representatives from the ready-mix supplier or the admixture company who are competent to determine the proper dosage of superplasticizer for the intended applications.

This written statement from the admixture manufacturer shall be made available to project personnel before any superplasticizer is added at the job site.

**601.4.1 - Sampling and Testing Methods:**

DELETE THE CONTENTS AND SUBSTITUTE THE FOLLOWING:

Sampling fresh concrete	AASHTO T 141
Sampling aggregate	MP 700.00.06
Sieve analysis of fine and coarse aggregates	AASHTO T 27 and T 11
Slump of portland cement concrete	AASHTO T 119 (Note 1)
Air content of freshly mixed concrete	AASHTO T 152 AASHTO T 196
Unit weight/Yield of concrete	AASHTO T 121
Making and curing concrete compressive specimens	AASHTO T 23 With MP 601.04.20
Compressive strength of cylindrical concrete specimens	AASHTO T 22
Total moisture content of aggregate by drying	AASHTO T 255
Predicting potential strength of portland cement concrete	MP 711.03.31
Determination of $\bar{A}$ of total solids in concrete	MP 601.03.51
Determination of free moisture in fine aggregate using 20 gram or 26 gram A "Speedy Moisture Tester"	MP 702.00.20

**Note 1** - When testing concrete produced by volumetric batching and continuous mixing, the consistency testing shall be delayed for approximately three to five minutes after mixing.

**601.4.2-Contractor's Quality Control:**

INSERT THE FOLLOWING AFTER THE 2<sup>ND</sup> SENTENCE:

The Contractor's personnel who conducts the field sampling and testing shall be a certified Portland Cement Concrete Inspector.

**601.8 - FORMS:****601.8.1 - General:**

DELETE THE FIRST PARAGRAPH REPLACE WITH THE FOLLOWING:

## 601.8.9

Forms shall be of wood, metal or other approved material and shall be mortar tight and sufficiently rigid to prevent distortion due to pressure of the concrete and other loads incidental to the construction operations including vibration. Wood forms shall be constructed and maintained so as to prevent the opening of joints due to shrinkage of the lumber.

ADD THE FOLLOWING SUBSECTION:

**601.8.9 - Stay-in-Place Fabricated Metal Forms for Concrete Bridge Decks:** All concrete bridge decks shall be constructed with a stay-in-place fabricated metal forming system per the requirements shown in this specification unless otherwise noted in the plans.

**601.8.9.1 - General:** Stay-in-place fabricated metal forms for concrete deck slabs of bridges shall be used on all interior bays of beams. For overhangs and where longitudinal expansion joints are located between stringers removable forms shall be used. The design and material of the forms, in the judgment of the Engineer, shall be such as to give an expected maintenance free service life equal to the service life of the concrete slab. The stay-in-place fabricated metal forms shall be crimped at each end.

Unless otherwise specified in the plans, the weight of stay-in-place fabricated metal forms plus concrete in the form flutes used in the design is 15 psf (74 N/m<sup>2</sup>). The contractor shall submit revised computations if the proposed forming system is heavier than 15 psf (74 N/m<sup>2</sup>). The cost of the revised computations shall be at no additional cost to the Division.

**601.8.9.2 - Material:** Stay-in-place fabricated metal forms for concrete deck slabs and exposed material for supports shall be zinc-coated (galvanized) steel sheet conforming to ASTM A-653 with G165 coating weight and minimum yield strength of 80 ksi (555 Mpa). The stay-in-place fabricated metal forms shall be designed on the basis of dead load of the forms, reinforcement, and the plastic concrete plus 50 psf (245 N/m<sup>2</sup>) for construction loads. Unit working stresses shall be in accordance with the AASHTO LRFD Bridge Design Specifications for construction loads and the unit stress in the steel sheet shall be not more than 0.725 of the specified minimum yield strength of the material furnished but not to exceed 36,000 psi (250 Mpa). Maximum deflection under weight of plastic concrete, reinforcement and form shall not exceed 1/180 of the form span or ½" (13 mm), whichever is less. Maximum deflection under 60 psf (290 N/m<sup>2</sup>) of live loads shall not exceed 1/360 of the form span or ¼" (6 mm), whichever is less. The form span for design and deflection shall be the clear distance between the flanges of the supporting beams less 2" (50 mm), measured parallel to the form flutes.

All stay-in-place fabricated metal forms shall have a minimum thickness of 22 gage.

### 601.8.9.5

Physical design properties shall be computed in accordance with requirements of American Iron and Steel Institute Specification for the Design of Cold-Formed Steel Structural members, latest published edition.

All reinforcing bars in the bottom layer of the deck slab reinforcement shall have a minimum concrete cover of 1" (25 mm). The distance from the top of the slab to the bottom layer of deck slab reinforcement shall not be less than that shown on the plans.

**601.8.9.3 - Installation:** All forms shall be installed in accordance with detailed fabrication plans submitted to the Engineer for approval. The fabrication plans shall clearly indicate locations where the forms are supported by steel beam flanges.

Form sheets shall not be permitted to rest directly on the top of the stringer or floor beam flanges. Sheets shall be securely fastened to form supports and shall have a minimum bearing length of 1" (25 mm) at each end. Form supports shall be placed in direct contact with the flange of stringer or floor beam. All attachments shall be made by bolts, clips, or other approved means. Welding of form supports to flanges shall not be permitted.

Any exposed form metal where the galvanized coating has been damaged shall be thoroughly cleaned and wire brushed, and then painted with two coats of zinc-rich primer, conforming to Subsection 711.21, to the satisfaction of the Engineer.

Transverse construction joints shall be located at the bottom of a flute and ¼" (6 mm) weep holes shall be provided in the field at 12" (300 mm) ± 3" (75 mm) on center along the line of the joint.

**601.8.9.4 - Placement Of Concrete:** Concrete shall be placed in accordance with the contract specifications. The entire form shall be filled with deck concrete. No filler material shall be permitted. Particular emphasis should be placed on proper vibration of the concrete to avoid honeycomb and voids, especially at construction joints, expansion joints, flutes, and ends of form sheets.

The use of covered flutes or fillers of any kind in the flutes of the stay-in-place fabricated metal forms is not permitted.

**601.8.9.5 - Inspection:** The Contractor's method of construction shall be carefully observed during all phases of the construction of the bridge deck. These methods include installation of the Stay-in-place fabricated metal forms; location and fastening of the reinforcement; composition of concrete, placement and vibration; and finishing of the bridge deck.

The Contractor shall remove at least one section of the forms at a location and time selected by the Engineer for each concrete placement in each approved pour sequence. This should be done as soon after placing the concrete as practicable in order to provide visual evidence that the concrete mix and the Contractor's procedures are obtaining the desired results. An additional section shall be removed each time the concrete mix or the Contractor's procedures are changed.

### **601.8.9.6**

After the deck concrete has been in place for a minimum of two days, the concrete shall be tested for soundness and bonding of the forms by sounding on the forms with a hammer at least 50 percent of the area of at least 25 percent of the individual form panels, as selected by the Engineer on a random basis. If areas of doubtful soundness are disclosed by this procedure, the Contractor will be required to remove the forms from such areas for visual inspection.

At locations where sections of the forms are removed, the Contractor will not be required to replace the forms, but the adjacent metal forms and supports shall be repaired to present a neat appearance and assure their satisfactory retention. As soon as the form is removed, the concrete surfaces will be examined for cavities, honeycombing and other defects. If irregularities are found, and in the opinion of the Engineer these irregularities do not justify rejection of the work, the concrete shall be given a Class 1, Ordinary Surface Finish in accordance with the contract specifications and shall be repaired as the Engineer may direct. If the concrete where the form is removed is unsatisfactory, additional forms shall be removed, as necessary, to inspect and repair the slab, and the Contractor's methods of construction shall be modified as required to obtain satisfactory concrete in the slabs.

The amount of sounding and form removal may be moderated, at the Engineer's discretion, after a substantial amount of slab has been constructed and inspected if the Contractor's methods of construction and the results of the inspections as outlined above indicate that sound concrete is being obtained throughout the slabs.

The Contractor shall provide all facilities required for the safe and convenient conduct of the Engineer's inspection procedures.

**601.8.9.6 - Forming System Changes:** The contractor shall not utilize a removable forming system without the submittal of the following information:

1. Revised camber tables based on actual forming system.
2. Revised dead load deflection tables based on actual forming system.

These revised drawings must be stamped by a West Virginia Professional Engineer and approved by the Engineer prior to commencing forming. No change in unit prices, or contract completion date will be permitted for the use of a removable forming system.

ADD THE FOLLOWING SUBSECTION:

### **601.8.10 - Architectural Formwork:**

#### 601.8.10.4

**601.8.10.1- General:** This work includes additional requirements for the forming of cast-in-place structural concrete designated as *architectural*. The scope of this work is as indicated and as detailed on the drawings.

**601.8.10.2- Submittals:** The following shall be submitted to the Engineer for his review:

- A. Product data and installation instructions for manufactured form systems, form liners, release agents, ties, and accessories. The release agent manufacturer shall certify that the products supplied comply with regulations controlling the use of volatile organic compounds (VOC's).
- B. Shop drawings for fabrication and erection. These drawings shall show all items that visually affect the exposed concrete, including, but not limited to, general form construction, jointing, specially formed joints or reveals, and patterns of placement. The Engineer's review will be for general architectural applications and features only. Formwork design for structural stability and sufficiency is the Contractor's responsibility and shall not be submitted for the Engineer's review.
- C. Mockup or Sample Panels. The Contractor shall submit a mockup or sample panel of their respective material indicating texture, finish, and pattern in accordance with Section 601.8.10.3.A. This Mockup or Sample Panel shall have a minimum front surface area of 15 ft<sup>2</sup> (1.2 m<sup>2</sup>).

#### 601.8.10.3- Quality Assurance:

- A. The Contractor shall construct a mockup or sample panel using the proposed formwork and facing materials in order to demonstrate the required finishes and textures. Actual construction of *architectural* concrete shall not proceed until the Engineer has accepted the sample units.
- B. Before placing concrete, the Contractor shall check lines and levels of erected formwork, and shall make corrections and adjustments to ensure:
  - 1) proper size and location of concrete members
  - 2) stability of the forming systems
- C. During concrete placement, the Contractor shall check formwork and related supports to ensure the forms are not displaced and that completed work will be within specified tolerances.

#### 601.8.10.4- Materials:

##### 601.8.10.4.1- Form Materials:

#### **601.8.10.4**

- A. Forms for Exposed-Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other paneled materials to provide as-cast surfaces. Furnish in largest sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form materials with sufficient thickness to withstand pressure of placed concrete without bow or deflection beyond allowable tolerances.
- 1) Use overlaid plywood, APA grade trademarked "HIGH DENSITY OVERLAY (HDO)."
  - 2) Use plywood, APA grade trademarked "B-B PLYFORM CLASS 1."
- B. Forms for Textured Finish Concrete: Provide special forming materials to produce surfaces with face design, texture, arrangement, and configuration as shown on drawings or as required to match Engineer's control sample. Provide solid backing and form supports to ensure stable textured form liners.
- C. Form Coating: Provide a commercial formula release agent that will not bond with, stain, or adversely affect concrete. Provide material that will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede wetting surfaces to be cured with water or a curing compound.

**601.8.10.4.2- Formwork Design:** Design formwork for easy removal without impact, shock, or damage to the concrete and adjacent materials.

#### **601.8.10.5- Construction Methods:**

##### **601.8.10.5.1- Form Construction:**

- A. General: Construct forms to sizes, shapes, lines, and dimensions shown, and as required to obtain accurate alignment, location, level, and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, chamfers, blocking, screeds, bulkheads, and other as required.
- B. Fabricate forms to prevent cement paste from leaking while placing concrete and for easy removal without hammering or prying against exposed concrete surfaces. Provide crush plates where stripping might damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete. Solidly butt joints and provide backup material at joints to prevent leakage and fins. Assemble forms so that they may be easily removed without damaging exposed concrete surfaces
- C. Provide temporary form openings where inaccessible formwork interior can be cleaned and inspected before placing concrete. Place temporary

## 601.11.5

form openings as inconspicuously as possible, consistent with project requirements.

- D. When drilling forms used for exposed concrete, drill from the contact face to the outside to suit the ties used and to prevent leakage of concrete mortar. Do not splinter the forms by driving ties through improperly prepared holes.
- E. Unless otherwise shown in the plans,
  - 1) provide sharp, clean corners at intersecting planes with no visible edges or offsets.
  - 2) provide accurately formed chamfered corners using  $\frac{3}{4} \times \frac{3}{4}$  inch (19 x 19 mm) strips, surfaced to produce uniformly straight lines and tight edge joints.

### 601.8.10.5.2- Form Coatings:

- A. General: Coat form contact surfaces with form-release agent before placing reinforcement. Do not allow excess material to accumulate in forms or to come into contact with reinforcement or surfaces that will be bonded to fresh concrete. Apply coating according to manufacturer's instructions.
- B. Coat steel forms with non-staining, rust-preventative release agent, or otherwise protect from rusting. Rust-stained steel formwork is not acceptable.

**601.8.10.5.3- Reusing Forms:** Split, frayed, delaminated, or otherwise damaged form-facing materials are not acceptable. Clean and apply a new form-release agent to concrete contact surfaces.

## 601.11 - FINISHING CONCRETE SURFACES:

### ADD THE FOLLOWING:

Unless otherwise shown in the plans, all concrete designated as *architectural* shall receive a Class 1, Ordinary Surface Finish, as defined in Section 601.11.1.

### ADD THE FOLLOWING SUBSECTION:

### 601.11.5 - Finishing Concrete Decks For the Placement of Specialized Overlay:

When the plans require the placement of a Specialized Concrete Overlay, per Section 679, on a newly placed concrete deck, the concrete surface shall be intentionally roughened. The surface shall be raked and roughened to provide a surface profile that will facilitate the bond of the

#### **601.14**

specialized concrete overlay. Floating of this surface shall be minimized to avoid formation of bleed water on the surface.

#### **601.14 - METHOD OF MEASUREMENT:**

DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

The quantity of work done for Class A, Class B, Class C and Class D concrete will be measured in cubic yards (meters), complete in place and accepted, as determined by the dimensions on the Plans or contract documents, and will be the number of cubic yards (meters) established in the Proposal, subject to adjustment as provided for in 104.2 and 109.2.

The quantity of work done for Class K concrete will be measured in cubic yards (meters), complete in place and accepted, as measured from one end of the bridge to the other, fascia to fascia, and from the top of the forms to the finished elevation of the proposed deck surface. If stay-in-place prefabricated metal forms are used, an additional 1 inch (25 mm) of concrete over the area of stay-in-place prefabricated metal forms, will be used to measure the concrete that fills the form flutes. The stay-in-place prefabricated metal form area shall be as defined in the plans.

No deductions will be made for the volume occupied by pipe less than 8 inches (200 mm) in diameter, nor for reinforcing steel, anchors, conduits, weep holes or piling, or other small inserts.

The cost of copper, copper-nickel alloy or other type of flashing, expansion joint filler, preformed joint filler, concrete bearing pads, drain pipes for weep drains through abutments, wings and walls or bridge floors, unless otherwise specified, shall be included in the unit prices bid for the several classes of concrete.

All costs associated with the revised mix design and proportions shall be in the unit price bid for the class of concrete designated as *modified*.

All costs associated with architectural formwork shall be in the unit price bid for the class of concrete designated as *architectural*. No deductions will be made for the volume occupied by the architectural formwork.

#### **601.15 - BASIS OF PAYMENT:**

ADD THE FOLLOWING PARAGRAPH TO THIS SUBSECTION:

The cost of stay-in-place fabricated metal forms and all work associated therewith shall be included in the unit price bid for concrete placed as the bridge deck. The amount of concrete required to fill the form flutes is included in the plan quantity of the concrete bridge deck material, and shall be paid for per Section 601 of the Specifications.

#### **601.16 - PAY ITEMS:**

## ADD THE FOLLOWING:

ITEM	DESCRIPTION	UNIT
601025-*	MODIFIED CONCRETE, CLASS y, zz PSI (MPA)	cubic yard (meter)
601002-*	CLASS B CONCRETE, ARCHITECTURAL	cubic yard (meter)
601003-*	CLASS K CONCRETE, ARCHITECTURAL	cubic yard (meter)
601026-*	MODIFIED ARCHITECTURAL CONCRETE, CLASS y, zz PSI (MPA)	cubic yard (meter)

\* = Sequence number

y = Class of concrete

zz = Design 28-day Compressive Strength

## SECTION 602 REINFORCING STEEL

**602.9 - METHOD OF MEASUREMENT:**

DELETE THE TABLE AND REPLACE WITH THE FOLLOWING:

TABLE 602.9

Bar Designation	Weight Per Lin. Ft. in Lb. ( <u>Mass</u> kg per meter)	Bar Designation	Weight Per Lin. Ft. in Lb. ( <u>Mass</u> kg per meter)
# 3 (10)	0.376 (.560)	# 9 (29)	3.400 (5.060)
# 4 (13)	0.668 (.994)	# 10 (32)	4.303 (6.404)
# 5 (16)	1.043 (1.552)	# 11 (36)	5.313 (7.907)
# 6 (19)	1.502 (2.235)	# 14S (43)	7.650 (11.38)
# 7 (22)	2.044 (3.042)	# 18S (57)	13.600 (20.24)
# 8 (25)	2.670 (3.973)		

**SECTION 604**  
**PIPE CULVERTS**

**604.14-PAY ITEMS:**

DELETE ALL AFTER THE PAY ITEM TABLE AND INSERT THE  
FOLLOWING:

\* Sequence Number

\*\* Class designated by Roman numerals

**Note:** For Aluminum Box Culverts, haunch and crown plate thicknesses as specified on the Plans.

**Note:**

Y = a letter, if present, designating base metal thickness or type of elliptical concrete pipe in accordance with the following table.

Z = a one digit number designating metal pipe corrugations or Roman numerals designating concrete pipe class or a one digit number designating elliptical concrete pipe class in accordance with the following table.

Y	Mil Thickness	
	Steel	Aluminum
A	64 (1.63)	60 (1.52 mm)
B	79 (2.0)	75 (1.90 mm)
C	109 (2.77)	105 (2.67 mm)
D	138 (3.51)	135 (3.43 mm)
E	168 (4.27)	164
F	188 (4.78)	---
G	218 (5.54)	---
H	249 (6.32)	---
J	4 BOLTS/FT (13 BOLTS/M) 280 (7.11)	--
K	6 BOLTS/FT (19 BOLTS/M) 280 (7.11)	100 (2.54 mm)
L	8 BOLTS/FT (26 BOLTS/M) 280 (7.11)	125 (3.18 mm)
M	313 (7.95)	150 (3.81 mm)
N	375 (9.52)	185 (4.41 mm)
P	---	200 (5.08 mm)
Q	---	225 (5.72 mm)
R	---	250 (6.35 mm)

Z	Metal Corrugations	Pipe Class
1	1½" x ¼" (37.5 x 6.25 mm)	---
2	2⅝" x ½" (66.8 x 12.5 mm)	---
3	3" x 1" (75 x 25 mm)	---
5	5" x 1" (125 x 25 mm)	---
6	6" x 2" (150 x 50 mm)	---
7	7½" x ¾" x ¾" (190 x 19x 19)	---
I or 1	---	I
II or 2	---	II
III or 3	---	III
IV or 4	---	IV
V or 5	---	V
<b>Concrete Pipe</b>		
H	Horizontal Elliptical	
V	Vertical Elliptical	

## 607.1

### SECTION 607 GUARDRAIL

#### 607.1-DESCRIPTION:

ADD THE FOLLOWING CLASSES:

Class IV: 3 ft. – 1 ½in. (952 mm) post spacing without blocks.

Class V: 3 ft. – 1 ½in. (952 mm) post spacing with blocks.

### SECTION 609 SIDEWALKS

#### 609.2 - MATERIALS:

DELETE THE LAST TWO PARAGRAPHS.

### SECTION 612 TUNNEL LINER PLATE PIPE

#### 612.9-PAY ITEMS:

DELETE PAY ITEM TABLE AND SUBSTITUTE THE FOLLOWING:

ITEM	DESCRIPTION	UNIT
612001-*	"size" TUNNEL LINER PLATE PIPE, 2-FLANGE DESIGN, Y	LINEAR FOOT (METER)
612002-*	"size" TUNNEL LINER PLATE PIPE, 4-FLANGE DESIGN, TYPE "type", Y	LINEAR FOOT (METER)

\* Sequence Number

### SECTION 615 STEEL STRUCTURES

#### 615.1.3-Inspection:

DELETE THE 1<sup>ST</sup> PARAGRAPH AND REPLACE WITH THE FOLLOWING:

Structural steel shall be inspected in the fabrication shop. The Contractor shall furnish the Engineer with a copy of all mill orders and shop lists showing heat numbers to be used for each piece. Mill test reports that document the chemical analysis and physical test results for each heat

of steel to be used in the work shall also be furnished. Final approval of the material in the shop will not be given until the above data is approved.

ADD THE FOLLOWING SUBSECTION:

**615.2.1-Shop Drawings:** The Contractor shall submit copies of the detailed shop drawings to the Engineer for approval. Shop drawings shall be submitted sufficiently in advance of the start of the work to allow time for review by the Engineer and corrections to be made by the Contractor without delaying the work. Upon completion of the work, reproducible, full-size tracings of the original drawings shall be delivered to the Engineer. The size of the original drawings shall be 22 inches (559 mm) x 34 inches (864 mm), including margins, unless otherwise permitted. The shop drawings submitted for approval may be of a reduced size.

The title block of all sheets of the shop drawings shall contain at a minimum the following: state project number, federal project number, bridge name, bridge (design) number, prime contractor's name and fabricator's name.

Shop drawings shall give full detailed dimensions and sizes of component parts of the structure and details of all miscellaneous parts, such as pins, nuts, bolts, drains, etc.

Where specific orientation of plates is required, the direction of rolling of plates shall be shown.

Shop drawings shall specifically identify each piece that is to be made of steel which is to be other than AASHTO M 270 (M270M) Grade 36 (245) steel.

ADD THE FOLLOWING SECTION:

**SECTION 616  
PILING**

**616.1-DESCRIPTION:**

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

**616.2-MATERIALS:**

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

## 616.3

MATERIAL	SUBSECTION
*Steel Bearing Piles and Splices	709.12
Prestressed concrete piles	603
Precast concrete piles	601
Steel Pile Points	709.50

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

### CONSTRUCTION METHODS

#### 616.3-PREPARATION FOR DRIVING:

**616.3.1-General:** Piles shall not be driven until required excavation or embankment is completed. Material forced up between the piles shall be removed to correct elevation, without cost to the Division, before concrete for the foundation is placed.

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

#### 616.4-EQUIPMENT FOR DRIVING:

**616.4.1-General:** When a steam or air hammer is used for driving any type of piles, both the volume and pressure of steam or air recommended by the manufacturer of the hammer, as well as the rated number of strokes per minute, shall be maintained at all times to insure full energy of the driving blows.

Before pile driving is started, the Contractor shall provide written certification to the Engineer that the pile hammer, air compressors, and air valves have been inspected and found to be in good working condition. In case the required penetration is not obtained by the use of a hammer complying with the minimum requirements in 616.4.2 and 616.4.3, the Contractor shall provide a heavier hammer or resort to jetting at their own expense, unless jetting is specifically prohibited.

**616.4.2-Hammers for Steel Piles:** Gravity hammers for driving steel piles shall weigh not less than 2,000 and 3,000 lb. (907 to 1,360 kg) respectively, and in no case shall the weight of the hammer be less than the combined weight of the driving head and pile, unless noted otherwise on the Plans. The fall shall be so regulated as to avoid injury to the piles and in no case shall exceed 15 ft. (4.5 m).

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

**616.4.3-Hammers for Concrete Piles:** Steam or air hammers used for driving precast concrete piles with a mandrel shall develop an energy per blow, at each full stroke of the piston, of not less than 15,000 ft.-lb. (20.3 kJ) or not less than one foot-pound for each pound of weight driven.

**616.4.4-Leads:** Pile driver leads shall be constructed in such a manner as to afford freedom of movement to the hammer, and they shall be held in position by guys or still braces to insure firm support to the pile during driving to the lowest point the hammer must reach.

**616.4.5-Water Jets:** When water jets are used, the numbers of jets and the volume and pressure of water at the jet nozzles shall be sufficient to freely erode the material adjacent to the piles. The plant shall have sufficient capacity to deliver at all times at least 100 psi (689 kPa) pressure at two  $\frac{3}{4}$  in. (19 mm) jet nozzles.

#### **616.5-METHOD OF DRIVING:**

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

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

#### **616.6-ACCURACY OF DRIVING:**

All piles shall be driven with a variation of not more than 2% from the vertical or from the batter line indicated. The plan elevation for cut off shall be measured from the lowest point of the pile head with a maximum deviation of 2 inches (50 mm) above plan cut off providing this deviation does not interfere with other construction requirements. The cut off shall be made at right angles to the pile. The concrete cover from the face of the

### **616.6.1**

concrete to any face of the pile shall not be less than 9 inches (225 mm) except on the side the pile penetrates the structure. Additional concrete cover may be monolithically added to the structure to maintain the minimum 9 inches (225 mm) cover at no cost to the Division.

**616.6.1-Foundations:** The location in plan for piles in foundations may have a maximum deviation of 6 inches (150 mm) from that shown in the contract documents except as provided in 616.6.2.

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

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

### **616.7-DEFECTIVE PILES:**

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

### **616.8-DETERMINATION OF BEARING VALUES:**

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

**616.8.2-From Blow Count at Refusal:** The size of piles, energy rating of hammer, and design load will be designated on the Plans. All piles shall be driven to refusal into the foundation strata as indicated by the estimated pile lengths or pile tip elevations. Refusal is defined as the equivalent of 20 blows for 1 in. (25 mm) of penetration with a power hammer developing the minimum designated foot pounds per blow. The minimum number of blows in the last inch of penetration shall be as specified on the Plans. If a

larger hammer is used, the Engineer will specify the blow count to determine refusal.

### **616.9-PRECAST CONCRETE PILES:**

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

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

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

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

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

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

**616.9.5-Handling:** Removal of forms, curing, storing, transporting, and handling precast concrete piles shall be done in such a manner as to avoid excessive bending stresses, cracking, spalling, or other injurious

## **616.10**

results. Piles shall be lifted by means of suitable bridles or slings attached to the pile along its length. The arrangement shall be such that no stresses in excess of 12,000 (82.7 MPa) psi are developed in the reinforcement, and the maximum compressive stress in the concrete is not over 600 psi (4 Mpa) allowing 100 % of the calculated load for impact and shock.

### **616.10-PRESTRESSED CONCRETE PILES:**

Prestressed concrete piles shall conform to the requirements of 603.

### **616.11-STEEL PILING:**

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

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

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

### **616.12-PREDRILLED PILING:**

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

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

**616.13-EXTENSIONS OR “BUILD-UPS”:**

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

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

**616.14-METHOD OF MEASUREMENT:**

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

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

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

**616.15-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 materials and doing all the work prescribed in a workmanlike and acceptable manner, including all labor, tools, equipment, supplies, and incidentals necessary to complete the work. The cost of preboring, filling of voids, splicing, and metal shoes or points shall be included in the price bid for the piles.

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

## 616.16

### 616.16-PAY ITEMS:

ITEM	DESCRIPTION	UNIT
616003-*	CONCRETE PILES	LINEAR FOOT (METER)
616004-*	“size” STEEL BEARING PILES, DRIVEN	LINEAR FOOT (METER)
616005-*	STEEL BEARING PILES, PRE-DRILLED AND DRIVEN	LINEAR FOOT (METER)
616007-*	PILE LOADING TESTS	PER PILE
616016-*	SHEET PILING LEFT IN PLACE	LINEAR FOOT (METER)
616017-*	SHEET PILING, DRIVEN	LINEAR FOOT (METER)

\* Sequence number

## SECTION 625 DRILLED CAISSON FOUNDATIONS

DELETE THE ENTIRE SECTION AND ADD THE FOLLOWING:

### 625.1 - DESCRIPTION:

The work of this section includes the furnishing of all materials and the construction of foundations consisting of reinforced concrete caissons placed within drilled excavations. Each drilled caisson foundation shall consist of a shaft section, with the lower portion in a drilled rock socket and with the upper portion in a steel casing. This casing will normally be removed during concrete placement unless otherwise shown in the plans or directed by the Engineer.

### 625.2 - TESTS AND SUBMITTALS:

The Contractor shall deliver all submittals required by this specification to the Engineer no later than one month prior to constructing any drilled caissons shown in the plans. No drilled caissons shall be constructed prior to the Engineer's review and acceptance of all submittals and test hole results.

#### 625.2.1 - Experience:

- 1) A satisfactory record of experience in drilled caisson construction is considered to be of the utmost importance in obtaining a satisfactory drilled caisson installation. The installation of the drilled caisson is required to be performed by a contractor or specialty subcontractor specializing in installing drilled caissons and having experience with caissons of similar length, diameter, and subsurface conditions as those shown in the contract documents.
- 2) The Contractor shall submit data on at least two projects performed during the past ten years, for which the Contractor (or the

### 625.2.3

Subcontractor if applicable) has installed drilled caissons of a range of diameters and lengths similar to those shown in the plans, in similar quantities, and under similar subsurface conditions. The list of projects shall contain names and phone numbers of owners' representatives who can verify the participation in those projects.

- 3) The Engineer shall review and approve the Contractor's (Subcontractor's) caisson. If in the opinion of the Engineer the Contractor's qualifications are not adequate, the Contractor shall submit to the Engineer a proposed method of obtaining the necessary qualifications.
- 4) The installation of all components of the drilled caisson including; drilling, reinforcement placement, concrete placement, and required wet hole condition work, casing installation and removal, slurry placement, and any other work required to complete the drilled caisson, shall be performed by the approved contractor or specialty subcontractor.

**625.2.2 - Site Inspection:** A signed statement shall be submitted affirming that the Contractor (or the Subcontractor if applicable) has inspected the project site and the available subsurface information including any available soil or rock samples.

**625.2.3 - Installation Plan:** The Contractor shall submit an Installation Plan for review by the Engineer. This plan shall provide information on the following:

- a) Name and experience record of the drilled caisson superintendent in charge of drilled caisson operations for this project.
- b) List of proposed equipment to be used on the project, including barges, cranes, templates, drill rigs, drills, augers, bailing buckets, final cleaning equipment, slurry desanding equipment, slurry pumps, core sampling equipment, welding equipment, tremie or concrete pumps, casing, etc.
- c) Details of overall construction operation sequence and the sequence of caisson construction in the piers and/or the abutments; taking due care not to damage fresh concrete by drilling in the immediate vicinity too quickly.
- d) Method for maintaining drilled caisson position and alignment during excavation, and details and sequencing of caisson excavation.

### 625.2.3

- e) Details of casing and splices to be used, including calculations (signed and stamped by a Professional Engineer knowledgeable in drilled caissons) showing ability of casing to withstand anticipated hydraulic and earth pressures and to withstand stresses due to installation without undue deformation. Description for withdrawal of casings to demonstrate that concrete will not be lifted during withdrawal.
  
- f) When the use of slurry is anticipated, details of the methods to mix, circulate, and desand slurry. Any request to use a slurry displacement method for the construction of caissons shall also provide information for the Engineer's approval as follows:
  - 1. Detailed description of proposed construction method.
  - 2. Concrete mix, as modified for use with the slurry displacement method.
  - 3. Components and proportions in proposed slurry mixture.
  - 4. Tests proving slurry mixture will not degrade rock or interfere with bond.
  - 5. Methods to agitate slurry mixture prior to concrete placement.
  - 6. Methods to clean slurry mixture for re-use.
  - 7. Disposal methods for used slurry.
  
- g) Details of methods to mechanically clean the caisson excavation.
  
- h) Details of reinforcing cage fabrication and placement including support of the reinforcing cage during handling, after installation, and during concrete placement, along with methods and devices that will be used to center the reinforcing cage and maintain concrete cover over the bars.
  
- i) Details of concrete placement including proposed operational procedures for free-fall, tremie, pumping or other methods.
  
- j) Sample of proposed drilled caisson report, proposed drilled caisson log, and proposed Preinstallation core hole log.
  
- k) Welding procedures and qualifications of welders and tackers as specified in ANSI/AWS D1.1 for casing steel and in ANSI/AWS D1.4 for reinforcing steel.
  
- l) Preinstallation Coring procedure.

### 625.2.5

- m) Qualifications and experience record of firm proposed to perform Preinstallation Coring, including experience record of the supervisor designated to oversee the work.
- n) Mix design for concrete and for non-shrink grout.
- o) Plan to minimize vibration and wheel loads in the vicinity of newly placed caissons.
- p) Plan for compliance with applicable environmental regulations, including but not limited to the protection of river water from degradation due to material excavated from drilled caisson locations or due to other harmful erosion, protection of the environment from slurry spillage or discharge if slurry is used, and general environmental protection of the area from all operations related to drilled caissons.
- q) The Contractor's proposed Safety Plan per Section 625.5.2.7.

The Engineer will evaluate the Drilled Caisson Installation Plan for conformance with the Plans, Specifications, and this Special Provision. Within 14 days after receipt of the plan, the Engineer will notify the Contractor in writing of any additional information required and/or changes necessary to meet the contract requirements. All procedural approvals given by the Engineer shall be subject to trial in the field and shall not result in any additional cost to the Division if they fail to perform also shall not relieve the Contractor of the responsibility to satisfactorily complete the work as detailed in the Plans and Specifications.

**625.2.4 - As-Built Records:** Within 24 hours of the completed construction of each drilled caisson, the Contractor shall submit a report on the actual location, alignment, elevation, and dimensions of the drilled caisson, and will also submit a completed drilled caisson log as specified herein.

**625.2.5 - Test Hole:** A test hole shall be drilled at the location and to the diameter and depth shown in the plans. The test hole shall be unreinforced but shall otherwise be constructed the same as other drilled caissons in the plans. This shall include casing extraction if required by the project or the Contractor's proposed installation plan. CSL testing will not be required for the test hole, however the Contractor may, at his own expense perform CSL testing. The Contractor shall revise his methods and equipment as necessary during construction of the test hole when he is unable to carry out the requirements of the plans. Completed test holes shall be left in place except that the top of the caisson shall be removed to a depth of 2 ft (600 mm) below final ground line. Disturbed areas at the site of the test hole shall be restored

## 625.2.6

to their original condition. If the Contractor fails to demonstrate the adequacy of his methods or equipment, the Engineer shall require additional test holes be provided at the Contractor's expense.

### 625.2.6 - Nondestructive Testing

**625.2.6.1 - General Requirements:** The nondestructive testing method known as Crosshole Sonic Logging (CSL) shall be used on any drilled caisson which is constructed with the placement of concrete underwater or as required in the plans. The testing shall not be conducted until at least twenty-four hours after placement of concrete is concluded in the caisson, and will be completed within 14 calendar days after such placement.

The CSL tests shall be conducted by the Engineer with the cooperation of the Contractor. The Contractor shall provide suitable working space and access to every tested caisson and shall provide a reliable 1000-watt generator for use by the Engineer.

**625.2.6.2 - Preparation for Testing:** To accommodate the CSL test requirements, the Contractor shall install a number of tubes in each caisson to be tested. The number of tubes per caisson shall be as tabulated below:

**TABLE 625.2.6.2**

<b>Caisson Diameter</b>	<b>Number of Tubes</b>	<b>Tube Spacing</b>
Up to 42" (1 049 mm)	3	120°
42" to 60" (1 050 mm to 1 499 mm)	4	90°
60" to 96" (1 500 mm to 2 399 mm)	6	60°
96" (2 400 mm) and larger	8	45°

The tubes shall be per section 625.4.4. Each tube shall have a round, regular internal diameter free of defects or obstructions including defects or obstructions at pipe joints; in order to permit the free, unobstructed passage of 1½ inch (35 mm) diameter source and receiver probes. The tubes shall be watertight and free from corrosion with clean internal and external faces to ensure passage of the probes inside and a good bond with the concrete outside.

Each tube shall be fitted with a watertight shoe on the bottom and a removable cap or plug on the top. The tubes shall be securely attached to the interior of the reinforcing steel cage. The tubes are typically wire-tied to the reinforcing cage every 40 inches (1 000 mm), or otherwise secured such that the tubes stay in position during placement of the cage and during placement of concrete. The tubes shall be installed in each shaft in a regular, symmetric pattern such that the tube spacing in degrees will correspond to that shown in the table above.

### 625.2.6.5

The tubes shall be as near to parallel as possible. They shall extend from 6 inches (150 mm) above the caisson bottom to at least 40 inches (1 000 mm) above the caisson top. No tube may be allowed to rest on the bottom of a drilled excavation. If the caisson top is sub-surface, then the tubes shall extend at least 2 ft (600 mm) above the ground surface or above the water surface if the ground surface is below water. Any joints required to achieve full length tubes shall be made watertight. Care shall be taken during placement of the reinforcing steel cage so as not to damage the tubes.

After placement of the cage, and before placement of concrete, the tubes shall be filled with clean water and the tube tops shall be capped or sealed to keep debris or other foreign matter out of the tubes. Care shall be exercised in the removal of caps or plugs so as not to apply excess torque, hammering, or other stresses that could break the bond between the tubes and the concrete.

**625.2.6.3 - CSL Logging Procedures:** Before placement of concrete, the Contractor shall investigate at least one tube per shaft. This investigation is to make sure that there are no bends, crimps, obstructions or other impediments to the free passage of the testing probes. A record of the tube length or lengths, including a note of the projection of the tubes above the top of the shaft shall be made. The Contractor shall provide information on the shaft bottom and top elevations, length and construction dates to the Engineer prior to the CSL tests.

The Contractor shall make the caisson and the caisson site available to the Engineer for the conduct of the CSL tests. Any defects indicated by tests shall be evaluated by the Engineer and further tests may be conducted in regard to the extent of such defects. Any time required by such tests will be considered incidental to the work and will not be cause for extra compensation related to a claim or extension of contract.

**625.2.6.4 - CSL Testing Results:** The CSL test results will be compiled into a caisson integrity testing report for each caisson. The report will summarize and analyze any defect zones indicated on the logs. A copy of each report will be provided to the Contractor.

**625.2.6.5 - Evaluation of CSL Test Results:** The Engineer will evaluate the CSL test results and will determine whether or not the drilled caisson as constructed is acceptable. If the Engineer determines that the drilled caisson is acceptable based on the CSL tests, then the caisson and the caisson site will be turned back to the Contractor and further construction may proceed.

The acceptance of each drilled caisson shall be the decision of the Engineer, based on the results of the caisson integrity testing report and other information on the caisson placement. Rejection of a caisson shall require conclusive evidence that a defect exists in the caisson, which will result in inadequate or unsafe performance under service loads. If the Non Destructive Testing records are complex or inconclusive, the Engineer may require the

#### **625.2.6.6**

Contractor to verify caisson conditions, in accordance with 625.2.6.6. If a defect is confirmed, the Contractor shall pay for all coring and grouting costs. If no defect is encountered, compensation for all coring and grouting will be in accordance with 104.3 and 109.4 of the Standard Specifications.

In the case that any caisson is determined to be unacceptable, the Contractor shall submit a plan for remedial action to the Engineer for approval. Any modifications to the foundation caisson and load transfer mechanisms caused by the remedial action will require calculations and working drawings stamped by a professional engineer registered in the State of West Virginia for all foundation elements affected. All labor and materials required to perform remedial caisson action shall be provided at no cost to the Division and with no extension of the contract time.

**625.2.6.6 - Evaluation by Core Drilling:** A drilled caisson that is found to be unacceptable shall be cored by the Contractor using double tube core barrels. One or more core holes shall be drilled at the location(s) as determined by the Engineer. A core sample shall be taken from each defect location, at a length specified by the Engineer. An accurate log of the core shall be kept and the core shall be crated and properly marked showing the caisson depth at each interval of core recovery. The core along with five copies of the coring log shall be provided to the Engineer.

If the quality of the caisson, as represented by the core samples, is determined to be acceptable, then the caisson and the caisson site will be turned back to the Contractor and further construction may proceed. If the quality of the caisson is determined to be unacceptable, then the Contractor shall proceed in accordance with 625.2.6.5.

#### **625.3 - DIMENSIONAL REQUIREMENTS:**

The dimensional requirements for Placement Tolerances and Caisson Diameters shall be met prior to placement of reinforcing steel. The Contractor shall submit his corrective plan for any deviation from the caisson location, alignment and elevation tolerances, and reinforcement dimensional requirements to the Engineer for approval. The cost of any corrective action shall be borne by the Contractor.

**625.3.1 - Placement Tolerances:** For any drilled caisson the maximum permissible deviation from plumb shall be 2% or a ratio of 2:100 with respect to a truly vertical axis. For any drilled caisson at its top, the maximum deviation of the center shall be 3 inches (75 mm) from its project plan location.

**625.3.2 - Caisson Diameters:** Rock sockets shall be of a minimum diameter equal to the caisson diameter shown in the plans. Casings, extending upward from the rock surface, shall have a minimum inside diameter equal to the caisson diameter shown in the plans, but may be larger in diameter to expedite the Contractor's operations.

**625.3.3 - Bottom Excavation:** Excavation equipment and methods shall provide the completed caisson excavation with a flat bottom. The cutting edges of excavation equipment shall be normal to the vertical axis of the equipment within a tolerance of plus or minus 1¼ in. per 40 in. (30 mm per 1 000 mm) of diameter.

**625.3.4 - Caisson Cutoff Elevations:** For any drilled caisson the maximum permissible deviation from finished top of shaft elevation shall be minus 3 inch (75 mm) and plus 1 inch (25 mm).

**625.3.5 - Reinforcement:** After all concrete has been placed, the top of the reinforcing steel cage shall be no more than 4 inches (100 mm) above, and no more than 2 inches (50 mm) below, the plan elevation. An absolute minimum clearance of 3 inches (75 mm) to the reinforcing steel is strictly required.

## **625.4 - MATERIALS:**

**625.4.1 - Concrete:** Concrete for the drilled caissons shall be Class "B" (modified) and shall conform to the requirements of Section 601 of the Standard Specifications, except for those requirements which are superseded by this Special Provision.

The design 28-day compressive strength shall be not less than 4500 psi (31 Mpa) unless shown otherwise in the plans. The Contractor will prepare a mix design to attain this strength, retaining the basic characteristics of Class "B" concrete. Slump for dry placement will be 7 inches (175 mm) plus-or-minus 1 inch (25 mm). Unless otherwise specified in the plans, the cement shall be Type I.

For placement of caisson concrete by tremie or pumping, the cement content shall be increased to 8 bags per cubic yard (435 kg/m<sup>3</sup>), the slump shall be 8 inches (200 mm) plus-or-minus 1 inch (25 mm) and shall maintain a slump in excess of 4 inches (100 mm) throughout the concrete placement, and the maximum aggregate size shall be 1 inch (25 mm).

**625.4.2 - Reinforcing Steel:** Reinforcing steel for main vertical bars and ties shall conform to Section 709.1, deformed type, grade 60 (400). Reinforcing steel for use as spirals shall conform to Section 709.1, plain type, grade 60 (400).

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

#### 625.4.4

Casing pipe shall conform to ASTM A 252/A 252M, Grade 2, for either temporary or permanent application.

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

Permanent casing is required in all caissons where noted on the plans. All temporary casing shall be removed during placement of concrete unless otherwise noted on the plans. Should the Contractor be unable to remove the temporary casing, the Contractor shall pressure grout the annular space between the casing and soil. Materials and methods for grouting operation shall be submitted to the Engineer for approval for the grouting operation at no additional cost to the Division.

**625.4.4 - CSL Testing Tubes:** Tubes required for CSL Tests shall be ASTM A53, Grade B, nominal 2 inch (50 mm) diameter. Hydrostatic test requirements are waived. Threaded Couplings shall be used per ASTM A 865.

#### 625.5 - CONSTRUCTION:

**625.5.1 - General:** The following sequence describes a generalized construction method that is expected to be appropriate for the installation of the drilled caissons. Deviations will be permitted with the Engineer's approval.

- a) Excavate to top of shaft elevation.
- b) Drilling of a "Preinstallation Core Hole" prior to drilling of caisson hole. The drilling and sampling of the preinstallation core holes shall be done by use of double tube core barrels. Additional preinstallation core holes in other locations may be required where directed by the Engineer. Such additional core holes shall be paid for at the contract unit bid price. The preinstallation core hole will be drilled from the ground surface, downward a distance equal to the caisson diameter below the expected bottom of rock socket. Its purpose is to assure that the rock just below the socket is sound and able to carry the loads that will be imposed on it.

A preinstallation core hole is a 2 inches (50 mm) nominal diameter hole, with coring, where the quality of the rock core and the rate of drilling are used to determine if there is satisfactory rock of sufficient type and thickness, and to locate the presence of open joints, voids, soft rock or other deleterious material. Logs of the core hole shall be provided to the Engineer within 24 hours of completion of coring. All cores

### 625.5.2

shall be maintained by the Contractor until completion of the project and shall then become the property of the Engineer.

- c) Drilling of cased hole through the soil overburden down to top of competent rock. Seating bottom of casing to minimize entry of ground water.
- d) Drilling of rock socket to the minimum diameter shown in the plans and to a depth shown on the drawings or otherwise directed by the Engineer.
- e) Cleaning of the drilled hole, particularly the rock socket and the inside face of the casing; inspection of the hole and approval for placement of the caisson material.
- f) Placement of the pre-assembled cage of reinforcing steel and securing it in place against movement during concreting and during casing withdrawal. It also must be secured in such a way that the minimum clear cover over the bars is maintained. Placement of tubes as required for CSL testing.
- g) Placement of concrete in either dry or wet conditions. In the case of dry conditions, concrete placement shall be by the free-fall method with the concrete carefully directed down the center of the caisson without striking the casing, the reinforcing steel, the CSL tubes or the sides of the rock socket. In the case of wet conditions, concrete placement shall be by tremie or pumping with the mix adjusted accordingly. If the temporary casing is to be removed it shall be withdrawn carefully and slowly so as not to leave any voids in the concrete and so as not to dislocate any reinforcing steel. Any concrete not meeting this specification's slump requirements shall be rejected.
- h) For any parts of any caisson that extend above either the existing or permanent grade, that portion shall be placed by use of forms of the diameters shown in the plans. Curing, stripping, and finishing shall be the same as for other structural concrete. Casing may be used as forms.
- i) Turning the site over to the Engineer for CSL testing if required. Cooperation with the Engineer in the conduct of the testing, as specified herein. Corrective measures for any unacceptable caissons. Removal of water from the CSL tubes and filling with an approved grout. All core holes must be filled with an approved grout.

### 625.5.2 - Excavation:

### 625.5.2.1

**625.5.2.1 - Scope:** The Contractor shall drill one preinstallation core hole at each caisson location unless otherwise noted on the plans. The Contractor shall perform all excavations required for the caissons and the rock sockets, through whatever materials are encountered, to the dimensions shown in the plans, or required by the site conditions, or directed by the Engineer. The Contractor shall make each caisson excavation available to the Engineer for inspection, providing tools, equipment, and safety measures as hereinafter specified. Based on preinstallation core hole information or on general inspection of the rock socket, the Contractor shall drill the rock socket deeper if directed by the Engineer.

**625.5.2.2 - Excavation through Overburden:** Unless otherwise shown in the plans, drilled caisson excavations in the overburden shall be vertical bored holes extending from the ground surface down to the surface of competent rock. Temporary or permanent casings may be required down to the competent rock surface and shall be seated in rock in a manner that prevents caving and minimizes the entry of ground water. In the event of a groundwater condition, appropriate measures shall be taken subject to the Engineer's approval. Such measures may include pumping from within the excavation, external dewatering, or excavation through a slurry-filled hole until the casing can be seated and sealed. In cases in which the water is difficult to control, the Engineer may permit wet excavation which could require later inspection by diving methods and would require later placement of concrete by underwater methods.

**625.5.2.3 - Excavation in Rock:** Rock sockets shall be excavated to the dimensions and depths shown in the plans, forming a flat bearing area at the bottom of the socket. Each socket shall be excavated into continuous rock for the indicated length, by use of methods subject to the Engineer's approval. Blasting methods will not be permitted.

Upon completion of each rock socket excavation, the Engineer may (1) accept the socket, or (2) order deeper excavation based upon preinstallation core hole data or general inspection of the socket. The adequacy of each socket will depend on the soundness of its bottom surface and on the soundness of its underlying layers. The Contractor shall drill required preinstallation core holes as directed and shall excavate sockets to the depth directed by the Engineer.

Contractor is cautioned not to over-drill the rock sockets. Unauthorized over-drilling will be at the Contractor's expense. In the case where over-drilling would bring the caisson base too close to a coal seam or other weak layer, then drilling must be extended through such weak layer, at the Contractor's expense, to a satisfactory deeper bearing level as determined by the Engineer.

No portion of the rock socket shall be exposed to drilling fluid or groundwater for more than 96 hours. Any portion of the rock socket exposed to drilling fluid or water for more than 96 hours, and any portion

### 625.5.2.7

of the rock socket which, in the opinion of the Engineer, has deteriorated due to exposure to air or water, shall be reamed with an approved grooving tool to a depth of not less than ¼ in. (6 mm), or as directed by the Engineer. Reaming of the socket, if necessary, is considered incidental to the cost of drilling the rock socket, and no separate payment will be made for this work.

**625.5.2.4 - Providing for Socket Inspection:** Upon completion of the excavation of each rock socket, and upon mechanical cleaning of the socket, the Contractor shall make the socket available to the Engineer for inspection. The Contractor shall provide suitable access for inspection, electric lighting, devices for checking dimensions, alignment and plumbness, ventilation equipment, the protective cage, radio communication, and auxiliary safety line. The air in the caisson shall be tested for noxious and/or explosive gases prior to and during entry of inspection personnel, to assure a safe working environment.

**625.5.2.5 - Disposal of Materials:** Disposal of excavated materials shall be accomplished under the general provisions of Section 207.6 of the Standard Specifications.

**625.5.2.6 - River Area:** Drilled caisson construction in the river shall employ whatever special methods the Contractor finds necessary for access and for accomplishing the work. These methods may include cofferdams, temporary sand islands, or other suitable measures. The Contractor will be responsible for conforming to all regulatory and environmental requirements related to the river and for obtaining any permits that are required by his river operations.

**625.5.2.7 - Safety Measures:** Safety of all persons is to be considered an objective of the utmost importance on this project. Therefore, the Contractor will take whatever measures are necessary to protect his own personnel, his subcontractors' personnel, the Engineer or other agents of the state, regulatory personnel, and others including the general public. The following list is presented as representative of issues that the Contractor must address. It is not intended as all-inclusive and does not relieve the Contractor of conforming to other regulations, laws, requirements, or other measures reasonably required for safe excavating operations. The Contractor shall develop a safety plan in accordance with these requirements and provide this plan to the Engineer for his review.

- a) Any required equipment within an excavation shall be operated by air or electricity. The use of gasoline-driven engines or diesel engines within an excavation will not be permitted. All lighting shall be electric and precautions shall be taken in regard to potential short circuits of electric current within ground water.

### 625.5.3

- b) The Contractor will take precautions to assure that no explosive or noxious gases are present. Fresh air shall be supplied into the excavation and foul air shall be removed whenever any personnel are present in the hole.
- c) A safety harness or chair lift, with separate safety line, protective cage, and two-way radio communication shall be used for any entry into an excavation.
- d) No open excavation shall be left unattended. During non-working hours excavations shall be protected by the use of solid, safe covers that are firmly fastened in place.

**625.5.3 - Reinforcing Steel Installation:** Prior to installation of reinforcing steel, the steel cage shall be checked and cleaned of any materials that would tend to prevent bonding. The excavated hole shall also be checked and any remaining or newly deposited debris shall be removed. Immediately upon the Engineer's approval of the condition of the cage and his acceptance of the socket, and just prior to placement of concrete, the fully assembled cage of reinforcing steel shall be installed into the excavation.

The cage will consist of longitudinal (vertical) bars, spiral or tie bars, cage stiffener bars as required, spacing devices, and any other appurtenances required to maintain alignment, shape, and clearances. Cages shall include steel tubes in shafts where CSL testing is to occur. Each cage shall be placed in one unit by lowering into the hole in a manner that will prevent distortion. Concrete spacers or other approved noncorrosive spacing devices shall be used at sufficient intervals (near the bottom and at intervals not exceeding 10 ft (3 000 mm) along the caisson) to ensure concentric spacing for the entire cage length. The minimum number of centering devices at each level shall be three. All steel centering devices with less than 3 inches (75 mm) of concrete cover shall be epoxy coated. The cage shall be supported from the top by use of a ground surface frame or other positive means. Setting the cage on the socket bottom without support will not be permitted. The Contractor may with the approval of the Engineer, remove the top support after sufficient concrete has been placed to adequately support the cage vertically and prevent distortion or racking of the cage.

The bottom of the reinforcing steel cage shall be a minimum of 3 inches (75 mm) and a maximum of 24 inches (600 mm) from the bottom to the drilled caisson excavation. Additional clearance may be approved by the engineer.

All intersections of drilled caisson reinforcing steel shall be tied with cross or "figure 8" ties. The reinforcing steel in the caisson shall be 100% tied and supported so that the reinforcing steel will remain within allowable tolerances for position. Unless otherwise shown in the plans, splicing shall be by mechanical connectors or couplers which develop at least 125% of yield strength of the reinforcing bar. No more than 50% of the longitudinal

#### 625.5.4

reinforcing shall be spliced within 60 bar diameters of any lapped splice location or within 2 ft (600 mm) of any mechanical splice or coupler location. Cage stiffener bars shall be used as required to provide a reinforcement cage of sufficient rigidity to prevent racking, permanent deformations, etc. during installation. If the concrete is to be placed by the free-fall method, these bars must first be removed.

In the event that the caisson has been excavated below the anticipated tip elevation, the reinforcing cage may be extended at the tip (low) end by lap splices, mechanical connectors, or welded splices in conformance with the Standard Specifications. In this instance, splices need not be staggered and 100% of the reinforcing bars may be spliced at a given location. Lap splice lengths shall be as shown in the plans or approved by the Engineer.

Prior to placing the reinforcement cage, the Contractor shall demonstrate to the satisfaction of the Engineer that the fabrication and handling methods to be used will result in a reinforcing cage placed in the proper position, with the proper clearances, and without permanent bending or racking of the reinforcement cage.

The elevation of the top of the steel cage shall be checked before and after the concrete is placed. If the rebar cage is not maintained within the specified tolerances, corrections shall be made by the Contractor to the satisfaction of the Engineer. No additional caissons shall be constructed until the Contractor has modified his rebar cage support system in a manner satisfactory to the Engineer.

**625.5.4 - Placement of Concrete:** Prior to concrete placement, the Contractor shall make all necessary arrangements to assure the uninterrupted delivery of concrete so that there will not be any cold joints in the caissons. Placement of concrete shall generally conform to the applicable portions of Section 601.10 of the Standard Specifications. The rate of placement of concrete, as related to the height of fresh concrete at any time, will be subject to the Engineer's approval. The placement method will be developed by the Contractor, taking account of set time, hydraulic pressures and casing removal.

The placement of concrete in dry conditions shall be by a free-fall method. The height of free fall is not limited, but segregation of the concrete is not permitted. In order to qualify as a dry condition the caisson excavation must meet two requirements. The first requirement is the infiltration rate shall not exceed ¼ in. (6 mm) of depth per minute as measured in the bottom 18 inches (450 mm) of the rock socket. The second requirement is that at the time of concrete placement the depth of water in the bottom of the rock socket shall not exceed 2 in. (50 mm). The dry concrete placement method may be used only when the sides and the bottom of the caisson excavation remain stable without detrimental caving, sloughing or swelling, and water can be satisfactorily removed prior to inspection and prior to placing concrete.

In a case where the Engineer determines that dry conditions cannot be attained, he will require placement by the wet placement method shown in the

#### 625.5.4

approved Installation Plan. The casing shall be filled with clean water to an elevation not less than 4 feet (1 200 mm) above the water elevation outside the casing, to provide a positive water pressure inside the casing. Concrete will then be placed by conventional tremie or pumping methods. Tremie or pump placement methods shall not utilize aluminum parts which would be in contact with the concrete.

Tremies used to place concrete shall consist of a tube of sufficient length, weight, and diameter to discharge concrete at the caisson base elevation. The tremie inside diameter shall not be less than 10 inches (250 mm). The inside and outside surfaces of the tremie shall be clean and smooth to permit both flow of concrete and unimpeded withdrawal during concreting. The wall thickness of the tremie shall be adequate to prevent crimping or sharp bends which restrict concrete placement.

The tremie used for concrete placement shall be watertight. Concrete placement shall not begin until the tremie is placed at the caisson base elevation. Valves, bottom plates, or plugs may be used only if concrete discharge starts within approximately 2 inches (50 mm) above the excavation bottom. Plugs shall either be removed from the excavation or be of a material approved by the Engineer which will not cause defects in the caisson if not removed.

The discharge end of the tremie shall be constructed to permit the free radial flow of concrete during placement operations. The tremie discharge end shall remain at or near the bottom of excavation as long as practicable during concrete placement. The tremie discharge end shall remain immersed as deep as practicable in the concrete, consistent with the Contractor's construction methods, and shall be immersed at least 10 ft (3 000 mm) in concrete at all times after starting the flow of concrete. The flow of the concrete shall be continuous. The concrete in the tremie shall be maintained at a positive pressure differential at all times to prevent water or slurry intrusion into the caisson concrete.

All pump lines shall have a minimum diameter of 4 inches (100 mm) and shall be constructed with watertight joints. Concrete placement shall not begin until the pump line discharge orifice is at the caisson base elevation. A plug or similar device shall be used to separate the concrete from the fluid in the hole until pumping begins. The plug shall either be removed from the excavation or be of a material approved by the Engineer which will not cause a defect in the caisson if the plug is not removed. The discharge orifice shall remain at least 10 ft (3000 mm) below the surface of the fluid concrete.

If at any time during the concrete pour, the tremie line orifice or the pump line orifice is removed from the fluid concrete column and discharges concrete above the rising concrete level, the entire drilled caisson shall be considered defective. In such case, the Contractor shall remove the reinforcing cage and concrete, complete any necessary sidewall removal directed by the Engineer and repour the caisson. All costs of replacement of defective caissons shall be the responsibility of the Contractor and shall be at no cost to the Department.

## 625.6.1

After the concrete level has reached the required top elevation, it will be forced to overflow in the case of tremie or pump placement, leaving only fresh, uncontaminated concrete. In the case of placement by free fall (dry conditions), the concrete will be continued high enough to compensate for any settlement due to removal of casing.

The top 10 ft (3 000 mm) of each drilled caisson shall be vibrated except, when more than 10 ft (3 000 mm) is to be exposed above the ground line or the riverbed, then the entire exposed portion shall be vibrated. Exposed portions of each drilled caisson shall be cured in accordance with Section 601.12 of the Standard Specifications.

**625.5.5 - Removal of Casing:** Removal of the casing from a shaft may occur gradually as concrete is placed. In all cases, extraction of casing shall begin within one hour from the beginning of concrete placement in the cased portion of the shaft. Insofar as possible, casing extraction shall be done at a slow uniform rate by application of a steady vertical upward pull in the direction of the axis of the shaft. To facilitate extraction, tapping on the casing, exertion of temporary downward pressure, slight rotation, or the controlled use of a vibratory hammer will be permitted, but care must be taken to avoid harmful impacts or disturbances to the fresh concrete. Vibration or rodding may not be used to break the casing loose for extraction.

If, during extraction of casing, upward movement of concrete and/or reinforcing steel occurs, the Engineer shall be notified immediately. If he considers the movement to be minor, he may permit the extraction of the casing to continue. If, however, the movement is deemed significant and indicative of squeezing of the surrounding soil thus resulting in a reduction of the caisson diameter, then he may order the casing to be left in place, or he may permit extraction to proceed and order a later non-destructive load test, or may order other procedures as appropriate at no additional cost to the Division.

For the upper portions of drilled caissons that will be exposed and visible, the casing may remain in place as a form until the concrete has attained a strength that enables it to stand alone without further deformation. Casing shall then be removed.

## 625.6 - INSPECTION OF SOCKETS:

**625.6.1 - Depth of Rock Socket:** Each rock socket shall be drilled to the shaft diameter shown in the plans unless otherwise directed by the Engineer based on subsurface conditions encountered.

The top elevation of competent rock must be confirmed as the socket drilling is started. The effective "top elevation" is based on observation of the boundary zone where broken or weathered rock becomes competent rock, and is also influenced by the presence of any shale or coal seams. Based on that elevation, and the information from the preinstallation core hole, the Engineer will determine the final depth of socket and bottom elevation. The drilled rock

## **625.6.2**

socket will then be inspected per 625.5.2.3 and will either be accepted or drilled deeper as determined by the Engineer.

**625.6.2 - Inspection Under Water:** In a case where it is considered unfeasible to dewater a caisson, the Contractor shall provide drilled caisson logs and screenings to the Engineer for evaluation. If this material is not sufficient for a proper judgement, the Engineer will reserve the right to order an inspection by diving or other methods either through a separate specialty subcontractor or through the Contractor in which case compensation would be under Sections 104.3 and 109.4 of the Standard Specifications. Any time required for inspection under water will be considered incidental to the work and will not be cause for extra compensation related to a claim or extension of contract time.

## **625.7 - METHOD OF MEASUREMENT:**

Drilled caissons and Rock Socket foundations will be measured by the linear foot (meter). Drilled Caissons are the portion from the finished top of each caisson to the top of competent rock. Rock Socket is the portion from the top of competent rock to the bottom of the caisson as shown in the plans or as directed by the Engineer. Each measured caisson is to be complete in place, accepted, and ready to function. "Top of caisson" is the top of concrete as shown in the plans. "Top of competent rock" is as tabulated in the drilled shaft schedules in the plans unless a difference of one 1 foot (300 mm) or more is found during drilling.

Drilled Caisson test hole will be measured in Lump Sum basis.

Preinstallation core hole shall be measured by the linear foot (meter) based upon actual length drilled. The plan quantity shall be based on one core hole, per drilled caisson, measured from the top shaft elevation to one caisson diameter below the bottom of rock socket unless otherwise noted in the plans. No payment shall be made for additional length of Preinstallation core hole drilled above the top of the drilled caisson.

## **625.8 - BASIS OF PAYMENT:**

The accepted quantities of drilled caisson foundations, measured as provided above, will be paid for at the contract unit price per linear foot (meter); complete in place including excavation, slurry if required, temporary or permanent metal casing, steel reinforcing, concrete, curing, and any required forming and finishing. No additional payment will be made for temporary casing that remains in place and pressure grouting due to the Contractor's inability to stabilize a drilled excavation, for the need to place concrete by tremie or pumping, for the need to use slurry for drilling, or for extra excavation and concrete that may be required due to drilling diameters larger than the minimum diameters specified. No additional payment will be made for methods employed to gain access to drilled caisson construction or for means required to provide a dry working environment within the drilled caissons. Tubes for CSL testing, other responsibilities related to testing and inspection assistance are incidental, with no separate payment being made.

Drilled caisson test holes will be paid for at the contract lump sum price for each such hole.

Preinstallation core hole will be paid for by the linear foot (meter).

### 625.9 - PAY ITEMS:

ITEM	DESCRIPTION	UNIT
625001-*	DRILLED CAISSONS "D" DIAMETER	LINEAR FOOT (METER)
625003-*	"D" ROCK SOCKET FOUNDATION LINEAR	LINEAR FOOT (METER)
625004-*	"D" DRILLED CAISSON TEST HOLE	LUMP SUM
625005-*	PREINSTALLATION CORE HOLE	LINEAR FOOT (METER)

\* Sequence number

D = Diameter of drilled caisson, in inches (millimeters)

## SECTION 626 RETAINING WALL SYSTEMS

DELETE THE ENTIRE SECTION AND REPLACE WITH THE FOLLOWING:

### 626.1 - DESCRIPTION:

This work shall consist of furnishing the design, wall construction plans, materials, and construction of cast-in-place reinforced concrete or Mechanically Stabilized Earth (MSE) walls in accordance with these specifications and in reasonably close conformity with the lines, grades, design, and dimensions shown in the plans.

### 626.2 - GENERAL:

Unless specified otherwise in the contract documents the wall may be, at the Contractor's option, any one of the wall systems on the approved vendor list corresponding to the applicable pay Item. The approved Vendor Lists are available through the Materials Control Soils and Testing Division.

The Contractor shall indicate which wall system is to be constructed by the bid alternative chosen in the proposal. No change of the wall system indicated in the bid proposal shall be permitted after the bid opening unless approved by the Engineer.

The wall design and detail plans for construction shall be submitted to the Engineer for approval. The time required for preparation and review of these submittals shall be charged to the allowable contract time. Delays caused by untimely submittals or insufficient data will not be considered justification for time extensions. No additional compensation will be made for any additional material, equipment, or other items found necessary to comply with the project specifications as a result of the Engineer's review. The proposed wall design shall be compatible with the Contractor's proposed method of construction, and shall be compatible with any method of construction shown in the plans. The Division does not assume nor

### **626.3**

warrant any wall system's compatibility with any particular construction methods.

### **626.3 - DESIGN CRITERIA:**

**626.3.1 - General:** The size of all structural elements shall be determined such that the design load stresses do not exceed the allowable stresses found in the AASHTO LRFD Bridge Design Specifications, latest edition.

Analysis of external stability of the in-place retaining wall system will be the responsibility of the Division. Any staged or temporary construction affecting wall stability shall be the responsibility of the Contractor.

The parapets on any portion of the retaining walls as shown in the plans shall be designed to resist traffic loads in accordance with the AASHTO LRFD Bridge Design Specifications, latest edition.

**626.3.2 - Mechanically Stabilized Earth:** The design for the MSE wall shall consider the internal stability of the wall mass. The design shall conform to the requirements found in AASHTO LRFD Bridge Design Specifications, latest edition.

External loads, which affect the internal stability such as those, applied through piling, bridge footings, temporary construction, etc. shall be accounted for in the design. A design life of 100 years shall be used throughout the design. The factor of safety for pullout resistance shall not be less than 1.50 based on pullout resistance at  $\frac{3}{4}$  inch (19 mm) deflection.

The allowable bearing pressure under the stabilized mass shall be as shown in the plans. The minimum length of the soil reinforcing system, as measured from the back of the wall face to the end at the back of the soil stabilized mass, shall be as shown in plans, and shall be the same from top to bottom of the wall at any cross section.

All appurtenances behind, in front of, under, mounted upon, or passing through the wall such as drainage structures, utilities, or other items shown in the plans must be accounted for in the design of the wall.

**626.3.3 - Cast-in-Place Reinforced Concrete:** When a Cast-in-Place Reinforced Concrete option is included in the plans the following shall be applicable.

The information shown in the plans for the cast-in-place alternative is schematic; however, all dimensions shown in the plans shall be considered minimums.

The allowable bearing pressure of the foundation soils, the unit weight of the retained soils, and the characteristics of the retained soils necessary for design purposes shall be as shown in the plans.

### **626.4 - SUBMITTALS:**

**626.4.1 - General:** The Contractor shall submit complete design calculations, explanatory notes, and detail plans for the proposed wall system. The detail plans shall include all details, dimensions, quantities, and cross sections necessary to construct the wall and shall include but not be limited to the following items:

A plan and elevation sheet or sheets for the wall which shall contain the following:

1. An elevation view of the wall which shall indicate the elevations at the top of the wall at all horizontal and vertical break points and at least every 50 ft. (15 m) along the face of the wall, all steps in the footings or leveling pads, the original and final ground lines, the maximum bearing pressures, and the summary of quantities for each wall.
2. A plan view of the wall which shall indicate the offsets from the construction centerline to the face of the wall at all changes in horizontal alignment and the centerline of any drainage structure or drainage pipe behind, passing through, or under the wall.
3. A typical cross section or cross sections showing elevation relationship between existing ground conditions and proposed grades.
4. All general notes required for constructing the wall. The required batter to compensate for the wall movement during erection shall be shown for each different required height.
5. All horizontal and vertical curve data affecting the wall.
6. All details for footings or leveling pads shall be shown including details for steps in the footings or leveling pads.
7. All details for construction of walls with appurtenances behind, under, mounted upon, or passing through the wall such as drainage structures or utilities shall be clearly indicated.
8. The wall manufacturer shall submit copies of their Quality Assurance/Quality Control Manuals on each project.
9. Required architectural treatments shall be as indicated and as detailed in the plans. All details for any required architectural treatments shall be shown including:
  - a. Product data and installation instructions for manufactured form systems, form liners, release agents, ties, and

#### 626.4.1

accessories. The release agent manufacturer shall certify that the products supplied comply with regulations controlling the use of volatile organic compounds (VOC's).

- b. Shop drawings for fabrication and erection. These drawings shall show all items that visually affect the exposed concrete, including, but not limited to, general form construction, jointing, specially formed joints or reveals, and patterns of placement. The Engineer's review will be for general architectural applications and features only. Formwork design for structural stability and sufficiency is the Contractor's responsibility and shall not be submitted for the Engineer's review.
- c. Mockup or Sample Facing elements. The Contractor shall construct a mockup or sample facing element using the proposed formwork and facing materials in order to demonstrate the required finishes and textures. Actual construction of concrete shall not proceed until the Engineer has accepted the sample units.

At the time the detail plans are submitted for review, they shall be accompanied by design calculations and explanatory wall notes. These documents shall be legible and shall demonstrate that the design criteria have been met. Specified minimum factors of safety and the maximum soil pressure beneath the wall footing or earth stabilized mass shall be clearly indicated.

The plans shall be prepared on reproducible sheets 22 x 34 inches (550 mm x 850 mm) including borders. Each sheet shall have a title block in the lower right hand corner. The title block shall include the sheet number of the drawing, name or designation of the wall, the state and federal project designation, project name, fabricator and Contractor name. Design calculations and notes shall be prepared on sheets 8½ x 11 inches (216 mm x 280 mm), and shall contain the project designation, wall designation, date of preparation, initials of designer and checker, and page number at the top of the page. The Detail Plans, Design Calculations, and Explanatory Notes shall be signed and stamped by a Professional Engineer registered in West Virginia and knowledgeable in the proposed alternative wall system.

The initial submission shall include three sets of the detail plans, calculations, and notes. One set of notes and plans will be returned to the Contractor with any indicated corrections. When the plans and notes are stamped approved by the Engineer, the Contractor shall furnish the Engineer with the requested number of sets of prints and a Mylar set of the plans for distribution by the Division. The Contractor shall perform no work or ordering of materials for the structures until the Engineer has approved the submittal.

**626.4.2 - Mechanically Stabilized Earth:** The details and material specifications for the wall facing elements and incidental accessories shall be included with the detail plans for approval by the Engineer.

The designation as to the type of facing element, the length of the soil reinforcing systems, the distance along the face of the wall where changes in lengths of the soil reinforcing systems occur, and the limit of mesh, strip, or anchor shall be clearly shown in the plans.

All wall facing elements shall be detailed. The details shall show all dimensions necessary to construct the element, all reinforcing steel in the element, and the location of soil reinforcing system attachment devices embedded in the elements.

**626.4.3 - Cast-in-Place Reinforced Concrete:** The plans for the cast-in-place wall shall contain a complete reinforcing bar schedule showing all bending details and bar marks. The plans shall also show the location of all construction joints, expansion joints, or other joints in the wall. All wall thickness shall be shown and transition details at wall thickness changes.

## **626.5 - MATERIALS:**

**626.5.1 - Mechanically Stabilized Earth Components:** The Contractor shall make arrangements to purchase the facing elements, reinforcing mesh or strips, attachment devices, joint materials, and all other necessary components. Materials not conforming to this section of the specifications or from sources not listed in the contract documents shall not be used without written consent from the Engineer.

### **626.5.1.1 – Facing Elements:**

**626.5.1.1.1 – Reinforced Concrete Facing Elements:** The facing elements shall be fabricated in accordance with Section 601 of the Standard Specifications with the following exceptions and additions:

- A. Concrete for the reinforced concrete facing elements shall attain a minimum compressive strength of 4,000 psi (27 Mpa) at 28 days. All concrete shall have air entrainment of 7 % plus or minus 2.5 % with no other additives. Specified concrete properties are to be tested in accordance with applicable provision of Section 601.4.1 of the Standard Specifications. Acceptance of a Production LOT will be made if the compressive strength test result is greater than or equal to, 4,000 psi (27 Mpa). A Production LOT is defined as a group of elements that will be represented by a single compressive strength sample and will consist of a single day's production. A minimum of two cylinders shall be required for every compressive strength sample.

### 626.5.1.1.1

- B. The units shall be fully supported until the concrete reaches a minimum compressive strength of 1,000 psi (7 Mpa).
- C. Unless otherwise indicated in the plans or elsewhere in the specifications, the concrete surface for the front face shall have a Class 1 finish as defined by Section 601.11 and a uniform surface finish for the rear face. The rear face of the element shall be screeded to eliminate open pockets of aggregate and surface distortions in excess of ¼ inch (6 mm). The elements shall be cast on a flat area. The clevis loops, tie strip guide, or other galvanized devices shall not contact or be attached to the face element reinforcement steel.
- D. The date of manufacture, the Production LOT number, and the piece mark shall be clearly scribed on an unexposed face of each element.
- E. All units shall be handled, stored, and shipped in such a manner as to eliminate the dangers of chipping, discoloration, cracks, fractures, and excessive bending stresses. Elements in storage shall be supported in firm blocking to protect the element connection devices and the exposed exterior finish.
- F. All units shall be manufactured within the following tolerances:
  - 1. Element Dimensions: Position of element connection devices within 1 in. (25 mm), except for coil and loop embeds which shall be 3/16 inch (5 mm). All other dimensions within 3/16 inch (5 mm).
  - 2. Element Squareness: Squareness as determined by the difference between the two diagonals shall not exceed ½ in. (13 mm).
  - 3. Element Surface Finish: Surface defects on smooth formed surfaces measured over a length of 5 feet (1.5 m) shall not exceed ¼ in. (6 mm). Surface defects on the textured-finished surfaces measured over a length of 5 feet shall not exceed 5/16 in. (8 mm).

Units shall be rejected because of failure to meet any of the requirements specified above. In addition, any or all of the following defects shall be sufficient cause for rejection:

- 1. Defects that indicate imperfect molding.

## 626.5.1.1

2. Defects indicating honeycombed or open textured concrete.
3. Cracked or severely chipped elements.
4. Color variation on front face of element due to excess form oil or other reasons.

All reinforcing steel shall be in accordance with Section 602 of the Standard Specifications and shall be epoxy coated.

**626.5.1.1.2 – Modular Block Facings:** The length and width of each block shall be within  $\pm 1/8$  inch (3.2 mm). The height of each block shall be within  $\pm 1/16$  inch (1.6 mm). Hollow units shall have a minimum wall thickness of 1.25 inch (32 mm). When a broken face finish is used the dimension of the front face shall be within 1 inch (25 mm) of the theoretical dimension of the unit.

All units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or performance of the construction. Cracks greater than  $1/64$  inch (0.5 mm) wide and greater than 25% of the block height is grounds for rejection.

The front face or faces of units that are to be exposed shall be free of chips, cracks or other imperfections that can be seen when viewed from a distance of 30 feet (10 m) under diffused lighting. Up to 5% of the shipment may contain slight cracks or small chips not larger than 1 inch (25 mm).

Color and finish shall be shown on the shop drawings and shall be erected with a running bond configuration.

When cap units are used they shall be cast to or attached to the top of the modular block wall in strict accordance with the manufacturer's recommended procedure.

**626.5.1.1.2.1 – Mix Design:** Each manufacturing facility shall provide a copy of their mix design, including test results and material sources, to the MCS&T Division for each type of block. An approved independent lab shall perform the testing when establishing the mix design. The manufacturing facility shall submit to MCS&T Division yearly test results, from an approved independent lab, to verify each mix design. If there are any changes in the mix, such as changes in material sources, any materials such as pigments are added, or the pigment color is changed, then a new mix design is required. The modular block units shall conform to the following:

### 626.5.1.1

All of the units shall conform to ASTM C 1372, except that:

- (a) The minimum compressive strength requirements shall be 4000 Psi (28 Mpa) for any individual unit. The average of five units shall be used as the mix design strength.
- (b) The maximum 24 hour water absorption shall not exceed 7 %. The average of five units shall be used as the mix design absorption.
- (c) The freeze/thaw durability of wall units tested in accordance with ASTM C 1262 in a 3% saline solution shall be the minimum of the following:
  - 1) The weight loss of each of five test specimens at the conclusion of 90 cycles shall not exceed 1% of its initial weight.
  - 2) The weight loss of each of 4 of the 5 test specimens at the conclusion of 100 cycles shall not exceed 1.5% of its initial weight, with the maximum allowable weight loss for the 5<sup>th</sup> specimen to not exceed 10%.
- (d) The freeze/thaw durability of cap units shall be tested in accordance with ASTM C 1262 in a 3% saline solution shall be the minimum of the following:
  - 1) The weight loss of each of five test specimens at the conclusion of 40 cycles shall not exceed 1% of its initial weight;
  - 2) The weight loss of each of 4 of the 5 test specimens at the conclusion of 50 cycles shall not exceed 1.5% of its initial weight, with the maximum allowable weight loss for the 5<sup>th</sup> specimen not to exceed 10%.
- (e) ASTM C 1262 test results shall be recorded and reported in 10 cycle intervals.

**626.5.1.1.2.2 – Modular Block Production:** Each manufacturing facility shall provide the Engineer with a copy of their quality control plan and procedures.

Sampling and Testing shall conform to ASTM C 140, except:

Section 6.2.4 shall be deleted and replaced with the following:

"The specimens shall be coupons cut from a face shell of each unit and sawn to remove any face shell projections. The coupon size shall have a height to thickness ratio of 2 to 1 before capping and a length to thickness ratio of 4 to 1. The coupon shall be cut from the unit such that the coupon height dimension is in the same direction as the unit height dimension. Compressive testing of full size units will not be permitted. The compressive strength of the coupon shall be assumed to represent the net area compressive strength of the whole unit."

Each manufacturing facility is required to sample and test each block type at the rate of one sample per 5000 units of continuous production from each mix design or fraction thereof (if production is interrupted) as part of their overall quality control testing. Each manufacturing facility shall forward all quality control test reports and documentation to the MCS&T Division. The manufacturing facility or other testing facilities may perform this quality control testing.

### 626.5.1.1.2.3

The average compressive strength of each lot of the modular block units shall be a minimum of 90% of the mix design strength, and the average absorption of each lot shall be between 1.5% less than to 0.5% greater than the mix design absorption. If the compressive strength or absorption criteria are not met, then the modular block in that lot are rejected and cannot be incorporated into the work unless that lot is tested and found to be acceptable under section 626.5.1.1.2.1.

Cap units and wall units shall be sampled and tested as separate block types.

Minimum manufacturer testing shall include 6 randomly selected units and the following testing:

- a. Compressive strength (average of 3 units)
- b. 24 hour absorption (average of 3 units)

The MCS&T Division will randomly select 6 units for testing by the Division for every 15 000 units of continuous production from each mix design or fraction thereof (if production is interrupted). MCS&T may require the manufacturer to conduct freeze/thaw durability testing when inconsistencies in the test results arise.

**626.5.1.1.2.3 – Sealing:** All modular block retaining wall surfaces shall be sealed. This work shall consist of preparation, furnishing and applying the surface sealer to the exposed front face, of all the wall units, as well as the back side of the upper courses of the wall layer of reinforcement, and the top of the uppermost block or cap unit.

Surface sealers shall be one of the approved from the list for Modular Block Use.

Due to the potentially hazardous ingredients contained in sealer formulations extreme care must be exercised in their handling and use, and the manufacturer's recommendations shall be closely followed.

Construction Requirements:

1. The Contractor shall comply with the manufacturer's written instructions for preparing, handling and applying the surface sealer.
2. The surface to be treated shall receive a light water-blast to the extent that the surface is clean and free of oils.
3. Before the surface sealer is applied, the surface shall be dry and free of all dust, debris, and frost.
4. Surface sealers shall be applied at the heaviest application rate specified by the manufacturer.

### **626.5.1.1.3**

All materials and work performed as specified above will be incidental to the construction of the wall.

**626.5.1.1.3 – Wire Facings:** Wire facing shall be shop fabricated of cold drawn steel wire conforming to the minimum requirements of AASHTO M 32 M/M 32 and welded into the finished configuration in accordance with AASHTO M 55 M/M 55. Galvanizing shall conform to the minimum requirements of AASHTO M 111.

Retention material shall be placed along the back face of the wire facing to retain the backfill behind the wall. Retention material shall be capable of retaining the backfill, UV resistant and shall have a high permittivity.

**626.5.1.2 - Soil Reinforcing and Attachment Devices:** All reinforcing and attachment devices shall be carefully inspected to insure they are true to size and free from defects that may impair their strength and durability. Ensure that pins used to align the precast components during construction are of the size, shape and material required for the wall system chosen.

#### **626.5.1.2.1 – Metal Soil Reinforcing or Attachment Devices:**

Cutting of reinforcing strips or mesh at vertical obstacles shall not be permitted. Care must be taken to avoid damage to the galvanized coating during handling, storing, and shipping.

The following requirements shall apply to all soil reinforcing and attachment devices.

- A) Reinforcing strips shall be hot rolled from bars to the required shape and dimensions. Their physical and mechanical properties shall conform to ASTM A-36. Galvanization shall be required and shall conform to the minimum requirements of AASHTO M-111.
- B) Reinforcing mesh shall be shop fabricated of cold drawn steel wire conforming to the requirements of paragraph one of Section 709.4. Galvanization shall be applied after the mesh is fabricated and shall conform to the minimum requirements of AASHTO M-111.
- C) The tie strips shall be shop fabricated of a hot rolled steel conforming to the minimum requirements of ASTM A-570, Grade 50 or equivalent. Galvanization shall be required and shall conform to AASHTO M-111.
- D) Loop embedments shall be fabricated of cold drawn steel wire conforming to ASTM A-510, UNS G-10350 or AASHTO M-32. Loop embeds shall be welded in accordance with ASTM A-185.

Both shall be galvanized in accordance with ASTM B-633 or AASHTO M-111.

- E) Bolts shall meet the requirements of AASHTO M-164. Nuts shall meet the requirements of AASHTO M-291 Grade DH or AASHTO M-292 2H. Fasteners shall be galvanized in accordance with AASHTO M-232.
- F) Connector pins and mat bars shall be fabricated from cold drawn steel conforming to AASHTO M-32 and welded to the soil reinforcement mats as shown in the plans. Galvanization shall be required and shall conform to AASHTO M-111.

#### **626.5.1.2.2 – Geosynthetics Soil Reinforcing or Attachment Devices:**

Cutting of geosynthetic reinforcing longitudinal to the wall face at vertical obstacles shall not be permitted. End to End splicing of geosynthetic material will not be permitted.

The geosynthetic used shall meet the minimum requirements shown on the shop drawings. Each roll of geosynthetic material shall be labeled as to its properties. Geosynthetics shall be made of polypropylene, high-density polyethylene or high-tenacity polyester fibers having cross-sections sufficient to permit significant mechanical interlock with the soil/backfill. Geosynthetics shall have a high tensile modulus in relation to the soil/backfill. Geosynthetics shall have a high resistance to deformation under sustained long term design loads while in service and resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.

Store the geosynthetics in conditions above 20°F [-7°C] and not greater than 140°F [60°C]. Prevent mud, wet cement, epoxy, and like materials from coming into contact with and affixing to the geosynthetic material. Rolled geosynthetic may be laid flat or stood on end for storage. Cover the geosynthetic and protect from sunlight prior to placement in the wall system.

Carefully inspect all reinforcement to ensure they are the proper size and free from defects that may impair their strength and durability.

The geosynthetic reinforcement structure shall be dimensionally stable and able to retain its geometry under construction stresses and shall have high resistance to damage during construction. The contractor shall submit a manufacturer's certification that the geosynthetics supplied meets the design criteria shown on the shop drawings, measured in full accordance with all test methods and standards specified. In case of dispute over validity of values, the Engineer can require the contractor to supply test data from an approved laboratory to support the certified values submitted.

The Contractor's submittal's package shall include actual test results for tension/creep, durability/aging, construction damage, pullout, quality control and a copy of the Manufacturers installation procedures. Also

### 626.5.1.2.2

included should be the Long -Term Design Strength (**LTDS**) of the Geosynthetic material. The Manufacturer shall also provide written certification that all resin used to produce the geosynthetic is virgin and classified as high density polyethylene, polypropylene, or high tenacity polyester and is capable of withstanding direct exposure to sunlight for 14 days with no measurable deterioration as per **ASTM D4355**.

The allowable tensile strength shall not exceed 30% for class 1 walls and 25% for all other walls of the ultimate tensile strength of the reinforcement used. The allowable tensile properties of geosynthetic reinforcement as shown on the shop drawings shall be calculated using the following method.

<u>Property</u>	<u>Method</u>
Tensile Strength	
Ultimate, kN/m	ASTM D4595
Long-term ( $T_a$ ), kN/m	FHWA/SA-93-025

**Where:**  $T_a = T_{ult} / \{ (RF_{cr})(RF_{id})(RF_{du}) \}$   
(as described in FHWA/SA-93-025)

**$T_{ult}$ ,** Ultimate Tensile Strength shall be the minimum average roll value ultimate tensile strength as tested per ASTM D4595.

**$RF_{cr}$ ,** Partial Factor for Creep Deformation, is the ratio of  $T_{ult}$  to the creep limited strength determined in accordance with ASTM D5262. The test results shall be extrapolated for a 100 year design life per GRI GG4. Creep performance data of a polymer product at a designed temperature is limited to one order of magnitude in extrapolation. Creep performance data at an elevated temperature permits an additional order of magnitude in extrapolation with time temperature superposition principals. Elevated temperature testing of the specific geogrid for 10,000 hours or creep testing at room temperature for 100,000 hours is required. Creep limited strength testing is required on representative samples of the finished product for each product proposed for use and not a single component of the geogrid (i.e. polymer strand). Default values for  $RF_{cr}$  are not allowed.

**$RF_{id}$ ,** Partial Factor for Installation Damage, shall be determined from construction damage tests for each product proposed for use with project specific representative or more severe backfill and construction techniques. The backfill soil used if other than project specific, shall have a  $D_{50} > 1''$  (30mm) sieve. Testing shall be consistent with GRI GG4. A Maximum  $RF_{id}$  value shall be used if such testing has not been conducted.

RECOMMENDED VALUES FOR $RF_{id}$		
Geosynthetic	Min $RF_{id}$	Max $RF_{id}$
HDPE uniaxial geogrid	1.20	1.45
PP biaxial geogrid	1.20	1.45
PVC – coated PET geogrid	1.30	1.85
Acrylic – coated PET geogrid	1.30	2.05
Woven geotextiles (PP and PET)	1.40	2.20
Nonwoven geotextiles (PP and PET)	1.40	2.50
Silt – film woven PP geotextiles	1.60	3.00

**$RF_{du}$** , Partial Factor for Durability / Aging is the combined partial factor for potential chemical and biological degradation.  $RF_{du}$  shall be determined from polymer specific (HDPE and PP as identified by specific gravity and melt flow index and PETP as identified by CEG number and intrinsic viscosity) durability testing covering the range of expected soil environments. Prior to approval by the Engineer, the manufacturer shall submit test results from a minimum of at least four (4) tests conducted in accordance with EPA 9090 at temperatures of 23° and 50° C. EPA 9090 test results shall include the following minimum number of leachate types:

**pH    Minimum # of test results**

3≤pH≤7	1
7<pH≤9	1
9<pH<11	1
11≤pH≤14	1

As a minimum, the following tests should be performed for geogrids after immersion in the above-described leachates:

<u>TEST</u>	<u>TEST PROCEDURE</u>	<u>MAX % CHANGE ALLOWED</u>
Mass per Unit Area	EPA 9090	±1.0
Dimensions	EPA 9090	±1.0
Thickness	ASTM D374C	±5.0
Wide Width Strip	ASTM D4595	-2.0
Tensile		

$FS_d$  shall not be less than the recommended minimum values discussed in FHWA/RD-89-186 and listed below:

High Density Polyethylene (HDPE)	1.10
Coated High Tenacity Polyester (PETP)	1.15
Polypropylene (PP)	1.25
Geotextiles	1.60
Uncoated High Tenacity Polyester (PETP)	1.60

### 626.5.1.3

- Composite (flexible/coated) geogrids shall be evaluated based on the durability characteristics of the interior reinforcement polymer. Therefore, any protective coating shall be removed prior to durability testing unless a minimum 40-micron coating thickness is used on flexible geogrids and certified by the manufacturer.
- For soils of potential concern, as presented below (modified soils shall include lime stabilized soil, cement stabilized soil or concrete), only polymers listed as “no effect” shall be used within or adjacent to (3 feet shortest measurable distance) these soil environments (Ref: Table 28, FHWA/RD-89-186).

<u>SOIL ENVIRONMENT</u>	<u>PETP</u>	<u>PE</u>	<u>PP</u>	<u>PVC</u>
Acid Sulfate Soils	?	NE	?	?
Organic Soils	NE	NE	NE	?
Salt Affected Soils	?	NE	NE	NE
Ferroginous	NE	NE	X	?
Calcareous	X	NE	NE	?
Modified Soils	X	NE	NE	?

NE = No Effect

? = Questionable Use

X = Not Recommended

<b>RECOMMENDED MINIMUM VALUES FOR <math>RF_{du}</math></b>					
Products	Aging Reduction factor, $RF_{du}$ – 100 years				
	pH ≤ 3	3 < pH ≤ 5	5 < pH < 8	8 ≤ pH < 9	pH ≤ 9
<b>PET Geotextiles</b> Mn < 20,000 40 < GEG < 50	*	2.0	1.6	2.0	*
<b>PET Coated Geogrids</b> Mn > 25,000 GEG < 30	*	1.3	1.15	1.3	*
<b>Polypropylene &amp; HDPE Geogrids</b>	1.1	1.1	1.1	1.1	1.1
* use of materials in this pH range is not recommended but can be used if product specific testing is done.					

**626.5.1.3. - Joint Materials:** Joint materials are to be installed to the dimensions and thicknesses in accordance with the plans or approved shop drawings, unless otherwise indicated:

- Provide either preformed EPDM rubber pads conforming to ASTM D-2000 for 4AA, 812 rubbers; neoprene elastomeric

### 626.5.3.1

pads have a Durometer Hardness of  $55 \pm 5$ ; or polyethylene bearing pads meeting the density requirements of ASTM D-1505 in horizontal joints between elements.

- B. Cover all joints between elements on the backside of the wall with a geotextile fabric that meets the requirements of Section 715.11.4 of the Standard Specifications. The minimum width and lap of the fabric shall be as follows:

Vertical and horizontal joints: 12”(300 mm); lap-4”(100 mm).

**626.5.1.4 - Acceptance:** The Contractor shall furnish the Engineer a Certificate of Compliance certifying the above materials comply with the applicable contract specifications.

**626.5.2 - Concrete Leveling Pad:** All concrete used in the leveling pad shall as a minimum conform to Section 601 of the Standard Specifications for Class C Concrete.

### 626.5.3 - Select Granular Backfill

**626.5.3.1- Test Requirements:** All backfill material used in the structure volume shall conform to the following gradation limits as determined by AASHTO T-27:

Sieve Size	Percent Passing
4 inches (100 mm)	100
No. 40 (375 $\mu$ m)	0 - 60
No. 200 (75 $\mu$ m)	0 - 15

The backfill shall conform to the following additional requirements:

- A. The plasticity index (P.I.) as determined by AASHTO T-90 shall not exceed 6, or the material is described as non-plastic.
- B. The material shall exhibit an angle of internal friction of not less than 34 degrees, as determined by the standard Direct Shear Test, utilizing a sample of the material compacted to 95% of AASHTO T-99, Methods C or D (with oversized correction as outlined in Note 7) at optimum moisture content. No testing is required for backfills where 80% of sizes are greater than  $\frac{3}{4}$  in. (19 mm).
- C. Soundness: The materials shall be substantially free of shale or other soft, poor durability particles. The material shall have a magnesium sulfate soundness loss of less than 30% after four cycles as determined by AASHTO T-104, or a sodium sulfate loss of less than 15% after five cycles as determined in accordance with AASHTO T-104.

D. Electrochemical Requirements: The backfill materials shall meet the following criteria:

Requirements	Test Methods
***Resistivity greater than 3,000 ohm Centimeters	AASHTO T-288
**Ph 5-10	AASHTO T-289
*Chlorides less than 100 parts per million	AASHTO T-291
*Sulfates less than 200 parts per million	AASHTO T-290
Organic Content: 1% maximum	AASHTO T-267

\* If resistivity is greater than 5,000 ohm-cm, the chlorides and sulfates requirements may be waived. Requirement is waived if geosynthetics are used for soil reinforcements and attachment devices.

\*\* May be adjusted if geosynthetic material is used for soil reinforcements or attachment devices see shop drawings and section 626.5.1.2.2.

\*\*\* Requirement is waived if geosynthetics are used for reinforcements and attachment devices.

**626.5.3.2 - Quality Control Testing:** Quality control of the select granular material is the responsibility of the contractor as specified in 106.1.

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

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

**626.5.3.3 - Sampling and Testing:** Frequency of sampling and testing shall be in accordance with the Contractor's Quality Control Plan. The minimum frequencies for gradation and plastic limits shall be as stated in MP 717.04.21, Table D, for subgrade.

**626.5.3.4 - Acceptance:** The Contractor shall furnish certified test results that the select granular backfill meets the contract specifications. The test results for the select granular backfill shall not be used to verify compliance for a period exceeding one year. The Division may request that the tests be performed at any time if the material changes. Additional tests

## 626.6.1.2

for gradations and plastic limits shall be determined during the placement of the material.

Acceptance for compaction shall be on a LOT-by-LOT basis. A LOT shall be divided into five approximately equal sized sub-lots. A sub-lot shall consist of the quantity of material to backfill a single lift for 100 feet (30 m) of wall and at least one test per lift. One nuclear moisture and density measurement shall be made at a random location within each of the five sub-lots according to MP 207.07.20 for material having less than 40% retained on the  $\frac{3}{4}$  in. (75 mm) sieve and MP 700.00.24 for material having 40% or more retained on the  $\frac{3}{4}$  in. (75 mm) sieve. The moisture tolerance shall be from optimum to two percentage points below optimum. The random locations shall be determined in accordance with MP 712.21.26. The target percentage of dry density shall be 95%. For applications where spread footings are used to support a bridge or other structural loads, the target percentage of dry density shall be 100%. If the results of five density tests on a LOT indicates that at least 80% of the material, in accordance with 106.3.1 (West Virginia AP-A), has been compacted to the specified target percentage of dry density, the LOT will be accepted. If less than 80 % has been compacted to the specified target percentage of dry density and/or the moisture content is outside the tolerance range, no additional material shall be placed until the LOT has been reworked to meet the specified requirements. Reworking and retesting shall be at the expense of the Contractor. When the Division performs the testing in the evaluation of reworked LOTs, the testing will be at the expense of the Contractor at the unit cost specified in 109.2.2.

The backfill material must compact to a stable condition. If the material is not stable under the weight of construction equipment, the contractor must correct the problem or replace the material even if test results indicate that the material meets the moisture and density specifications.

## 626.6 - CONSTRUCTION METHODS:

### 626.6.1 - Mechanically Stabilized Earth:

**626.6.1.1 - Foundation Preparation:** The foundation for the structure shall be graded level for a width equal to the length of reinforcement elements plus one (1) foot (300 mm) or as shown in the plans. Prior to wall construction, except where constructed on rock, the foundation shall be compacted with a smooth wheel vibratory roller. Any foundation soils found to be unsuitable shall be removed and replaced with select granular backfill as per Section 614.5.1.4 of the specifications.

**626.6.1.2 - Wall Erection:** A MSE wall supplier representative shall be present a minimum of three (3) days and as required thereafter during erection of the wall to assist the fabricator, contractor, and Engineer. The cost of the representative shall be considered incidental to the unit price of the MSE Wall System.

### 626.6.1.3

When facing elements are handled by means of lifting devices they shall be lifted by connecting to the upper edge of the element.

Facing elements shall be placed so that their final position is vertical or battered as shown in the plans. Facing elements shall be placed in successive horizontal lifts in the sequence shown in the plans as backfill placement proceeds. As backfill material is placed behind the elements, the elements shall be maintained in position by means of temporary wedges or bracing according to the wall supplier's recommendations. The Contractor shall not have more than two levels of temporary wedges in place at any time during wall erection. Concrete facing vertical tolerances and horizontal alignment tolerances shall not exceed  $\frac{3}{4}$  in. (19 mm). The overall vertical tolerance of the wall (top to bottom) shall not exceed  $\frac{1}{2}$  in. (13 mm) per 10 feet (3 m) of wall height.

Reinforcement elements shall be placed normal to the face of the wall, unless otherwise shown in the plans. Prior to placement of the reinforcing elements, backfill shall be compacted in accordance with these Specifications.

**626.6.1.3 - Backfill Placement:** Backfill placement shall closely follow erection of each course of facing elements. Backfill shall be placed in such a manner as to avoid any damage or disturbance of the wall materials or misalignment of the facing or reinforcing elements. Any wall materials that become damaged during backfill placement shall be removed and replaced at the Contractor's expense. The Contractor at his expense shall correct any misalignment or distortion of the wall facing elements due to placement of backfill outside the limits of this specification. At each reinforcement level, the backfill shall be placed to the level of the connection. Backfill placement methods near the facing shall assure that no voids exist directly beneath the reinforcing elements.

The backfill required to be placed in front of the wall, from the leveling pad to finished ground, shall be placed immediately after the select granular backfill is above the first layer of soil reinforcing.

The maximum lift thickness after compaction shall not exceed 6 inches (150 mm) unless approved by the Engineer. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density.

The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Backfill materials shall have placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniformly acceptable throughout the entire lift.

Compaction within 3 ft. (900 mm) of back face of the wall shall be achieved by at least three passes of a lightweight mechanical tamper, roller, or vibratory system.

At the end of each day's operation, the Contractor shall slope the last level of the backfill away from the wall facing to rapidly direct runoff away

from the wall face. In addition, the Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

One foot (300 mm) behind the modular block units and the modular block unit cores shall be filled with crushed granular material with less than 2% passing the #200 (75  $\mu$ m) sieve and shall be consistent with the manufacture recommendation. If the modular block unit cores are not accessible the engineer may upon the advise of the wall designer omit the fill in the modular block cores.

## **626.6.2 - Cast-in-Place Reinforced Concrete:**

**626.6.2.1 - General:** Except as otherwise shown in the plans or herein, construction methods for cast-in-place retaining walls shall comply with the Standard Specifications.

Construction methods for the following shall be per the indicated section of the Standard Specifications:

<u>Item</u>	<u>Section</u>
Unclassified Borrow Excavation	211
Structure Excavation	212
Wet Excavation	212
Rock Excavation	212
Select Material for Backfilling	212
Concrete	601
Reinforcing Steel	602

## **626.6.2.2 - Architectural Forms:**

**626.6.2.2.1 - General:** Construct forms to sizes, shapes, lines, and dimensions shown, and as required to obtain accurate alignment, location, level, and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, chamfers, blocking, screeds, bulkheads, and other items as required.

Fabricate forms to prevent cement paste from leaking while placing concrete and for easy removal without hammering or prying against exposed concrete surfaces. Provide crush plates where stripping might damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete. Solidly butt joints and provide backup material at joints to prevent leakage and fins. Assemble forms so that they may be easily removed without damaging exposed concrete surfaces.

Provide temporary form openings where inaccessible formwork interior can be cleaned and inspected before placing concrete. Place temporary form openings as inconspicuously as possible, consistent with project requirements.

When drilling forms used for exposed concrete, drill from the contact face to the outside to suit the ties used and to prevent leakage of

### 626.6.2.2

concrete mortar. Do not splinter the forms by driving ties through improperly prepared holes.

Unless otherwise shown in the plans:

- Provide sharp, clean corners at intersecting planes with no visible edges or offsets; or provide accurately formed chamfered corners using  $\frac{3}{4} \times \frac{3}{4}$  inch (19 x 19 mm) strips, surfaced to produce uniformly straight lines and tight edge joints.

**626.6.2.2.2 - Form Coatings:** Coat form contact surfaces with form-release agent before placing reinforcement. Do not allow excess material to accumulate in forms or to come into contact with reinforcement or surfaces that will be bonded to fresh concrete. Apply coating according to manufacturer's instructions.

Coat steel forms with non-staining, rust-preventative release agent, or otherwise protect from rusting. Rust-stained steel formwork is not acceptable.

**626.6.2.2.3 - Reusing Forms:** Split, frayed, delaminated, or otherwise damaged form-facing materials are not acceptable. Clean and apply a new form-release agent to concrete contact surfaces.

## 626.7 - METHOD OF MEASUREMENT:

**626.7.1 - General:** The unit of measurements shall be the gross area in square feet (square meters) lying in a plane outside the front face of the structure as determined by the dimensions in the contract documents. The gross area shall not include barriers, footings, or leveling pads. The gross area shall be the number of square feet (square meters) established in the proposal, subject to adjustment as provided in Sections 104.2 and 109.2 of the Standard Specifications. No adjustment of pay quantity shall be allowed for changes in wall design to facilitate the Contractor's methods of construction of wall type.

Unless otherwise specified in the contract documents, items such as concrete barriers that are not part of normal retaining wall construction shall be measured separately for payment.

The quantity of earthwork shown in the plans does not include any work within the wall pay limits shown in the plans. Any adjustments to the required amount of embankment or select granular backfill due to the particular wall system proposed by the contractor shall be considered incidental to the project. No separate payment shall be made for increased embankment or increased select granular backfill requirements. The Contractor shall be responsible for any of the cost of changes in waste, borrow, or earthwork quantities from those shown in the plans caused by the requirements of the proposed wall system.

**626.7.2 - Mechanically Stabilized Earth:** The unit price shall include in place: facing elements, soil reinforcing and attachment devices

and associated hardware, coping and trim, or similar items that are normal parts of wall construction. No separate measurement of these items shall be made.

The unit price shall also include, in place, all the following items shown within the wall pay limits in the plans: select granular backfill, excavation, embankment, foundation preparation, and leveling pads. No separate measurement of these items shall be made.

**626.7.3 - Cast-in-Place Reinforced Concrete:** The unit price shall include in place: concrete, reinforcing, joint materials, underdrains, weepholes, or similar items that are normal parts of wall construction. No separate measurement of these items shall be made.

The unit price shall also include in place: all the following items shown within the wall pay limits in the plans: select material for backfilling, excavation, embankment, and foundation preparation. No separate measurement of these items shall be made.

### **626.8 - BASIS OF PAYMENT:**

The quantities, determined as provided above, will be paid for at the contract price per unit of measurement, respectively, for each pay item listed below and shown in the bid schedule, which prices and payment will be full compensation for the work prescribed in this section.

### **626.9 - PAY ITEMS:**

<b>ITEM</b>	<b>DESCRIPTION</b>	<b>UNIT</b>
626001-*	RETAINING WALL, CAST-IN-PLACE REINFORCED CONCRETE	SQUARE FOOT (METER)
626002-*	MSE RETAINING WALL, "vender name"	SQUARE FOOT (METER)
626003-*	MSE MODULAR BLOCK RETAINING WALL, CLASS "class", "vender name"	SQUARE FOOT (METER)
626004-*	MSE WIRE FACE RETAINING WALL, "vender name"	SQUARE FOOT (METER)

\*Sequence number

class – From approved vender list

## **SECTION 636 MAINTAINING TRAFFIC**

### **636.23.6**

DELETE THE ADDRESS AND SUBSTITUTE THE FOLLOWING ADDRESS:

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

## 636.19

### 636.19-CHANGEABLE MESSAGE SIGN:

DELETE ENTIRE SECTION AND REPLACE WITH THE FOLLOWING:

### 636.19- PORTABLE MESSAGE SIGNS:

**636.19.1 – General:** Portable Message signs shall consist of the furnishing, installing and maintaining of a variable message sign on a portable trailer. Each unit shall be self-contained and consist of a display board, controller, power supply, electrical cable and adjustable height structural support system. It shall be equipped to accept power supply from a completely self-contained diesel generator, existing commercial electrical service, or battery pack which is recharged automatically by solar panels. The trailer system assemblage shall conform to the laws of the State of West Virginia and all articles of the licensing regulations presently in effect. The sign shall only be attached to its tow vehicle when installation or removal is in progress. The trailer and its leveling jacks shall be designed to keep the unit from changing its deployed position once placed. Devices that lock the wheels and/or leveling jacks into place shall be employed. Sandbagging of the frame and/or leveling jacks is not an acceptable manner of lock down.

The unit shall be kept in good repair at all times. The Contractor shall maintain the device if failures occur. Failure, malfunction or damage to the unit for any reason shall require the Contractor to expedite the repair and furnish adequate signing and flaggers as deemed necessary by the Engineer to safely control traffic through the work area. Maintenance shall include periodic cleaning of the unit.

All parts of the system shall comply with codes annotated in the National Fire Protection Association and Underwriters Laboratory and all local electrical codes. Earth ground shall be tied to the sign's chassis. Lightning protection shall be supplied for the load site.

**636.19.2 – Display:** The Portable Message Sign shall be the disc matrix or LED lamp matrix panel type capable of operating in temperatures from  $-30^{\circ}$  to  $+160^{\circ}$  F ( $-36^{\circ}$  to  $72^{\circ}$  C) and capable of displaying alphanumeric characters and arrows. The sign panel assembly, including the mounting brackets, shall not exceed 128 inches (3.15 meters) in overall width. The bottom of the sign panel shall be a minimum of 7 feet (2.13 m) above the roadway. A minimum character height of 18 inches (450 mm), and character spacing at a minimum of two dots or one half the character width unless otherwise approved by Traffic Engineering Division.

If battery backup (in event of power interruption) is called for on the plans, all functional operations to include sign lighting shall be operational up to two hours. Fluorescent lighting or LED lamp matrix shall be applied

to provide nighttime visibility and the intensity of the sign shall be adjustable by automatically dimming or manual control.

### **636.19.3 – Sign Types:**

**636.19.3.1 - Changeable Message Sign:** The Changeable Message Sign system shall have three (3) lines, unless otherwise noted on the plans and shall conform to the general requirements of 636.19.1. The unit shall have several preprogrammed messages and be capable of programming at least fifty new messages and storing such. The controller shall be housed in a weatherproof lockable cabinet that is accessible from a suitable mounting on the trailer. The controller shall be a microprocessor controller or laptop computer with an incorporated keyboard and CRT that allows the users to access, generate, and store messages. The controller display shall be a miniaturized approximation of the actual display or a message being assembled. The display shall be yellow or amber character on black background, a 7 x 5-character font.

The cycle time and duration of message for a changeable message sign is a function of the highway operating speeds and the size letters displayed. The entire message should be visible at least twice at the operating speed. When traveling at 65 MPH (105 km/h) (freeway speeds), a driver has approximately seven (7) seconds to read the message, resulting in that the message should not be longer than four (4) words or numbers and not longer than two (2) units of information. The message displayed from each unit shall be visible from one-half mile (805 meters).

The sign shall be capable of changing to and displaying a programmed default message or four corner dots flashing in the event of power failure.

**636.19.3.2 – Speed Monitoring Trailer:** A Speed Monitoring Trailer system shall conform to the general requirements of 636.19 and shall consist of a trailer, radar, and display.

**636.19.3.2.1 – Radar:** The radar unit shall be capable of an output in miles per hour (mph) or kilometers per hour (km/h) operating at a frequency of 24.15 GHz (K-Band)  $\pm$  100 MHz accurate to within 3 mph at a target speed of 10 to 199 mph (16 to 230 km/h).

**636.19.3.2.2 – Display:** The display board shall be a minimum two-digit, high brightness, amber and red display on a black background. The system shall be equipped with a violator alert feature. This feature shall change the color of the display from amber to red and flash the speed reading when a vehicle exceeds a programmable speed threshold. This threshold shall be adjustable.

**636.19.4**

**636.19.4 – Placement:** Site selection and message displayed shall be approved by the Engineer. A changeable message sign and a speed monitoring trailer are not to be placed whereas to conflict with one another.

The changeable message sign shall always be located behind the channelizing devices or barriers away from moving traffic lanes. In work zones, it shall be located in clear buffer barricades without reducing the sign's visibility.

**636.23.22-Changeable Message Sign:**

DELETE THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

**636.23.22-Portable Message Sign:**

The quantity of “Changeable Message Sign” and “Speed Motoring Trailer” shall be the actual number of days that the sign is used on the project.

**636.24-BASIS OF PAYMENT:**

ADD THE FOLLOWING AFTER THE 1<sup>ST</sup> PARAGRAPH:

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

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

**636.25 - PAY ITEMS:**

ADD THE FOLLOWING:

ITEM	DESCRIPTION	UNIT
636030-*	SPEED MONITORING TRAILER	PER DAY

\* Sequence Number

## SECTION 637 WATER

### 637.4-METHOD OF MEASUREMENT:

DELETE THE SECOND PARAGRAPH AND REPLACE WITH THE FOLLOWING:

Water used by the Contractor for purposes other than those specifically included in the item shall not be paid for separately.

When the excavation is less than 10,000 cubic yards (meters) and separate payment for water is not included in the plans the water shall be incidental to the work and shall not be paid for separately.

## SECTION 640 FIELD OFFICE AND STORAGE BUILDING

DELETE THE ENTIRE SECTION REPLACE WITH THE FOLLOWING:

### 640.1-DESCRIPTION:

This work shall consist of furnishing and maintaining in good condition suitable offices for the exclusive use of the Engineer as a field office or for making field tests, a storage building for concrete cylinder curing tanks, and equipment for the field office, all in accordance with these Specifications.

### 640.2-MATERIALS:

Not specified.

### 640.3-LOCATION AND TIME OF ERECTION:

The field office and storage building shall be set up at approved locations on or in the immediate vicinity of the Project. They shall be separated from any building used by the Contractor.

The field office and storage building shall be set up, equipped, and made ready for use at least three days prior to the beginning of the work on the project.

### 640.4-FIELD OFFICE:

**640.4.1-General:** The office shall be entirely enclosed, waterproofed, and sealed inside with wall board which will provide efficient insulation against heat and cold. The building shall have a pitched roof and two ventilating louvers, one in each gable, in order to provide for circulation of air between roof and ceiling. The floors shall be double thickness, with building paper between layers, and the ceiling height shall be not less than

#### **640.4.2**

7 feet (2.1 m). All doors, both interior and exterior, shall be equipped with locks. Windows, to furnish natural light, shall be constructed to open and close and shall be provided with latches. Screens shall be provided for all windows and exterior doors, and the building shall be generally flytight. The screen doors shall be equipped with springs and latches.

The office shall be provided with an approved type of heating and cooling equipment that will maintain a comfortable seasonable temperature throughout the project life. It shall be furnished with satisfactory electric lighting and lighting service. A minimum of two duplex convenience outlets shall be provided in each room. The building shall be provided with neat, sanitary, enclosed toilet with exhaust fan accommodations for the exclusive use of the Engineer, and such facilities shall meet the requirements of the State Department of Health or other authorities having jurisdiction. It shall be stocked with lavatory and sanitary supplies at all times during the period of the Contract.

The office shall be attractively painted on the outside and shall be provided with a sign at least 4 feet (1.2 m) by 1 ft. (300 mm), with the sign content as follows:

### **FIELD OFFICE--THE WEST VIRGINIA DIVISION OF HIGHWAYS**

The letters shall not be less than 3 inches (75 mm) high and shall be white on a black background. The sign shall have a white border at least 1½ in. (38 mm) wide.

The office shall be equipped per section 640.10 and shall include OSHA approved steps and entrance porch with railing.

**640.4.2-Large field office:** The large field office shall have a minimum floor space of 800 sq. ft. (80 sq. meters). This may be accomplished by the use of two (2) standard field offices or one large equivalent office. The office shall contain the following additional equipment:

- 1) One office-type desk having at least two drawers on each side and one secretarial-type desk each having minimum top dimension of 30 in. by 60 in. (750mm by 1500mm).
- 2) One plan rack.
- 3) One utility table 30 in. (750mm) high and having top dimensions not less than 30 in. by 72 in. (750 mm by 1800 mm)
- 4) One sanitary-type water cooler supplied with water that shall be kept cooled electrically or with gas.
- 5) One desk model electronic adding machine with, tape totaling a minimum of 10 digits.
- 6) One desk model, and two hand held model electronic calculators (all equipped with scientific functions), with a minimum entry of 10 digits and a minimum readout of 10 digits.

**640.4.3-Standard Field Office:** The standard field office shall have a minimum floor space of 400 sq. ft. (40 square meters) and shall contain two rooms, each with a minimum plan dimension of 20 ft. by 10 ft. (4 by 5 meters). One room shall contain sufficient floor area to include such soil equipment necessary to perform the various compaction control tests as may be required as the work progresses.

**640.4.4-Small Field Office:** The small field office shall have a minimum floor space of 250 sq. ft. (23.2 sq. m) and shall contain two rooms, each with a floor space of approximately 10 ft. by 12 ½ ft. (3.1 by 3.75 m).

**640.4.5-Minimal Field Office:** The field office shall have a minimum floor space of 100 square feet (9.3 square meters) with a minimum plan dimension in one direction of 6 ft. (1.8 m). When a sanitary enclosed toilet is not provided, a chemically treated portable toilet shall be provided. The office shall be furnished with a desk, chair, one fireproof filing cabinet equipped with locks, one desk top copier capable of producing 8½ x 11 and 8½ by 14 copies and a phone, fax and answering (message) machine that utilizes the same phone line. The door for the field office shall be provided with a suitable lock. A sanitary water cooler using bottled water or approved equal shall be provided. The requirements of sections 640.10 and 640.11 shall not apply.

#### **640.5-STORAGE BUILDING:**

The storage building for concrete cylinder tanks shall have a minimum floor space of 80 sq. ft. (7.4 m) preferably 8 feet by 10 feet (2.4 by 3.1 m). The ceiling height shall not be less than 7 feet (2.1 m). The storage building shall be well insulated and capable of maintaining a reasonably constant temperature. It shall be provided with water, as required, and satisfactory electric lighting. Chairs, tables, and stools, as required, shall be furnished.

The Contractor shall furnish curing tanks with sufficient capacity to handle peak cylinder curing requirements. The tanks shall be equipped with thermostatically controlled units which are capable of maintaining specification water temperature in the tanks, and power shall be furnished.

#### **640.6-INSURANCE:**

By the time the field office is made available to the Engineer, the Contractor shall have furnished the Engineer with evidence that insurance has been obtained and is in effect which will protect the Division to the extent of \$20,000.00 (non-deductible) against any loss of its property in the field office and storage building as a result of fire or theft.

This insurance must be kept in effect until office has been vacated, and the evidence of renewal of the policy as necessary must be forwarded to the Engineer.

#### **640.7-MAINTENANCE:**

## **640.8**

The Contractor for the duration of the project shall maintain the field office and storage building in good condition and appearance. No compensation will be allowed for loss by fire or by vandalism caused by non-Division personnel or for loss due to normal wear and tear.

### **640.8-REMOVAL:**

After all field records pertinent to the project have been completed, the office and storage building shall be removed and disposed of by the Contractor and the site cleaned up and left in a neat and acceptable condition. The field office and storage building shall be allowed to remain for 45 days after final acceptance of the project, and shall be completely removed prior to 60 days after final acceptance of the project.

### **640.9-ALTERNATE FOR OFFICE BUILDING:**

The Contractor, in lieu of the field office building, may furnish adequate trailer space equivalent to the minimum floor space requirements. Minimum requirements for heat, lights, toilet facilities, insurance, maintenance, etc., shall be furnished for the trailer as for the office building.

### **640.10-EQUIPMENT:**

The following equipment shall be furnished for any field office.

- 1) One office-type desk having at least two drawers on each side and one secretarial-type desk each having minimum top dimension of 30 in. by 60 in. (750 by 1 500 mm).
- 2) One filing cabinet when the total project bid is less than \$1,000,000; two filing cabinets when the total project bid is \$1,000,000 and less than \$3,000,000; and three filing cabinets when the total project bid is \$3,000,000 or more. Cabinets shall be fireproof, four-drawer, legal size, and equipped with locks.
- 3) One plan rack.
- 4) One utility table 30 in. (750 mm) high and having top dimensions not less than 30 in. (750 mm) by 72 in. (1 800 mm)
- 5) One sanitary-type water cooler supplied with water that shall be kept cooled electrically or with gas.
- 6) One closet extending the full height from floor to ceiling measuring not less than 24 by 30 in. (600 by 750 mm) in plan, having at least two shelves, and equipped with a lock.
- 7) One desk model electronic adding machine with tape totaling a minimum of 10 digits.
- 8) One desk model, and two hand held model electronic calculators (all equipped with scientific functions), with a minimum entry of 10 digits and a minimum readout of 10 digits.
- 9) Comfortable chairs and stools as required.
- 10) The Contractor shall provide at their own expense all utilities and janitor service. Telephone service, limited to the best available

local facilities, shall be furnished unless Plan notes require alternate communication facilities.

- 11) Provide two telephones for a large or standard office and one telephone for a small office. One answering (message) machine shall be provided. Monthly telephone invoices will be paid by the Engineer.
- 12) One table top copier meeting the following minimum requirements:
  - a) Produce 8½ in. by 11 in. (A4 and A3), 8½ in. x 14 in. and 11 in. x 17 in. copies.
  - b) Reduction and enlargement features.
  - c) Produce a minimum of 10,000 copies per month.
  - d) The Contractor shall provide all service and maintenance of the copier.
- 13) Provide one facsimile data processing unit that is compatible with Division's facsimile equipment.
- 14) If any of the equipment items are included as "in-built" in the field office or trailer, they may be omitted from the list.

#### **640.11-COMPUTER SYSTEM FOR FIELD OFFICE:**

Provide one (1) desktop computer system composed of the following minimum components.

1. The Contractor shall supply one (1) desktop computer with the following minimum components:
  - a) Pentium II (Tower or Desktop) or greater
  - b) 32 MB RAM upgradeable to 64 using onboard memory
  - c) 512 K L2 Cache
  - d) 4.0 GB Hard Drive
  - e) 24 x CD ROM may be omitted if item "k" is a CD/RW
  - f) 3.5" diskette
  - g) 4 MB AGP video
  - h) 101 enhanced keyboard and Mouse
  - i) 17" non-Interlaced color monitor with .28 mm or less dot pitch with 1024x768 resolution
  - j) 1 - 56K V.90 Internal Fax/Modem
  - k) Internal tape backup (minimum 250 MC-1/4" removable data cartridge media) or CD R/W (4x write, 8x read minimum)
2. The Contractor shall supply one (1) laser printer with the following minimum components:
  - a) 10 pages per minute
  - b) 2 MB memory
  - c) Parallel interface
  - d) Post Script emulation (Level 2)
  - e) Standard tray with minimum capacity of 200 sheets
3. The following accessories shall be supplied:
  - a) Dust cover for all equipment
  - b) Surge protector

## **640.12**

- c) One (1) box (10 disks) Floppy diskettes
  - d) One (1) box (5 cartridges) ¼” removable data cartridges (If tape drive provided) or 1 box (10 disc) CDR if CD R/W is provided
  - e) Mouse and mouse pad
4. The following software shall be supplied:
- a) One (1) Windows 95 or NT 4.0 package
  - b) One (1) Tape backup package for Windows (latest version)
  - c) One (1) Procomm, Plus communication package for Windows (latest version)
  - d) One (1) Microsoft Office package ‘97
  - e) If the Contract documents specify the use of a CPM Schedule, the Contractor shall furnish one (1) CPM software package, SureTrak Project Manager for Windows by Primavera Systems, Inc. (latest version). This desktop computer system, including hardware, software and manuals, will be furnished and maintained throughout the life of the project and shall be removed when the field office has been vacated by the Division of Highways project staff in accordance with 640.8.

The Contractor shall be responsible for all service and maintenance of the entire desktop computer system, including hardware and software. Replacement equipment shall be provided within five (5) working days of breakdown, theft or damage at no additional cost to the Division.

### **640.12-METHOD OF MEASUREMENT:**

The “Large Field Office and Storage Building”, “Standard Field Office and Storage Building” shall include the field office and the storage building and shall be measured as one complete unit and paid by the month. The “Small Field Office” and “Minimal Field Office” shall be measured as one complete unit and paid for by the month. The “Building Equipment” and “Computer System for Field Office” will be measured as complete units and paid as a lump sum unit.

### **640.13-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, erecting, insuring, maintaining and removing the field office and storage building computer system, and sanitary conveniences for the Engineer; all labor and materials, and all other work necessary and incidental thereto. Monthly telephone invoices will be paid by the Engineer. The field office, storage building equipment, computer system, furniture, fixtures, and facilities shall remain the property of the Contractor and shall be removed in accordance with 640.8 and the area dressed and restored.

**640.14 - PAY ITEMS:**

<b>ITEM</b>	<b>DESCRIPTION</b>	<b>UNIT</b>
640001-*	STANDARD FIELD OFFICE AND STORAGE BUILDING	MONTH
640002-*	LARGE FIELD OFFICE AND STORAGE BUILDING	MONTH
640003-*	BUILDING EQUIPMENT	LUMP SUM
640004-*	COMPUTER SYSTEM FOR FIELD OFFICE	LUMP SUM
640005-*	MINIMAL FIELD OFFICE	MONTH
640006-*	SMALL FIELD OFFICE	MONTH

\* Sequence number

## **SECTION 642 TEMPORARY POLLUTION CONTROL**

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

DELETE THE FOURTH PARAGRAPH AND SUBSTITUTE THE FOLLOWING:

Ditch checks shall be constructed of log, stone or similar device to control velocity and to aid in erosion and sediment control. Silt fence and bales of hay or straw will **not** be permitted for use in ditches. Silt fence and bales of hay or straw can be used elsewhere on projects provided that they are embedded and staked as detailed in the Erosion and Sediment Control Manual wherever they are used.

### **642.7 - METHOD OF MEASUREMENT:**

DELETE THE FIFTH PARAGRAPH AND SUBSTITUTE THE FOLLOWING:

Ditch checks will be measured by the unit.

## **SECTION 651 FURNISHING AND PLACING TOPSOIL**

### **651.2-MATERIALS:**

DELETE THE LAST SENTENCE AND INSERT THE FOLLOWING:

Acceptable topsoil shall contain organic matter in the range of 1.5% to 20%.

**SECTION 653  
VINE AND GROUND COVER PLANTING**

**653.9 - PAY ITEMS:**

DELETE THE SECTION AN INSERT THE FOLLOWING:

ITEM	DESCRIPTION	UNIT
653001-*	VINES, FAST GROWING, "scientific name"	EACH
653002-*	VINES, MEDIUM GROWING, "scientific name"	EACH
653003-*	VINES, CLUMP TYPE, "scientific name"	EACH
653004-*	GROUND COVERS, "scientific name"	EACH
653005-*	WATER FOR PLANTS	THOUSAND GALLON (LITER)

\* Sequence Number

**SECTION 654  
TREE AND SHRUB PLANTING**

**654.17 - PAY ITEMS:**

DELETE THE SECTION AN INSERT THE FOLLOWING:

ITEM	DESCRIPTION	UNIT
654001-*	TREE, DECIDUOUS, "scientific name"	EACH
654002-*	TREE, ORNAMENTAL FLOWERING, "scientific name"	EACH
654003-*	SHRUB, DECIDUOUS, "scientific name"	EACH
654004-*	SHRUB, EVERGREEN, "scientific name"	EACH
654005-*	TREE, EVERGREEN, "scientific name"	EACH
654006-*	WATER FOR PLANTS	THOUSAND GALLON (LITER)

\* Sequence Number

**SECTION 656  
SEEDLING PLANTING**

**656.8 - PAY ITEMS:**

DELETE THE SECTION AN INSERT THE FOLLOWING:

ITEM	DESCRIPTION	UNIT
656001-*	SEEDLING, "scientific name"	EACH

\* Sequence Number

**SECTION 657  
ROADSIDE SIGN SUPPORTS**

**657.2.2.9 – Anchor Bolts:**

DELETE THE SECOND SENTENCE AND SUBSTITUTE THE FOLLOWING:

Anchor bolts (unless otherwise directed on the Plans) shall be fabricated from high strength steel, meeting the requirements specified in ASTM F 1554, Grade 55.

**SECTION 658  
OVERHEAD SIGN STRUCTURES**

**658.2.2.2-Weathering Steel:**

DELETE THE FIRST PARAGRAPH AND REPLACE WITH THE FOLLOWING:

All components of the overhead sign supports including miscellaneous fixtures, shall be fabricated from plates, bars, standard W, M, and S shapes produced from steel conforming to AASHTO M270, Grade 50W T-2, and tubes produced from steel conforming to ASTM A 618, Grade 1 with AASHTO M270 supplementary section S83, zone 2 toughness requirements.

**658.2.2.1 – Galvanized Steel:**

IN THE SECOND SENTENCE OF THE EIGHTH PARAGRAPH, CHANGE ASTM A1554, GR. 105 TO ASTM F 1554, GRADE 105.

**SECTION 662  
ROADWAY LIGHTING**

**662.2.13.1.5-Bases:**

DELETE THE LAST SENTENCE IN THE 4<sup>TH</sup> PARAGRAPH AND INSERT THE FOLLOWING:

When aluminum transformer bases are used with unpainted weathering steel poles and bases, both the bottom of the steel anchor base and the top of the aluminum transformer base shall be coated with a heavy film of zinc-rich paint.

**662.2.13.1.6 – Anchor Bolts:**

### **662.2.13.3.5**

IN THE SECOND SENTENCE, CHANGE ASTM A1444 GR.55 TO ASTM F 1554, GRADE 55.

### **662.2.13.3.5 – Anchor Bolts:**

IN THE SECOND SENTENCE, CHANGE ASTM A1554 GR.55 TO ASTM F 1554, GRADE 55.

## **SECTION 663 PAVEMENT MARKINGS**

### **663.5.4 – Extruded Thermoplastic Pavement Markings:**

DELETE THE ENTIRE SUBSECTION.

### **663.5.5 – Preformed Traffic Markings:**

DELETE THE FIRST SENTENCE AND INSERT THE FOLLOWING:

Preformed traffic markings shall be fabricated to a uniform thickness of not less than 125 mils.

### **663.5.10 – Glass Beads:**

DELETE ALL AFTER THE FIRST PARAGRAPH.

ADD THE FOLLOWING SECTION:

## **SECTION 679 OVERLAYING OF PORTLAND CEMENT CONCRETE BRIDGE DECKS**

### **679.1 - DESCRIPTION:**

The work shall consist of furnishing and placing a specialized concrete overlay to a designated grade line. Unless otherwise indicated on the plans, the Contractor may place any one of the specialized overlays allowed by the terms of this specification. Only one type of overlay will be allowed on any one structure.

**679.1.1 - Other Work:** The following work, as required by the contract plans, may also be performed under the terms of this section:

- a) Clean the bridge deck
- b) Bridge deck repair

- c) Clean exposed reinforcing steel
- d) Support and tie reinforcing steel
- e) Place slab reconstruction concrete
- f) Abutment backwalls and approach slabs repair (same as bridge deck or as shown in the plans.)
- g) Hydrodemolition of existing deck surface

### 679.1.2 - Definitions:

**679.1.2.1 - Specialized Concrete Overlay:** Two types of specialized concrete overlay are permitted as follows:

- 1) **Latex Modified Concrete:** A portland cement concrete to which an approved styrene butadiene latex admixture has been added.
- 2) **Microsilica Concrete:** A portland cement concrete to which an approved Microsilica admixture has been added.

**679.1.2.2 - Slab Reconstruction Concrete:** Slab reconstruction concrete is that concrete placed completely around exposed reinforcing bars.

**679.1.2.3 - Curing Hour:** A curing hour is any hour, beginning with the hour of placement, during which the ambient air temperature at the concrete surface remains at, or above, 45° F (7° C) as measured by a recording thermometer.

**679.1.2.4 - Curing Temperature:** This is the air temperature at the concrete surface, or the air temperature between the concrete surface and its protective covering.

## 679.2 - MATERIALS:

**679.2.1 - General:** Materials used in the manufacture of specialized concrete overlays shall meet the requirements specified in Section 601.2 of the Specifications and as required herein.

**679.2.1.1 - Fine Aggregate:** Fine aggregate shall be silica sand meeting the requirements of Sections 702.1.2 through 702.1.5 and 702.6 of the Specifications.

**679.2.1.2 - Coarse Aggregate:** Coarse aggregate shall be AASHTO Size No. 8 crushed stone or gravel conforming to Section 703 of the Specifications.

**679.2.1.3 - Latex Admixture:** Formulated latex modifier shall meet the requirements of Section 707.5 of the Standard Specifications.

#### 679.2.1.4

**679.2.1.4 - Microsilica Admixture:** Microsilica Admixture shall meet the requirements of Section 707.4.3 of the Standard Specifications.

**679.2.1.5 - Bonding Grout:** Bonding Grout shall consist of the actual modified concrete being used, with the coarse aggregates removed, mixed with sufficient water to form a slurry. The consistency of the slurry shall be such that it can be applied to the prepared concrete surfaces with a stiff bristle broom in a thin, even coating that will not run or puddle. The bonding grout shall be applied using a stiff broom and worked into all areas of the slab.

**679.2.1.6 - Class K Concrete:** Class K Concrete shall meet the requirements of Section 601 of the Specifications except that coarse aggregate shall meet the requirements of 679.2.1.2.

#### 679.2.1.7 - Curing Materials:

**Burlap:** This shall meet the requirements of Section 707.7 of the Specifications.

**Quilted Covers:** These shall be clean and free of defects, providing a water retention blanket over the concrete. Acceptance will be based on visual inspection.

**Polyethylene Curing Covers:** These shall meet the requirements of Section 707.6 of the Specifications.

**Plastic Coated Fiber Blankets:** These shall be clean and free of defects, providing a water retention blanket over the concrete. Acceptance will be based on visual inspection.

**679.2.1.8 - Replacement Bars:** Reinforcing bars shall be Grade 60 and shall meet the material requirements of Section 602 of the Specifications. Replacement bars shall be spliced to existing bars using either minimum 30-bar diameter lap splices or approved mechanical connectors.

**679.2.2 - Specialized Concrete Mix Design and Testing:** Specialized concrete shall consist of a homogeneous mixture of cement, fine aggregate, coarse aggregate, latex or microsilica admixture, chemical admixtures and water.

The Contractor shall determine mixture proportions in general accordance with ACI 211.1, "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete." Establishment of mixture proportions shall be coordinated with the manufacturer of the latex or microsilica admixture.

Design mixture testing shall include air content, slump, and compressive strength results at 28 days and results of rapid chloride permeability tests. For establishment of mixture proportions, rapid chloride permeability tests shall be made on representative samples cured for 28 days in accordance with

### 679.2.2.1

ASTM C31, then prepared and tested in accordance with AASHTO T277 at an age of 35 to 42 days. The results of this test should not exceed 750 coulombs.

The 28-day compressive strength of the test mix that satisfies the 750 coulomb threshold, shall be used as the basis for acceptance of the Specialized Concrete Overlay permeability requirements. Concrete for any slump test shall be deposited in a manner and location that excludes the effects of vibrations caused by traffic and concrete placement operations.

The total concrete constituents shall contribute less than 0.10% water soluble chloride ion by weight of cement. Use one brand and/or one source for any concrete constituent.

The Contractor shall obtain a written statement from the manufacturer of the latex or microsilica admixture that confirms the compatibility of the material combination and the sequence in which they are combined. The written statement, along with the results of all required tests, shall be furnished to the Engineer prior to the pre-construction meeting (refer to 679.2.2.3). Substantiating data showing compliance with the requirements of this specification shall also be submitted. This data shall also include the sources of coarse and fine aggregates as well as the brands of all admixtures to be used.

**679.2.2.1 - Latex Modified Concrete:** The following test criteria must be met for all latex modified concrete pours placed at the structure. This testing shall be performed by the Contractor or his designated representative and certified results provided to the Engineer prior to final acceptance of the project.

Chloride Permeability (a)	1000 coulombs @ 90 days, maximum (per AASHTO T277)
Compressive Strength,(b)	not less than 80% of 28-day compressive strength of the approved test mix
Water/(Cement + fly ash) Ratio (c)	0.40 by weight, maximum
Portland Cement Content (d)	658 lb/cu. yd., minimum (390 kg/m <sup>3</sup> , minimum)
Latex Admixture Content (e)	24.5 gal/cu. yd., minimum (121 liters/m <sup>3</sup> , minimum)
Air Content (f)	6.5% maximum (Per AASHTO T152)
Slump	4.0 inches ± 2.0 inches (100 mm ± 50 mm)

- Note (a) Chloride permeability test shall be performed and the results tabulated and submitted to the Engineer. These results will not be used for acceptance provided the compressive strength requirements are satisfied.

### 679.2.2.2

- Note (b) The minimum compressive strength for the overlay concrete shall be 80% of the 28-day compressive strength of the approved test mix. However, the minimum 28-day compressive strength shall be 4,000 psi (28 Mpa). Overlay concrete with a compressive strength of less than this acceptance level may be removed and replaced at the contractor's expense.
- Note (c) The amount of added water shall be adjusted to provide slump at or below the prescribed limit. The water portion of all admixtures shall be included as part of the water/cement ratio.
- Note (d) An equal volume of fly ash may be substituted for cement to a maximum of 1 ¼ bags per cubic yard (meter). When fly ash is used, equivalent volumes of fly ash shall be considered as cement for purposes of determining the proportioning ratios.
- Note (e) Latex sampling shall be in accordance with 707.5.
- Note (f) The initial mix design shall be based on an expected air content range of 3% to 6%. The mixture proportions shall be determined using actual conditions for fineness modulus and bulk specific gravities (saturated surface dry for aggregates).

**679.2.2.2 - Microsilica Concrete:** The following test criteria must be met for all microsilica concrete pours placed at the structure. This testing shall be performed by the Contractor or his designated representative and certified results provided to the Engineer prior to final acceptance of the project.

Chloride Permeability (a)	1000 coulombs @ 90 days, maximum (per AASHTO T277)
Compressive Strength,(b)	not less than 80% of 28-day compressive strength of the approved test mix
Water/(Cement + microsilica + fly ash) Ratio (c)	0.37 by weight, maximum
Portland Cement Content (d)	680 lb/cu.yd., minimum (404 kg/m <sup>3</sup> , minimum)
Microsilica Content (e) (Dry Weight)	50 lb./cu. Yd., minimum (30 kg/m <sup>3</sup> , minimum)
Air Content	7.0% (plus or minus 1.5%) (Per AASHTO T152)
Slump	6.5 inches ± 1.5 inches (165 mm ± 40 mm)
High Range Water Reducer(Superplasticizers) (f)	As needed for workability, slump and water/cementitious ratios

#### 679.2.2.4

- Note (a) Chloride permeability test shall be performed and the results tabulated and submitted to the Engineer. These results will not be used for acceptance provided the compressive strength requirements are satisfied.
- Note (b) The minimum compressive strength for the overlay concrete shall be 80% of the 28-day compressive strength of the approved test mix. However, the minimum 28-day compressive strength shall be 4,000 psi (28 Mpa). Overlay concrete with a compressive strength of less than this acceptance level may be removed and replaced at the contractor's expense.
- Note (c) The amount of added water shall be adjusted to provide slump at or below the prescribed limit. The water portion of all admixtures shall be included as part of the water/cement ratio.
- Note (d) An equal volume of fly ash may be substituted for cement to a maximum of 1 ¼ bags per cubic yard. When fly ash is used, equivalent volumes of fly ash shall be considered as cement for purposes of determining the proportioning ratios.
- Note (e) Microsilica sampling shall be in accordance with 707.4.3.
- Note (f) A high range water-reducing admixture is required to improve workability. No more than two additions of the admixture shall be made, and the total quantity shall not exceed the manufacturer's maximum dosage rate. Each time high range water reducer is added, the concrete shall be mixed an additional minimum of 30 revolutions. The total number of revolutions shall not exceed 300.

**679.2.2.3 - Pre-Pour Meeting:** The Contractor shall schedule a meeting prior to the start of the concrete work. The Engineer, Construction Manager, Prime Contractor, Concrete Contractor, Concrete Finisher, and the Concrete Supplier shall attend. Topics of discussion shall include specialized concrete mixture proportions, batching, transporting, handling, placing, finishing and curing.

**679.2.2.4 - Test Slab Requirements:** After obtaining the Engineer's approval of mixture proportions and at least one week before any slab reconstruction concreting or overlay is to be placed, the Contractor shall make one or more trial batches of the specialized concrete of the size to be hauled or mixed at the site. The trial shall simulate transportation and job site conditions, utilizing proposed material and methods of placing, finishing and curing. The test slab shall be constructed the same as the actual work (depth, reinforcing steel, etc.) and shall be at least one lane width wide and of a length to allow the use of the contractor's entire paving train from placement to finishing. The test slab location shall be as shown in the plans or as approved by the Engineer. The prime intent is to familiarize the concrete finishing crew

### **679.2.3**

with the handling, finishing and curing characteristics of the concrete. Batching, placement and texturing shall be in strict accordance with this specification. Additional reference test slabs may be constructed as necessary to provide an acceptable standard of reference. This standard of reference shall serve throughout the project construction period as the basis of acceptance of the actual as-built work. This Item may be deleted at the discretion of the Engineer.

**679.2.3 - Equipment:** All equipment proposed for use shall have the Engineer's approval prior to its usage.

**679.2.3.1 - Cutting Equipment:** Shall consist of a high pressure water jet (hydrodemolishing) system per the following requirements.

**679.2.3.1.1 - Hydrodemolishing Equipment:** The hydrodemolishing system shall be self-propelled, completely programmable, designed for high production concrete removal, and capable of removing precise depths of sound concrete. Hydrodemolishers shall be capable of removing concrete from around and below the steel reinforcement. Lances shall be of a type intended to remove rather than scarify concrete. Individuals certified by the equipment manufacturers shall operate the removal equipment.

All removal equipment shall be capable of operating at a noise level of less than 90 decibels at a distance of 50 feet (15 m) from the noise source. The Contractor shall monitor noise levels throughout the project to insure compliance, if required by the Engineer. No separate or additional payment will be made for monitoring -noise levels.

Potable or filtered water may be used. Filtered water shall have all visible solids and oils removed that could prevent a proper bonding with the remaining concrete. When filtered water is used, the Contractor shall wash the bridge deck with potable water in water blasting equipment as soon as all the concrete debris have been cleaned up. This water blasting shall be in addition to any other water blasting that may be required by any other special provisions.

The Contractor shall shield his operations to prevent injury or damage from flying or falling debris. The Contractor shall provide a method for handling expected and unexpected blow-through of the deck. This method shall provide for the containment of runoff water and debris, and the protection of the area under the bridge deck. The Contractor shall be responsible for any injury or damage caused by his operations.

**679.2.3.1.2 - Hydrodemolishing Equipment Demonstration:** Two trial areas will be designated by the Engineer to allow the Contractor to demonstrate that the equipment, personnel, and methods of operation can meet the requirements of this specification. The demonstration shall follow any roto-milling permitted by this specification. No separate or additional payment will be made for this demonstration.

#### 679.2.3.4

The first trial area will consist of approximately 30 square feet (9 m<sup>2</sup>) of sound concrete. The hydrodemolisher shall be calibrated to remove sound concrete to the depth specified in the contract documents without damaging the underlying sound concrete. After removing the sound concrete in the first trial area, the hydrodemolisher shall be moved to the second trial area. This area will consist of deteriorated or defective concrete. This trial will determine whether this unsound concrete will be completely removed with the above calibration.

If the equipment is deemed inadequate for use, the Contractor shall obtain another hydrodemolisher for a subsequent demonstration. When satisfactory results are obtained, production removal may proceed. No adjustment in the completion date of the project will be considered due to delays in obtaining suitable equipment.

If concrete is not being adequately removed during production work, recalibration of the equipment will be required.

**679.2.3.2 - Blastcleaning Equipment:** Blastcleaning Equipment shall be capable of removing rust from reinforcing bars, laitance, and small chips of partially loosened concrete. Certain qualities of rust are not necessary to be removed (refer to Section 679.3.3).

**679.2.3.3 - Proportioning and Mixing Equipment:** Shall consist of the following:

**679.2.3.3.1 - Latex Modified Concrete:** Self-contained, continuous mixing and proportioning mobile units shall be used. A minimum of two units shall be supplied. The requirements of Sections 679.2.3.4 and 679.2.3.5 shall apply.

**679.2.3.3.2 - Microsilica Concrete:** An approved concrete batch plant, mobile mixer or truck mixer shall supply all concrete. The requirements of Section 601 of the Specifications shall apply, except as modified herein.

When microsilica densified powder is used, the densified powder shall be weighed using an approved cement scale or supplied in bags, the weight of each bag shall be clearly marked on the bag. The densified powder shall be last in the weighing sequence and the tolerance for each material draw weight shall be based upon the total weight of cement plus densified powder. Batching tolerance for the cement plus densified powder shall be 0.5%.

When microsilica slurry is used, the slurry shall be added prior to the initiation of the batching sequence using calibrated proportioning equipment approved by the Engineer. Batching tolerance of the slurry shall be 2%.

**679.2.3.4 - Mobile Mixer Units:** Each unit shall be self-propelled and shall be capable of carrying sufficient unmixed material to produce on site, no less than 6 cubic yards (4.5 cubic meters) of specialized concrete.

The Engineer will inspect each unit. A unit not functioning in a manner the Engineer considers acceptable shall be repaired. If repair is impractical,

### 679.2.3.5

the unit shall be replaced. All costs associated with delays attributable to mobile mixer replacement shall be borne by the Contractor. No extension of time, for the purpose of replacing unacceptable mixers, will be granted. Conditions which will automatically designate a unit unacceptable are: hydrated cement deposits; broken, bent, loose or scalloped mixing paddles; mixing paddles worn 20% in any dimension; mixing paddles heavily caked with mortar; and admixture or water delivery system out of tolerance.

Proportioning devices shall deliver the materials within the following tolerances:

Coarse Aggregate	2%
Fine Aggregate	2%
Cement + fly ash	0% to 4 %
Water	2%
Cement + microsilica powder	0.5%
Microsilica Slurry	2%
Latex Admixture	1%
Other Admixtures	3%

The unit shall be capable of positive measurement of cement being introduced into the mix.

There shall be positive control of the flow of water into the mixing chamber. Water flow shall be indicated by a flowmeter and readily adjustable to provide for minor variations in aggregate moisture. The system shall be equipped with a bypass valve, or hose, for determining proportioning accurately. Also, there shall be a positive control of the flow of admixture into the mixing chamber. The admixture discharge pipe shall be readily accessible for determining proportioning accuracy.

The units shall be capable of being calibrated to automatically proportion and blend all components of indicated composition on a continuous or intermittent basis as required by the finishing operation, and shall discharge mixed material through a conventional chute directly in front of the finishing machine.

A sufficient number of self-propelled mixers shall be available at the job site to insure that not more than 30 minutes shall elapse between the placement of batches.

**679.2.3.5 - Mobile Mixer Unit Testing:** The units shall be calibrated by the Contractor to accurately proportion the approved mix design prior to placing the mix. The Engineer may require recalibration of any mixer as deemed necessary. Yield tests shall be performed by the Contractor for each mixer for each day's operation and when there appears to be a change in the mix. Certification of the calibration by an approved testing authority will be accepted as evidence of this accuracy if the yield is shown to be true within a tolerance of 1.0% according to the following test:

### 679.2.3.7

With the cement yard set on zero and all controls set for the approved design mix, activate the mixer and discharge mixed material into a 0.25 cubic yard (meter) container 1 yard (meter) square by 9 inches (250 mm) tall. When the container is level-struck full, making provision for settling the material into all corners, the cement yard shall show the discharge for a 0.25 cubic yard (meter) pour within the tolerance specified (refer to 679.2.3.4). No calibration shall be performed while it is raining.

**679.2.3.6 - Placing and Finishing Equipment:** This shall include adequate hand tools for the placement of plastic concrete and for working down to approximately the correct level for the auger strike-off. A self-propelled finishing machine will be required to place and finish all concrete, except in areas inaccessible to the machine.

The finishing machine shall be capable of forward and reverse motion under positive control. Provisions shall be made for raising the screeds to clear the screeded surface, if traveling in reverse.

The machine shall be capable of placing full width, in one operation, the pours shown in the plans. The finishing machine shall be equipped with a vibrating device to consolidate the concrete, a power driven strike-off auger, a power driven finishing roller, and a pan float. The vibrating device shall vibrate at a frequency between 50 Hz and 115 Hz. A sufficient number of suitable portable lightweight or wheeled work bridges shall be required and used behind the finishing operation for touch-up work, surface texturing and curing cover placement.

Approved manual type screeds, metal plates equipped with electric vibrators, or hand held vibrators shall be used to consolidate and finish small inaccessible areas and slab reconstruction concrete.

Supporting rails shall be required. Rails may be two inch by 2 in. (50 mm) perforated steel bar stock, 2 in. (50 mm) pipe rail, or approved equal. They shall exhibit no bends or kinks. Rail supports shall be fully adjustable (not shimmed) to obtain the correct profile. Rail supports are subject to the requirements of 679.3.7.2.

When placing concrete adjacent to a previously completed pour, the side of the finishing machine adjacent to the completed pour shall be equipped to travel on the completed lane on rail supports only.

The placing and finishing equipment shall be designed so that the elapsed time between depositing concrete and final finishing shall not exceed 10 minutes.

**679.2.3.7 - Recording Thermometer:** The Contractor shall supply a continuous recording thermometer capable of recording temperatures in the 30 - 100° F (2 - 30° C) range. It shall likewise provide a recording capability over a 24-hour continuous period, minimum. The Contractor shall provide any ancillary equipment, supplies and labor necessary for calibration of this equipment.

### **679.2.3.8**

**679.2.3.8 - Compressors Or Water Flushing Equipment:** Equipment used for surface preparation shall be of such size and capacity to thoroughly remove all foreign material from the surface being prepared.

**679.2.3.9 - Saw Cutting Equipment:** Only multi-bladed saw cutting equipment, using circular saw blades, will be permitted for final deck finish operations. The Engineer may allow the use of single blade circular saw equipment only where such equipment is necessary to complete the work as required.

**679.2.3.10 - Fogging Equipment:** Fogging equipment shall be available for use in accordance with these specifications. The fogging nozzles shall produce an atomized mist. Fogging nozzles shall incorporate compressed air to create the mist. Hand held or hand operated equipment shall be permitted when the Contractor has demonstrated that his operator has been trained in its use.

## **679.3 - CONSTRUCTION METHODS:**

**679.3.1 - Removal of Existing Deck Surface:** Prior to concrete deck removal operations, asphaltic patches or bituminous overlays shall be removed by hydrodemolishing, roto-milling, or other approved methods. All debris from patch or overlay removal shall be legally disposed.

To facilitate hydrodemolishing, up to one half of the total depth of concrete to be removed may be removed using roto-milling machines. If the Contractor chooses to use roto-milling, he shall determine the depth to the top mat of reinforcing steel using methods acceptable to the Engineer. The roto-milling operation shall be conducted in a manner that does not damage the existing reinforcing mats. If in the judgement of the Engineer the reinforcing mat is being damaged the remainder of the deck removal shall be by hydrodemolishing.

One pass of the hydrodemolisher shall be made to remove all concrete within the limits shown and to the depth specified in the contract documents. Care shall be exercised to avoid removing sound concrete beyond the specified depth.

Following the first pass of concrete deck removal, the Contractor shall sound the deck using chain drags and outline remaining areas of delaminated and unsound concrete for removal subject to the approval of the Engineer. Aerosol spray paint for outlining shall be provided by the Contractor. Edges around these concrete removal areas shall be vertical or slightly undercut. A second pass of the hydrodemolisher shall be made to remove the above concrete.

During the second pass, lances may be substituted for the hydrodemolisher in areas inaccessible or otherwise inconvenient to hydrodemolishing. Chipping hammers will be permitted by the Engineer only in areas demonstrated by the Contractor to be inaccessible to the hydrodemolisher and lances. Chipping hammers shall weigh less than 30

pounds and only chisel bits shall be used. Chipping hammers heavier than the nominal 15-pound (6.5-kilogram) class shall not be used to remove concrete from beneath any reinforcing bar.

Debris shall be removed directly following any concrete removal operations. Removal of debris shall be accomplished by hand and vacuum methods. All debris shall become the property of the Contractor and shall be legally disposed. The Contractor shall exercise care to avoid damage to the remaining concrete or exposed reinforcement.

The Contractor shall provide for the collection and disposal of all runoff water generated by the removal process. The Contractor shall obtain all required permits and shall comply with applicable local, state, and federal regulations concerning such water disposal. The Contractor shall make provision for the safe handling of runoff water insofar as it may constitute a physical hazard on the adjacent or underlying traveled roadway surface.

Water will not be allowed to enter storm sewers, bridge drainage, downspouts, fingerdams, or any other drainage area of the deck surface. The Contractor shall exercise care to protect existing berm slopes from scouring by water jets or runoff water.

The Contractor shall provide adequate lighting to allow for the safe conduct of night removal operations, and shall obtain the Engineer's approval for same, exercising care to avoid any hazardous glare in the direction of oncoming traffic.

When a bridge deck has an asphalt overlay, the stated depth of removal shall be measured from the bottom of the asphalt overlay.

When full depth removal is necessary, the forming shall be performed in accordance with Sections 104.3 and 109.4 of the Specifications.

**679.3.2 – Removal of Newly Placed Deck Surface:** The finished deck surface shall be shotblasted in preparation for a mechanically bonded surface. Shotblasting shall remove the upper surface of the deck to the satisfaction of the engineer. This may require approximately 1/8 in. to 1/4 in. (3 to 6 mm) of the concrete to be removed. In all cases the surface laitance shall be removed to provide a solid profile on which to bond the overlay. The cost of shot-blasting of the concrete deck shall be considered incidental to the Specialized Concrete Overlay.

**679.3.3 - Preparation of Surface:** Blastcleaning shall be performed to thoroughly clean all horizontal and vertical receiving surfaces. Surfaces, which will be in contact with the specialized concrete overlay, shall have laitance and partially loosened chips of concrete removed by blastcleaning, which shall produce a bright, clean appearance. The edge of previously placed pours shall be similarly treated to promote bond.

All reinforcing steel, or other steel, which is to be in contact with the new concrete, shall be cleaned of all grease, dirt, concrete mortar and injurious rust. Injurious rust is defined as all scale, loose rust deposits, or all rust not firmly bonded to steel. Rust and concrete deposits, which in the

#### **679.3.4**

Engineer's opinion, cannot be removed by blastcleaning, will be considered firmly bonded and may remain. Any portion of a reinforcing bar judged by the Engineer to have any more than 50% section loss shall be replaced at no additional cost to the Division. A light coating of orange colored rust that forms on the reinforcing steel, after blastcleaning is not considered detrimental to bond and may remain unless the time limit that follows is exceeded, or if ordered to be removed by the Engineer.

All debris from the blastcleaning operation shall be removed. After removal, the exposed reinforcing steel shall be supported and tied. Rustproof chairs shall be provided. If a continuous length of 6 ft. (1.8 m) or more of reinforcing bar is exposed, the Engineer may require supports and positive tie-downs at a maximum spacing of 4 ft. (1.2 m). Positive tie-downs shall consist of anchors drilled into the structural slab and connected to the reinforcing bars. Replacement bars shall be spliced to existing bars using either minimum 30 bar diameter lap splices, approved mechanical connectors, or a welded splice as directed by the Engineer. Welded splices, if approved, shall be in accordance with ANSI/AWS Structural Welding Code - Reinforcing Steel D1.4. The Engineer shall be allowed sufficient time to inspect the work after the supporting and tying of the reinforcing steel has been completed.

Blastcleaning operations may be commenced in an area after necessary concrete removal, per Section 679.3.1 or Section 679.3.2, as applicable, has been completed. If more than 48 hours elapse from the termination of any blastcleaning operation to slab wetting, blastcleaning shall be repeated per the Engineers direction regardless of the apparent condition of the receiving surfaces.

**679.3.4 - Structural Slab Wetting:** The structural slab surface and any other porous surface, which will be in contact with new concrete, shall be prewetted with water. All standing water in depressions or areas of concrete removal shall be blown out with oil-free compressed air. The surface shall be thoroughly wetted to a saturated condition and shall be visibly moist when placement begins.

**679.3.5 - Placement Preconditions:** Slab reconstruction concrete, or overlay concrete, shall be placed only after all of the following preconditions are satisfied:

The Contractor has submitted to the Engineer, in writing, the proposed sequence of operations, equipment, number of personnel, and category of personnel to be used during the concrete placement.

- a) All concrete removal operations in the placement area are complete and approved.
- b) Deck drains have been cleaned of all debris and plugged.

- c) Blastcleaning has been completed on an area large enough to require one working day for concrete overlay placement. In no case shall this be less than one span long.
- d) Any additional blastcleaning, if required, has been completed and approved on an area large enough to require one working day for concrete overlay placement. In no case shall this be less than one span long.
- e) Slab temperature and wetting requirements are met.

**679.3.6 - Placing, Finishing and Curing Slab Reconstruction Concrete:** Slab reconstruction concrete shall be placed separately from overlay concrete except when both of the following conditions are, in the opinion of the Engineer, present:

- a) Areas of exposed reinforcing steel do not exceed 5% of the total slab area ready to be overlaid.
- b) Individual areas of exposed reinforcing shall not exceed 25 square feet (7.5 m) in area.

When these two conditions are present, slab reconstruction concrete may be placed integrally with overlay concrete.

The Contractor has the following choices of concrete placed as slab reconstruction concrete:

Overlay Type	Slab Reconstruction Concrete
Latex Modified	Latex Modified or Class K
Microsilica	Microsilica or Class K

Slab reconstruction concrete placed integrally with overlay shall match the Specialized Concrete Overlay.

Bonding grout shall be placed against all vertical surfaces receiving slab reconstruction concrete. The perimeter of these surfaces shall be nearly vertical or slightly undercut.

When Class K Concrete is used as reconstruction concrete, a self-contained mobile mixer meeting the requirements of 679.2.3.4 may be used to provide the concrete.

After blastcleaning is completed, the Contractor shall place slab reconstruction concrete in the locations where reinforcing bars have been exposed. The concrete shall be consolidated by internal vibration in accordance with Section 601.10.3 of the Specifications. It shall be finished to the level of the surrounding concrete, or to the middle of the reinforcing steel, whichever is higher. The surface of the new concrete shall be intentionally

### **679.3.6.1**

roughened to a raked finish. Placement of slab reconstruction concrete in accordance with this subsection shall not relieve the Contractor of the requirements to provide the minimum required thickness of overlay material.

**679.3.6.1 - Slab Reconstruction Concrete Curing Requirements:** Curing shall be accomplished in the following manner:

Latex Modified Concrete. Curing shall be performed in accordance with 679.3.7.5.1.

Microsilica and Class K Concrete. Curing shall be by means of quilted covers, or plastic coated fiber blankets. Quilted covers, if used, shall be kept wet for the entire curing period in accordance with 679.3.7.5.2. The wet curing period shall be 72 curing hours.

The use of membrane curing compounds shall not be allowed.

**679.3.6.2 - Removal of Slab Reconstruction Concrete Surface:** The slab reconstruction concrete surface shall be blastcleaned per the requirements of Section 679.3.3 prior to the placement of the overlay.

### **679.3.7 - Placing and Finishing Specialized Concrete Overlay:**

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

- a) The normal overlay thickness shall be as shown on the plans. Under any circumstances, the overlay shall not be less than 1 ¼ inches (31 mm).
- b) The prepared surface of the structural slab shall be protected from contamination by any source.
- c) Concrete may be mixed at the point of deposition.
- d) When placing Specialized Concrete Overlays on a newly placed deck, the deck concrete shall be a minimum of 28 days old. The sidewalks, parapets, or curbs shall be a minimum of 7 days old.

**679.3.7.2 - Finishing Equipment:** Supporting rails upon which the finishing machine travels shall be placed outside the area to be overlaid. Said rails shall be supported at spacings sufficient to prevent any deflections. If deflections occur, support spacings shall be reduced, or rails shall be replaced by more resistant rail material. Anchorage of supporting rails shall provide for horizontal and vertical stability. The Engineer may require positive anchorage. A hold-down device shot into the prepared surface, or new overlay, will not be permitted. Supporting rails shall not be treated with parting compounds or release agents to facilitate their removal.

### 679.3.7.3

Immediately prior to the beginning of overlay operations, the finishing machine shall be operated over the full length of the bridge segment to be overlaid. This test run shall be made with the screed adjustment set to its finishing position. While operating the finishing machine during the test, the screed rails shall be checked for deflection and the minimum overlay thickness confirmed. The clearance shall be checked with the use of 1 ¼ inches (31 mm) thick filler blocks attached to the bottom of the screed during the test run. All necessary corrections shall be made prior to any concrete placement.

**679.3.7.3 - Placement:** The following requirements shall apply during placement of the Specialized Concrete Overlay:

No concrete shall be placed unless surface slab temperature requirements of 679.4.6 and 679.4.7 are met. So that the use of hand tools will be kept to a minimum, concrete shall be deposited as nearly as possible to its final position. Internal vibrators shall not be used for moving concrete into position.

- a) A pencil type vibrator shall be used along all construction joints to further consolidate the concrete to prevent voids.
- b) The new concrete shall be placed slightly above final grade. It shall then be struck-off, screeded, and finished to final grade.
- c) The finished surface, before texturing, shall be uniformly smooth, dense and even. Variations in pavement surface in excess of ⅛ in. (3 mm) above, or below, the proper finished elevation, or surface irregularities of more than ⅛ in. in 10 feet (3 mm in 3 m), will not be accepted.
- d) At transverse and longitudinal construction joints, the overlay placement shall be continued beyond the joint location a distance at least equal to the placement depth, and shall be allowed to stand free or shall be formed. After the overlay has cured, the concrete shall be sawed to a depth of ¾ in. ± ⅛ in. (19 mm ± 3 mm). The overlay material beyond the saw cut shall be chipped out to the level of the original prepared surface, or to the level of the reinforcing bars, whichever is higher. The chipped face of the construction joints shall not undercut the saw cut and shall have a slope of approximately 45°. Chipping hammers shall weigh less than 30 lb. (15 kg), and only chisel bits shall be used.
- e) A construction dam, or bulkhead, shall be installed in case of a delay in the placement operations exceeding 30 minutes duration. During any delays of 30 minutes or less, the placement shall be protected from drying with several layers of wet burlap. If the concrete placement is stopped, or delayed, for 90 minutes or more, further placement shall be

#### 679.3.7.4

discontinued and may be resumed only upon the approval of the Engineer. When a placement delay greater than 90 minutes occurs, the Contractor shall saw and seal a control joint in the overlay.

- f) Adequate precautions shall be taken to protect freshly placed concrete from rainfall. All placement operations shall stop when it starts to rain. The Engineer may order removal and replacement of material damaged by rainfall in accordance with 679.4.9.
- g) The addition of superficial water to the surface of the concrete to assist in finishing operations will not be permitted.

**679.3.7.4 - Surface Texturing:** The surface of the specialized concrete overlay shall be uniformly smooth, dense and even. The surface shall then be given a suitable texture with an approved burlap drag.

The Contractor shall texture in a transverse or longitudinal direction. Once begun, the direction of texturing shall not change. All texturing shall be performed prior to the beginning of curing operations. Only one pass of the drag over the finished area will be permitted. Texturing shall be in strict accordance with the time requirements of 679.3.7.5 for applying wet burlap.

If texturing is done in the transverse direction, the Contractor shall texture by hand methods as soon as practicable after finishing machine passage.

If texturing is done in the longitudinal direction, the burlap drag shall be a seamless strip and shall be attached to the work bridge such that the surface of the concrete is textured as soon as practicable after finishing machine passage. Small areas, inaccessible to the attached drag, may be textured by hand methods.

The finishing movement and resulting progress of the burlap drag shall be done in a manner so as to prevent ridges or gouges from forming in the concrete surface. The drag shall be weighted and the contact area changed as required to produce a texture acceptable to the Engineer. The drag shall be cleaned as required; to remove all hardened concrete particles.

Texture resulting from the drag shall stop within 1 ft. (300 mm) of curbs or parapets.

**679.3.7.5 - Curing:** It is the nature of specialized concrete overlay material to quickly form a plastic film at the surface upon drying. This film is to be protected from drying and cracking by prompt covering with wet burlap. Regardless of the type of concrete placed, the use of membrane curing compounds will not be allowed. Floor drains shall be immediately unplugged to permit the deck to drain.

The overlay surface shall be completely covered with clean, wet burlap. The burlap shall be thoroughly saturated over its entire area, but shall be drained of excess water before application. Burlap shall be lapped a minimum of 1 ft. (300 mm) and shall lay flat. Failure to apply wet burlap within 10 minutes after the concrete has been placed will be cause for

### 679.4.3.1

rejection of the work as determined by the Engineer. The Engineer may extend time if the plastic film has not formed or the Contractor's fogging operation adequately protects the film.

**679.3.7.5.1 – Curing Latex Modified Concrete:** A layer of 4-mil (0.1 mm) thick white polyethylene film shall be placed over the burlap as soon as possible. The overlay shall then be wet cured for 48 curing hours. Care shall be exercised to ensure the burlap remains saturated for the 48-hour cure period. Plastic coated fiber blankets may be substituted for the polyethylene film, but shall not replace the initial wet burlap. The film (or fiber blankets) shall be anchored along all edges and internally to prevent the loss of moisture and from being displaced. After the wet cure, the polyethylene film and burlap shall be removed and the concrete shall be air-cured for 48 hours.

**679.3.7.5.2 – Curing Microsilica Concrete:** Care shall be exercised to ensure that the burlap is well drained. Burlap shall be continuously wet for a period of 96 curing hours by means of automatic intermittent sprinkling or a continuous wetting system.

## 679.4 - CONSTRUCTION LIMITATIONS AND REQUIREMENTS:

**679.4.1 - Stockpiling Aggregates:** All aggregates shall be stockpiled at the concrete mixing site or another location approved by the Engineer.

Stockpiles shall be completely covered and no additions to approved stockpiles are permitted.

The free moisture content of each aggregate type, at the time of batching, shall not exceed 7% of the saturated-surface dry weight of the fine or coarse aggregate or 8% total for both aggregates.

Fine and coarse aggregates, which are stored in piles or bins, shall be kept entirely separated.

**679.4.2 - Storage and Handling of Cement:** Suitable provisions shall be made to prevent the loss of cement during handling. Cement to be stored shall be kept in suitable weatherproof enclosures, which will protect the cement from dampness. Cement, which has developed lumps in storage, shall not be used.

**679.4.3 - Vehicular and Equipment Restrictions:** The operation of vehicles and equipment on or over, the structural slab area where concrete removal operations have been started is subject to the following restrictions:

**679.4.3.1 - Vehicle Weight Limits:** Vehicular traffic is limited to necessary construction equipment. No vehicle or construction equipment weighing in excess of 7000 lb., (48 Mpa), shall be allowed to operate on, or over, any area of structural slab which exhibits unprotected, fully exposed reinforcing steel.

### **679.4.3.2**

**679.4.3.2 - Runways:** Properly supported runways shall be provided where concrete transporting devices operate over exposed reinforcing steel and expansion devices.

**679.4.3.3 - Reinforcing Steel Protection:** Exposed reinforcing steel shall be protected from concrete transporting devices so that no debonding, loosening, bending, or breaking occurs. Reinforcement that is damaged by any of the Contractor's operations shall be removed and replaced to the satisfaction of the Engineer and at no additional cost to the Division.

**679.4.3.4 - Construction Loading Limitations During Curing:** No load shall be permitted on new concrete until the specified curing period(s) has been completed. No structural slab concrete removal work shall be performed on structural slab areas adjoining new concrete during the time the new concrete is curing.

**679.4.4 - Concrete Placement Limitations:** The plastic concrete, as discharged from the mobile mixer or delivery unit, shall be at a temperature of 50° F (10° C), minimum. If conditions are such that, in the opinion of the Engineer, this minimum may not be met, the provisions of Section 601.9.1 of the Specifications will apply. If the evaporation rate exceeds 0.10 lb./sq. ft. per hour (see Figure 1), the Contractor shall make provisions (i.e. wind breaks, fogging, etc.) to reduce the rate prior to placing concrete.

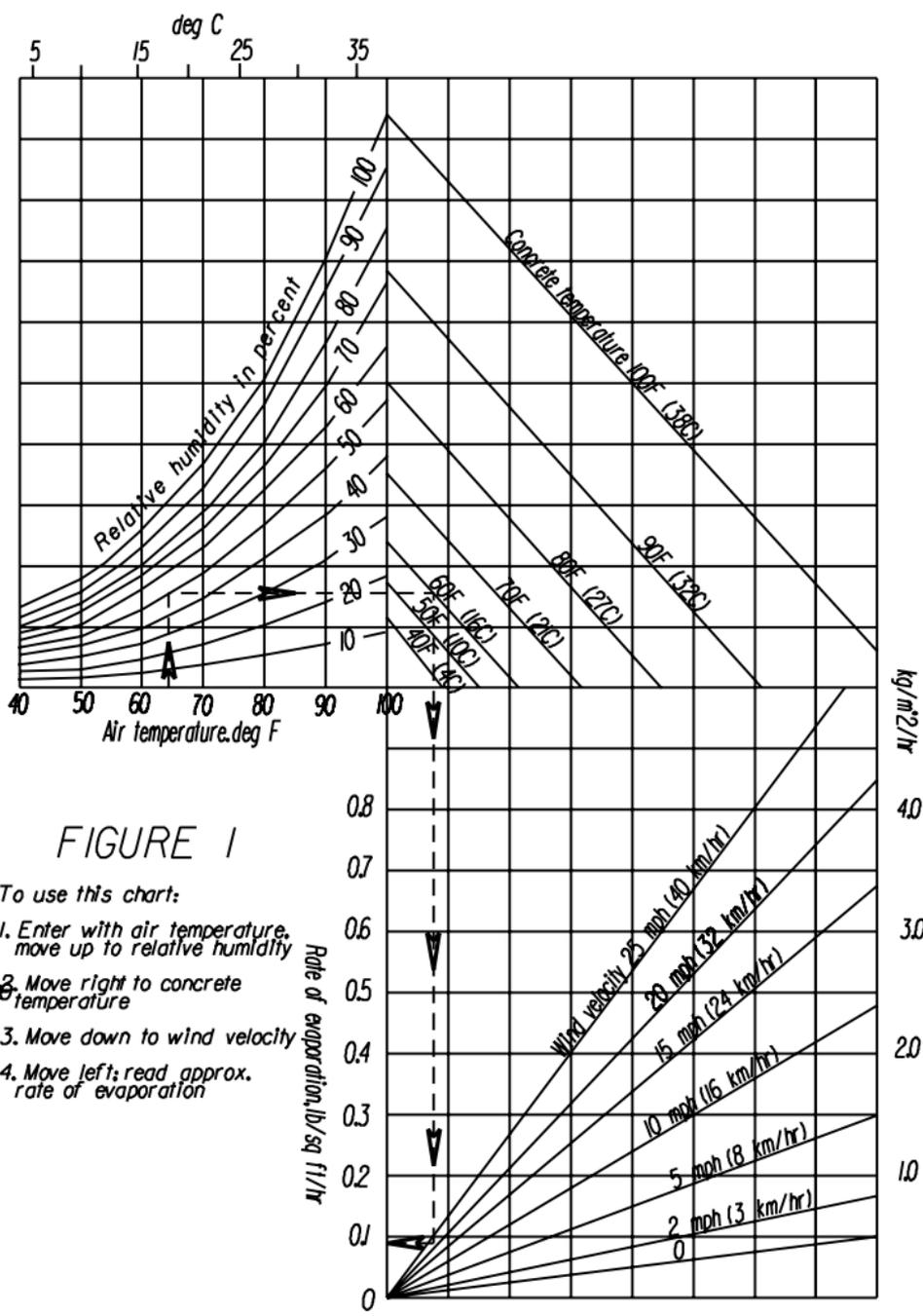


FIGURE 1

To use this chart:

1. Enter with air temperature, move up to relative humidity
2. Move right to concrete temperature
3. Move down to wind velocity
4. Move left; read approx. rate of evaporation

## 679.4

**679.4.5 - Concrete Pavement at Night:** If placement of any concrete is to be made at night, a plan which provides adequate lighting for the work area shall be submitted at least 14 days before concrete is placed for the Engineer's approval

**679.4.6 - Hot Weather Provisions:** The requirements of ACI 855, Hot Weather Concreting, shall apply except no concrete shall be placed when the ambient air temperature or deck surface temperature, after prewet, is above of 85° F (30° C). Concrete may be placed at an ambient air temperature of 85° F (30° C), if the deck temperature, after prewet, is no higher than 85° F of 85° F (30° C), and falling temperatures are predicted, and then only if the prediction indicates a temperature of under of 85° F (30° C) for the placement period. The time limitations for the placement of wet burlap, as required by 609.3.7.5, shall also apply.

**679.4.7 - Cold Weather Provisions:** No concrete shall be placed if the ambient air temperature or deck surface temperature, after prewet, is below 50° F (10° C), except as noted. Concrete may be placed at an ambient air temperature of 50° F (10° C) if the deck surface temperature, after prewet, is no less than 50° F (10° C) and rising air temperatures are predicted, and then only if the prediction indicates a temperature of over 50° F (10° C) for the eight hours immediately after placement. If air temperatures are such that the minimum temperature will not be met, the Contractor may place concrete if external heat is provided (refer to 679.4.8).

If the curing temperature drops below 45° F (7° C) during the curing period, then the surface shall be enclosed and external heat shall be provided in accordance with the provisions of 679.4.8. The time required for tenting will not be counted as curing time. Once external heat provisions are required, they shall remain on the surface until curing is complete, regardless of the ambient air temperature.

If curing temperature falls below 32° F (0° C), at any time during the curing period, the concrete will be rejected.

Continuous wetting shall be replaced by wetting at regular intervals if, in the opinion of the Engineer, expected air temperatures could result in freezing of run-off water.

**679.4.8 - External Heat Provisions:** The provisions of ACI 306, Cold Weather Concreting, and the following modifications shall apply:

- a) Temperature limits shall be maintained for 168 curing hours.
- b) If the concrete is latex modified concrete, then steam equipment shall not be used to supply external heat after the initial 48 curing hours.

- c) Enclosures for heat retention shall be properly vented to prevent surface disintegration from carbon dioxide gas.
- d) Continuous wetting will not be required, but the burlap shall be kept wet by wetting at regular intervals in a manner satisfactory to the Engineer for microsilica concrete.

**679.4.9 - Defective or Damaged Concrete:** After the overlay has been cured, the Contractor in the presence of the Engineer shall sound the deck in order to detect delaminated areas. All defective or damaged concrete, as determined by the Engineer, shall be repaired or replaced at no additional cost to the Division. Defects shall include but not be limited to delaminations, cracking, tearing, damage or other imperfections. The Contractor shall propose repair methods for approval by the Engineer. All concrete requiring removal and replacement, as determined by the Engineer, shall be removed by sawcutting the perimeter to a depth of  $\frac{3}{4}$  in.  $\pm$   $\frac{1}{8}$  in. (19 mm  $\pm$  3 mm). Damaged concrete shall then be chipped out to the level of the original prepared surface. The chipped face shall not undercut the sawcut and shall have a slope of approximately 45°. Chipping hammers shall weigh less than 30 pounds (15 kg), and only chisel bits shall be used. The prepared surface shall be blastcleaned prior to applying the overlay concrete.

## **679.5 - FINAL BRIDGE DECK FINISH:**

**679.5.1 – Straightedge Test:** After defective or damaged concrete has been repaired and cured in accordance with 679.4.9 and before opening to traffic, the bridge deck shall be grooved perpendicular (or radial) to the centerline of the roadway. Prior to grooving, the entire deck shall be checked by the Contractor in the presence of the Engineer with an approved straightedge not less than 10 ft. (3 m) long. The straightedge shall be laid parallel to the centerline and half-lapped along lines approximately 5 feet (1.5 m) apart to cover the entire deck surface. Surface irregularities of more than  $\frac{1}{8}$  in. in 10 feet (3 mm in 3 m) shall be removed by grinding. Grinding shall leave a smooth surface within the straightedge tolerance.

**679.5.2 – Finished Deck Grooving:** After corrective grinding and before opening to traffic, grooves shall be cut into the concrete using a mechanical saw. These grooves shall be 0.10 inch (2.5 mm) wide and 0.25 inch (6 mm) deep. Groove spacing shall be 1.5 inches (37 mm) center to center. No later than one week prior to grooving operations, the Contractor shall provide the Engineer with two accurate, easily readable gauges with which to verify groove dimensions. Groove depth and spacing tolerances are limited to  $\pm 1/16$  inch (1.5 mm). Groove width tolerances are +0.02 inch (.5 mm) and -0.0 inch (0 mm). Grooves shall be cut continuously across the deck to within 1 ft. (300 mm) of gutter lines or drainage structures. Grooves shall also be continuous across the full width of the deck surface including construction joints. Grooves shall terminate

## **679.6**

within 1 in. (25 mm) of any exposed metal component or elastomeric concrete of an expansion joint. When the deck is skewed and the contractor is using gang blades to saw the grooves, the maximum distance (measured perpendicular to the centerline of the expansion joint) from the last groove termination in the pass to the expansion joint shall be 1 ft., 8 inches (200 mm). Radial grooving shall be performed in increments limited to 12 ft. (3.6 m) of bridge length.

### **679.6 - METHOD OF MEASUREMENT:**

**679.6.1 - General:** The quantity of work performed for Specialized Concrete Overlay shall be measured in cubic yards (meters) of material complete in place and accepted. If the material is delivered in a mobile mixer, the pay quantity will be based on the printed ticket from the mixer. If the material is delivered from a central batch plant or truck mixer, the pay quantity will be based on the printed batch tickets as required in AASHTO M 157, Section 16, with adjustment for waste. The contractor and the engineer shall agree in advance on a method to determine the volume of the waste.

Test Slab will be measured on a lump sum basis complete in place. This shall include the complete execution of work required herein, regardless of the number of test slabs constructed. This item may be deleted at the discretion of the Engineer.

The quantity of work performed for Slab Reconstruction Concrete shall be measured in Cubic yards (meters) of material complete in place and accepted. Slab Reconstruction Concrete placed monolithic with the overlay shall be included in the overlay quantity. Concrete that is placed separately from the overlay shall be the volume as indicated by the batch quantity tickets for the ready-mix trucks or portable mixers adjusted for any material not incorporated into the work.

Removal of Existing Deck Surface shall be measured in square yards (square meters) of deck area that is to be overlaid. Existing concrete or asphalt removal shall be considered incidental to Removal of Existing Deck Surface as specified herein.

### **679.7 – BASIS OF PAYMENT:**

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

**679.7.1 - Rideability Price Adjustments:** Section [601.15.2](#) of the Standard Specifications shall apply to the finish requirements of the specialized concrete overly.

**679.8 - PAY ITEMS:**

ITEM	DESCRIPTION	UNIT
679002-*	SPECIALIZED CONCRETE OVERLAY	CUBIC YARD (METER)
679003-*	REMOVAL OF EXISTING DECK SURFACE	SQUARE YARD (METER)
679005-*	SLAB RECONSTRUCTION CONCRETE	CUBIC YARD (METER)
679006-*	TEST SLAB	LUMP SUM

\* Sequence number

## SECTION 688

### PAINTING STEEL STRUCTURES

**688.1 – Description:**

ADD THE FOLLOWING TO THE END OF THE PARAGRAPH.

At no time shall any paint be used beyond the manufacturer's shelf life.

**688.2.7 – Handling Steel Structures:**

ADD THE FOLLOWING TO THE END OF THE SECTION.

Upon arrival at the project site, if weather conditions were such that deicing materials from the roadway were thrown onto the steel during shipment, the contractor shall be responsible for washing the entire surface of the steel with low pressure water and testing for chloride contamination. This also includes unpainted portions of weathering steel. Water shall be from an approved source of drinking water. The water is to be applied at minimum pressure of 3000 PSI (21 Mpa) to a maximum of 4500 PSI (31 Mpa) at the nozzle end, with the nozzle held at a distance of 4" (100 mm) to 8" (200 mm) from the surface.

After the low pressure wash, a minimum of one area on each piece is to be tested for chloride contamination. The testing shall be by the CHLOR\*TEST (chloride test kit) method. The maximum chloride contamination shall be 5 micrograms/cm<sup>2</sup>. If the degree of contamination is above the maximum level, the steel is to be re-washed, using a mixture of low pressure water and a solution of a commercial brand of soluble salt remover, followed by additional testing for chloride contamination. The Soluble Salt Remover shall be CHLOR\*RID or equal.

The steel to be washed shall not be erected until it has been washed, tested and accepted.

**SECTION 689**  
**METALIZING STEEL**

**689.4 - APPLICATION OF METALLIC COATING:**

ADD TO THE END OF THE FIRST PARAGRAPH:

The steel shall be cleaned with sharp, angular grit, to at least a near white finish meeting SSPC-SP-10. No shot will be allowed as the blasting abrasive. The profile of the anchor pattern shall be 2-4 mils (50-100  $\mu\text{m}$ ).

# DIVISION 700

## MATERIALS DETAILS

### SECTION 702

#### FINE AGGREGATE

#### 702.1.2-Deleterious Substances:

DELETE THE TABLE AND INSERT THE FOLLOWING:

MATERIAL	PERCENT BY WEIGHT
Amount finer than No. 200 (75 $\mu$ m) sieve for manufactured fine aggregate (determined by AASHTO T 11 and T 27). A manufactured fine aggregate is one which has been reduced in particle size by crushing	5.0
Amount finer than No. 200 (75 $\mu$ m) sieve for all other sands (determined by AASHTO T 11 and T 27)	3.0
Coal and other lightweight deleterious material (determined by MP 702.01.20)	2
Friable particles (determined by MP 703.01.20)	1

### SECTION 704

#### STONE AND CRUSHED AGGREGATE

DELETE TABLE 704.6.2A AND 704.6.2B AND REPLACE WITH THE FOLLOWING:

## 704.6

**TABLE 704.6.2A – GRADATION REQUIREMENTS**

Gradation Amounts Finer Than Each Laboratory Sieve (Square Openings), % By Weight										
Aggr. class	8" (200)	2½" (63)	2" (50)	1½" (37.5)	¾" (19)	#4 (4.75)	#40 (42.5 µm)	#100 (150 µm)	#200 (75 µm)	
1				100	50-90	20-50	5-20		0-7	
2				100	80-100	35-75	10-30		0-10	
3				100	50-90	20-50	5-20		4-12	
4				100	50-95	20-60	5-35			
5			100			30-90			0-25	
6				100	50-100	25-70	10-45	3-28		
7	90-100		0-5	with intermediate sizes between 6" (150 mm) and 4" (100 mm) represented						30
8				100	80-100	35-75	10-40		4-14	
9		100		80-95	50-70	20-40		0-8		

**TABLE 704.6.2B - QUALITY REQUIREMENTS**

Aggr. class	Los Angeles Abrasion, Percent, Max.	Sodium Sulphate Soundness, Percent Max.	Liquid Limit Max.	Plasticity Index, Max.	Deleterious Material Percent Max.
1	50	12	25	6	5
2	50	12	25	6	5
3	50	12	25	6	5
4	Note 1		25	6	5
5			25	6	5
6		30	25	6	5
7					10 (by visual observation)
8	50	12	25	6	5
9	50	12	25	6	5

**Note 1:** The Los Angeles Abrasion value of aggregate comprising the base course shall be treated in the manner hereinafter set forth to determine the specification requirement for the item:

STABILIZATION REQUIREMENTS		
Los Angeles Abrasion Value Assigned to the Base Course Aggregate	LA ≤ 50	None
	50 < LA ≤ 65	Top 4 inches (100 mm)
	65 < LA ≤ 80	Top 6 inches (150 mm)
	80 < LA	Top 8 inches (200 mm)

## SECTION 705 ASPHALT MATERIALS

### 705.5 – PERFORMANCE GRADED BINDERS:

DELETE ALL AFTER THE FIRST SENTENCE.

**SECTION 707**  
**CONCRETE ADMIXTURES, CURING AND**  
**COATING MATERIALS**

**707.2.2.1:**

ADD THE FOLLOWING AT THE END OF THE SECTION:

When a Type G admixture is used for the sole purpose of increasing the slump of the subject concrete mix (no water is removed when this admixture is added), the requirements of AASHTO M 194 for water reduction and compressive strength increases will be waived.

**707.3.2.1:**

ADD THE FOLLOWING AT THE END OF THE SECTION:

When a Type F admixture is used for the sole purpose of increasing the slump of the subject concrete mix (no water is removed when this admixture is added), the requirements of AASHTO M 194 for water reduction and compressive strength increases will be waived.

**707.4.3 - Microsilica Admixture:**

DELETE THE CONTENTS OF THE FOLLOWING SUBSECTION AND INSERT THE FOLLOWING:

The microsilica admixture shall be supplied in either a densified powder or slurry form or a blend of portland cement and densified powder. The slurry shall be homogeneous and agitated as necessary to prevent separation. The microsilica admixture will be accepted at the work site provided it meets all of the following requirements:

- a) Manufacturer's written certification that the material supplied meets all of the requirements of AASHTO M307.

The microsilica slurry admixture shall be maintained in storage above the temperature of 32° F (0° C). Slurries exposed to temperatures of 32° F (0° C) or lower shall be removed and replaced at no additional cost to the Department. Water in the slurry shall meet the requirements of Section 601.2 of the Specifications.

- b) Only one brand from one source shall be supplied.

## **707.5**

INSERT THE FOLLOWING SUBSECTION:

**707.5 - Latex Admixture:** Formulated latex modifier shall be Dow Modifier A, Tylac 97-314 (Thermoflex 8002), BASF Latex 1186 or Deco-Ray 4776. The manufacturer of these products shall certify that the latex being supplied is of equal formulation to that supplied to the FHWA Turner-Fairbank Highway Research Station for initial approval. Other Styrene-Butadiene latex modifiers may be used provided they have been tested in accordance with and meet the acceptance criteria of the testing program outlined in Report No. FHWA-RD-78-35 of the Federal Highway Administration. The manufacturer shall certify that the latex being supplied meets the acceptance criteria used in the testing program. Only one brand shall be supplied. Samples taken at the job site shall contain a minimum of 46% solids in the latex when tested in accordance with MP 679.03.00.

The latex admixture shall be agitated as necessary to prevent separation of the emulsion. It shall be maintained in storage within the temperature range of 35°F (2° C) to 85° F (29° C). Admixture obtaining temperatures outside the foregoing limits shall be removed and replaced at no additional cost to the Division.

## **SECTION 709 METALS**

**709.8 - HIGH STRENGTH LOW ALLOY STRUCTURAL METAL:**  
DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

High-strength structural steel for bridges shall conform to AASHTO M270, grades 50, 50W or 70W. High-strength steel for all other applications shall conform to ASTM A588 (weathering) or ASTM A572, Grade 50.

**709.12 - STRUCTURAL AND EYEBAR STEEL:**  
DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

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

**709.15 - COATED DOWEL BARS & DOWEL BASKET ASSEMBLIES:**

DELETE THE SUBSECTION AND INSERT THE FOLLOWING:

Coated dowel bars shall meet the requirements of AASHTO M254 except that the steel used to make the dowel bars shall meet the requirements of

Section 709.1. Additionally, the coating applicator shall meet the requirements of Section 709.1.2 and the saw cut ends of the coated dowel bars shall be touched-up with a coating material in accordance with the requirements of Section 602.6.2.

#### **709.45-GALVANIZED STEEL GUARDRAIL POSTS:**

DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

Steel guardrail posts shall be fabricated from steel meeting the requirements of ASTM A36 or fabricated in accordance with ASTM A 769, Grade 40. They shall be of a section, length and weight as specified on the Plans. The weight shall not be less than 97.5 percent of that specified.

Galvanizing shall be in accordance with AASHTO M 111, with a minimum of 2 oz. per square foot (600 grams per square meter).

#### **709.46 - STEEL POSTS, POST BRACES AND GATE FRAMES FOR RIGHT-OF-WAY FENCE**

DELETE THE CONTENTS AND SUBSTITUTE THE FOLLOWING:

Unless otherwise specified, all right-of-way fence posts, post braces and gate frames shall meet the requirements of AASHTO M 181. Either Grade 1 or Grade 2 may be used unless one is specifically called for in the contract. Pipe members shall have the dimensions and weights called for on the Plans.

### **SECTION 711 PAINTS, COATINGS, OILS, AND INKS**

DELETE THE 2<sup>ND</sup> PARAGRAPH AND INSERT THE FOLLOWING:

General Requirements: The finished products shall not settle excessively nor cake in the container, shall be readily mixed with a paddle to a smooth uniform paint of specified consistency and working properties. The product shall not thicken, liver, skin, or curdle. The paint shall have a storage life of at least 12 months. No product may have VOC's in excess of 3.5 lb./gal (420 g/l).

#### **711.6 – FIELD PRIMER:**

DELETE THE HEADING AND SUBSTITUTE THE FOLLOWING:

“ORGANIC ZINC PRIMER”

**711.11.1****711.11.1-General:**

ADD TO THE TABLE:

<b>Federal Standard Number</b>	<b>x Coordinates</b>	<b>y Coordinates</b>	<b>Y Coordinates</b>
26373	0.3054	0.3156	37.19

**711.12.3-Physical Requirements:**

DELETE v “FLEXIBILITY” AND INSERT THE FOLLOWING:

A steel panel that is No. 20 gage (0.0375 in. or 0.952 mil), but in no case, no thinner than No. 24 gage (0.025 in. or 0.635 mil) shall be blasted to a white finish meeting SSPC-SP-5, and dried for 14 days at  $75^{\circ} \pm 5^{\circ}$  F ( $24^{\circ}$  C  $\pm 3^{\circ}$  C). The epoxy mastic coating shall be applied at a minimum of 5 mils (125  $\mu$ m) dry film thickness. The coating shall display no signs of cracking or loss of adhesion when the panel is uniformly bent  $180^{\circ}$  around an  $\frac{1}{8}$  inch (3 mm) diameter mandrel.

**711.12.6:**

ADD TO THE TABLE:

<b>Federal Standard Number</b>	<b>x Coordinates</b>	<b>y Coordinates</b>	<b>Y Coordinates</b>
26373	0.3054	0.3156	37.19

**711.20.1 – General:**

DELETE THE 7<sup>TH</sup> SENTENCE.

“The use of an intermediate coat shall be the option of the top coat manufacturer.”

**711.20.2 – Primer:**

ADD THE FOLLOWING TO THE END OF THE SECTION:

**4.3.2** Delete the VOC (volatile organic compound) requirement and substitute the following: The VOC shall not exceed 3.5 lbs/gal (420 kg/m<sup>3</sup>) for shop or field application.

**711.20.4-Top Coat:**

ADD TO THE TABLE:

<b>Federal Standard Number</b>	<b>x Coordinates</b>	<b>y Coordinates</b>	<b>Y Coordinates</b>
26373	0.3054	0.3156	37.19

**711.20.4.1-Physical Requirements:**

DELETE PARAGRAPH “iv. Accelerated Weathering”. REPLACE WITH THE FOLLOWING:

iv. Accelerated Weathering - After cycling 1000 hours there shall be no evidence of checking, cracking, rusting, or blistering. The degree of chalking shall not be less than No. 6 when tested according to ASTM D4214. The color difference after 1000 hours shall be no more than five  $\Delta E$  units.

**711.22-INORGANIC ZINC RICH LOW VOC SYSTEM:**

DELETE THE WORD “INORGANIC” FROM HEADING.

**711.22.1-General:**

DELETE ALL AFTER THE FIRST PARAGRAPH AND INSERT THE FOLLOWING:

### **711.22.2**

All products are to have a VOC of 2.8 lbs (1.02 kg) Max. except the primer, which can go to 3.5 lbs (1.52 kg) Max. The fabricator responsible for the major portion of the painting will choose the paint system.

#### **711.22.2-Primer:**

DELETE THE SENTENCE AND INSERT THE FOLLOWING:

The primer shall meet the requirements of 711.6 or 711.20.2.

#### **711.22.4.1-Requirements:**

DELETE THE CONTENTS AND SUBSTITUTE THE FOLLOWING:

- i. Dry Hard - 24 Hours Maximum
- ii. Color - Shall meet the requirements of 711.20.4.1 (iv).
- iii. Gloss - Shall meet the requirements of 711.20.4.1 (vii).

#### **711.22.5.1-System Requirements:**

DELETE PARAGRAPH "ii. Accelerated Weathering". REPLACE WITH THE FOLLOWING:

ii. Accelerated Weathering - After cycling 1000 hours there shall be no evidence of checking, cracking, rusting, or blistering. The degree of chalking shall not be less than No. 6 when tested according to ASTM D4214. The color difference after 1000 hours shall be no more than five  $\Delta E$  units.

## **SECTION 712 GUARDRAIL AND FENCE**

ADD THE FOLLOWING SUBSECTION:

#### **712.11 – SAFETY FENCE:**

Safety Fence shall be orange in color, commercially manufactured from UV stabilized high-density polyethylene or a suitable substitute approved by the Engineer

## **SECTION 713 METAL PIPE**

### **713.9 - FULL BITUMINOUS COATED STRUCTURAL PLATE PIPE, PIPE ARCH, AND ARCHES:**

DELETE THE ENTIRE SUBSECTION AND REPLACE WITH THE FOLLOWING:

These conduits shall conform to the requirements of AASHTO M 167 and shall be coated with bituminous material. When the coating can be applied in the shop it shall conform to the requirements of AASHTO M 190, Type A Coating. When the coating must be applied in the field the coating shall conform to the requirements of AASHTO M 243. The bituminous coating shall coat the entire inside and outside of the pipe and is not required between the metal sheets at the splices.

## **SECTION 715 MISCELLANEOUS MATERIALS**

### **715.11.6-ENGINEERING FABRIC FOR EROSION CONTROL:**

DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

Engineering fabric for erosion control shall meet the applicable requirements of AASHTO M 288, Section 7, Class 1.

### **715.11.8-ENGINEERING FABRIC FOR SEPARATION:**

DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

Engineering fabric for separation shall meet the applicable requirements of AASHTO M 288, Section 7, Class 2.

### **715.11.9-ENGINEERING FABRIC FOR STABILIZATION:**

DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

Engineering fabric for stabilization shall meet the applicable requirements of AASHTO M 288, Section 7, Class 1.

## 715.23

### 715.23 - GABIONS:

DELETE THE CONTENTS. SUBSTITUTE THE FOLLOWING:

Welded wire fabric gabions shall conform to ASTM A974 and non-welded (twisted) wire mesh gabions shall conform to ASTM A975. Additionally, the use of fastener rings in the assembly of the gabion baskets may be permitted by the Engineer, providing the rings have at least the same tensile strength, zinc coating, and size as the wire used in the body of the gabion.

### 715.24.2-Permanent Erosion Matting:

DELETE THE CONTENTS AND SUBSTITUTE THE FOLLOWING:

The matting shall consist of a machine produced mat of 100% ultraviolet stabilized polymeric or other suitable fibers resistant to degradation and having uniform thickness and mass per unit area throughout. The matting shall conform to the following:

Property <sup>1</sup>	Test Method	Type A	Type B	Type C
Minimum Mat Thickness	ASTM D1777	0.35 in. (9 mm)	0.50 in. (13 mm)	0.50 in. (13 mm)
Minimum (Wide Width) Tensile Strength	ASTM D4595	145 x 110 lb/ft (2.16 x 1.6 kN/m)	170 x 130 lb/ft (2.5 x 1.5 kN/m)	3100 x 2000 lb/ft (45 x 29 kN/m)
Maximum Elongation	ASTM D4595	50%	50%	50%
Minimum Porosity (Calculated)		95%	95%	95%
Resiliency	ASTM D1777	80%	80%	80%
Ultraviolet Stability	ASTM D4355	80%	80%	80%

<sup>1</sup> Property values are reported as minimum average roll values (MARV)

### Tractive Force (Shear Stress) Performance Specification

**Type A Matting** shall have the ability to prevent soil loss where the maximum channel shear stress ranges from 0-4 lb/ft<sup>2</sup> (0-20 kg/m<sup>2</sup>) in a vegetated state, @ 0.5 hours peak flow duration.

**Type B Matting** shall have the ability to prevent soil loss where the maximum channel shear stress ranges from 0-6 lb/ft<sup>2</sup> (0-29 kg/m<sup>2</sup>) in a vegetated state, @ 0.5 hours peak flow duration.

**Type C Matting** shall have the ability to prevent soil loss where the maximum channel shear stress ranges from 0-8 lb/ft<sup>2</sup> (0-39 kg/m<sup>2</sup>) in a

vegetated state, @ .5 hours peak flow duration.

**715.24.3 Acceptance:**

DELETE THE CONTENTS AND SUBSTITUTE THE FOLLOWING:

Acceptance of temporary erosion control matting shall be based upon the manufacturer's written certification that the erosion control mat used is well suited to the particular site to be protected and upon the Division's visual inspection of the material. Acceptance of permanent erosion control matting shall be based upon certified test data with each shipment of matting. Compliance of this data with the requirements specified will be the basis of acceptance.

**715.25 - GROUND AGRICULTURAL LIMESTONE:**

DELETE THE ENTIRE SECTION AND INSERT THE FOLLOWING:

Ground agricultural limestone shall consist of high calcitic or dolomitic limestone containing not less than 85% of total calcium and magnesium carbonates, ground to such fineness and clearly labeled in accordance with the requirements of the West Virginia Department of Agriculture. Ground agricultural limestone shall be furnished and used in accordance with State Laws. Suppliers must be registered with the West Virginia Department of Agriculture.

**715.40 – PAVEMENT MARKING MATERIAL:**

**715.40.2 – Preformed Traffic Markings:**

DELETE THE ADDRESS AND SUBSTITUTE THE FOLLOWING ADDRESS:

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

DELETE THE SECOND PARAGRAPH AND INSERT THE FOLLOWING:

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 their issuance, after which re-certification is required. The material must perform successfully in the Division's field evaluation test. A list of approved

#### **715.40.4**

Contractor's personnel and suppliers and their code numbers may be obtained by contacting:

ADD SECTION 715.40.4 AS FOLLOWS:

#### **715.40.4 - Temporary Pavement Markings (Type VIIB)**

##### **715.40.4.1 - Deleted**

**715.40.4.2 - Temporary Pavement Markings (Type VIIB):** This specification describes a removable pavement marking consisting of a film designed to be used for precut symbols, legends and lines. The temporary pavement markings shall be white or yellow as denoted on the Plans or required by the MUTCD.

##### **715.40.4.2.1 - Requirements:**

- i. **Composition:** The removable preformed plastic pavement marking film shall consist of a mixture of polymeric materials, pigments, nonmetallic reinforcing medium to facilitate removal, glass beads and a retroreflective layer of glass beads firmly bonded to the top surface.
- ii. **Adhesive:** The removable preformed plastic pavement marking film shall be precoated with a pressure sensitive adhesive capable of being affixed to bituminous concrete and portland cement concrete pavement surfaces without the use of heat, solvents and other additional adhesives or activators. The adhesive shall exhibit excellent shear characteristics and minimal tensile characteristics. The adhesive shall not require a protective liner when the preformed plastic pavement marking film is in rolled form for shipment. The adhesive shall be capable of temporarily bonding to the roadway pavement at temperatures at 60°F (16°C) and above without pickup or distortion by vehicular traffic.
- iii. **Pigmentation:** Color pigments shall be thoroughly blended to provide a plastic marking film that maintains uniform color under both daylight and night lighting conditions throughout the expected life of the film. White pavement marking film shall be similar to Federal Standard Color No. 595-17886. Yellow pavement marking film shall be similar to Federal Standard Color No. 595-13538.
- iv. **Thickness:** The thickness of the removable plastic marking film without adhesive shall be not less than 30 mils.

#### **715.42.9.1.4**

- v. **Glass Beads:** The glass beads shall be colorless and shall have a minimum refraction index of 1.50 when tested using the liquid oil immersion method. The size and quantity of beads shall be such that retroreflectivity of preformed plastic film is maintained as film wears through the surface course. The preformed plastic film shall have approximately 2 percent by weight of glass beads firmly adhered to the top of the film. Bead adhesion shall be such that beads are not easily removed when film surface is scratched firmly with thumbnail.
- vi. **Skid Resistance:** The surface for the retroreflective preformed plastic pavement marking film shall provide a minimum skied resistance value of 50 BPN when tested in accordance with ASTM E 303.
- vii. **Removability:** The preformed plastic pavement marking film shall be removable from bituminous concrete and portland cement concrete in its entirety, either manually or by a mechanical roll-up device, at temperatures above 40°F (4°C) and without the use of heat, solvents, grinding or blasting.
- vii. **Approved Suppliers:** The material must perform successfully in the Division's Field Evaluation Test. A list of approved suppliers and their code numbers may be obtained from Contract Administration Division.

#### **715.42.9.1.4 – Material incorporated into the Support:**

DELETE THE FIRST SENTENCE OF THE FOURTH PARAGRAPH AND SUBSTITUTE THE FOLLOWING:

Anchor bolts shall be fabricated from steel meeting the requirements of ASTM F 1554, Grade 55.

#### **715.42.9.2.2 – Material incorporated into the Support:**

DELETE THE FIRST SENTENCE OF THE FOURTH PARAGRAPH AND SUBSTITUTE THE FOLLOWING:

Anchor bolts shall be fabricated from steel meeting the requirement of ASTM F 1554, Grade 55.

#### **715.42.9.4.1 - Type E1:**

DELETE THE FIRST SENTENCE OF THE THIRD PARAGRAPH AND SUBSTITUTE THE FOLLOWING:

#### **715.42.9.4.2**

Anchor bolts shall be fabricated from steel meeting the requirement of ASTM F 1554, Grade 55.

#### **715.42.9.4.2 – Type E2:**

DELETE THE FIRST SENTENCE OF THE THIRD PARAGRAPH AND SUBSTITUTE THE FOLLOWING:

Anchor bolts shall be fabricated from steel meeting the requirements of ASTM F 1554, Grade 55

#### **715.42.9.4.3 – Type E3:**

DELETE THE FIRST SENTENCE OF THE THIRD PARAGRAPH AND SUBSTITUTE THE FOLLOWING:

Anchor bolts shall be fabricated from steel meeting the requirements of ASTM F 1554, Grade 55.

### **SECTION 717 COMPACTION CONTROL OF BASE COURSE MATERIAL**

DELETE THE ENTIRE SECTION AND REPLACE WITH THE FOLLOWING:

#### **717.1-GENERAL:**

The Contractor shall notify the Engineer prior to construction of the test strips as set forth in MP 700.00.24. The Contractor shall perform quality control compaction tests and record the data on the forms as set forth in the Materials Procedures (MPs). The test data shall be available to the Engineer at the time of testing or as indicated in the Contractor's quality control plan.

#### **717.2-TEST METHODS:**

Maximum density, quality control density and acceptance density for crushed aggregate base course and aggregate subbase shall be determined in accordance with MP 700.00.24.

#### **717.3-DENSITY:**

The crushed aggregate base course and aggregate subbase shall be compacted to the target percentage of dry density of 95%. The maximum required dry density shall be determined in accordance with MP 700.00.24 Part I on a control test strip having a compacted thickness of 6 inches (150 mm) or less. The in-place dry density of each base course layer shall be determined in accordance with MP 700.00.24 Part II. The maximum layer thickness, other than the test strip(s), shall not exceed 12 in. (300 mm) or as

specified in the project documents. The density of layers with thickness that differ from the thickness of the control test strip(s) shall be subject to the density requirements determined by the control test strip.

## **SECTION 718 SEWER AND WATERLINE MATERIAL**

### **718.5 - PLASTIC PIPE (PVC)**

DELETE THE CONTENTS AND SUBSTITUTE THE FOLLOWING:

Plastic Pipe shall conform to the following requirements unless otherwise specified by the Utility responsible for its operation:

<b>Pipe Size</b>	<b>Pressure Applications</b>	<b>Non-Pressure Applications</b>
Less than 4 in (100 mm)	ASTM D2241, SDR 21	ASTM D3034
4 in (100 mm) to 12 in (300 mm)	AWWA C900, DR 14	ASTM D3034
14 in (350 mm) to 16 in (400 mm)	AWWA C905, DR 14	ASTM D3034
<b>Joint Requirements</b>	ASTM D3139	ASTM D3212

### **718.7-PLASTIC PIPE (POLYETHYLENE):**

DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

Plastic pipe (polyethylene) shall conform to ASTM D2239 "PE3408". Additionally, when used for potable water, polyethylene pipe shall be approved by the National Sanitation Foundation for use in transmitting liquids for human consumption.

### **718.10 - GATE VALVES**

DELETE THE CONTENTS AND SUBSTITUTE THE FOLLOWING:

Gate valves shall conform to AWWA C500 or C509.