# APPENDIX B2

## AMENDMENTS TO THE WSDOT STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION

## I-405, SR520 to SR522 Stage 1 (Kirkland Stage 1)

Draft RFP

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# APPENDIX B2

## AMENDMENTS TO THE WSDOT STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION

## GENERAL

The following Amendments to the Standard Specifications are made a part of this contract and supersede any conflicting provisions of the Standard Specifications. Each Amendment contains all current revisions to the applicable section of the Standard Specifications and may include references which do not apply to this particular project.

The Technical Specifications, Chapter 2, of the Contract Documents shall govern in the event of any conflict between these amendments and the specifications in the Technical Specifications.

# DIVISION 2

## SECTION 2-02, REMOVAL OF STRUCTURES AND OBSTRUCTIONS

### *2-02.3(3) Removal of Pavement, Sidewalks, and Curbs*

The section title is revised to read:

**2-02.3(3) Removal of Pavement, Sidewalks, Curbs, and Gutters**

The first sentence is revised to read:

In removing pavement, sidewalks, curbs, and gutters, the Contractor shall:

Item 3 is revised to read:

3. Make a vertical saw cut between any existing pavement, sidewalk, curb, or gutter that is to remain and the portion to be removed.

## SECTION 2-03, ROADWAY EXCAVATION AND EMBANKMENT

### *2-03.3(14)D Compaction and Moisture Control Tests*

This section is revised to read:

Maximum density and optimum moisture content shall be determined by one of the following methods:

1. materials with less than 30 percent by weight retained on the U.S. No. 4 sieve shall be determined using FOP for AASHTO T 99 Method A.
2. materials with 30 percent or more by weight retained on the U.S. No. 4 sieve and less than 30 percent retained on the 3/4 inch sieve shall be determined by WSDOT Test Method No. 606 or FOP for AASHTO T 180 Method D. The determination of which test procedure to use will be made solely by the Contracting Agency.
3. materials with 30 percent or more retained on the 3/4 inch sieve shall be determined by WSDOT Test Method No. 606.

In place density will be determined using Test Methods WSDOT FOP for AASHTO T 310 and WSDOT SOP for T 615.

# SECTION 2-09, STRUCTURE EXCAVATION

### *2-09.3(1)E Backfilling*

The first paragraph under Timing is revised to read:

> Backfill shall not be placed against any concrete structure until the concrete has attained 90 percent of its design strength and a minimum age of 14 days, except that reinforced concrete retaining walls 15 feet in height or less may be backfilled after the wall has attained 90 percent of its design compressive strength and curing requirements of Section 6-02.3(11) are met. Footings and columns may be backfilled as soon as forms have been removed, so long as the backfill is brought up evenly on all sides.

# SECTION 2-10, DITCH EXCAVATION

### *2-10.1 Description*

The second paragraph is supplemented with the following:

> Ditches 8 or more feet wide at the bottom shall be constructed in accordance with the requirements of Section 2-03.3(14)M.

# DIVISION 4

## SECTION 4-04, BALLAST AND CRUSHED SURFACING

### *4-04.3(5) Shaping and Compaction*

In the first paragraph, the first sentence is revised to read:

> Immediately following spreading and final shaping, each layer of surfacing shall be compacted to at least 95 percent of the standard density determined by the requirements of Section 2-03.3(14)D before the next succeeding layer of surfacing or pavement is placed.

# DIVISION 5

## SECTION 5-01, CEMENT CONCRETE PAVEMENT REHABILITATION

### *5-01.3(6) Dowel Bar Retrofit*

The sixth paragraph is revised to read:

All slot surfaces shall be cleaned to bare concrete by sand blasting or pressure washing. The cleaning shall remove all slurry, parting compound, and other foreign materials prior to installation of the dowel. If a pressure washer is used to clean the slots the pressure at the nozzle shall not exceed 4000 psi. Any damage to the concrete shall be repaired by the Contractor at no cost to the Contracting Agency. All washwater shall be cleaned from the slots prior to placement of any slot patching material. Traffic shall not be allowed on slots where concrete has been removed.

## SECTION 5-04, HOT MIX ASPHALT

### *5-04.3(8)A Acceptance Sampling and Testing - HMA Mixture*

In item 3, C. (Test Results), the second and third paragraphs are revised to read:

Sublot sample test results (gradation and asphalt binder content) may be challenged by the Contractor. For HMA mixture accepted by statistical evaluation with a mix design that did not meet the verification tolerances, the test results in the test section including the percent air voids (Va) may be challenged. To challenge test results, the Contractor shall submit a written challenge within five working days after receipt of the specific test results. A split of the original acceptance sample will be sent for testing to either the Region Materials Lab or the State Materials Lab as determined by the Project WSDOT. The split of the sample with challenged results will not be tested with the same equipment or by the same tester that ran the original acceptance test. The challenge sample will be tested for a complete gradation analysis and for asphalt binder content.

The results of the challenge sample will be compared to the original results of the acceptance sample test and evaluated according to the following criteria:

| **Deviation** | |
|---|---|
| U.S. No. 4 sieve and larger | Percent passing ±4.0 |
| U.S. No. 8 sieve | Percent passing ±2.0 |
| U.S. No. 200 sieve | Percent passing ±0.4 |
| Asphalt binder % | Percent binder content ±0.3 |
| Va % | Percent Va ±0.7 |

Item 3, D. (Test Methods) is revised to read:

D. Test Methods

Testing of HMA for compliance of volumetric properties (VMA, VFA and Va) will be by WSDOT Standard Operating Procedure SOP 731. Testing for compliance of asphalt binder content will be by WSDOT FOP for AASHTO T 308. Testing for compliance of gradation will be by WAQTC FOP for AASHTO T 27/T 11.

### *5-04.3(13) Surface Smoothness*

In the first paragraph, the second sentence is revised to read:

The completed surface of the wearing course shall not vary more than 1/8 inch from the lower edge of a 10-foot straightedge placed on the surface parallel to the centerline.

## SECTION 5-05, CEMENT CONCRETE PAVEMENT

### *5-05.3(1) Concrete Mix Design for Paving*

Number 1. Materials, is revised to read:

1. Materials. Materials shall conform to Section 5-05.2. Fine aggregate shall conform to Section 9-03.1(2), Class 1. Coarse aggregate shall conform to Section 9-03.1(4) AASHTO grading No. 467. An alternate combined gradation may be proposed, which has a maximum aggregate size equal to or greater than a 2-inch square sieve. The combined aggregate gradation shall conform to Section 9-03.1(5).

   Fly ash, if used, shall not exceed 35 percent by weight of the total cementitious material, shall conform to Section 9-23.9 and shall be limited to Class F with a maximum CaO content of 15 percent by weight.

   Ground granulated blast furnace slag, if used, shall not exceed 25 percent by weight of the total cementitious material and shall conform to Section 9-23.10. When both ground granulated blast furnace slag and fly ash are included in the concrete mix, the total weight of both these materials is limited to 35 percent by weight of the total cementitious material. As an alternative to the use of fly ash, ground granulated blast furnace slag and cement as separate components, a blended hydraulic cement that meets the requirements of Section 9-01.2(4) Blended Hydraulic Cements may be used.

   The water/cement ratio shall be calculated on the total weight of cementitious material. The following are considered cementitious materials: Portland cement, fly ash, ground granulated blast furnace slag and microsilica. The minimum cementitious material for any mix design shall be 564 pounds per cubic yard.

# DIVISION 6

## SECTION 6-02, CONCRETE STRUCTURES

### *6-02.3(2) Proportioning Materials*

This section is revised to read:

The total water soluble Chloride ion (Cl-) content of the mixed concrete shall not exceed 0.06 percent by weight of cementitious material for prestressed concrete nor 0.10 percent by weight of cementitious material for reinforced concrete. An initial evaluation may be obtained by testing individual concrete ingredients for total chloride ion content per AASHTO T 260 and totaling these to determine the total water soluble Chloride ion (Cl-) or the total water soluble Chloride ion (Cl-) in accordance with ASTM C 1218.

Unless otherwise specified, the Contractor shall use Type I or II Portland cement in all concrete as defined in Section 9-01.2(1).

The use of fly ash is required for Class 4000D and 4000P concrete. The use of fly ash and ground granulated blast furnace slag is optional for all other classes of concrete.

Fly ash, if used, shall not exceed 35 percent by weight of the total cementitious material and shall conform to Section 9-23.9. Ground granulated blast furnace slag, if used, shall not exceed 25 percent by weight of the total cementitious material and shall conform to Section 9-23.10. When both ground granulated blast furnace slag and fly ash are included in the concrete mix, the total weight of both these materials is limited to 35 percent by weight of the total cementitious material.

The water/cement ratio shall be calculated on the total weight of cementitious material. The following are considered cementitious materials: Portland cement, fly ash, ground granulated blast furnace slag and microsilica.

As an alternative to the use of fly ash, ground granulated blast furnace slag and cement as separate components, a blended hydraulic cement that meets the requirements of Section 9-01.2(4) Blended Hydraulic Cements may be used.

### *6-02.3(2)A Contractor Mix Design*

The seventh paragraph is revised to read:

A high-range water reducer (superplasticizer) may be used in all mix designs. Microsilica fume may be used in all mix designs. The use of a high-range water reducer or microsilica fume shall be submitted as a part of the Contractor's concrete mix design.

### *6-02.3(5)A General*

In the fourth paragraph, item 2 is revised to read:

2. An individual strength test averaged with the two preceding individual strength tests meets or exceeds specified strength (for the same class and exact mix I.D. of concrete on the same contract).

### *6-02.3(5)C Conformance to Mix Design*

This section is revised to read:

Cement, coarse and fine aggregate weights shall be within the following tolerances of the mix design:

Batch Volumes less than or equal to 4 cubic yards

| | | |
|---|---|---|
| Cement | +5% | -1% |
| Aggregate | +10% | -2% |

Batch Volumes more than 4 cubic yards

| | | |
|---|---|---|
| Cement | +5% | -1% |
| Aggregate | +2% | -2% |

If the total cementitious material weight is made up of different components, these component weights shall be within the following tolerances:

1. Portland cement weight plus 5% or minus 1 percent of that specified in the mix design.
2. Fly ash weight plus or minus 5 percent of that specified in the mix design.
3. Microsilica weight plus or minus 10 percent of that specified in the mix design.

Water shall not exceed the maximum water specified in the mix design.

### *6-02.3(6)A Weather and Temperature Limits to Protect Concrete*

The section "Cold Weather Protection" is revised to read:

The Contractor is solely responsible for protecting concrete from inclement weather during the entire curing period. The Contractor shall provide a written procedure for cold weather concreting to the Engineer for review and approval. The procedure shall detail how the Contractor will prevent the concrete temperature from falling below 50º F. Extra protection shall be provided for areas especially vulnerable to freezing (such as exposed top surfaces, corners and edges, thin sections, and concrete placed into steel forms). Permission given by the Engineer to place concrete during cold weather will in no way ensure acceptance of the work by the Contracting Agency. Should the concrete placed under such conditions prove unsatisfactory in any way, the Engineer shall still have the right to reject the work although the plan and the work were carried out with the Engineer's permission.

If weather forecasts predict air temperatures below 35º F during the seven days just after the concrete placement, the Contractor may place the concrete only if his approved cold weather concreting plan is implemented.

The Contractor shall provide and maintain a maturity meter in the concrete at a location specified by the Engineer for each concrete placement. During curing, data from the maturity meter shall be readily available to the Engineer. The Contractor shall record and provide time and temperature data on hourly intervals.

The Contractor shall not mix nor place concrete while the air temperature is below 35º F, unless the water or aggregates (or both) are heated to at least 70º F. The aggregate shall not exceed 150º F. If the water is heated to more than 150º F, it shall be mixed with the aggregates before the cement is added. Any equipment and methods shall heat the materials evenly. Concrete placed in shafts and piles is exempt from such preheating requirements.

The Contractor may warm stockpiled aggregates with dry heat or steam, but not by applying flame directly or under sheet metal. If the aggregates are in bins, steam or water coils or other heating methods may be used if aggregate quality is not affected. Live steam heating is not permitted on or through aggregates in bins. If using dry heat, the Contractor shall increase mixing time enough to permit the super-dry aggregates to absorb moisture.

Any concrete placed in air temperatures below 35º F shall be immediately protected. In addition to the monitoring of the concrete temperature with a maturity meter the Contractor shall provide recording thermometers or other approved devices to monitor the surface temperature of the concrete. The concrete surface temperature shall be maintained at or above 50º F and the relative humidity shall be maintained above 80 percent. These conditions shall be maintained for a minimum of seven days or for the cure period required by Section 6-02.3(11), whichever is longer. If artificial heat is used to maintain the temperature inside an enclosure, moisture shall be added to the enclosure to maintain the humidity as stated above. The Contractor shall stop adding moisture 24 hours before removing the heat.

If at any period during curing the concrete temperature falls below 50º F on the maturity meter or recording thermometer, no curing time is awarded for that day and the required curing time will be extended day for day where the temperature falls below 50º F. Should the Contractor fail to adequately protect the concrete and the temperature of the concrete falls below 35º F during curing, the Engineer may reject it.

### *6-02.3(11) Curing Concrete*

In the first paragraph, item 3 is supplemented with the following:

When continuous moisture or wet curing is required, the Contractor shall keep the concrete surfaces wet with water during curing.

In the second paragraph, the first sentence is revised to read:

The Contractor may provide continuous moisture by watering a covering of heavy quilted blankets, by keeping concrete surfaces wet with water continuously and covering with a white reflective type sheeting, or by wetting the outside surfaces of wood forms.

### *6-02.3(17)K Concrete Forms on Steel Spans*

The following new paragraph is inserted between the second and third paragraphs:

The compression member or bottom connection of cantilever formwork support brackets shall bear either within six inches maximum vertically of the bottom flange or within six inches maximum horizontally of a vertical web stiffener. The Contractor shall also furnish and install temporary struts and ties to prevent rotation of the steel girder. Partial depth cantilever formwork support brackets that do not conform to the above requirements shall not be used, unless the Contractor submits details showing the additional formwork struts and ties used to brace the steel girder against web distortion caused by the partial depth bracket, and receives the Engineer's approval of the submittal.

### *6-02.3(17)O Early Concrete Test Cylinder Breaks*

The third sentence in the first paragraph is revised to read:

The Contractor shall retain a testing laboratory to perform this work.

The first paragraph is supplemented with the following:

Testing laboratories' equipment shall be calibrated within one year prior to testing and testers must be ACI certified.

The first sentence in the fifth paragraph is revised to read:

The Contractor shall furnish the Engineer with all test results, proof of equipment calibration, and tester's certification.

The sixth paragraph is deleted.

### *6-02.3(19)A Elastomeric Bearing Pads*

This section including title is revised to read:

#### *6-02.3(19)A Vacant*

### *6-02.3(19)B Bridge Bearing Assemblies*

Item 4 is deleted.

### *6-02.3(20) Grout for Anchor Bolts and Bridge Bearings*

The eighth paragraph is supplemented with the following:

Grout pad may be loaded when a minimum of 4000 psi compressive strength is attained.

### *6-02.3(21) Drainage of Box Girder Cells*

This section is supplemented with the following:

All drainage holes shall be screened in accordance with the Plan details.

### *6-02.3(22) Drainage of Substructure*

The second sentence in the first paragraph is supplemented with the following:

> Weep holes shall be covered with geotextile meeting the requirements of Section 9-33.2, Table 2 Class C before backfilling. Geotextile screening shall be bonded to the concrete with an approved adhesive.

### *6-02.3(24)C Placing and Fastening*

The fifteenth paragraph beginning with "Reinforcing steel bars shall not vary..." is supplemented with the following:

> Drilled Shafts top of rebar cage elevation +6 in./-3 in.

### *6-02.3(24)E Welding Reinforcing Steel*

The ninth paragraph is revised to read:

> The minimum preheat and interpass temperature for welding Grade 60 reinforcing bars shall be in accordance with AWS D1.4 Table 5.2 and mill certification of carbon equivalence, per lot of reinforcing. Preheating shall be applied to the reinforcing bars and other splice members within 6 inches of the weld, unless limited by the available lengths of the bars or splice member.

The twelfth paragraph is revised to read:

> Under supervision of the State Materials and Fabrication Inspector, the welder shall weld three test joints of the largest size reinforcing bar to be weld spliced, per type of joint shown in the Plans. Two of the test welds shall be test loaded to no less than 125 percent of the minimum specified yield strength of the bar. The remaining test weld shall be mechanically cut perpendicular to the direction of the welding and macroetched. The macroetch specimen for Flare V groove welds will be inspected for the weld size and effective throat as shown in the Plans. Indirect butt splices shall be cut mechanically at two locations to provide a transverse cross-section of each of the bars spliced in the test assembly. The sections shall show the full cross-section of the weldment, the root of the weld, and any reinforcement. The etched cross-section shall have complete penetration and complete fusion with the base metal and between successive passes in the weld. Groove welds of direct butt splices and flare-groove welds shall not have reinforcement exceeding 1/8 inch in height measured from the main body of the bar and shall have a gradual transition to the base metal surface. No cracks will be allowed in either the weld metal or heat-affected zone. All craters shall be filled to the full cross-section of the weld. Weld metal shall be free from overlay. Undercutting deeper than 1/32 inch will not be allowed except at points where welds intersect the raised pattern of deformations where undercutting less than 1/16 inch deep will be acceptable. The sum of diameters of piping porosity in groove welds shall not exceed 1/8 inch in any linear inch of weld or exceed 9/16 inch in any 6-inch length of weld. Corrections to welds with shielded metal arc, gas metal arc, or flux-cored arc welding processes shall be made in accordance with Engineer's approval.

### *6-02.3(25) Prestressed Concrete Girders*

The fourth paragraph is replaced with the following:

The various types of girders are:

**Prestressed Concrete Girder** – Refers to prestressed concrete girders of all types, including prestressed concrete I girders, prestressed concrete wide flange I girders, bulb tee girders, deck bulb tee girders, thin flange deck bulb tee girders, precast prestressed concrete members, spliced prestressed concrete girders, and prestressed concrete tub girders.

**Prestressed Concrete I Girder** – Refers to a prestressed concrete girder with a flanged I shaped cross section, requiring a cast-in-place concrete deck to support traffic loads. WSDOT standard girders in this category include Series W42G, W50G, W58G, and W74G.

**Prestressed Concrete Wide Flange I Girder** – Refers to a prestressed concrete girder with an I shaped cross section with wide top and bottom flanges, requiring a cast-in-place concrete deck to support traffic loads. WSDOT standard girders in this category include Series WF42G, WF50G, WF58G, WF74G, W83G, and W95G.

**Bulb Tee Girder** – Refers to a prestressed concrete girder, with a wide top flange requiring a cast-in-place concrete deck to support traffic loads. WSDOT standard girders in this category include Series W32BTG, W38BTG, W50BTG, and W62BTG.

**Deck Bulb Tee Girder** – Refers to a bulb tee girder with a top flange designed to support traffic loads, and designed to be mechanically connected at the flange edges to adjacent girders at the job site. Except where specific requirements are otherwise specified for these girders, deck bulb tee girders shall conform to all requirements specified for bulb tee girders. WSDOT standard girders in this category include Series W35DG, W41DG, W53DG, and W65DG.

**Thin Flange Deck Bulb Tee Girder** – Refers to a bulb tee girder with a top flange width equal to the girder spacing and requiring a cast-in-place concrete deck to support traffic loads. Except where specific requirements are otherwise specified for these girders, thin flange deck bulb tee girders shall conform to all requirements specified for bulb tee girders. WSDOT standard girders in this category include Series W32TFG, W38TFG, W50TFG, W62TFG, and W74TFG.

**Precast Prestressed Member (PCPS Member)** – Refers to a precast prestressed slab, precast prestressed ribbed section, or a deck double tee girder. PCPS members are designed to be mechanically connected at the flange or member edges to adjacent PCPS members at the job site. Except where specific requirements are otherwise specified for these girders, PCPS members shall conform to all requirements specified for deck bulb tee girders.

**Double Tee Girder** – Refers to a hybrid PCPS member that is similar to a deck double tee girder, except that the top surface is a thin top flange requiring a cast-in-place concrete deck to support traffic loads. Double tee girders shall conform to all requirements specified for bulb tee girders and PCPS members.

**Spliced Prestressed Concrete Girder** – Refers to prestressed concrete girders initially fabricated in segments to be longitudinally spliced together with cast-in-place concrete closures at the job site. Except where specific requirements are otherwise specified for these girders, spliced prestressed concrete girders shall conform to all requirements specified for prestressed concrete girders. Anchorages shall conform to Sections 6-02.3(26)B, 6-02.3(26)C, and 6-02.3(26)D. Ducts shall conform to the Section 6-02.3(26)E requirements for internal embedded installation, and shall be round, unless the Engineer approves use of elliptical shaped ducts. Duct-wedge plate transitions shall conform to Section 6-02.3(26)E. Prestressing reinforcement shall conform to Section 6-02.3(26)F. WSDOT standard girders in this category include Series WF74PTG, W83PTG, and W95PTG.

**Prestressed Concrete Tub Girder** – Refers to prestressed concrete trapezoidal box or bathtub girders including those fabricated in segments to be spliced together with cast-in-place concrete closures at the job site. Except where specific requirements are otherwise specified for these girders, prestressed concrete tub girders shall conform to all requirements specified for prestressed concrete girders and spliced prestressed concrete girders. WSDOT standard girders in this category include Series U**G* or Series UF**G*, where U specifies webs without flanges, UF specifies webs with flanges, ** specifies the girder height in inches, and * specifies the bottom flange width in feet.

### *6-02.3(25)A Shop Plans*

The second, third and fourth paragraphs are revised to read:

Shop plans shall show the size and location of all cast-in holes for installation of deck formwork hangers and/or temporary bracing. Holes for formwork hangers shall match approved deck formwork plans designed in accordance with Section 6-02.3(16). There shall be no field-drilled holes in prestressed concrete girders. Post-tensioning ducts in spliced prestressed concrete girders shall be located so their center of gravity is in accordance with the Plans.

The Contractor shall have the option to furnish Series W74G prestressed concrete girders with minor dimensional differences from those shown in the Plans. The 2 5/8-inch top flange taper may be reduced to 1 5/8 inches and the bottom flange width may be increased to 2 feet 2 inches. Other dimensions of the girder shall be adjusted as necessary to accommodate the above mentioned changes. Reinforcing steel shall be adjusted as necessary. The overall height and top flange width shall remain unchanged.

If the Contractor elects to provide a prestressed concrete girder with an increased web thickness, shop plans along with supporting design calculations shall be submitted to the Engineer for approval prior to girder fabrication. The girder shall be designed for at least the same load carrying capacity as the girder shown in the Plans. The load carrying capacity of the mild steel reinforcement shall be the same as that shown in the Plans.

The sixth paragraph is revised to read:

The Contractor shall provide five copies of the shop plans to the Engineer for approval, except as otherwise noted. Shop drawings for spliced prestressed concrete girders shall conform to Section 6-02.3(26)A, and seven copies of the shop drawings shall be submitted to the Engineer for approval. The shop drawings for spliced prestressed concrete girders shall include all details related to the post-tensioning operations in the field, including details of hardware required, tendon geometry, blockout details, and details of additional or modified steel reinforcing bars required in cast-in-place closures. Approval of shop plans means only that the Engineer accepts the methods and materials. Approval does not imply correct dimensions.

### *6-02.3(25)B Casting*

The first paragraph is revised to read:

Before casting girders, the Contractor shall have possession of an approved set of shop drawings. Side forms shall be steel except that cast-in-place concrete closure forms for spliced prestressed concrete girders, interior forms of prestressed concrete tub girders, and end bulkhead forms of prestressed concrete girders may be plywood. Interior voids for precast prestressed slabs with voids shall be formed by either wax soaked cardboard or expanded polystyrene forms. The interior void forms shall be secured in the position as shown in the Plans and shall remain in place.

The fourth paragraph is revised to read:

Air-entrainment is not required in the concrete placed into prestressed precast concrete girders, including cast-in-place concrete closures for spliced prestressed concrete girders, unless otherwise noted. The Contractor shall use air-entrained concrete in the top two inches, minimum, of the roadway deck flange of deck bulb-tee girders, deck double tee girders, and precast prestressed ribbed sections. All concrete for precast prestressed slabs shall be air entrained, except for slabs where the Engineer approves use of air-entrained concrete in the top two inches, only. Maximum and minimum air content shall be as specified in Section 6-02.3(2)A.

The sixth paragraph is revised to read:

The Contractor may form circular block-outs in the girder top flanges to receive falsework hanger rods. These block-outs shall:

1. Not exceed 1 inch in diameter;
2. Be spaced no more than 72 inches apart longitudinally on the girder;
3. Be located 3 inches or more from the outside edge of the top flange on Series W42G, W50G, and W58G girders, 6 inches or more for Series W74G girders, and 7 inches or more for Series WF42G, WF50G, WF58G, WF74G, WF74PTG, W83G, W83PTG, W95G, W95PTG, W32BTG, W38BTG, W50BTG, W62BTG girders and other bulb tee girders.

### *6-02.3(25)C Prestressing*

The sixth paragraph is revised to read:

Post-tensioning of spliced prestressed concrete girders shall conform to Section 6-02.3(26)G, and the following requirements:

1. Before tensioning, the Contractor shall remove all side forms from the cast-in-place concrete closures. From this point until 48 hours after grouting the tendons, the Contractor shall keep all construction and other live loads off the superstructure and shall keep the falsework supporting the superstructure in place.
2. Once the post-tensioning steel is installed, no welds or welding grounds shall be attached to metal forms, structural steel, or steel reinforcing bars of the structural member.
3. The Contractor shall not tension the post-tensioning reinforcement until the concrete in the cast-in-place closures reaches the minimum compressive strength specified in the Plans (or 5,000 psi if the concrete strength is not specified in the Plans). This strength shall be measured with concrete cylinders made of the same concrete and cured under the same conditions as the cast-in-place closures.
4. All post-tensioning shall be completed before placing the sidewalks and barriers on the superstructure.

### *6-02.3(25)D Curing*

The fourth paragraph is revised to read:

Curing of cast-in-place concrete closures for spliced prestressed concrete girders shall conform to Section 6-02.3(11).

### *6-02.3(25)E Contractors Control Strength*

The sixth through eleventh paragraphs are revised to read:

For precast prestressed members, a test shall consist of four cores measuring 3 inches in diameter by 6 inches in height (for slabs) and by the thickness of the web (for ribbed sections). Two cores shall be taken from each side of the member and on each side of the member's span midpoint, at locations approved by the Engineer. The core locations for precast prestressed slabs shall be near mid-depth of the slab, within the middle third of the span length, and shall avoid all prestressing strands and steel reinforcing bars. The core locations for precast prestressed ribbed sections shall be immediately beneath the top flange, within the middle third of the span length, and shall avoid all prestressing strands and steel reinforcing bars.

For prestressed concrete tub girders, a test shall consist of four cores measuring 3 inches in diameter by the thickness of the web, taken from each web approximately three feet to the left and to the right of the center of the girder span. The cores shall avoid all prestressing strands and steel reinforcing bars.

For all other prestressed concrete girders, a test shall consist of three cores measuring 3 inches in diameter by the thickness of the web and shall be removed from just below the top flange; one at the midpoint of the girder's length and the other two approximately 3 feet to the left and approximately 3 feet to the right.

The cores shall be taken in accordance with AASHTO T 24 and shall be tested in accordance with WSDOT FOP for AASHTO T 22. The Engineer may accept the girder if the average compressive strength of the four cores from the precast prestressed member, or prestressed concrete tub girder, or of the three cores from any

other prestressed concrete girder, is at least 85 percent of the specified compressive strength with no one core less than75 percent of specified compressive strength.

If the girder is cored to determine the release strength, the required patching and curing of the patch shall be done prior to shipment. If there are more than three holes or if they are not in a neutral location, the prestress steel shall not be released until the holes are patched and the patch material has attained a minimum compressive strength equal to the required release compressive strength or 4,000 psi, whichever is larger.

The Contractor shall coat cored holes with an epoxy bonding agent and patch the holes using the same type concrete as that in the girder, or a mix approved during the annual plant review and approval. The epoxy bonding agent shall meet the requirements of Section 9-26.1 for Type II, Grade 2 epoxy. The girder shall not be shipped until tests show the patch material has attained a minimum compressive strength of 4,000 psi.

### *6-02.3(25)F Prestress Release*

The third paragraph is revised to read:

The Contractor may request permission to release the prestressing reinforcement at a minimum concrete compressive strength less than specified in the Plans. This request shall be submitted to the Engineer for approval in accordance with Section 6-01.9 and shall be accompanied with calculations showing the adequacy of the proposed release concrete compressive strength. The release strength shall not be less than 3,500 psi, except that the release strength for spliced prestressed concrete girders shall not be less than 4,000 psi. The calculated release strength shall meet the requirements outlined in the Washington State Department of Transportation Bridge Design Manual for tension and compression at release. The proposed minimum concrete compressive strength at release will be evaluated by the Contracting Agency. Fabrication of girders using the revised release strength shall not begin until the Contracting Agency has provided written approval of the revised release compressive strength. If a reduction of the minimum concrete compressive strength at release is allowed, the Contractor shall bear any added cost that results from the change.

### *6-02.3(25)G Protection of Exposed Reinforcement*

The second paragraph is revised to read:

Grouting of post-tensioning ducts for spliced prestressed concrete girders shall conform to Section 6-02.3(26)H.

### *6-02.3(25)H Finishing*

The fourth paragraph is revised to read:

On the deck bulb tee girder section and all precast prestressed members, the Contractor shall test the roadway deck surface portion for flatness. This test shall occur after floating but while the concrete remains plastic. Testing shall be done with a 10-foot straightedge parallel to the girder centerline and with a flange width straightedge at right angles to the girder centerline. The Contractor shall fill

depressions, cut down high spots, and refinish to correct any deviation of more than 1/4 inch within the straightedge length. This section of the roadway surface shall be finished to meet the requirements for finishing roadway slabs, as defined in Section 6-02.3(10) except that, if approved by the Engineer, a coarse stiff broom may be used to provide the finish in lieu of a metal tined comb.

### *6-02.3(25)I Tolerances*

The title, first paragraph, and items 7, 10, and 21 following the first paragraph are revised to read:

#### *6-02.3(25)I Fabrication Tolerances*

The girders shall be fabricated as shown in the Plans and shall meet the dimensional tolerances listed below. Construction tolerances of cast-in-place closures for spliced prestressed concrete girders shall conform to the tolerances specified for spliced prestressed concrete girders. Actual acceptance or rejection will depend on how the Engineer believes a defect outside these tolerances will affect the structure's strength or appearance:

7. Flange Depth:

| | |
|---|---|
| For I and Wide Flange I girders: | ± 1/4 inch |
| For bulb tee and deck bulb tee girders: | + 1/4 inch, - 1/8 inch |
| For PCPS members: | + 1/4 inch, - 1/8 inch |

10. Longitudinal Position of the Harping Point:

| | |
|---|---|
| Single harping point | ± 18 inches |
| Multiple bundled strand groups | |
| First bundled strand group | ± 6 inches |
| Second bundled strand group | ± 18 inches |
| Third bundled strand group | ± 30 inches |

21. Differential Camber Between Girders in a Span (measured in place at the job site):

| | |
|---|---|
| For I, Wide Flange I, bulb tee, and spliced prestressed concrete girders: | 1/8 inch per 10 feet of beam length. |
| For deck bulb tee girders: | Cambers shall be equalized by an approved method when the |

| | |
|---|---|
| | differences in cambers between adjacent girders or stages measured at mid-span exceeds 1/4 inch. |
| For PCPS members: | ± 1/4 inch per ten feet of member length measured at midspan, but not greater than ± 1/2 inch total. |
| For prestressed concrete tub girders: | ± 1/4 inch per ten feet of member length measured at midspan, but not greater than ± 1/2 inch total. |

### *6-02.3(25)J Horizontal Alignment*

The fourth paragraph is revised to read:

The maximum deviation of the side of the precast prestressed slab, or the edge of the roadway deck slab of the deck double tee girder or the precast prestressed ribbed section, measured from a chord that extends end to end of the member, shall be ± 1/8 inch per 10 feet of member length, but not greater than 1/2 inch total.

### *6-02.3(25)L Handling and Storage*

The first and second paragraphs are revised to read:

During handling and storage, each girder shall always be kept plumb and upright, and each precast prestressed member and prestressed concrete tub girder shall always be kept in the horizontal position as shown in the Plans. It shall be lifted only by the lifting devices (strand lift loops or high-strength threaded steel bars) at either end. For strand lift loops, a minimum 2 inch diameter straight pin of a shackle shall be used through the loops. For high-strength threaded steel bars, the lifting hardware that connects to the bars shall be designed, detailed, and furnished by the Contractor. Series W42G, WF42G, W50G, WF50G, W58G, and WF58G girders, and Series W32BTG, W38BTG, W50BTG, W62BTG, and W74G girders up to 145 feet in length, can be picked up at a minimum angle of 60 degrees from the top of the girder. All other prestressed girders shall be picked up within 10 degrees of perpendicular to the top of the girder.

For some girders, straight temporary top flange strands may be specified in the Plans. Pretensioned top temporary strands for full length prestressed concrete girders shall be unbonded over all but the end 10 feet of the girder length. As an alternative for full length prestressed concrete girders, temporary top strands may be post-tensioned prior to shipment. When temporary top strands are specified for spliced prestressed concrete girders, the temporary top strands shall be post-tensioned prior to lifting the assembled girder. When the post-tensioned alternative is used, the Contractor shall be responsible for properly sizing the anchorage plates, and the reinforcement adjacent to the anchorage plates, to prevent bursting or splitting of the concrete in the top flange. Temporary strands shall be cut or released in accordance with Section 6-02.3(25)N.

### *6-02.3(25)M Shipping*

The third and fourth paragraphs are revised to read:

No double tee girder, deck double tee girder, precast prestressed slab or precast prestressed ribbed section shall be shipped for at least three days after concrete placement. No deck bulb tee girder or prestressed concrete tub girder shall be shipped for at least seven days after concrete placement, except that deck bulb tee girders or prestressed concrete tub girders may be shipped three days after concrete placement when L/(bd) is less than or equal to 5.0, where L equals the shipping length of the girder, b equals the girder top flange width (for deck bulb tee girders) or the bottom flange width (for prestressed concrete tub girders), and d equals the girder depth, all in feet. No other girder shall be shipped for at least ten days after concrete placement.

Girder support during shipping shall be located as follows unless otherwise shown in the Plans:

| Type of Girder | Centerline Support Within This Distance From Either End |
|---|---|
| Precast Prestressed Members | 2 feet |
| Series W42G, WF42G, W50G and WF50G | 3 feet |
| All bulb tee and | |
| deck bulb tee girders, except as noted | 3 feet |
| Series W58G, WF58G, and W62BTG | 4 feet |
| Series W74G and WF74G | 5 feet |
| Series W83G and W95G | 8 feet |
| Series WF74PTG, W83PTG, and W95PTG segments | 4 feet |
| Prestressed concrete tub girder segment | 4 feet |

The sixth, seventh and eighth paragraphs are revised to read:

If the Contractor elects to assemble spliced prestressed concrete girders into components of two or more segments prior to shipment, the Contractor shall submit shipment support location working drawings with supporting calculations to the Engineer in accordance with Section 6-01.9. The calculations shall show that concrete stresses in the assembled girders will not exceed those listed below.

Lateral bracing for shipping is not required for prestressed concrete tub girders and precast prestressed members. Other prestressed concrete girders of lengths equal or shorter than the following will not require lateral bracing for shipping:

| Type of Girder | Maximum Length Not Requiring Bracing for Shipping |
|---|---|
| Series W42G, WF42G, W32BTG, and W38BTG | 80 feet |

| | |
|---|---|
| Series W50G and WF50G | 100 feet |
| Series W58G, WF58G, W50BTG, and W62BTG | 105 feet |
| All deck bulb tee girders | 120 feet |
| Series W74G and WF74G | 130 feet |

For all girders exceeding these lengths, and all Series WF74PTG, W83G, W83PTG, W95G, and W95PTG girders, the Contractor shall provide bracing to control lateral bending during shipping, unless the Contractor furnishes calculations in accordance with Section 6-01.9 demonstrating that bracing is not necessary. External bracing shall be attached securely to the top flange of the girder. The Contractor is cautioned that more conservation guidelines for lateral bracing may be required for some delivery routes. The Contractor shall submit a bracing plan, with supporting calculations, to the Engineer for approval in accordance with Section 6-01.9. The Contractor shall not begin shipping the girders until receiving the Engineer's approval of the bracing plan, and shall perform all bracing operations at no additional cost to the Contracting Agency.

**Criteria for Checking Girder Stresses**
**At the Time of Lifting or Transporting and Erecting**

Stresses at both support and harping points shall be satisfied based on these criteria:

1. Allowable compression stress, fc = 0.60f'cm
   a. f'cm = compressive strength at time of lifting or transporting verified by test but shall not exceed design compressive strength (f'c) at 28 days in psi + 1,000 psi
2. Allowable tension stress, ksi
   a. With no bonded reinforcement = 3 times square root (f'cm) ≤ 0.20 ksi
   b. With bonded reinforcement to resist total tension force in the concrete computed on the basis of an uncracked section 6.0 times square root (f'cm). The allowable tensile stress in the reinforcement is 30 ksi (AASHTO M-31, Gr. 60)
3. Prestress losses
   a. 1 day to 1 month = computed losses
   b. 1 month to 1 year = 75 percent of computed final losses
   c. 1 year or more = computed final losses
4. Impact on dead load
   a. Lifting from casting beds = 0 percent
   b. Transporting and erecting = 20 percent

### *6-02.3(25)N Prestressed Concrete Girder Erection*

The fifth paragraph is revised to read:

The concrete in piers and crossbeams shall reach at least 80 percent of design strength before girders are placed on them. The Contractor shall hoist girders only by the lifting devices at the ends, always keeping the girders plumb and upright. Once erected, the girders shall be braced to prevent tipping until the intermediate diaphragms are cast and cured. **When temporary strands in the top flange are used, they shall be cut after the girders are braced and before the intermediate diaphragms are cast.** The Contractor shall place the cast-in-place deck on the girders within 30 calendar days of cutting the temporary strands, except as otherwise approved by the Engineer.

For situations where the Contractor proposes to delay placing the cast-in-place deck on the girders beyond 30 calendar days after cutting the temporary strands, the Contractor shall submit supporting girder camber calculations to the Engineer for approval in accordance with Section 6-01.9. The Contractor shall not cut the temporary strands until receiving the Engineer's approval of the girder camber calculations.

### *6-02.3(25)O Deck Bulb Tee Girder Flange Connection*

This section is revised to read:

The Contractor shall submit a method of equalizing deck bulb tee girder (and precast prestressed member) deflections to the Engineer for approval in accordance with Section 6-01.9, except that the submittal shall be made a minimum of 60 days prior to field erection of the deck bulb tee girder. Deflection equalizing methods approved for previous Contracting Agency contracts will be acceptable providing the bridge configuration is similar and the previous method was satisfactory. A listing of the previous Contracting Agency contract numbers for which the method was used shall be included with the submittal. The weld-ties may be used as a component of the equalizing system provided the Contractor's procedure outlines how the weld-ties are to be used, and that the Contractor's submittal includes a list and description of previous bridge projects where the Contractor has successfully used weld-ties as a component of the equalizing system.

The concrete diaphragms for deck bulb tee girders shall attain a minimum compressive strength of 2,500 psi before any camber equalizing equipment is removed.

On deck bulb tee girders, girder deflection shall be equalized utilizing the approved method before girders are weld-tied and before keyways are filled. Keyways between tee girders shall be filled flush with the surrounding surfaces with nonshrink grout. This nonshrink grout shall have a compressive strength of 5,000 psi before the equalizing equipment is removed. Compressive strength shall be determined by fabricating and testing cubes in accordance with WSDOT Test Method 813 and testing in accordance with WSDOT FOP for AASHTO T-106.

Welding ground shall be attached directly to the steel plates being welded when welding the weld-ties on bulb tee girders.

No construction equipment shall be placed on the structure, other than equalizing equipment, until the girders have been weld-tied and the keyway grout has attained a compressive strength of 5,000 psi.

### *6-02.3(26) Cast-in-Place Prestressed Concrete*

### *6-02.3(26)C Bearing Type Anchorages*

Item 6 in the first paragraph is revised to read:

6. For transverse post-tensioning of roadway slabs, the bearing stress shall not exceed 0.9f'c at Pjack of all strands (before seating) or 4,000 psi at service load after all losses.

### *6-02.3(26)H Grouting*

The first sentence in the sixth paragraph is revised to read:

The Contractor shall proportion the mix to produce a grout with a flow of 11 to 20 seconds as determined by WSDOT Test Method for ASTM C 939, Flow of Grout for Preplaced Aggregate Concrete (Flow Cone Method).

The third sentence in the seventh paragraph is revised to read:

Cubes shall be made in accordance with WSDOT Test Method T 813 and stored in accordance with WSDOT FOP for AASHTO T 23.

### *6-02.3(27) Concrete for Precast Units*

This section is supplemented with the following:

Self compacting concrete (SCC) may be used for precast concrete barrier covered under Section 6-10 and drainage items covered under Section 9-12. If self compacting concrete has been approved for use the requirements of Section 6-02.3(4)C consistency shall not apply. Self compacting concrete is concrete that is able to flow under its own weight and completely fill the formwork, even in the presence of dense reinforcement, without the need of any vibration, while maintaining homogeneity. When using SCC modified testing procedures for air content and compressive strength will be used. The modification shall be that molds will be filled completely in one continuous lift without any rodding, vibration, tamping or other consolidation methods other than lightly taping around the exterior of the mold with a rubber mallet to allow entrapped air bubbles to escape. In addition the fabricators QC testing shall include Slump Flow Test results, which do not indicate segregation. As part of the plants approval for use of SCC the plant fabricator shall cast one barrier, or drainage item and have that barrier or drainage item sawed in half for examination by the Contracting Agency to determine that segregation has not occurred.

# SECTION 6-03, STEEL STRUCTURES

### *6-03.3(14) Edge Finishing*

The first and second paragraphs are revised to read:

All rolled, sheared, and thermal cut edges shall be true to line and free of rough corners and projections. Corners along exposed edges shall be rounded to a minimum radius of 1/16 inch.

Sheared edges on plates more than 5/8 inch thick shall be planed, milled, ground, or thermal cut to a depth of at least 1/8 inch.

### *6-03.3(33) Bolted Connections*

Table 4 and the paragraph beneath it are revised to read:

**Table 4**
**Turn-of-Nut Tightening Method**
**Nut Rotational from Snug-Tight Condition**

| **Bolt Length** | **Disposition of Outer Faces of Bolted Parts** | | |
|---|---|---|---|
| | *Condition 1* | *Condition 2* | *Condition 3* |
| L <= 4D | 1/3 turn | 1/2 turn | 2/3 turn |
| 4D < L<= 8D | 1/2 turn | 2/3 turn | 5/6 turn |
| 8D < L<= 12D | 2/3 turn | 5/6 turn | 1 turn |

Bolt length measured from underside of head to top of nut.

### *6-03.3(39) Swinging the Span*

The second paragraph is revised to read:

After the falsework is released (spans swung free) the masonry plates, shoes, and keeper plates are grouted, and before any load is applied, the WSDOT will (or, if the Contractor is specified as responsible for surveying, the Contractor shall) measure elevations at the tenth points along the tops of girders and floorbeams.

The WSDOT will compare steel mass camber elevations with the elevations measured above, and will furnish the Contractor with new dead-load camber dimensions.

# SECTION 6-06, BRIDGE RAILINGS

### *6-06.2 Materials*

This section is revised to read:

Materials shall meet the requirements of the following sections:

| | |
|---|---|
| Timber Railing | 9-09 |
| Metal Railing | 9-06.18 |

# SECTION 6-07, PAINTING

### *6-07.3(2)A Bridge Cleaning*

The third sentence under **Pressure Flushing** is revised to read:

The pressure flushing equipment shall produce (at the nozzle) at least 3,000 psi with a discharge of at least 4 gpm.

# SECTION 6-10, CONCRETE BARRIER

### *6-10.3 Construction Requirements*

This section is supplemented with the following:

Concrete barrier installed in conjunction with geosynthetic wall moment slabs, light standard foundations, and sign bridge foundations, regardless of the barrier shape, shall be cast-in-place using stationary forms.

# SECTION 6-11, PRECAST CONCRETE RETAINING WALL STEMS

This section including title is revised to read:

## SECTION 6-11, REINFORCED CONCRETE WALLS

### 6-11.1 Description

This work consists of constructing reinforced concrete retaining walls, including those shown in the Standard Plans, L walls, and counterfort walls.

### 6-11.2 Materials

Materials shall meet the requirements of the following sections:

| | |
|---|---|
| Cement | 9-01 |

| | |
|---|---|
| Aggregates for Portland Cement Concrete | 9-03.1 |
| Gravel Backfill | 9-03.12 |
| Premolded Joint Filler | 9-04.1(2) |
| Steel Reinforcing Bar | 9-07.2 |
| Epoxy-Coated Steel Reinforcing Bar | 9-07.3 |
| Concrete Curing Materials and Admixtures | 9-23 |
| Fly Ash | 9-23.9 |
| Water | 9-25 |

Other materials required shall be as specified in the Special Provisions.

## 6-11.3 Construction Requirements

### 6-11.3(1) Submittals

The Contractor shall submit all excavation shoring plans to the WSDOT for approval in accordance with Section 2-09.3(3)D.

The Contractor shall submit all falsework and formwork plans to the WSDOT for approval in accordance with Sections 6-02.3(16) and 6-02.3(17).

If the Contractor elects to fabricate and erect precast concrete wall stem panels, the following information shall be submitted to the WSDOT for approval in accordance with Sections 6-01.9 and 6-02.3(28)A:

1. Working drawings for fabrication of the wall stem panels, showing dimensions, steel reinforcing bars, joint and joint filler details, surface finish details, lifting devices with the manufacturer's recommended safe working capacity, and material specifications.
2. Working drawings and design calculations for the erection of the wall stem panels showing dimensions, support points, support footing sizes, erection blockouts, member sizes, connections, and material specifications.
3. Design calculations for the precast wall stem panels, the connection between the precast panels and the cast-in-place footing, and all modifications to the cast-in-place footing details as shown in the Plans or Standard Plans.

The Contractor shall not begin excavation and construction operations for the retaining walls until receiving the WSDOT's approval of the above submittals.

### 6-11.3(2) Excavation and Foundation Preparation

Excavation shall conform to Section 2-09.3(3), and to the limits and construction stages shown in the Plans. Foundation soils found to be unsuitable shall be removed and replaced in accordance with Section 2-09.3(1)C.

### 6-11.3(3) Precast Concrete Wall Stem Panels

The Contractor may fabricate precast concrete wall stem panels for construction of Standard Plan Retaining Wall Types 1 through 6 and 1SW through 6SW. Precast concrete wall stem panels may be used for construction of non-Standard Plan retaining

walls if allowed by the Plans or Special Provisions. Precast concrete wall stem panels shall conform to Section 6-02.3(28), and shall be cast with Class 4000 concrete.

The precast concrete wall stem panels shall be designed in accordance with the requirements for Load Factor Design in the following codes:

1. For all loads except as otherwise noted - AASHTO Standard Specifications for Highway Bridges, latest edition and current interims. The seismic design shall use the acceleration coefficient and soil profile type as specified in the Plans.
2. For all wind loads - AASHTO Guide Specifications for Structural Design of Sound Barriers, latest edition and current interims.

The precast concrete wall stem panels shall be fabricated in accordance with the dimensions and details shown in the Plans, except as modified in the shop drawings as approved by the WSDOT.

The precast concrete wall stem panels shall be fabricated full height, and shall be fabricated in widths of 8 feet, 16 feet, and 24 feet.

The construction tolerances for the precast concrete wall stem panels shall be as follows:

| | | |
|---|---|---|
| Height | ±¼ | inch |
| Width | ±¼ | inch |
| Thickness | +¼ | inch |
| | -1/8 | inch |
| Concrete cover for steel reinforcing bar | +3/8 | inch |
| | -1/8 | inch |
| Width of precast concrete wall stem panel joints | ±¼ | inch |
| Offset of precast concrete wall stem panels | ±¼ | inch |

(Deviation from a straight line extending 5 feet on each side of the panel joint)

The precast concrete wall stem panels shall be constructed with a mating shear key between adjacent panels. The shear key shall have beveled corners and shall be 1-1/2 inches in thickness. The width of the shear key shall be 3-1/2 inches minimum and 5-1/2 inches maximum. The shear key shall be continuous and shall be of uniform width over the entire height of the wall stem.

The Contractor shall provide the specified surface finish as noted, and to the limits shown, in the Plans to the exterior concrete surfaces. Special surface finishes achieved with form liners shall conform to Sections 6-02.2 and 6-02.3(14) as supplemented in the Special Provisions. Rolled on textured finished shall not be used. Precast concrete wall stem panels shall be cast in a vertical position if the Plans call for a form liner texture on both sides of the wall stem panel.

The precast concrete wall stem panel shall be rigidly held in place during placement and curing of the footing concrete.

The precast concrete wall stem panels shall be placed a minimum of one inch into the footing to provide a shear key. The base of the precast concrete wall stem panel shall be sloped ½ inch per foot to facilitate proper concrete placement.

To ensure an even flow of concrete under and against the base of the wall panel, a form shall be placed parallel to the precast concrete wall stem panel, above the footing, to allow a minimum one foot head to develop in the concrete during concrete placement.

The steel reinforcing bars shall be shifted to clear the erection blockouts in the precast concrete wall stem panel by 1-1/2 inches minimum.

All precast concrete wall stem panel joints shall be constructed with joint filler installed on the rear (backfill) side of the wall. The joint filler material shall extend from two feet below the final ground level in front of the wall to the top of the wall. The joint filler shall be a nonorganic flexible material and shall be installed to create a waterproof seal at panel joints.

The soil bearing pressure beneath the falsework supports for the precast concrete wall stem panels shall not exceed the maximum design soil pressure shown in the Plans for the retaining wall.

### 6-11.3(4) Cast-In-Place Concrete Construction

Cast-in-place concrete for concrete retaining walls shall be formed, reinforced, cast, cured, and finished in accordance with Section 6-02, and the details shown in the Plans and Standard Plans. All cast-in-place concrete shall be Class 4000.

The Contractor shall provide the specified surface finish as noted, and to the limits shown, in the Plans to the exterior concrete surfaces. Special surface finishes achieved with formliners shall conform to Sections 6-02.2 and 6-02.3(14) as supplemented in the Special Provisions.

Cast-in-place concrete for adjacent wall stem sections (between vertical expansion joints) shall be formed and placed separately, with a minimum 12 hour time period between concrete placement operations.

Premolded joint filler, 1/2" thick, shall be placed full height of all vertical wall stem expansion joints in accordance with Section 6-01.14.

### 6-11.3(5) Backfill, Weepholes and Gutters

Unless the Plans specify otherwise, backfill and weepholes shall be placed in accordance with Standard Plan D-4 and Section 6-02.3(22). Gravel backfill for drain shall be compacted in accordance with Section 2-09.3(1)E. Backfill within the zone defined as bridge approach embankment in Section 1-01.3 shall be compacted in accordance with Method C of Section 2-03.3(14)C. All other backfill shall be compacted in accordance with Method B of Section 2-03.3(14)C, unless otherwise specified.

Cement concrete gutter shall be constructed as shown in the Standard Plans.

### 6-11.3(6) Traffic Barrier and Pedestrian Barrier

When shown in the Plans, traffic barrier and pedestrian barrier shall be constructed in accordance with Sections 6-02.3(11)A and 6-10.3(2), and the details shown in the Plans and Standard Plans.

# SECTION 6-12, NOISE BARRIER WALLS

## 6-12.1 Description

This work consists of constructing cast-in-place concrete, precast concrete, masonry, and timber noise barrier walls, including those shown in the Standard Plans.

## 6-12.2 Materials

Materials shall meet the requirements of the following sections:

| | |
|---|---|
| Cement | 9-01 |
| Aggregates for Portland Cement Concrete | 9-03.1 |
| Gravel Backfill | 9-03.12 |
| Premolded Joint Filler | 9-04.1(2) |
| Bolts, Nuts, and Washers | 9-06.5(1) |
| Steel Reinforcing Bar | 9-07.2 |
| Epoxy-Coated Steel Reinforcing Bar | 9-07.3 |
| Paints | 9-08 |
| Concrete Curing Materials and Admixtures | 9-23 |
| Fly Ash | 9-23.9 |
| Water | 9-25 |

Other materials required shall be as specified in the Special Provisions.

## 6-12.3 Construction Requirements

### 6-12.3(1) Submittals

All noise barrier walls not constructed immediately adjacent to the roadway, and which require construction of access for work activities, shall have a noise barrier wall access plan. The Contractor shall submit the noise barrier wall access plan to the WSDOT for approval in accordance with Section 6-01.9. The noise barrier wall access plan shall include, but not be limited to, the locations of access to the noise barrier wall construction sites, and the method, materials, and equipment used to construct the access, remove the access, and recontour and reseed the disturbed ground.

For construction of all noise barrier walls with shafts, the Contractor shall submit a shaft construction plan to the WSDOT for approval in accordance with Section 6-01.9, including but not limited to the following information:

1. List and description of equipment to be used to excavate and construct the shafts, including description of how the equipment is appropriate for use in the expected subsurface conditions.
2. The construction sequence and order of shaft construction.
3. Details of shaft excavation methods, including methods to clean the shaft excavation.
4. Details and dimensions of the shaft, and casing if used.

5. The method used to prevent ground caving (temporary casing, slurry, or other means).
6. Details of concrete placement including procedures for deposit through a conduit, tremie, or pump.
7. Method and equipment used to install and support the steel reinforcing bar cage.

For construction of precast concrete noise barrier walls, the Contractor shall submit shop drawings for the precast concrete panels to the WSDOT in accordance with Section 6-02.3(28)A. In addition to the items listed in Section 6-02.3(28)A, the precast concrete panel shop drawings shall include the following:

1. Construction sequence and method of forming the panels.
2. Details of additional reinforcement provided at lifting and support locations.
3. Method and equipment used to support the panels during storage, transporting, and erection.
4. Erection sequence, including the method of lifting the panels, placing and adjusting the panels to proper alignment and grade, and supporting the panels during bolting, grouting, and backfilling operations.

The Contractor shall not begin noise barrier wall construction activities, including access construction and precast concrete panel fabrication, until receiving the WSDOT's approval of all appropriate and applicable submittals.

### 6-12.3(2) Work Access and Site Preparation

The Contractor shall construct work access in accordance with the work access plan as approved by the WSDOT. The construction access roads shall minimize disturbance to the existing vegetation, especially trees. Only trees and shrubs in direct conflict with the approved construction access road alignment shall be removed. Only one access road into the noise barrier wall from the main roadway and one access road from the noise barrier wall to the main roadway shall be constructed at each noise barrier wall.

Existing vegetation that has been identified by the WSDOT shall be protected in accordance with Sections 1-07.16 and 2-01, and the Special Provisions.

### 6-12.3(3) Shaft Construction

The Contractor shall excavate and construct the shafts in accordance with the shaft construction plan as approved by the WSDOT.

The shafts shall be excavated to the required depth as shown in the Plans. The excavation shall be completed in a continuous operation using equipment capable of excavating through the type of material expected to be encountered.

If the shaft excavation is stopped, the Contractor shall secure the shaft by installing a safety cover over the opening. The Contractor shall ensure the safety of the shaft and surrounding soil and the stability of the side walls. A temporary casing, slurry, or other methods approved by the WSDOT shall be used as necessary to ensure such safety and stability.

When caving conditions are encountered, the Contractor shall stop further excavation until implementing the method to prevent ground caving as specified in the shaft construction plan approved by the WSDOT.

When obstructions are encountered, the Contractor shall notify the WSDOT promptly. An obstruction is defined as a specific object (including, but not limited to, boulders, logs, and man made objects) encountered during the shaft excavation operation which prevents or hinders the advance of the shaft excavation. When efforts to advance past the obstruction to the design shaft tip elevation result in the rate of advance of the shaft drilling equipment being is significantly reduced relative to the rate of advance for the rest of the shaft excavation, then the Contractor shall remove the obstruction under the provisions of Section 6-12.5 as supplemented in the Special Provisions. The method of removal of such obstructions, and the continuation of excavation shall be as proposed by the Contractor and approved by the WSDOT.

The Contractor shall use appropriate means to clean the bottom of the excavation of all shafts. No more than two inches of loose or disturbed material shall be present at the bottom of the shaft just prior to beginning concrete placement.

The Contractor shall not begin placing steel reinforcing bars and concrete in the shaft until receiving the WSDOT's approval of the shaft excavation.

The steel reinforcing bar cage shall be rigidly braced to retain its configuration during handling and construction. The Contractor shall not place individual or loose bars. The Contractor shall install the steel reinforcing bar cage as specified in the shaft construction plan as approved by the WSDOT. The Contractor shall maintain the minimum concrete cover shown in the Plans.

If casings are used, the Contractor shall remove the casing during concrete placement. A minimum five feet head of concrete shall be maintained to balance soil and water pressure at the bottom of the casing. The casing shall be smooth. Where the top of the shaft is above the existing ground, the Contractor shall case the top of the hole prior to placing the concrete.

Concrete for shafts shall conform to Class 4000P. The Contractor shall place concrete in the shaft immediately after completing the shaft excavation and receiving the WSDOT's approval of the excavation. The Contractor shall place the concrete in one continuous operation to the elevation shown in the Plans, using a method to prevent segregation of aggregates. The Contractor shall place the concrete as specified in the approved shaft construction plan. If water is present, concrete shall be placed in accordance with Section 6-02.3(6)B.

### 6-12.3(4) Trench, Grade Beam, or Spread Footing Construction

Where the noise barrier wall foundations exist below the existing groundline, excavation shall conform to Section 2-09.3(4), and to the limits and construction stages shown in the Plans. Foundation soils found to be unsuitable shall be removed and replaced in accordance with Section 2-09.3(1)C.

Where the noise barrier wall foundations exist above the existing groundline, the Contractor shall place and compact backfill material in accordance with Section 2-03.3(14)C.

Concrete for trench, grade beam, or spread footing foundations shall conform to Class 4000.

Cast-in-place concrete shall be formed, placed, and cured in accordance with Section 6-02, except that concrete for trench foundations shall be placed against undisturbed soil.

The excavation shall be backfilled in accordance with item 1 of the Compaction subsection of Section 2-09.3(1)E.

The steel reinforcing bar cage and the noise barrier wall anchor bolts shall be installed and rigidly braced prior to grade beam and spread footing concrete placement to retain their configuration during concrete placement. The Contractor shall not place individual or loose

steel reinforcing bars and anchor bolts, and shall not install anchor bolts during or after concrete placement.

### 6-12.3(5) Cast-In-Place Concrete Panel Construction

Construction of cast-in-place concrete panels for noise barrier walls shall conform to Section 6-11.3(4). For noise barrier walls with traffic barrier, the construction of the traffic barrier shall also conform to Section 6-10.3(2).

The top of the cast-in-place concrete panels shall conform to the top of wall profile shown in the Plans. Where a vertical step is constructed to provide elevation change between adjacent panels, the dimension of the step shall be 2 feet. Each horizontal run between steps shall be a minimum of 48 feet.

### 6-12.3(6) Precast Concrete Panel Fabrication and Erection

The Contractor shall fabricate and erect the precast concrete panels in accordance with Section 6-02.3(28), and the following requirements:

1. Concrete shall conform to Class 4000.
2. Except as otherwise noted in the Plans and Special Provisions, all concrete surfaces shall receive a Class 2 finish in accordance with Section 6-02.3(14)B.
3. The precast concrete panels shall be cast in accordance with Section 6-02.3(28)B. The Contractor shall cast the precast concrete panels horizontally, with the traffic side surface cast against the form liner on the bottom. The Contractor shall fully support the precast concrete panel to avoid bowing and sagging surfaces.

After receiving the WSDOT's approval of the shop drawings, the Contractor shall cast one precast concrete panel to be used as the sample panel. The Contractor shall construct the sample panel in accordance with the procedure and details specified in the shop drawings approved by the WSDOT. The Contractor shall make the sample panel available to the WSDOT for approval.

Upon receiving the WSDOT's approval of the sample panel, the Contractor shall continue production of precast concrete panels for the noise barrier wall. All precast concrete panels will be evaluated against the sample panel for the quality of workmanship exhibited. The sample panel shall be retained at the fabrication site until all precast concrete panels have been fabricated and have received the WSDOT's approval. After completing precast concrete panel fabrication, the Contractor may utilize the sample panel as a production noise barrier wall panel.

4. In addition to the fabrication tolerance requirements of Section 6-02.3(28)F, the precast concrete panels for noise barrier walls shall not exceed the following scalar tolerances:

   Length and Width: $\pm$ 1/8 inch per five feet, not to exceed 1/4 inch total.

   Thickness: $\pm$ 1/4 inch.

   The difference obtained by comparing the measurement of the diagonal of the face of the panels shall not be greater than 1/2 inch.

   Dimension tolerances for the traffic barrier portion of precast concrete panels formed with traffic barrier shapes shall conform to Section 6-10.3(2).

5. After erection, the precast concrete panels shall not exceed the joint space tolerances shown in the Plans. The panels shall not exceed 3/8 inch out of plumb in any direction.

   The Contractor shall seal the joints between precast concrete panels with a backer rod and sealant system as specified. The Contractor shall seal both sides of the joint full length.

The top of precast concrete panels shall conform to the top of wall profile shown in the Plans. Where a vertical step is constructed to provide elevation change between adjacent panels, the dimension of the step shall be 2 feet. Each horizontal run between steps shall be a minimum of 48 feet.

### 6-12.3(7) Masonry Wall Construction

Construction requirements for masonry noise barrier wall panels shall be as specified in the Special Provisions.

### 6-12.3(8) Fabricating and Erecting Timber Noise Barrier Wall Panels

Construction requirements for timber noise barrier wall panels shall be as specified in the Special Provisions.

### 6-12.3(9) Access Doors and Concrete Landing Pads

The Contractor shall install access doors and door frames as shown in the Plans and Standard Plans. The Contractor shall install the access doors to open toward the roadway side. The door frames shall be set in place with grout conforming to Section 6-02.3(20), with the grout completely filling the void between the door frame and the noise barrier wall panel.

The Contractor shall apply two coats of paint, as specified in the Special Provisions, to all exposed metal surfaces of access doors and frames, except for stainless steel surfaces. Each coat shall be 3 mils minimum wet film thickness.

The Contractor shall construct a concrete landing pad on the roadway side of each access door location as shown in the Plans. The concrete shall conform to Section 6-02.3(2)B.

### 6-12.3(10) Finish Ground Line Dressing

The Contractor shall contour and dress the ground line on both sides of the noise barrier wall, providing the minimum cover over the foundation as shown in the Plans. The Contractor shall contour the ground adjacent to the barrier to ensure good drainage away from the barrier.

After the access roads are no longer needed for noise barrier wall construction activities, the Contractor shall restore the area to the original condition. The Contractor shall recontour the access roads to match into the surrounding ground and shall reseed all disturbed areas in accordance with the Section 8-01 and the Special Provisions, and the noise barrier wall access plan as approved by the WSDOT.

## SECTION 6-13, STRUCTURAL EARTH WALLS

### 6-13.1 Description

This work consists of constructing structural earth walls (SEW).

### 6-13.2 Materials

Materials shall meet the requirements of the following sections:

| | |
|---|---|
| Cement | 9-01 |
| Aggregates for Portland Cement Concrete | 9-03.1 |
| Gravel Backfill | 9-03.12 |
| Premolded Joint Filler | 9-04.1(2) |
| Steel Reinforcing Bar | 9-07.2 |
| Epoxy-Coated Steel Reinforcing Bar | 9-07.3 |
| Concrete Curing Materials and Admixtures | 9-23 |
| Fly Ash | 9-23.9 |
| Water | 9-25 |

Other materials required shall be as specified in the Special Provisions.

### 6-13.3 Construction Requirements

Proprietary structural earth wall systems shall be as specified in the Special Provisions.

### 6-13.3(1) Quality Assurance

The structural earth wall manufacturer shall provide a qualified and experienced representative to resolve wall construction problems as approved by the WSDOT. The structural earth wall manufacturer's representative shall be present at the beginning of wall construction activities, and at other times as needed throughout construction. Recommendations made by the structural earth wall manufacturer's representative and approved by the WSDOT shall be followed by the Contractor.

The completed wall shall meet the following tolerances:

1. Deviation from the design batter and horizontal alignment, when measured along a ten foot straight edge, shall not exceed the following:
   a. Welded wire faced structural earth wall: 2 inches
   b. Precast concrete panel and
      concrete block faced structural earth wall: 3/4 inch
2. Deviation from the overall design batter of the wall shall not exceed the following per ten feet of wall height:
   a. Welded wire faced structural earth wall: 1.5 inches
   b. Precast concrete panel and
      concrete block faced structural earth wall: 1/2 inch
3. The maximum outward bulge of the face between welded wire faced structural earth wall reinforcement layers shall not exceed two inches. The maximum allowable offset in any precast concrete facing panel joint shall be 3/4 inch. The maximum allowable offset in any concrete block joint shall be 3/8 inch.
4. The base of the structural earth wall excavation shall be within three inches of the staked elevations, unless otherwise approved by the WSDOT.

5. The external structural earth wall dimensions shall be placed within two inches of that staked on the ground.
6. The backfill reinforcement layers shall be located horizontally and vertically within one inch of the locations shown in the structural earth wall working drawings as approved by the WSDOT.

At least five working days prior to the Contractor beginning any structural earth wall work at the site, a structural earth wall preconstruction conference shall be held to discuss construction procedures, personnel, and equipment to be used, and other elements of structural earth wall construction. Those attending shall include:

1. (representing the Contractor) The superintendent, on site supervisors, and all foremen in charge of excavation, leveling pad placement, concrete block and soil reinforcement placement, and structural earth wall backfill placement and compaction.
2. (representing the Structural Earth Wall Manufacturer) The qualified and experienced representative of the structural earth wall manufacturer as specified at the beginning of this Section.
3. (representing the Contracting Agency) The Project WSDOT, key inspection personnel, and representatives from the WSDOT Construction Office and Materials Laboratory Geotechnical Services Branch.

### 6-13.3(2) Submittals

The Contractor, or the supplier as the Contractor's agent, shall furnish to the WSDOT a Manufacturer's Certificate of Compliance in accordance with Section 1-06.3, certifying that the structural earth wall materials conform to the specified material requirements. This includes providing a Manufacturer's Certificate of Compliance for all concrete admixtures, cement, fly ash, steel reinforcing bars, reinforcing strips, reinforcing mesh, tie strips, fasteners, welded wire mats, backing mats, construction geotextile for wall facing, drainage geosynthetic fabric, block connectors, and joint materials. The Manufacturer's Certificate of Compliance for geogrid reinforcement shall include the information specified in Section 9-33.4(4) for each geogrid roll, and shall specify the geogrid polymer types for each geogrid roll.

A copy of all test results, performed by the Contractor or the Contractor's supplier, which are necessary to assure compliance with the specifications, shall submitted to the WSDOT along with each Manufacturer's Certificate of Compliance.

Before fabrication, the Contractor shall submit a field construction manual for the structural earth walls, prepared by the wall manufacturer, to the WSDOT for approval in accordance with Section 6-01.9. This manual shall provide step-by-step directions for construction of the wall system.

The Contractor, or the supplier as the Contractor's agent, shall submit detailed design calculations and working drawings to the WSDOT for approval in accordance with Section 6-01.9.

The design calculation and working drawing submittal shall include detailed design calculations and all details, dimensions, quantities, and cross-sections necessary to construct the wall. The calculations shall include a detailed explanation of any symbols and computer

programs used in the design of the walls. All computer output submitted shall be accompanied by supporting hand calculations detailing the calculation process.

The design calculations shall be based on the current AASHTO Standard Specifications for Highway Bridges including current interims, and also based on the following:

1. The factor of safety for overturning and sliding are 2.0 and 1.5 respectively for AASHTO Load Group I, and 1.5 and 1.1 respectively for AASHTO Load Group VII.
2. The wall surcharge conditions (backfill slope) shown in the Plans.
3. If a highway is adjacent to and on top of the wall, a two foot surcharge shall be used in the design.
4. If the Plans detail a traffic barrier on top of the wall, the barrier and wall shall be capable of resisting a 10,000 pound horizontal load applied at the top of the barrier.
5. The geotechnical design parameters for the wall shall be as specified in the Special Provisions.

A minimum of six sets of working drawings shall be fully detailed and shall include, but not be limited to, the following items:

1. A plan and elevation sheet or sheets for each wall, containing the following:
    a. An elevation view of the wall which shall include the following:
        i. the elevation at the top of the wall, at all horizontal and vertical break points, and at least every 50 feet along the wall;
        ii. elevations at the base of welded wire mats or the top of leveling pads and foundations, and the distance along the face of the wall to all steps in the welded wire mats, foundations and leveling pads;
        iii. the designation as to the type of panel, block, or module;
        iv. the length, size, and number of geogrids or mesh or strips, and the distance along the face of the wall to where changes in length of the geogrids or mesh or strips occur; or
        v. the length, size, and wire sizes and spacings of the welded wire mats and backing mats, and the distance along the face of the wall to where changes in length, size, and wire sizes and spacings of the welded wire mats and backing mats occur; and
        vi. the location of the original and final ground line.
    b. A plan view of the wall which shall indicate the offset from the construction centerline to the face of the wall at all changes in horizontal alignment; the limit of the widest module, geogrid, mesh, strip or welded wire mat, and the centerline of any drainage structure or drainage pipe which is behind or passes under or through the wall.
    c. General notes, if any, required for design and construction of the wall.
    d. All horizontal and vertical curve data affecting wall construction.
    e. A listing of the summary of quantities provided on the elevation sheet of each wall for all items including incidental items.

f. Cross-section showing limits of construction. In fill sections, the cross-section shall show the limits and extent of select granular backfill material placed above original ground.

g. Limits and extent of reinforced soil volume.

2. All details including steel reinforcing bar bending details. Bar bending details shall be in accordance with Section 9-07.1.

3. All details for foundations and leveling pads, including details for steps in the foundations or leveling pads, as well as allowable and actual maximum bearing pressures for AASHTO Load Groups I and VII.

4. All modules and facing elements shall be detailed. The details shall show all dimensions necessary to construct the element, all steel reinforcing bars in the element, and the location of reinforcement element attachment devices embedded in the precast concrete facing panel or concrete block.

5. All details for construction of the wall around drainage facilities, sign, signal, luminaire, and noise barrier wall foundations, and structural abutment and foundation elements shall be clearly shown.

6. All details for connections to traffic or pedestrian barriers, coping, parapets, noise barrier walls, and attached lighting shall be shown.

7. All details for the traffic or pedestrian barrier attached to the top of the wall (if shown in the Plans) including interaction with bridge approach slabs.

The Contractor shall not begin wall construction (including precast concrete facing panel fabrication) until receiving the WSDOT's written approval of the material certifications and test results, design calculations and working drawing submittals.

### 6-13.3(3) Excavation and Foundation Preparation

Excavation shall conform to Section 2-09.3(4) and to the limits and construction stages shown in the Plans. Foundation soils found to be unsuitable shall be removed and replaced in accordance with Section 2-09.3(1)C. The foundation for the structure shall be graded level for a width equal to or exceeding the length of reinforcing as shown in the structural earth wall working drawings as approved by the WSDOT and, for walls with geogrid reinforcing, in accordance with Section 2-12.3. Prior to wall construction, the foundation, if not in rock, shall be compacted as approved by the WSDOT.

At the foundation level of the bottom course of precast concrete facing panels and concrete blocks, an unreinforced concrete leveling pad shall be provided as shown in the Plans. The leveling pad shall be cured a minimum of 12 hours and have a minimum compressive strength of 1500 psi before placement of the precast concrete facing panels or concrete blocks.

### 6-13.3(4) Precast Concrete Facing Panel and Concrete Block Fabrication

Concrete for precast concrete facing panels shall meet the following requirements:

1. Have a minimum 28 day compressive strength of 4,000 pounds per square inch, unless otherwise specified in the Special Provisions for specific proprietary wall systems.

2. Contain a water-reducing admixture meeting AASHTO M 194 Type A, D, F, or G.

3. Be air-entrained, 6 percent □ 1 1/2 percent.

4. Have a maximum slump of four inches, or six inches if a Type F or G water reducer is used.

Concrete for dry cast concrete blocks shall meet the following requirements:

1. Have a minimum 28 day compressive strength of 4,000 psi.
2. Conform to ASTM C 1372, except as otherwise specified.
3. The lot of blocks produced for use in this project shall conform to the following freeze-thaw test requirements when tested in accordance with ASTM C 1262. Minimum acceptable performance shall be defined as weight loss at the conclusion of 150 freeze-thaw cycles not exceeding one percent of the block's initial weight for a minimum of four of the five block specimens tested.
4. The concrete blocks shall have a maximum water absorption of one percent above the water absorption content of the lot of blocks produced and successfully tested for the freeze-thaw test specified in item 3 above.

Precast concrete facing panels and concrete blocks will be accepted based on successful compressive strength tests and visual inspection. The precast concrete facing panels and concrete blocks shall be considered acceptable regardless of curing age when compressive test results indicate that the compressive strength conforms to the 28-day requirements and when the visual inspection is satisfactorily completed. Testing and inspection of precast concrete facing panels shall conform to Section 6-02.3(28). Testing and inspection of dry cast concrete blocks shall conform to ASTM C 140.

All precast concrete facing panels shall be five feet square, except:

1. for partial panels at the top, bottom, and ends of the wall, and
2. as otherwise shown in the Plans.

All precast concrete facing panels shall be manufactured within the following tolerances:

1. All dimensions □ 3/16 inch.
2. Squareness, as determined by the difference between the two diagonals, shall not exceed 1/2 inch.
3. Surface defects on smooth formed surfaces measured on a length of 5 feet shall not exceed 1/8 inch. Surface defects on textured-finished surfaces measured on a length of five feet shall not exceed 5/16 inch.

All concrete blocks shall be manufactured within the following tolerances:

1. Vertical dimensions shall be $\pm$ 1/16 inch of the plan dimension, and the rear height shall not exceed the front height.
2. The dimensions of the grooves in the top and bottom faces of the concrete blocks shall be formed within the tolerances specified by the proprietary wall manufacturer, for the fit required for the block connectors.
3. All other dimensions shall be $\pm$ 1/4 inch of the plan dimension.

Tie attachment devices, except for geosynthetic reinforcement, shall be set in place to the dimensions and tolerances shown in the Plans prior to casting.

The forms forming precast concrete facing panels, including the forms for loop pockets and access pockets, and the forms forming the concrete blocks, shall be removed in accordance with the recommendations of the wall manufacturer, without damaging the concrete.

The concrete surface for the precast concrete facing panel shall have the finish shown in the Plans for the front face and an unformed finish for the rear face. The rear face of the precast concrete facing panel shall be roughly screeded to eliminate open pockets of aggregate and surface distortions in excess of 1/4 inch.

The concrete surface for the front face of the concrete block shall be flat, and shall be a conventional "split face" finish in accordance with the wall manufacturer's specifications. The concrete surface of all other faces shall be Class 2 in accordance with Section 6-02.3(14)B. The finish and appearance of the concrete blocks shall also conform to ASTM C 1372. The color of the concrete block shall be concrete gray, unless otherwise shown in the Plans.

The date of manufacture, production lot number, and the piece-mark, shall be clearly marked on the rear face of each precast concrete facing panel, and marked or tagged on each pallet of concrete blocks.

All precast concrete facing panels and concrete blocks shall be handled, stored, and shipped in accordance with Sections 6-02.3(28)G and 6-02.3(28)H to prevent chipping, cracks, fractures, and excessive bending stresses.

Precast concrete facing panels in storage shall be supported on firm blocking located immediately adjacent to tie strips to avoid bending the tie strips.

### 6-13.3(5) Precast Concrete Facing Panel and Concrete Block Erection

The precast concrete facing panels shall be placed vertically. During erection, precast concrete facing panels shall be handled by means of a lifting device set into the upper edge of the panels.

Concrete blocks shall be erected in a running bond fashion in accordance with the wall manufacturer's field construction manual, and may be placed by hand. The top surface of each course of concrete blocks, including all pockets and recesses, shall be cleaned of backfill and all extraneous materials prior to connecting the reinforcing strips or geosynthetic reinforcing, and placing the next course of concrete blocks. Concrete blocks receiving geosynthetic reinforcement shall be connected as specified in the Special Provisions. Cap block top courses shall be bonded to the lower course of concrete blocks as specified below. All other concrete blocks shall be connected with block connectors or pins placed into the connector slots.

Precast concrete facing panels and concrete blocks shall be placed in successive horizontal lifts as backfill placement proceeds in the sequence shown in the structural earth wall working drawings as approved by the WSDOT.

External bracing is required for the initial lift for precast concrete facing panels.

As backfill material is placed behind the precast concrete facing panels, the panels shall be maintained in vertical position by means of temporary wooden wedges placed in the joint at the junction of the two adjacent panels on the external side of the wall.

Reinforcing shall be placed normal to the face of the wall, unless otherwise shown in the Plans or directed by the WSDOT. Prior to placement of the reinforcing, backfill shall be compacted.

Geosynthetic reinforcing shall be placed in accordance with Section 2-12.3 and as follows:

1. The Contractor shall stretch out the geosynthetic in the direction perpendicular to the wall face to remove all slack and wrinkles, and shall hold the geosynthetic in place

with soil piles or other methods as recommended by the geosynthetic manufacturer, before placing backfill material over the geosynthetic to the specified cover.

2. The geosynthetic reinforcement shall be continuous in the direction perpendicular to the wall face from the back face of the concrete panel to the end of the geosynthetic or to the last geogrid node at the end of the specified reinforcement length. Geosynthetic splices parallel to the wall face will not be allowed.

At the completion of each course of concrete blocks and prior to installing any block connectors or geosynthetic reinforcement at this level, the Contractor shall check the blocks for level placement in all directions, and shall adjust the blocks by grinding or rear face shimming, or other method as recommended by the structural earth wall manufacturer's representative and as approved by the WSDOT, to bring the blocks into a level plane.

For concrete block wall systems receiving a cap block top course, the cap blocks shall be bonded to the lower course with mortar, or with an adhesive capable of bonding the concrete block courses together.

### 6-13.3(6) Welded Wire Faced Structural Earth Wall Erection

The Contractor shall erect the welded wire wall reinforcement in accordance with the wall manufacturer's field construction manual and as approved by the WSDOT. Construction geotextile for wall facing shall be placed between the backfill material within the reinforced zone and the coarse granular material immediately behind the welded wire wall facing, as shown in the Plans and the structural earth wall working drawings as approved by the WSDOT.

### 6-13.3(7) Backfill

Backfill placement shall closely follow erection of each course of welded wire mats and backing mats, precast concrete facing panels, or concrete blocks. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials or misalignment of the welded wire mats and backing mats, precast concrete facing panels, or concrete blocks. Backfill shall be placed in a manner that segregation does not occur.

The Contractor shall place wall backfill over geosynthetic reinforcement, or construction geotextile for wall facing, in accordance with Section 2-12.3 and as follows:

1. The Contractor shall ensure that six inches minimum of backfill shall be between the geogrid reinforcement, or construction geotextile for wall facing, and any construction vehicle or equipment tires or tracks at all times.

Misalignment or distortion of the precast concrete facing panels or concrete blocks due to placement of backfill outside the limits of this specification shall be corrected in a manner as approved by the WSDOT.

The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer of material. The moisture content of all backfill material shall conform to Sections 2-03.3(14)C and 2-03.3(14)D.

Backfill shall be compacted in accordance with Method C of Section 2-03.3(14)C, except as follows:

1. The maximum lift thickness after compaction shall not exceed ten inches.
2. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density.

3. The Contractor shall not use sheepsfoot rollers or rollers with protrusions for compacting backfill reinforced with geosynthetic layers, or for compacing the first lift of backfill above the construction geosynthetic for wall facing for each layer of welded wire mats. Rollers shall have sufficient capacity to achieve compaction without causing distortion to the face of the wall in accordance with the tolerances specified in Section 6-13.3(1).
4. The Contractor shall compact the zone within three feet of the back of the wall facing panels without causing damage to or distortion of the wall facing elements (welded wire mats, backing mats, construction geotextile for wall facing, precast concrete facing panels, and concrete blocks) by using light mechanical tampers as approved by the WSDOT. No soil density tests will be taken within this area.
5. For wall systems with geosynthetic reinforcement, the minimum compacted backfill lift thickness of the first lift above each geosynthetic reinforcement layer shall be six inches.

At the end of each day's operation, the Contractor shall shape the last level of backfill to permit runoff of rainwater away from the wall face. In addition, the Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

Wall materials damaged or disturbed during backfill placement shall be either removed and replaced, or adjusted and repaired, by the Contractor as approved by the WSDOT at no additional expense to the Contracting Agency.

### 6-13.3(8) Guardrail Placement

Where guardrail posts are required, the Contractor shall not begin installing guardrail posts until completing the structural earth wall to the top of wall elevation shown in the Plans. The Contractor shall install the posts in a manner that prevents movement of the precast concrete facing panels or concrete blocks, and prevents ripping, tearing, or pulling of the wall reinforcement.

The Contractor may cut welded wire reinforcement of welded wire faced structural earth walls to facilitate placing the guardrail posts, but only in the top two welded wire reinforcement layers and only with the approval of the WSDOT in a manner that prevents bulging of the wall face and prevents ripping or pulling of the welded wire reinforcement. Holes through the welded wire reinforcement shall be the minimum size necessary for the post. The Contractor shall demonstrate to the WSDOT prior to beginning guardrail post installation that the installation method will not rip, tear, or pull the wall reinforcement.

The Contractor shall place guardrail posts between the reinforcing strips, reinforcing mesh, and tie strips of the non-geosynthetic reinforced precast concrete panel or concrete block faced structural earth walls. Holes through the reinforcement of geosynthetic reinforced walls, if necessary, shall be the minimum size necessary for the guardrail post.

### 6-13.3(9) SEW Traffic Barrier and SEW Pedestrian Barrier

SEW traffic barrier and SEW pedestrian barrier, if shown in the Plans, shall be constructed in accordance with Sections 6-02.3(11)A and 6-10.3(2), the details in the Plans and in the structural earth wall working drawings as approved by the WSDOT, except as follows:

1. The slip-form method of barrier construction will not be allowed for SEW traffic barrier and SEW pedestrian barrier.
2. The Contractor shall not begin placing backfill above the bottom of the SEW traffic barrier and SEW pedestrian barrier until removing the forms from the portion of the

barrier being embedded. The Contractor shall not remove forms from the embedded portion of the barrier until the concrete has set for at least three days or has attained a minimum compressive strength of 2,400 psi.

# SECTION 6-14, GEOSYNTHETIC RETAINING WALLS

## 6-14.1 Description

This work consists of constructing geosynthetic retaining walls, including those shown in the Standard Plans.

## 6-14.2 Materials

Materials shall meet the requirements of the following sections:

| | |
|---|---|
| Gravel Borrow For Geosynthetic Retaining Wall | 9-03.14(4) |
| Construction Geosynthetic | 9-33 |

The requirements specified in Section 2-12.2 for geotextiles shall also apply to geosynthetic and geogrid materials used for permanent and temporary geosynthetic retaining walls.

Other materials required shall be as specified in the Special Provisions.

## 6-14.3 Construction Requirements

Temporary geosynthetic retaining walls are defined as those walls and wall components constructed and removed or abandoned before the physical completion date of the project or as shown in the Plans. All other geosynthetic retaining walls shall be considered as permanent.

## 6-14.3(1) Quality Assurance

The Contractor shall complete the base of the retaining wall excavation to within plus or minus three inches of the staked elevations unless otherwise directed by the WSDOT. The Contractor shall place the external wall dimensions to within plus or minus two inches of that staked on the ground. The Contractor shall space the reinforcement layers vertically and place the overlaps to within plus or minus one inch of that shown in the Plans.

The completed wall(s) shall meet the following tolerances:

| | Permanent Wall | Temporary Wall |
|---|---|---|
| Deviation from the design batter and horizontal alignment for the face when measured along a ten foot straight edge at the midpoint of each wall layer shall not exceed: | 3 inches | 5 inches |
| Deviation from the overall | | |

| | | |
|---|---|---|
| design batter per ten feet of wall height shall not exceed: | 2 inches | 3 inches |
| Maximum outward bulge of the face between backfill reinforcement layers shall not exceed: | 4 inches | 6 inches |

### 6-14.3(2) Submittals

A minimum of 14 calendar days prior to beginning construction of each wall the Contractor shall submit detailed plans for each wall in accordance with Section 6-01.9. As a minimum, the submittals shall include the following:

1. Detailed wall plans showing the actual lengths proposed for the geosynthetic reinforcing layers and the locations of each geosynthetic product proposed for use in each of the geosynthetic reinforcing layers.
2. The Contractor's proposed wall construction method, including proposed forming systems, types of equipment to be used and proposed erection sequence.
3. Manufacturer's Certificate of Compliance, samples of the retaining wall geosynthetic and sewn seams for the purpose of acceptance as specified.
4. Details of geosynthetic retaining wall corner construction, including details of the positive connection between the wall sections on both sides of the corner.
5. Details of terminating a top layer of retaining wall geosynthetic and backfill due to a changing retaining wall profile.

Approval of the Contractor's proposed wall construction details and methods shall not relieve the Contractor of their responsibility to construct the walls in accordance with the requirements of these Specifications.

### 6-14.3(3) Excavation and Foundation Preparation

Excavation shall conform to Section 2-09.3(4), and to the limits and construction stages shown in the Plans. Foundations soils found to be unsuitable shall be removed and replaced in accordance with Section 2-09.3(1)C.

The Contractor shall direct all surface runoff from adjacent areas away from the retaining wall construction site.

### 6-14.3(4) Erection and Backfill

The Contractor shall begin wall construction at the lowest portion of the excavation and shall place each layer horizontally as shown in the Plans. The Contractor shall complete each layer entirely before beginning the next layer.

Geotextile splices shall consist of a sewn seam or a minimum 1'-0" overlap. Geogrid splices shall consist of adjacent geogrid strips butted together and fastened using hog rings, or other methods approved by the WSDOT, in such a manner to prevent the splices from separating during geogrid installation and backfilling. Splices exposed at the wall face shall prevent loss of backfill material through the face. The splicing material exposed at the wall face shall be as durable and strong as the material to which the splices are tied. The Contractor shall offset

geosynthetic splices in one layer from those in the other layers such that the splices shall not line up vertically. Splices parallel to the wall face will not be allowed, as shown in the Plans.

The Contractor shall stretch out the geosynthetic in the direction perpendicular to the wall face to ensure that no slack or wrinkles exist in the geosynthetic prior to backfilling.

For geogrids, the length of the reinforcement required as shown in the Plans shall be defined as the distance between the geosynthetic wrapped face and the last geogrid node at the end of the reinforcement in the wall backfill.

The Contractor shall place fill material on the geosynthetic in lifts such that six inches minimum of fill material is between the vehicle or equipment tires or tracks and the geosynthetic at all times. The Contractor shall remove all particles within the backfill material greater than three inches in size. Turning of vehicles on the first lift above the geosynthetic will not be permitted. The Contractor shall not end dump fill material directly on the geosynthetic without the prior approval of the WSDOT.

Should the geosynthetic be damaged or the splices disturbed, the backfill around the damaged or displaced area shall be removed and the damaged strip of geosynthetic replaced by the Contractor at no expense to the Contracting Agency.

The Contractor shall use a temporary form system to prevent sagging of the geosynthetic facing elements during construction. A typical example of a temporary form system and sequence of wall construction required when using this form are detailed in the Plans. Soil piles or the geosynthetic manufacturer's recommended method, in combination with the forming system shall be used to hold the geosynthetic in place until the specified cover material is placed.

The Contractor shall place and compact the wall backfill in accordance with the wall construction sequence detailed in the Plans and Method C of Section 2-03.3(14)D, except as follows:

1. The maximum lift thickness after compaction shall not exceed ten inches
2. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density.
3. Rollers shall have sufficient capacity to achieve compaction without causing distortion to the face of the wall in accordance with Section 6-14.3(1).
4. The Contractor shall not use sheepsfoot rollers or rollers with protrusions.
5. The Contractor shall compact the zone within three feet of the back of the wall facing panels without causing damage to or distortion of the wall facing elements (welded wire mats, backing mats, construction geotextile for wall facing, precast concrete facing panels, and concrete blocks) by using light mechanical tampers as approved by the WSDOT. No soil density tests will be taken within this area.
6. For wall systems with geosynthetic reinforcement, the minimum compacted backfill lift thickness of the first lift above each geosynthetic reinforcement layer shall be six inches.

The Contractor shall construct wall corners at the locations shown in the Plans, and in accordance with the wall corner construction sequence and method submitted by the Contractor and approved by the WSDOT. Wall angle points with an interior angle of less than 150 degrees shall be considered to be a wall corner. The wall corner shall provide a positive connection between the sections of the wall on each side of the corner such that the wall backfill material cannot spill out through the corner at any time during the design life of

the wall. The Contractor shall construct the wall corner such that the wall sections on both sides of the corner attain the full geosynthetic layer embedment lengths shown in the Plans.

Where required by retaining wall profile grade, the Contractor shall terminate top layers of retaining wall geosynthetic and backfill in accordance with the method submitted by the Contractor and approved by the WSDOT. The end of each layer at the top of the wall shall be constructed in a manner which prevents wall backfill material from spilling out the face of the wall throughout the life of the wall. If the profile of the top of the wall changes at a rate of 1:1 or steeper, this change in top of wall profile shall be considered to be a corner.

### 6-14.3(5) Guardrail Placement

The Contractor shall install guardrail posts as shown in the Plans after completing the wall, but before the permanent facing is installed. The Contractor shall install the posts in a manner that prevents bulging of the wall face and prevents ripping, tearing, or pulling of the geosynthetic reinforcement. Holes through the geosynthetic reinforcement shall be the minimum size necessary for the post. The Contractor shall demonstrate to the WSDOT prior to beginning guardrail post installation that the installation method will not rip, tear, or pull the geosynthetic reinforcement.

### 6-14.3(6) Permanent Facing

The Contractor shall apply a permanent facing to the surface of all permanent geosynthetic retaining walls as shown in the Plans. Shotcrete facing, if shown in the Plans, shall conform to Section 6-18. Concrete fascia panel, if shown in the Plans, shall conform to Section 6-15.3(9).

### 6-14.3(7) Geosynthetic Retaining Wall Traffic Barrier and Geosynthetic Retaining Wall Pedestrian Barrier

Geosynthetic retaining wall traffic barrier and geosynthetic retaining wall pedestrian barrier, if shown in the Plans, shall be constructed in accordance with Sections 6-02.3(11)A and 6-10.3(2), and the details in the Plans, except as follows:

1. The slip-form method of barrier construction will not be allowed for geosynthetic retaining wall traffic barrier and geosynthetic retaining wall pedestrian barrier.
2. The Contractor shall not begin placing backfill above the bottom of the geosynthetic retaining wall traffic barrier and geosynthetic retaining wall pedestrian barrier until removing the forms from the portion of the barrier being embedded. The Contractor shall not remove forms from the embedded portion of the barrier until the concrete has set for at least three days or has attained a minimum compressive strength of 2,400 psi.

## SECTION 6-15, SOIL NAIL WALLS

### 6-15.1 Description

This work consists of constructing soil nail walls.

### 6-15.2 Materials

Materials shall meet the requirements of the following section:

| | |
|---|---|
| Prefabricated Drainage Mat | 9-33.2(3) |

Other materials required, including materials for soil nails, shall be as specified in the Special Provisions.

### 6-15.3 Construction Requirements

### 6-15.3(1) General Description

Soil nailing shall consist of excavating to the layer limits shown in the Plans, drilling holes at the specified angle into the native material, placing and grouting epoxy coated or encapsulated steel reinforcing bars (soil nails) in the drilled holes, placing prefabricated drainage material and steel reinforcement, and applying a shotcrete facing over the steel reinforcement. After completing the wall to full height, the Contractor shall construct the concrete fascia panels as shown in the Plans.

All proprietary items used in the soil nailed structure shall be installed in accordance with the manufacturer's recommendations. In the event of a conflict between the manufacturer's recommendations and these specifications, these specifications shall prevail.

### 6-15.3(2) Contractor's Experience Requirements

The Contractor or SubContractor performing this work shall have completed at least five projects, within the last five years, involving construction of retaining walls using soil nails or ground anchors or shall have completed the construction of two or more projects totaling at least 15,000 square feet of retaining wall with a minimum total of 500 soil nails or ground anchors.

The Contractor shall assign an WSDOT with at least three years of experience in the design and construction of permanently anchored or nailed structures to supervise the work. The Contractor shall not use consultants or manufacturer's representatives in order to meet the requirements of this section. Drill operators and on-site supervisors shall have a minimum of one year experience installing permanent soil nails or ground anchors.

Contractors or SubContractors that are specifically prequalified in Class 36 work will be considered to have met the above experience requirements.

### 6-15.3(3) Submittals

Work shall not begin on any soil nail wall system until the WSDOT has approved all of the required submittals. The Contractor shall submit the following information in accordance with Section 6-01.9 not less than 30 calendar days prior to the start of wall excavation.

1. A brief description of each project satisfying the Contractors Experience Requirements with the Owner's name and current phone number (this item is not required if the Contractor or SubContractor is prequalified in Class 36).
2. A list identifying the following personnel assigned to this project and their experience with permanently anchored or nailed structures:
    a. Supervising WSDOT
    b. Drill Operators
    c. On-site Supervisors who will be assigned to the project.
3. The proposed detailed construction procedure which includes:
    a. Proposed method(s) of excavation of the soil and/or rock.

b. A plan for the removal and control of groundwater encountered during excavation, drilling, and other earth moving activities. Include a list of the equipment used to remove and control groundwater.

c Proposed drilling methods and equipment.

d. Proposed hole diameter(s).

e. Proposed method of soil nail installation.

f. Grout mix design and procedures for placing the grout.

g. Shotcrete mix design with compressive strength test results.

h. Procedures for placing the shotcrete (include placement in conditions when ground water is encountered).

i. Encapsulation system for additional corrosion protection selected for the soil nails and anchorages requiring encapsulation.

4. Detailed working drawings of the method proposed for the soil nail testing which includes:

   a. All necessary drawings and details to clearly describe the proposed system of jacking support, framing, and bracing to be used during testing.

   b. Calibration data for each load cell, test jack, pressure gauge, stroke counter on the grout pump, and master gauge to be used. The calibration tests shall have been performed by an independent testing laboratory, and tests shall have been performed within 60 calendar days of the date submitted. Testing or work shall not commence until the WSDOT has approved the load cell, jack, pressure gage, and master pressure gauge calibrations.

5. Certified mill test results and typical stress-strain curves along with samples from each heat, properly marked, for the soil nail steel. The typical stress-strain curve shall be obtained by approved standard practices. The guaranteed ultimate strength, yield strength, elongation, and composition shall be specified.

### 6-15.3(4) Preconstruction Conference

A soil nail preconstruction conference shall be held at least five working days prior to the Contractor beginning any permanent soil nail work at the site to discuss construction procedures, personnel and equipment to be used. The list of materials specified on the Record of Materials Form (ROM) for this item of work will also be discussed. Those attending shall include:

1. (representing the Contractor) The superintendent, on site supervisors, and all foremen in charge of excavating the soil face, drilling the soil nail hole, placing the soil nail and grout, placing the shotcrete facing, and tensioning and testing the soil nail.

2. (representing the Contracting Agency) The Project WSDOT, key inspection personnel, and representatives from the WSDOT Construction Office and Materials Laboratory Geotechnical Services Branch.

If the Contractor's key personnel change, or if the Contractor proposes a significant revision of the approved permanent soil nail installation plan, an additional conference shall be held before any additional permanent soil nail operations are performed.

### 6-15.3(5) Earthwork

The ground contour above the wall shall be established to its final configuration and backslope as shown in the Plans prior to beginning excavation of the soil for the first row of soil nails. All excavation shall conform to Section 2-03.

The excavation shall proceed from the top down in a horizontal lift sequence with the ground level excavated no more than 3 feet below the elevation of the row of nails to be installed in that lift. The excavated vertical wall face should not be left open more than 24 hours for any reason. A lift shall not be excavated until the nail installation and reinforced shotcrete placement for the preceding lift has been completed and accepted. After a lift is excavated, the cut surface shall be cleaned of all loose materials, mud, rebound, and other foreign matter that could prevent or reduce shotcrete bond.

The accuracy of the ground cut shall be such that the required thickness of shotcrete can be placed within a tolerance of plus or minus 2 inches from the defined face of the wall, and overexcavation does not damage overlying shotcrete sections by undermining or other causes.

The Contractor should review the geotechnical recommendations report prepared for this project for further information on the soil conditions at the location of each wall. Copies of the geotechnical recommendations report are available for review by prospective bidders at the location identified in the Special Provisions.

### 6-15.3(6) Soil Nailing

The Contractor shall not handle and transport the encapsulated soil nails until the encapsulation grout has reached sufficient strength to resist damage during handling. The Contractor shall handle the encapsulated soil nails in such a manner to prevent large deflections or distortions during handling. When handling or transporting encapsulated soil nails, the Contractor shall provide slings or other equipment necessary to prevent damage to the soil nails and the corrosion protection. The WSDOT may reject any encapsulated nail which is damaged during transportation or handling. Damaged or defective encapsulation shall be repaired in accordance with the manufacturer's recommendations and as approved by the WSDOT.

Soil nails shall be handled and sorted in such a manner as to avoid damage or corrosion. Prior to inserting a soil nail in the drilled hole, the Contractor and the WSDOT will examine the soil nail for damage. If, in the opinion of the WSDOT, the epoxy coating or bar has been damaged, the nail shall be repaired. If, in the opinion of the WSDOT, the damage is beyond repair, the soil nail shall be rejected.

If, in the opinion of the WSDOT, the epoxy coating can be repaired, the Contractor shall patch the coating with an WSDOT approved patching material.

Nail holes shall be drilled at the locations shown in the Plans or as staked by the WSDOT. The nails shall be positioned plus or minus 6 inches from the theoretical location shown in the Plans. The Contractor shall select the drilling method and the grouting pressure used for the installation of the soil nail. The drill hole shall be located so that the longitudinal axis of the drill hole and the longitudinal axis of the nail are parallel. At the point of entry the soil nail shall be installed within plus or minus three degrees of the inclination from horizontal shown in the Plans, and the nail shall be within plus or minus three degrees of a line drawn perpendicular to the face of the wall unless otherwise shown in the Plans.

Water or other liquids shall not be used to flush cuttings during drilling, but air may be used. After drilling, the nail shall be installed and fully grouted before placing the shotcrete facing. The nail shall be inserted into the drilled hole with centralizers to the desired depth in such a manner as to prevent damage to the drilled hole, sheathing or epoxy during installation. The

centralizers shall provide a minimum of 0.5 inches of grout cover over the soil nail and shall be spaced no further than eight feet apart. When the soil nail cannot be completely inserted into the drilled hole without difficulty, the Contractor shall remove the nail from the drilled hole and clean or redrill the hole to permit insertion. Partially inserted soil nails shall not be driven or forced into the hole. Subsidence, or any other detrimental impact from drilling shall be cause for immediate cessation of drilling and repair of all damages in a manner approved by the WSDOT at no additional cost to the Contracting Agency.

If caving conditions are encountered, no further drilling will be allowed until the Contractor selects a method to prevent ground movement. The Contractor may use temporary casing. The Contractor's method to prevent ground movement shall be approved by the WSDOT. The casings for the nail holes, if used, shall be removed as the grout is being placed.

Where necessary for stability of the excavation face, a sealing layer of shotcrete may be placed before drilling is started, or the Contractor shall have the option of drilling and grouting of nails through a stabilizing berm of native soil at the face of the excavation. The stabilizing berm shall extend horizontally from the soil face and from the face of the shotcrete a minimum distance of one foot, and shall be cut down from that point at a safe slope, no steeper than 1H:1V unless approved by the WSDOT. The berm shall be excavated to final grade after installation and full length grouting of the nails. Nails damaged during berm excavation shall be repaired or replaced by the Contractor, to the satisfaction of the WSDOT, at no added cost to the Contracting Agency.

If sections of the wall are constructed at different times than the adjacent soil nail sections, the Contractor shall use stabilizing berms, temporary slopes, or other measures, as approved by the WSDOT, to prevent sloughing or failure of the adjacent soil nail sections.

If cobbles and boulders are encountered at the soil face during excavation, the Contractor shall remove all cobbles and boulders that protrude from the soil face into the design wall section and fill the void with shotcrete. All shotcrete used to fill voids created by removal of cobbles and boulders shall be incidental to shotcrete facing.

The grout equipment shall produce a grout free of lumps and undispersed cement. A positive displacement grout pump shall be used. The pump shall be equipped with a pressure gauge near the discharge end to monitor grout pressures. The pressure gauge shall be capable of measuring pressures of at least 150 psi or twice the actual grout pressures used by the Contractor, whichever is greater. The grouting equipment shall be sized to enable the grout to be pumped in one continuous operation. The mixer shall be capable of continuously agitating the grout.

The grout shall be injected from the lowest point of the drilled hole. The grout shall be pumped through grout tubes after insertion of the soil nail. The quantity of the grout and the grout pressures shall be recorded. The grout pressures and grout takes shall be controlled to prevent excessive ground heave.

### 6-15.3(7) Shotcrete Facing

Prior to placing any shotcrete on an excavated layer, the Contractor shall vertically center prefabricated drainage mat between the columns of nails as shown in the Plans. The prefabricated drainage mat shall be installed in accordance with the manufacturer's recommendations. The permeable drain side shall be placed against the exposed soil face. The prefabricated drainage mat shall be installed after each excavation lift and shall be hydraulically connected with the prefabricated drainage mat previously placed, such that the vertical flow of water is not impeded. The Contractor shall tape all joints in the prefabricated drainage mat to prevent shotcrete intrusion during shotcrete application.

The Contractor shall place steel reinforcing bars and welded wire fabric, and apply the shotcrete facing in accordance with Section 6-18 and the details shown in the Plans.

The shotcrete shall be constructed to the minimum thickness as shown in the Plans. Costs associated with additional thickness of shotcrete due to overexcavation or irregularities in the cut face shall be borne by the Contractor.

Each soil nail shall be secured at the shotcrete facing with a steel plate as shown in the Plans. The plate shall be seated on a wet grout pad of a pasty consistency similar to that of mortar for brick-laying. The nut shall then be sufficiently tightened to achieve full bearing surface behind the plate. After the shotcrete and grout have had time to gain the specified strength, the nut shall be tightened with at least 100 foot-pounds of torque.

### 6-15.3(8) Soil Nail Testing and Acceptance

Both verification and proof testing of the nails is required. The Contractor shall supply all materials, equipment, and labor to perform the tests. The Contractor shall submit all test data to the WSDOT.

The testing equipment shall include a dial gauge or vernier scale capable of measuring to 0.001 inch of the ground anchor movement. A hydraulic jack and pump shall be used to apply the test load. The movement-measuring device shall have a minimum travel equal to the theoretical elastic elongation of the total nail length plus 1 inch. The dial gauge or vernier scale shall be aligned so that its axis is within 5 degrees from the axis of the nail and shall be monitored with a reference system that is independent of the jacking system and excavation face.

The jack and pressure gauge shall be calibrated by an independent testing laboratory as a unit. Each load cell, test jack and pressure gauge, grout pump stroke counter, and master gauge, shall be calibrated as specified in Section 6-15.3(3) item 4b. Additionally, the Contractor shall not use load cells, test jacks and pressure gauges, grout pump stroke counters, and master gauges, greater than 60 calendar days past their most recent calibration date, until such items are re-calibrated by an independent testing laboratory.

The pressure gauge shall be graduated in 100 psi increments or less. The pressure gauge will be used to measure the applied load. The pressure gauge shall be selected to place the maximum test load within the middle two-thirds of the range of the gauge. The ram travel of the jack shall not be less than the theoretical elastic elongation of the total length at the maximum test load plus 1 inch. The jack shall be independently supported and centered over the nail so that the nail does not carry the weight of the jack. The Contractor shall have a second calibrated jack pressure gauge at the site. Calibration data shall provide a specific reference to the jack and the pressure gauge.

The loads on the nails during the verification and proof tests shall be monitored to verify consistency of load – defined as maintaining the test load within five percent of the specified value. Test loads less than 20,000 pounds shall be monitored by the jack pressure gauge. Test loads equal to or greater than 20,000 pounds shall be monitored with an electric or hydraulic load cell. The Contractor shall provide the load cell, the readout device, and a recent calibration curve. The load cell shall be selected to place the maximum test load within the middle two-thirds of the range of the load cell. The stressing equipment shall be placed over the nail in such a manner that the jack bearing plates, load cell and stressing anchorage are in alignment.

Nails to be tested shall be initially grouted no closer to the excavation face than the dimension shown in the Plans. After placing the grout, the nail shall remain undisturbed until

the grout has reached a strength sufficient to provide resistance during testing. Grouting to the excavation face shall be completed after successful testing has been performed. Test nails which are not part of the permanent wall may be left in the ground, provided the drill holes for the nails are completely filled with grout or non-structural filler after testing.

Load testing shall be performed against a temporary bearing yoke or reaction frame which bears directly against the existing soil or the shotcrete facing. Temporary bearing pads shall be kept a minimum of 12 inches from the edges of the drilled hole unless a rigid steel plate is used to distribute the stress around the drilled hole. If a steel plate is used, it shall be a minimum of 3 feet square and of sufficient thickness that it will distribute the load evenly to the soil. Where the reaction frame bears directly against the shotcrete, the reaction frame shall be designed to prevent fracture of the shotcrete. No part of the reaction frame shall bear within 12 inches of the edge of the test nail blockout unless otherwise approved by the WSDOT.

### 6-15.3(8)A Verification Testing

Verification testing shall be performed on nails installed within the pattern of production nails to verify the Contractor's procedures, hole diameter, and design assumptions. No drilling or installation of production nails will be permitted in any ground/rock unit unless successful verification testing of anchors in that unit has been completed and approved by the WSDOT, using the same equipment, methods, nail inclination, nail length, and hole diameter as planned for the production nails. Changes in the drilling or installation method may require additional verification testing as determined by the WSDOT and shall be done at no additional expense to the Contracting Agency. Verification tests may be performed prior to excavation for the soil nail wall.

Successful verification tests are required within the limits as specified in the Special Provisions. Test nail locations within these limits shall be at locations selected by the WSDOT.

The design details of the verification testing, including the system for distributing test load pressures to the excavation surface and appropriate nail bar size and reaction plate, shall be developed by the Contractor, subject to approval by the WSDOT. The intent is to stress the bond between the grout and the surrounding soil/rock to at least twice the design load transfer.

The bar shall be proportioned such that the maximum stress at 200 percent of the test load does not exceed 80 percent of the yield strength of the steel. The jack shall be positioned at the beginning of the test such that unloading and repositioning of the jack during the test will not be required. The verification tests shall be made by incrementally loading the nails in accordance with the following schedule of hold time:

| | |
|---|---|
| AL | 1 minute |
| 0.25TL | 10 minutes |
| 0.50TL | 10 minutes |
| 0.75TL | 10 minutes |
| 1.00TL | 10 minutes |
| 1.25TL | 10 minutes |
| 1.50TL | 60 minutes |

| | |
|---|---|
| 1.75TL | 10 minutes |
| 2.00TL | 10 minutes |

AL = Nail Alignment Load

TL = Nail Test Load

The test load shall be determined by the following equation = Test Load (TL) = Bond Length (BL) X Design Load Transfer (DLT).

The load shall be applied in increments of 25 percent of the test load. Each load increment shall be held for at least 10 minutes. Measurement of nail movement shall be obtained at each load increment. The load-hold period shall start as soon as the load is applied and the nail movement with respect to a fixed reference shall be measured and recorded at 1 minute, 2, 3, 5, 6, 10, 20, 30, 50, and 60 minutes.

The WSDOT will evaluate the results of each verification test and make a determination of the suitability of the test and of the Contractor's proposed production nail design and installation system. Tests which fail to meet the design criteria will require additional verification testing or an approved revision to the Contractor's proposed production nail design and installation system. If a nail fails in creep, retesting will not be allowed.

A verification tested nail with a 60 minute load hold at 1.50TL is acceptable if:

1. The nail carries the test load with a creep rate that does not exceed 0.08 inch per log cycle of time and is at a linear or decreasing creep rate.
2. The total movement at the test load exceeds 80 percent of the theoretical elastic elongation of the non-bonded length.

Furthermore, a pullout failure shall not occur for the verification test anchor at the 2.0TL maximum load. Pullout failure load is defined as the load at which attempts to increase the test load result only in continued pullout movement of the test nail without a sustainable increase in the test load.

The nails used for verification tests shall be sacrificial and shall not be used for production. The Contractor shall cut and remove the exposed end of all soil nails used for verification tests a minimum of two feet inside the finished groundline.

### 6-15.3(8)B Proof Testing

Proof tests shall be performed on production nails at the locations selected by the WSDOT. Up to five percent of the production nails will be tested. Prior to testing, only the bond length (BL) portion of the nail shall be grouted. The Contractor shall maintain the side-wall stability of the drill hole for the non-grouted portion during the test. Once proof testing is completed, the remainder of the proof tested nail shall be grouted. The bond length shall be determined from the Nail Schedule and Test Nail Detail shown in the Plans.

Proof tests shall be performed by incrementally loading the nail in accordance with the schedule below. The anchor movement shall be measured and recorded to the nearest 0.001 inch with respect to an independent fixed reference point in the same manner as for the verification tests at the alignment load and at each increment of load. The load shall be monitored in accordance with Section 6-15.3(8). The scheduling of hold times shall be as follows:

| | |
|---|---|
| AL | 1 minute |

| | |
|---|---|
| 0.25TL | 5 minutes |
| 0.50TL | 5 minutes |
| 0.75TL | 5 minutes |
| 1.00TL | 5 minutes |
| 1.25TL | 5 minutes |
| 1.50TL | 10 minutes |

AL = Nail Alignment Load

TL = Nail Test Load

The maximum load in a proof test shall be held for 10 minutes. The load hold period shall start as soon as the maximum load is applied and the nail movement with respect to an independent fixed reference shall be measured and recorded at 1, 2, 3, 4, 5, 6, and 10 minutes. The nail movement between 1 minute and 10 minutes shall not exceed 0.04 inches. If the nail movement between 1 and 10 minutes exceeds 0.04 inches, the maximum load shall be held an additional 50 minutes. If the load hold is extended, the nail movement shall be recorded at 20, 30, 50, and 60 minutes. If a nail fails in creep, retesting will not be allowed.

A proof tested nail is acceptable if:

1. The nail carries the maximum load with less than 0.04 inches of movement between 1 minute and 10 minutes, unless the load hold extended to 60 minutes, in which case the nail would be acceptable if the creep rate does not exceed 0.08 inches per log cycle of time.
2. The total movement at the maximum load exceeded 80 percent of the theoretical elastic elongation of the non-bonded length.
3 The creep rate is not increasing with time during the load hold period.

Due to the requirement for a non-bonded zone for testing purposes, the Contractor shall develop an installation method which will assure the stability of the non-bonded portion of the hole during testing and will allow for the non bonded zone to be grouted against the ground after testing.

If a proof test fails, the WSDOT may direct the Contractor to replace some or all of the installed production nails between the failed test and an adjacent proof test nail that has met the test criteria. The WSDOT may also require additional proof testing. All additional proof tests, and all installation of additional or modified nails, shall be performed at no additional expense to the Contracting Agency.

### 6-15.3(9) Concrete Fascia Panels

The Contractor shall construct the concrete fascia panels in accordance with Section 6-02 and the details in the Plans. The concrete fascia panels shall be cured in accordance with the Section 6-02.3(11) requirements specified for retaining walls. The Contractor shall provide the specified surface finish as noted, and to the limits shown, in the Plans to the exterior concrete surface. When noted in the Plans, the Contractor shall apply pigmented sealer to the limits shown in the Plans.

Asphalt or cement concrete gutter shall be constructed as shown in the Plans and as specified in Section 8-04.

# SECTION 6-16, SOLDIER PILE AND SOLDIER PILE TIEBACK WALLS

## 6-16.1 Description

This work consists of constructing soldier pile walls and soldier pile tieback walls.

## 6-16.2 Materials

Materials shall meet the requirements of the following sections:

| | |
|---|---|
| Controlled Density Fill | 2-09.3(1)E |
| Cement | 9-01 |
| Aggregates for Portland Cement Concrete | 9-03.1 |
| Gravel Backfill | 9-03.12 |
| Premolded Joint Filler | 9-04.1(2) |
| Welded Shear Studs | 9-06.15 |
| Steel Reinforcing Bar | 9-07.2 |
| Epoxy-Coated Steel Reinforcing Bar | 9-07.3 |
| Paints | 9-08 |
| Timber Lagging | 9-09.2 |
| Preservative Treatment for Timber Lagging | 9-09.3(1) |
| Soldier Piles | 9-10.5 |
| Concrete Curing Materials and Admixtures | 9-23 |
| Fly Ash | 9-23.9 |
| Water | 9-25 |
| Prefabricated Drainage Mat | 9-33.2(3) |

Other materials required shall be as specified in the Special Provisions.

## 6-16.3 Construction Requirements

### 6-16.3(1) Quality Assurance

The steel soldier piles shall be placed so that the center line of the pile at the top is within 1 inch of the plan location. The steel soldier pile shall be plumb, to within 0.5 percent of the length based on the total length of the pile.

Welding, repair welding, and welding inspection shall conform to the Section 6-03.3(25) requirements for welding, repair welding, and welding inspection for all other steel fabrication.

### 6-16.3(2) Submittals

The Contractor shall submit shop plans as specified in Section 6-03.3(7) for all structural steel, including the steel soldier piles and the permanent ground anchors to the WSDOT for approval.

The Contractor shall submit the permanent ground anchor grout mix design and the procedures for placing the grout to the WSDOT for approval.

The Contractor shall submit forming plans for the concrete fascia panels, as specified in Sections 6-02.3(16) and 6-02.3(17), to the WSDOT for approval.

1. Where the lateral pressure from concrete placement, as specified in Section 6-02.3(17)J, is less than or equal to the design earth pressure, the Contractor may tie forms directly to the soldier piles.

2. Where the lateral pressure from concrete placement, as specified in Section 6-02.3(17)J, is greater than the design earth pressure, the Contractor shall follow one of the following procedures:

   a. Tie the forms to strongbacks behind the lagging, or use some other system that confines the pressure from concrete placement between the lagging and the form panels, in addition to the ties to the soldier piles.

   b. Reduce the rate of placing concrete to reduce the pressure from concrete placement to less than or equal to the design earth pressure in addition to the ties to the soldier piles.

   c. Follow a procedure with a combination of a. and b.

3. The Contractor shall design the forms for an appropriate rate of placing concrete so that no cold joints occur, considering the wall thickness and height, and volume of concrete to be placed.

The Contractor shall submit four copies of a shaft installation plan in accordance with Section 6-01.9 not less than 30 calendar days prior to the beginning of shaft construction. In preparing the submittal, the Contractor shall reference the available subsurface data provided in the contract test hole boring logs and the geotechnical report(s) prepared for this project. This plan shall provide at least the following information:

1. An overall construction operation sequence and the sequence of shaft construction.

2. List, description, and capacities of proposed equipment including but not limited to cranes, drills, augers, bailing buckets, final cleaning equipment, and drilling units. The narrative shall describe why the equipment was selected, and describe equipment suitability to the anticipated site and subsurface conditions. The narrative shall include a project history of the drilling equipment demonstrating the successful use of the equipment on shafts of equal or greater size in similar soil/rock conditions.

3. Details of shaft excavation methods including proposed drilling methods, methods for cleanout of the shafts, disposal plan for excavated material and drilling slurry (if applicable), and a review of method suitability to the anticipated site and subsurface conditions.

4. Details of the method(s) to be used to ensure shaft stability (i.e., prevention of caving, bottom heave, etc. using temporary casing, slurry, or other means) during excavation and concrete placement. This shall include a review of method suitability to the anticipated site and subsurface conditions. If temporary casings are proposed, casing dimensions and detailed procedures for casing installation and removal shall be provided. If slurry is proposed, detailed procedures for mixing, using,

maintaining, and disposing of the slurry shall be provided. A detailed mix design, and a discussion of its suitability to the anticipated subsurface conditions shall also be provided for the proposed slurry.

5. Details of soldier pile placement including internal support bracing and centralization methods.

6. Details of concrete placement including proposed operational procedures for pumping and/or tremie methods.
7. Details of the device used to prevent unauthorized entry into a shaft excavation.
8. The method to be used to form the horizontal construction joint at the top elevation specified for concrete Class 4000P in the shaft.

Work shall not begin until the appropriate submittals have been approved in writing by the WSDOT.

### 6-16.3(3) Shaft Excavation

Shafts shall be excavated to the required depth as shown in the Plans. The minimum diameter of the shaft shall be as shown in the Plans. The excavation shall be completed in a continuous operation using equipment capable of excavating through the type of material expected to be encountered.

The Contractor may use temporary telescoping casing to construct the shafts.

If the shaft excavation is stopped the shaft shall be secured by installation of a safety cover. It shall be the Contractor's responsibility to ensure the safety of the shaft and surrounding soil and the stability of the side walls. A temporary casing, slurry, or other methods specified in the shaft installation plan as approved by the WSDOT shall be used if necessary to ensure such safety and stability.

Where caving in conditions are encountered, no further excavation will be allowed until the Contractor has implemented the method to prevent ground caving as submitted in accordance with item 4 of the Shaft Installation Plan and as approved by the WSDOT.

The Contractor shall use appropriate means such as a cleanout bucket, or air lift to clean the bottom of the excavation of all shafts. No more than 2 inches of loose or disturbed material shall be present at the bottom of the shaft just prior to beginning concrete placement.

The excavated shaft shall be inspected and approved by the WSDOT prior to proceeding with construction.

When obstructions are encountered, the Contractor shall notify the WSDOT promptly. An obstruction is defined as a specific object (including, but not limited to, boulders, logs, and man made objects) encountered during the shaft excavation operation which prevents or hinders the advance of the shaft excavation. When efforts to advance past the obstruction to the design shaft tip elevation result in the rate of advance of the shaft drilling equipment being significantly reduced relative to the rate of advance for the rest of the shaft excavation, then the Contractor shall remove the obstruction under the provisions of Section 6-16.5 as supplemented in the Special Provisions. The method of removal of such obstructions, and the continuation of excavation shall be as proposed by the Contractor and approved by the WSDOT.

Excavation of shafts shall not commence until a minimum of 12 hours after the shaft backfill for the adjacent shafts has been placed.

The temporary casings for the shafts shall be removed. A minimum 5 foot head of concrete shall be maintained to balance the soil and water pressure at the bottom of the casing. The casing shall be smooth.

### 6-16.3(4) Installing Soldier Piles

Soldier piles, if spliced, shall conform to all requirements of Section 6-05.3(6).

The prefabricated steel soldier piles shall be lowered into the drilled shafts and secured in position. Concrete cover over the soldier pile shall be 1 inch minimum.

The steel soldier piles and attachments shall be shop painted after fabrication to the limits shown in the Plans with one coat of inorganic zinc primer. Application of the one coat of primer shall be in accordance with Section 6-07. The welded shear studs may be attached before or after painting. Paint damaged by welding shear studs in place does not require repair.

### 6-16.3(5) Backfilling Shaft

The excavated shaft shall be backfilled with either controlled density fill (CDF), lean concrete, or concrete Class 4000P, as shown in the Plans.

Placement of the shaft backfill shall commence immediately after completing the shaft excavation and receiving the WSDOT's approval of the excavation. Concrete Class 4000P and lean concrete shall be placed in one continuous operation to the elevation shown in the Plans. CDF shall be placed in one continuous operation to the top of the shaft. Vibration of shaft backfill is not required.

If water is not present, the shaft backfill shall be deposited by a method which prevents segregation of aggregates. The shaft backfill shall be placed such that the free-fall is vertical down the shaft without hitting the sides of the soldier pile or the excavated shaft. The Contractor's method for depositing the shaft backfill shall have approval of the WSDOT prior to the placement of the shaft backfill.

If water is present, the shaft backfill shall be deposited in accordance with Section 6-02.3(6)B.

### 6-16.3(6) Installing Timber Lagging and Permanent Ground Anchors

The excavation and removal of CDF and lean concrete for the lagging installation shall proceed in advance of the lagging. The bottom of the excavation in front of the wall shall be level. Excavation shall conform to Section 2-03.

For walls without permanent ground anchors, the bottom of excavation shall be not more than three feet below the bottom level of the timber lagging already installed. For walls with permanent ground anchors, the bottom of excavation shall be not more than 3 feet below tieback anchor level until all permanent ground anchors at that level are installed and stressed. Installing, stressing, and testing the permanent ground anchors shall be in accordance with Section 6-17 and the construction sequence specified in the Plans.

Unless otherwise specified, timber lagging in walls with concrete fascia panels shall be untreated. Timber lagging for all other walls shall be treated.

The lagging shall be installed from the top of the pile proceeding downward. The timber lagging shall make direct contact with the soil. Voids shall be filled with gravel backfill for walls, which shall be considered incidental to the installation of the timber lagging.

Where timber lagging and backfill are above the existing or excavated groundline, the lagging and backfill shall be placed concurrently. The backfill layers shall be placed in accordance with Section 2-03.3(14) except that all layers shall be compacted to 90 percent of maximum density.

### 6-16.3(7) Prefabricated Drainage Mat

For walls with concrete fascia panels, prefabricated drainage mat shall be installed full height of the concrete fascia panel and full width between soldier pile flanges, unless otherwise shown in the Plans.

The prefabricated drainage mat shall be attached to the lagging in accordance with the manufacturer's recommendations. The fabric side shall face the lagging. Splicing of the prefabricated drainage mat shall be in accordance with the manufacturer's recommendations.

The Contractor shall ensure the hydraulic connection of the prefabricated drainage mat to the previously installed material so that the vertical flow of water is not impeded.

The Contractor shall tape all joints in the prefabricated drainage mat to prevent concrete intrusion during concrete fascia panel construction.

### 6-16.3(8) Concrete Fascia Panel

The Contractor shall construct the concrete fascia panels as shown in the Plans, and in accordance with the forming plan as approved by the WSDOT. The concrete fascia panels shall be cured in accordance with the Section 6-02.3(11) requirements specified for retaining walls.

The Contractor shall provide the specified surface finish as noted, and to the limits shown, in the Plans to the exterior concrete surface. When noted in the Plans, the Contractor shall apply pigmented sealer to the limits shown in the Plans.

Asphalt or cement concrete gutter shall be constructed as shown in the Plans.

## SECTION 6-17, PERMANENT GROUND ANCHORS

### 6-17.1 Description

This work consists of constructing permanent ground anchors.

### 6-17.2 Materials

Materials required, including materials for permanent ground anchors, shall be as specified in the Technical Specifications or Special Provisions.

### 6-17.3 Construction Requirements

The Contractor shall select the ground anchor type and the installation method, and determine the bond length and anchor diameter. The Contractor shall install ground anchors that will develop the load indicated in the Plans and verified by tests specified in Sections 6-17.3(8)A, 6-17.3(8)B, and 6-17.3(8)C.

### 6-17.3(1) Definitions

Anchor Devices: The anchorhead wedges or nuts which grip the prestressing steel.

Bearing Plate: The steel plate which evenly distributes the ground anchor force to the structure.

Bond Length: The length of the ground anchor which is bonded to the ground and transmits the tensile force to the soil or rock.

Ground Anchor: A system, referred to as a tieback or as an anchor, used to transfer tensile loads to soil or rock. A ground anchor includes all prestressing steel, anchorage devices, grout, coatings, sheathings and couplers if used.

Maintaining Consistency of Load: Maintaining the test load within five percent of the specified value.

Minimum Guaranteed Ultimate Tensile Strength (MUTS): The minimum guaranteed breaking load of the prestressing steel as defined by the specified standard.

Tendon Bond Length: The length of the tendon which is bonded to the anchor grout.

Tendon Unbonded Length: The length of the tendon which is not bonded to the anchor grout.

Total Anchor Length: The unbonded length plus the tendon bond length.

### 6-17.3(2) Contractor Experience Requirements

The Contractor or SubContractor performing this work shall have installed permanent ground anchors for a minimum of three years. Prior to the beginning of construction, the Contractor shall submit a list containing at least five projects on which the Contractor has installed permanent ground anchors. A brief description of each project and a reference shall be included for each project listed. As a minimum, the reference shall include an individual's name and current phone number.

The Contractor shall assign an WSDOT to supervise the work with at least three years of experience in the design and construction of permanently anchored structures. The Contractor shall not use consultants or manufacturer's representatives in order to meet the requirements of this section. Drill operators and on-site supervisors shall have a minimum of one year experience installing permanent ground anchors.

Contractors or SubContractors that are specifically prequalified in Class 36 work will be considered to have met the above experience requirements.

The Contractor shall allow up to 15 calendar days for the WSDOT's review of the qualifications and staff as noted above. Work shall not be started on any anchored wall system nor materials ordered until approval of the Contractor's qualifications are given.

### 6-17.3(3) Submittals

The Contractor shall submit working drawings and structural design calculations in accordance with Section 6-01.9 for the ground anchor system or systems intended for use.

The Contractor shall submit a detailed description of the construction procedure proposed for use to the WSDOT for approval.

The Contractor shall submit a ground anchor schedule giving:

1. Ground anchor number
2. Ground anchor design load
3. Type and size of tendon
4. Minimum total bond length

5. Minimum anchor length
6. Minimum tendon bond length
7. Minimum unbonded length

The Contractor shall submit working drawings of the ground anchor tendon and the corrosion protection system. Include details of the following:

1. Spacers and their location
2. Centralizers and their location
3. Unbonded length corrosion protection system, including the permanent rubber seal between the trumpet and the tendon unbonded length corrosion protection.
4. Bond length corrosion protection system
5. Anchorage and trumpet
6. Anchorage corrosion protection system
7. Anchors using non-restressable anchorage devices

The Contractor shall submit shop plans as specified in Section 6-03.3(7) for all structural steel, including the permanent ground anchors to the WSDOT for review and approval.

The Contractor shall submit the grout mix designs and the procedures for placing the grout to the WSDOT for approval. The Contractor shall also submit the methods and materials used in filling the annulus over the unbonded length of the anchor.

The Contractor shall submit five copies of detailed working drawings in accordance with Section 6-01.9 for the method proposed to be followed for the permanent ground anchor testing to the WSDOT for approval prior to the tests. This shall include all necessary drawings and details to clearly describe the method proposed.

The Contractor shall submit to the WSDOT calibration data for each load cell, test jack, pressure gauge and master pressure gauge to be used. The calibration tests shall have been performed by an independent testing laboratory and tests shall have been performed within 60 calendar days of the date submitted. The WSDOT shall approve or reject the calibration data after receipt of the data. Testing shall not commence until the WSDOT has approved the load cell, jack, pressure gauge and master pressure gauge calibrations.

Work shall not begin until the appropriate submittals have been approved in writing by the WSDOT.

### 6-17.3(4) Preconstruction Conference

A permanent ground anchor preconstruction conference shall be held at least five working days prior to the Contractor beginning any permanent ground anchor work at the site to discuss construction procedures, personnel, and equipment to be used. The list of materials specified on the Record of Materials Form (ROM) for this item of work will also be discussed. Those attending shall include:

1. (representing the Contractor) The superintendent, on site supervisors, and all foremen in charge of drilling the ground anchor hole, placing the permanent ground anchor and grout, and tensioning and testing the permanent ground anchor.
2. (representing the Contracting Agency) The Project WSDOT, key inspection personnel, and representatives from the WSDOT Construction Office and Materials Laboratory Geotechnical Services Branch.

If the Contractor's key personnel change, or if the Contractor proposes a significant revision of the approved permanent ground anchor installation plan, an additional conference shall be held before any additional permanent ground anchor operations are performed.

### 6-17.3(5) Tendon Fabrication

The tendons can be either shop or field fabricated. The tendon shall be fabricated as shown in the approved shop plans.

The Contractor shall select the type of tendon to be used. The tendon shall be sized so the design load does not exceed 60 percent of the minimum guaranteed ultimate tensile strength of the tendon. In addition, the tendon shall be sized so the maximum test load does not exceed 80 percent of the minimum guaranteed ultimate tensile strength of the tendon.

The Contractor shall be responsible for determining the bond length and tendon bond length necessary to develop the design load indicated in the Plans in accordance with Sections 6-17.3(8)A, 6-17.3(8)B, and 6-17.3(8)C. The minimum bond length shall be ten feet in rock and 15 feet in soil.

When the Plans require the tendon bond length to be encapsulated, the tendon bond length portion of the tendon shall be corrosion protected by encapsulating the tendon in a grout-filled PE or PVC tube as specified in Section 6-17.2 as supplemented in the Special Provisions. The tendons can be grouted inside the encapsulation prior to inserting the tendon in the drill hole or after the tendon has been placed in the drill hole. Expansive admixtures can be mixed with the encapsulation grout if the tendon is grouted inside the encapsulation while outside the drill hole. The tendon shall be centralized within the bond length encapsulation with a minimum of 0.20 inches of grout cover. Spacers shall be used along the tendon bond length of multi-element tendons to separate the elements of the tendon so the prestressing steel will bond to the encapsulation grout.

Centralizers shall be used to provide a minimum of 0.5 inches of grout cover over the tendon bond length encapsulation. Centralizers shall be securely attached to the encapsulation and the center-to-center spacing shall not exceed ten feet. In addition, the upper centralizer shall be located a maximum of five feet from the top of the tendon bond length and the lower centralizer shall be located a maximum of one foot from the bottom of the tendon bond length.

The centralizer shall be able to support the tendon in the drill hole and position the tendon so a minimum of 0.5 inches of grout cover is provided and shall permit free flow of grout.

Centralizers are not required on encapsulated, pressure-injected ground anchor tendons if the ground anchor is installed in coarse grained soils (more than 50 percent of the soil larger than the number 200 sieve) using grouting pressures greater than 150 psi.

Centralizers are not required on encapsulated, hollow-stem-augered ground anchor tendons if the ground anchor is grouted through and the hole is maintained full of a stiff grout (eight-inch slump or less) during extraction of the auger.

The minimum unbonded length of the tendon shall be the greater of 15 feet or that indicated in the Plans.

Corrosion protection of the unbonded length shall be provided by a sheath completely filled with corrosion inhibiting grease or grout. If grease is used under the sheath, provisions shall be made to prevent the grease from escaping at the ends of the sheath. The grease shall completely coat the tendon and fill the voids between the tendon and the sheath. The

working drawings shall show how the Contractor will provide a transition between the tendon bond length and the unbonded tendon length corrosion protection.

If the sheath is not fabricated from a smooth tube, a separate bondbreaker shall be provided. The bondbreaker shall prevent the tendon from bonding to the anchor grout surrounding the tendon unbonded length.

The total anchor length shall not be less than that indicated in the Plans or the approved working drawings.

Anchorage devices shall be capable of developing 95 percent of the minimum guaranteed ultimate tensile strength of the prestressing steel tendon. The anchorage devices shall conform to the static strength requirements of Section 3.1 of the Post Tensioning Institute "Specification for Unbonded Single Strand Tendons, First Edition - 1993".

Non-restressable anchorage devices may be used except where indicated in the Plans.

Restressable anchorages shall be provided on those ground anchors that require reloading. The post-tensioning supplier shall provide a restressable anchorage compatible with the post-tensioning system provided.

The bearing plates shall be sized so the bending stresses in the plate do not exceed the yield strength of the steel when a load equal to 95 percent of the minimum guaranteed ultimate tensile strength of the tendon is applied, and the average bearing stress on the concrete does not exceed that recommended in Section 3.1.3 of the Post Tensioning Institute, "Specification For Unbonded Single Strand Tendons, First Edition - 1993".

The trumpet shall have an inside diameter equal to or larger than the hole in the bearing plate. The trumpet shall be long enough to accommodate movements of the structure during testing and stressing. For strand tendons with encapsulation over the unbonded length, the trumpet shall be long enough to enable the tendon to make a transition from the diameter or the tendon in the unbonded length to the diameter of the tendon at the anchorhead without damaging the encapsulation. Trumpets filled with corrosion-inhibiting grease shall have a permanent rubber seal, as approved by the WSDOT, provided between the trumpet and the tendon unbonded length corrosion protection. Trumpets filled with grout shall have a temporary seal provided between the trumpet and the tendon unbonded length corrosion protection or the trumpet shall overlap the tendon unbonded length corrosion protection.

### 6-17.3(6) Tendon Storage And Handling

Tendons shall be handled and stored in such a manner as to avoid damage or corrosion. Damage to the prestressing steel as a result of abrasions, cut, nicks, welds and weld splatter will be cause for rejection by the WSDOT. The prestressing steel shall be protected if welding is to be performed in the vicinity. Grounding of welding leads to the prestressing steel is forbidden. Prestressing steel shall be protected from dirt, rust, and deleterious substances. A light coating of rust on the steel is acceptable. If heavy corrosion or pitting is noted, the WSDOT will reject the affected tendons.

The Contractor shall use care in handling and storing the tendons at the site. Prior to inserting a tendon in the drill hole, the Contractor and the WSDOT will examine the tendon for damage to the encapsulation and the sheathing. If, in the opinion of the WSDOT, the encapsulation is damaged, the Contractor shall repair the encapsulation in accordance with the tendon supplier's recommendations and as approved by the WSDOT. If, in the opinion of the WSDOT, the smooth sheathing has been damaged, the Contractor shall repair it with ultra high molecular weight polyethylene (PE) tape. The tape shall be spiral wound around the

tendon so as to completely seal the damaged area. The pitch of the spiral shall ensure a double thickness at all points.

### 6-17.3(7) Installing Permanent Ground Anchors

The Contractor shall select the drilling method, the grouting procedure, and the grouting pressure used for the installation of the ground anchor.

When caving conditions are encountered, no further drilling will be allowed until the Contractor selects a method to prevent ground movement. The Contractor may use a temporary casing. The Contractor's method to prevent ground movement shall be approved by the WSDOT. The casings for the anchor holes, if used, shall be removed. The drill hole shall be located so the longitudinal axis of the drill hole and the longitudinal axis of the tendon are parallel. The ground anchor shall not be drilled in a location that requires the tendon to be bent in order to enable the bearing plate to be connected to the supported structure. At the point of entry the ground anchor shall be installed within plus or minus three degrees of the inclination from horizontal shown in the Plans or the approved working drawings. The ground anchors shall not extend beyond the right of way limits.

The tendon shall be inserted into the drill hole to the desired depth. When the tendon cannot be completely inserted without difficulty, the Contractor shall remove the tendon from the drill hole and clean or redrill the hole to permit insertion. Partially inserted tendons shall not be driven or forced into the hole.

The Contractor shall use a grout conforming to Section 6-17.2 as supplemented in the Special Provisions.

The grout equipment shall produce a grout free of lumps and undispersed cement. A positive displacement grout pump shall be used. The pump shall be equipped with a pressure gauge near the discharge end to monitor grout pressures. The pressure gauge shall be capable of measuring pressures of at least 150 psi or twice the actual grout pressures used by the Contractor, whichever is greater. The grouting equipment shall be sized to enable the grout to be pumped in one continuous operation. The mixer shall be capable of continuously agitating the grout.

The grout shall be injected from the lowest point of the drill hole. The grout may be pumped through grout tubes, casing, or drill rods. The grout can be placed before or after insertion of the tendon. The quantity of the grout and the grout pressures shall be recorded. The grout pressures and grout takes shall be controlled to prevent excessive heave in soils or fracturing of rock formations.

After grouting, the tendon shall not be loaded for a minimum of 3 days.

No grout shall be placed above the top of the bond length during the time the bond length grout is placed. The grout at the top of the drill hole shall not contact the back of the structure or the bottom of the trumpet. Except as otherwise noted, only nonstructural filler shall be placed above the bond length grout prior to testing and acceptance of the anchor. The Contractor may place structural grout above the bond length grout prior to testing and acceptance of the anchor subject to the following conditions:

1. The anchor unbonded length shall be increased by eight feet minimum.
2. The grout in the unbonded zone shall not be placed by pressure grouting methods.

The corrosion protection surrounding the unbonded length of the tendon shall extend up beyond the bottom seal of the trumpet or one foot into the trumpet if no trumpet seal is

provided. If the protection does not extend beyond the seal or sufficiently far enough into the trumpet, the Contractor shall extend the corrosion protection or lengthen the trumpet.

The corrosion protection surrounding the no load zone length of the tendon shown in the Plans shall not contact the bearing plate or the anchorhead during testing and stressing. If the protection is too long, the Contractor shall trim the corrosion protection to prevent contact.

The bearing plate and anchorhead shall be placed so the axis of the tendon and the drill hole are both perpendicular to the bearing plate within plus or minus three degrees and the axis of the tendon passes through the center of the bearing plate.

The trumpet shall be completely filled with corrosion inhibiting grease or grout. Trumpet grease can be placed anytime during construction. Trumpet grout shall be placed after the ground anchor has been tested. The Contractor shall demonstrate to the WSDOT that the procedure selected by the Contractor for placement of either grease or grout produces a completely filled trumpet.

All anchorages permanently exposed to the atmosphere shall be covered with a corrosion inhibiting grease-filled or grout-filled cover. The Contractor shall demonstrate to the WSDOT that the procedures selected by the Contractor for placement of either grease or grout produces a completely filled cover. If the Plans require restressable anchorages, corrosion inhibiting grease shall be used to fill the anchorage cover and trumpet.

### 6-17.3(8) Testing And Stressing

Each ground anchor shall be tested. The test load shall be simultaneously applied to the entire tendon. Stressing of single elements of multi-element tendons will not be permitted. Test data will be recorded by the WSDOT.

The testing equipment shall consist of a dial gauge or vernier scale capable of measuring to 0.001 inches shall be used to measure the ground anchor movement. The movement-measuring device shall have a minimum travel equal to the theoretical elastic elongation of the total anchor length plus 1 inch. The dial gauge or vernier scale shall be aligned so that its axis is within 5 degrees from the axis of the tieback. A hydraulic jack and pump shall be used to apply the test load. The jack and pressure gauge shall be calibrated by an independent testing laboratory as a unit. Each load cell, test jack and pressure gauge, and master pressure gauge, shall be calibrated as specified in Section 6-17.3(3). Additionally, the Contractor shall not use load cells, test jacks and pressure gauges, and master pressure gauges, greater than 60 calendar days past their most recent calibration date, until such items are re-calibrated by an independent testing laboratory.

The pressure gauge shall be graduated in 100-psi increments or less. The pressure gauge will be used to measure the applied load. The pressure gauge shall be selected to place the maximum test load within the middle two-thirds of the range of the gauge. The ram travel of the jack shall not be less than the theoretical elastic elongation of the total anchor length at the maximum test load plus one inch. The jack shall be independently supported and centered over the tendon so that the tendon does not carry the weight of the jack. The Contractor shall have a second calibrated jack pressure gauge at the site. Calibration data shall provide a specific reference to the jack and the pressure gauge.

The loads on the tiebacks during the performance and verification tests shall be monitored to verify consistency of load as defined in Section 6-17.3(1). Test loads less than 20,000 pounds shall be monitored by the jack pressure gauge. Test loads equal to or greater than 20,000 pounds shall be monitored with an electric or hydraulic load cell. The Contractor shall provide the load cell and a readout device. The load cell shall be selected to place the

maximum test load within the middle two-thirds of the range of the load cell. The stressing equipment shall be placed over the ground anchor tendon in such a manner that the jack, bearing plates, load cell and stressing anchorage are in alignment.

### 6-17.3(8)A Verification Testing

Verification tests shall be performed to verify the design of the anchor system. These ground anchor test results shall verify the Contractor's design and be approved by the WSDOT prior to ordering anchor material for the tieback retaining walls. The tests shall be performed on sacrificial test anchors. A minimum of two successful verification tests shall be conducted. The locations shall be close to the anchor location of the production anchors. The test locations shall be selected by the Contractor and approved by the WSDOT.

The drilling method, anchor diameter, and depth of anchorage for the test anchor shall be identical as for the production anchors. The no-load zone shall be backfilled prior to withdrawing the casing.

The anchor tested shall be loaded to 200 percent of the design load (DL). The prestressing tendon shall be proportioned such that the maximum stress does not exceed 80 percent of the ultimate strength of the steel. The jack shall be positioned at the beginning of the test such that unloading and repositioning of the jack during the test will not be required.

The verification tests shall be made by incrementally loading the anchors in accordance with the following schedule.

AL - Anchor Alignment Load

DL - Anchor Design Load

| Load | Hold Time |
|---|---|
| AL | 1 Min. |
| 0.25DL | 10 Min. |
| 0.50DL | 10 Min. |
| 0.75DL | 10 Min. |
| 1.00DL | 10 Min. |
| 1.25DL | 10 Min. |
| 1.50DL | 60 Min. |
| 1.75DL | 10 Min. |
| 2.00DL | 10 Min. |
| AL | 1 Min. |

The test load shall be applied in increments of 25 percent of the design load. Each load increment shall be held for at least 10 minutes. Measurement of anchor movement shall be obtained at each load increment. The load-hold period shall start as soon as the test load is applied and the anchor movement, with respect to a fixed reference, shall be measured and recorded at 1 minute, 2, 3, 4, 5, 6, 10, 15, 20, 25, 30, 45, and 60 minutes.

The verification test will be considered successful if the anchor meets the criteria for a performance tested ground anchor in Section 6-17.3(9), and in addition, a pull-out failure does not occur at the 2.0DL maximum load.

The WSDOT will give the Contractor a written order concerning ground anchor construction within seven working days after completion of the verification tests. This written order will either confirm the bond lengths as shown in the Contractor's plans for ground anchors or reject the anchors based upon the result of the verification tests.

### 6-17.3(8)B Performance Testing

Performance tests shall be done in accordance with the following procedures. Five percent of the ground anchors or a minimum of three ground anchors, whichever is greater, shall be performance tested. The WSDOT shall select the ground anchors to be performance tested. The first production anchor shall be performance tested.

The performance test shall be made by incrementally loading and unloading the ground anchor in accordance with the following schedule. The load shall be raised from one increment to another immediately after a deflection reading.

Performance Test Schedule

| Load | Load |
|---|---|
| AL | AL |
| 0.25DL | 0.25DL |
| AL | 0.50DL |
| 0.25DL | 0.75DL |
| 0.50DL | 1.00DL |
| AL | 1.25DL |
| 0.25DL | AL |
| 0.50DL | 0.25DL |
| 0.75DL | 0.50DL |
| AL | 0.75DL |
| 0.25DL | 1.00DL |
| 0.50DL | 1.25DL |
| 0.75DL | 1.50DL |
| 1.00DL | AL |
| | Jack to lock-off load |

Where: AL - is the alignment load DL - is the anchor design load.

The maximum test load in a performance test shall be held for ten minutes. The load-hold period shall start as soon as the maximum test load is applied and the anchor movement, with

respect to a fixed reference, shall be measured and recorded at 1 minute, 2, 3, 4, 5, 6, and 10 minutes. If the anchor movement between one minute and ten minutes exceeds 0.04 inches, the maximum test load shall be held for an additional 50 minutes. If the load hold is extended, the anchor movement shall be recorded at 15 minutes, 20, 25, 30, 45, and 60 minutes. If an anchor fails in creep, retesting will not be allowed. All anchors not performance tested shall be proof tested.

### 6-17.3(8)C Proof Testing

Proof tests shall be performed by incrementally loading the ground anchor in accordance with the following schedule. The load shall be raised from one increment to another immediately after a deflection reading. The anchor movement shall be measured and recorded to the nearest 0.001 inches with respect to an independent fixed reference point at the alignment load and at each increment of load. The load shall be monitored with a pressure gauge. At load increments other than the maximum test load, the load shall be held just long enough to obtain the movement reading.

Proof Test Schedule

| Load | Load |
|---|---|
| AL | 1.00DL |
| 0.25DL | 1.25DL |
| 0.50DL | 1.50DL |
| 0.75DL | Jack to lock-off load |

Where: AL - is the alignment load

DL - is the anchor design load

The maximum test load in a proof test shall be held for ten minutes. The load-hold period shall start as soon as the maximum test load is applied and the anchor movement with respect to a fixed reference shall be measured and recorded at 1 minute, 2, 3, 4, 5, 6, and 10 minutes. If the anchor movement between one minute and ten minutes exceeds 0.04 inches, the maximum test load shall be held of an additional 50 minutes. If the load hold is extended, the anchor movements shall be recorded at 15 minutes, 20, 25, 30, 45, and 60 minutes. If an anchor fails in creep, retesting will not be allowed.

### 6-17.3(9) Permanent Ground Anchor Acceptance Criteria

A performance or proof tested ground anchor with a ten minute load hold is acceptable if the:

1. Ground anchor carries the maximum test load with less than 0.04 inches of movement between one minute and ten minutes; and
2. Total movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the tendon unbonded length.

A verification, performance or proof tested ground anchor with a 60-minute load hold is acceptable if the:

1. Ground anchor carries the maximum test load with a creep rate that does not exceed 0.08 inches/log cycle of time and is a linear or decreasing creep rate.
2. Total movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the tendon unbonded length.

If the total movement of the ground anchors at the maximum test load does not exceed 80 percent of the theoretical elastic elongation of the tendon unbonded length, the Contractor shall replace the ground anchor at no additional cost to the Contracting Agency. Retesting of a ground anchor will not be allowed.

Ground anchors which have a creep rate greater than 0.08 inches/log cycle of time can be incorporated in the finished work at a load equal to one-half its failure load. The failure load is the load carried by the anchor after the load has been allowed to stabilize for ten minutes.

When a ground anchor fails, the Contractor shall modify the design, the construction procedures, or both. These modifications may include, but are not limited to, installing replacement ground anchors, modifying the installation methods, increasing the bond length or changing the ground anchor type. Any modification which requires changes to the structure shall have prior approval of the WSDOT. Any modifications of design or construction procedures shall be at the Contractor's expense.

Upon completion of the test, the load shall be adjusted to the lock-off load indicated in the Plans and transferred to the anchorage device. The ground anchor may be completely unloaded prior to lock-off. After transferring the load and prior to removing the jack a lift-off reading shall be made. The lift-off reading shall be within ten percent of the specified lock-off load.

If the load is not within ten percent of the specified lock-off load, the anchorage shall be reset and another lift-off reading shall be made. This process shall be repeated until the desired lock-off load is obtained.

## SECTION 6-18, SHOTCRETE FACING

### 6-18.1 Description

This work consists of constructing shotcrete facing as shown in the Plans. Shotcrete constructed as concrete slope protection shall be constructed in accordance with Section 8-16.

### 6-18.2 Materials

Materials shall meet the requirements of the following sections:

| | |
|---|---|
| Cement | 9-01 |
| Aggregates for Portland Cement Concrete | 9-03.1 |
| Premolded Joint Filler | 9-04.1(2) |
| Steel Reinforcing Bar | 9-07.2 |
| Epoxy-Coated Steel Reinforcing Bar | 9-07.3 |
| Concrete Curing Materials and Admixtures | 9-23 |
| Fly Ash | 9-23.9 |

| | |
|---|---|
| Water | 9-25 |

Other materials required, including materials for shotcrete, shall be as specified in the Special Provisions.

### 6-18.3 Construction Requirements

### 6-18.3(1) Submittals

The Contractor shall submit the following information to the WSDOT at least 14 calendar days prior to beginning construction of the shotcrete facing:

1. The shotcrete mix design with compressive strength test results.
2. Method and equipment used to finish and cure the shotcrete facing.
3. Documentation of the experience of the nozzle operators in applying shotcrete.

The Contractor shall not begin construction of the shotcrete facing until receiving the WSDOT's approval of the above submittals.

### 6-18.3(2) Mix Design

Shotcrete shall be proportioned to produce a 4,000 psi compressive strength at 28 days. The Contractor shall submit the shotcrete mix design, proposed method of placement, and evidence that the proposed design and placement method will produce the desired compressive strength at 28 days, to the WSDOT at least 14 calendar days prior to the anticipated beginning of shotcrete placement. Shotcrete placement will not be allowed until the WSDOT has approved the mix design and method of placement.

Admixture shall be used only after receiving permission from the WSDOT. If admixtures are used to entrain air, to reduce water-cement ratio, to retard or accelerate setting time, or to accelerate the development of strength, the admixtures shall be used at the rate specified by the manufacturer and approved by the WSDOT.

### 6-18.3(3) Testing

The Contractor shall make shotcrete test panels for evaluation of shotcrete quality, strength, and aesthetics. Both preproduction and production test panels, shall be prepared. All cores obtained for the purpose of shotcrete strength testing shall have the following minimum dimensions:

a. The core diameter shall be at least 3 times the maximum aggregate size, but not less than 2 inches.

b. The core height shall be a minimum of 1.5 times the core diameter.

The Contractor shall remove at least three cores from each 36-inch by 36-inch shotcrete test panel in accordance with AASHTO T 24. Cores removed from the panel shall be immediately wrapped in wet burlap and sealed in a plastic bag. Cores shall be clearly marked to identify from where they were taken and whether they are for pre-production or production testing. If for production testing, the section of the wall represented by the cores shall be clearly marked on the cores. Cores shall be delivered to the WSDOT within 2 hours of coring. The remainder of the panels shall remain the property of the Contractor.

### 6-18.3(3)A Pre-production Testing

At least one 36-inch by 36-inch panel for each mix design shall be prepared for evaluation and testing of the shotcrete quality and strength. One 48-inch by 48-inch qualification panel shall be prepared for evaluation and approval of the proposed method for shotcrete

installation, finishing, and curing. Both the 36-inch and the 48-inch panels shall be constructed using the same methods and initial curing proposed to construct the shotcrete facing, except that the 36-inch panel shall not include wire reinforcement. The 36-inch panel shall be constructed to the minimum thickness necessary to obtain the required core samples. The 48-inch panel shall be constructed to the same thickness as proposed for the production facing. Production shotcrete work shall not begin until satisfactory test results are obtained and the panels are approved by the WSDOT.

### 6-18.3(3)B Production Testing

The Contractor shall make at least one 36-inch by 36-inch panel for each section of facing shot, or as many as directed by the WSDOT. A section is defined as one day's placement. The production panels shall be constructed using the same methods and initial curing used to construct the shotcrete wall, but without wire reinforcement. The panels shall be constructed to the minimum thickness necessary to obtain the required core samples. If the production shotcrete is found to be unsuitable based on the results of the test panels, the section(s) of the wall represented by the test panel(s) shall be repaired or replaced to the satisfaction of the WSDOT at no cost to the Contracting Agency.

### 6-18.3(4) Qualifications of Contractor's Personnel

All nozzle operators shall have had at least one year of experience in the application of shotcrete. Each nozzle operator will be qualified, by the WSDOT, to place shotcrete, after successfully completing one test panel for each shooting position and surface type which will be encountered.

Qualification will be based on a visual inspection of the shotcrete density, void structure, and finished appearance along with a minimum 7-day compressive strength of 2,500 psi determined from the average test results from two cores taken from each test panel.

The Contractor shall notify the WSDOT not less than 2 days prior to the shooting of a qualification panel. The mix design for the shotcrete shall be the same as that slated for the wall being shot.

Shotcrete shall be placed only by personnel qualified by the WSDOT.

If shotcrete finish Alternative B or C is specified, evidence shall be provided that all shotcrete crew members have completed at least three projects in the last five years where such finishing, or sculpturing and texturing of shotcrete was performed.

### 6-18.3(5) Placing Wire Reinforcement

Reinforcement of the shotcrete shall be placed as shown in the Plans. The wire reinforcement shall be securely fastened to the steel reinforcing bars so that it will be 1 to 1.5 inches from the face of the shotcrete at all locations, unless otherwise shown in the Plans. Wire reinforcement shall be lapped 1.5 squares in all directions, unless otherwise shown in the Plans.

### 6-18.3(6) Alignment Control

The Contractor shall install non-corroding alignment wires and thickness control pins to establish thickness and plane surface. The Contractor shall install alignment wires at corners and offsets not established by formwork. The Contractor shall ensure that the alignment wires are tight, true to line, and placed to allow further tightening. The Contractor shall remove the alignment wires after facing construction is complete.

### 6-18.3(7) Shotcrete Application

A clean, dry supply of compressed air sufficient for maintaining adequate nozzle velocity for all parts for the work and for simultaneous operation of a blow pipe for cleaning away rebound shall be maintained at all times. Thickness, method of support, air pressure, and rate of placement of shotcrete shall be controlled to prevent sagging or sloughing of freshly-applied shotcrete.

The shotcrete shall be applied from the lower part of the area upwards. Surfaces to be shot shall be damp, but free of standing water.

The nozzles shall be held at an angle approximately perpendicular to the working face and at a distance that will keep rebound at a minimum and compaction will be maximized. Shotcrete shall emerge from the nozzle in a steady uninterrupted flow. If, for any reason, the flow becomes intermittent, the nozzle shall be diverted from the work until a steady flow resumes.

Surface defects shall be repaired as soon as possible after initial placement of the shotcrete. All shotcrete which lacks uniformity; which exhibits segregation, honeycombing, or lamination; or which contains any dry patches, slugs, voids, or sand pockets, shall be removed and replaced with fresh shotcrete by the Contractor, to the satisfaction of the WSDOT at no cost to the Contracting Agency.

Construction joints in the shotcrete shall be uniformly tapered over a minimum distance of twice the thickness of the shotcrete layer. The surface of the joints shall be cleaned and thoroughly wetted before adjacent shotcreting is performed. Shotcrete shall be placed in a manner which provides a finish with uniform texture and color across the construction joint.

The shotcrete shall be cured by applying a clear curing compound in accordance with Section 9-23.2. The curing compound shall be applied immediately after final gunning. The air in contact with shotcrete surfaces shall be maintained at temperatures above 50F for a minimum of 7 days. Curing compounds shall not be used on any surfaces against which additional shotcrete or other cementitious finishing materials are to be bonded unless positive measures such as sandblasting, are taken to completely remove the curing compounds prior to the application of such additional materials.

If field inspection or testing, by the WSDOT, indicates that any shotcrete produced, fails to meet the requirements, the Contractor shall immediately modify procedures, equipment, or system, as necessary, and as approved by the WSDOT to produce specification material. All substandard shotcrete already placed shall be repaired by the Contractor, to the satisfaction of the WSDOT, at no additional cost to the Contracting Agency. Such repairs may include removal and replacement of all affected materials.

### 6-18.3(8) Shotcrete Finishing

When the shotcrete facing is an interim coating to be covered by a subsequent shotcrete coating or a cast-in-place concrete fascia later under the same contract, the Contractor shall strike off the surface of the shotcrete facing with a roughened surface as specified in Section 6-02.3(12). The grooves of the roughened surface shall be either vertical or horizontal.

When the shocrete facing provides the finished exposed final surface, the shotcrete face shall be finished using the alternative aesthetic treatment shown in the Plans. The alternatives are as follows:

### Alternative A

After the surface has taken its initial set (crumbling slightly when cut), the surface shall be broom finished to secure a uniform surface texture.

### Alternative B

Shotcrete shall be applied in a thickness a fraction beyond the alignment wires and forms. The shotcrete shall stiffen to the point where the surface does not pull or crack when screeded with a rod or trowel. Excess material shall be trimmed, sliced, or scraped to true lines and grade. Alignment wires shall be removed and the surface shall receive a steel trowel finish, leaving a smooth uniform texture and color. Once the shotcrete has cured, pigmented sealer shall be applied to the shotcrete face. The shotcrete surface shall be completed to within a tolerance of ½ inch of true line and grade.

### Alternative C

Shotcrete shall be hand-sculptured, colored, and textured to simulate the relief, jointing, and texture of the natural backdrop surrounding the facing. The ends and base of the facing shall transition in appearance as appropriate to more nearly match the color and texture of the adjoining roadway fill slopes. This may be achieved by broadcasting fine and coarse aggregates, rocks, and other native materials into the final surface of the shotcrete while it is still wet, allowing sufficient embedment into the shotcrete to become a permanent part of the surface.

# DIVISION 7

## SECTION 7-12, VALVES FOR WATER MAINS

### *7-12.3 Construction Requirements*

In the third paragraph the reference to Section 7-10 is revised to Section 7-09.

In the fourth paragraph the reference to Section 7-11 is revised to Section 7-09.

## SECTION 7-14, HYDRANTS

### *7-14.3(1) Setting Hydrants*

In the third paragraph the reference to Section 7-11 is revised to Section 7-09.

### *7-14.3(6) Hydrant Extensions*

The reference to Section 7-11 is revised to Section 7-09.

## SECTION 7-15, SERVICE CONNECTIONS

### *7-15.03 Construction Requirements*

In the second paragraph the reference to Section 7-10 is revised to Section 7-09.

## SECTION 7-17, SANITARY SEWERS

### *7-17.3(2)B Exfiltration Test*

In the third paragraph, "Maximum leakage (in gallons per hour)"= $0.28 \times \frac{\sqrt{H}}{\sqrt{6}} \times D \times \frac{L}{100}$.

### *7-17.3(2)C Infiltration Test*

In the second paragraph, "Maximum leakage (in gallons per hour)" = $0.16 \times \frac{\sqrt{H}}{\sqrt{2}} \times D \times \frac{L}{100}$.

### *7-17.3(2)E Low Pressure Air Test for Sanitary Sewers Constructed of Air-Permeable Materials*

In the seventh paragraph, the statement "If $C_T$ –1, then time = $K_T$" is revised to "If $C_T \leq 1$, then time = $K_T$."

In the seventh paragraph, the statement "If $C_T \bullet 1.75$, then time = $K_T/1.75$" is revised to "If $C_T \geq 1.75$, then time = $K_T/1.75$."

# DIVISION 8

## SECTION 8-01, EROSION CONTROL

### *8-01.3(1)B Erosion and Sediment Control (ESC) Lead*

This section is revised to read:

The Contractor shall identify the ESC Lead at the preconstruction discussions. The ESC Lead shall have, for the life of the contract, a current Certificate of Training in Construction Site Erosion and Sediment Control from a course approved by WSDOT's Statewide Erosion Control Coordinator.

The ESC Lead shall implement the Temporary Erosion and Sediment Control (TESC) plan. Implementation shall include, but is not limited to:

1. Installing and maintaining all temporary erosion and sediment control Best Management Practices (BMPs) included in the TESC plan to assure continued performance of their intended function. Damaged or inadequate TESC BMPs shall be corrected immediately.
2. Inspecting all on-site erosion and sediment control BMPs at least once every five working days and each working day there is a runoff event. Inspections shall occur within 24 hours of the runoff event. A TESC Inspection Report shall be prepared for each inspection and shall be included in the TESC file. A copy of each TESC Inspection Report shall be submitted to the WSDOT no later than the end of the next working day following the inspection. The report shall include, but not be limited to:
    a. When, where and how BMPs were installed, maintained, modified, and removed;
    b. Observations of BMP effectiveness and proper placement;
    c. Recommendations for improving future BMP performance with upgraded or replacement BMPs when inspections reveal TESC plan inadequacies.
3. Updating and maintaining a TESC file on site that includes, but is not limited to:
    a. TESC Inspection Reports.
    b. Temporary Erosion and Sediment Control (TESC) plan narrative.
    c. National Pollutant Discharge Elimination System construction permit (Notice of Intent).
    d. Other applicable permits.

Upon request, the file shall be provided to the WSDOT for review.

# SECTION 8-04, CURBS, GUTTERS, AND SPILLWAYS

### *8-04.3(1)A Extruded Cement Concrete Curb*

The second and third paragraphs are revised to read:

> The pavement shall be dry and cleaned of loose and deleterious material prior to curb placement. Cement concrete curbs shall be anchored to the existing pavement by placing steel tie bars 1 foot on each side of every joint.
>
> Tie bars shall meet the dimensions shown in the Standard Plans.

# SECTION 8-07, PRECAST TRAFFIC CURB AND BLOCK TRAFFIC CURB

### *8-07.1 Description*

This section is revised to read:

> This work shall consist of furnishing and installing precast traffic curb, block traffic curb, sloped mountable curb, or dual faced sloped mountable curb of the design and type specified in the plans in accordance with these Specifications and in conformity to the Standard Plans and the locations indicated in the plans or as directed by the WSDOT.

### *8-07.3(1) Installing Curbs*

This section is supplemented with the following:

> For sloped mountable curb installed in curves, the units shall be either curved blocks precast to the radii shown in the plans or tangent blocks sawn to the dimensions shown in the Standard Plans to conform to the specified radii.

### *8-07.3(2) Painting of Curbs*

The first sentence is revised to read:

> Concrete curbing shall be painted with two full coats of paint conforming to Section 9-34.2, as shown in the Plans or as designated by the WSDOT.

# SECTION 8-12, CHAIN LINK FENCE AND WIRE FENCE

### *8-12.3(1)A Posts*

The seventh paragraph is revised to read:

> Pullposts shall be spaced at 1,000-foot maximum intervals for Type 1, 3, and 6 fence, and at 500-foot maximum intervals for Type 4 fence.

# SECTION 8-14, CEMENT CONCRETE SIDEWALKS

### *8-14.3(3) Placing and Finishing Concrete*

The second sentence in the fourth paragraph is revised to read:

> The detectable warning pattern shall have the truncated dome shape shown in the Standard Plans and may be formed by either embossing the wet concrete, adding a manufactured material before or after the concrete has cured, or installing masonry or ceramic tiles.

### *8-14.3(5) Ramp Detectable Warning Retrofit*

This section is supplemented with the following:

> Where shown in the plans, the Contractor shall retrofit existing cement concrete sidewalk ramps by installing a detectable warning pattern having the truncated dome shape shown in the Standard Plans. The warning pattern shall be the width of the ramp and cover the bottom two feet of the ramp. The truncated dome pattern shall be perpendicular to the long axis of the ramp.
>
> The Contractor shall use one of the detectable warning pattern products listed in the Qualified Products List or submit another manufacturer's product for approval by the WSDOT. The warning pattern shall be capable of being bonded to an existing cement concrete surface. The surface of the warning pattern, excluding the domes, shall not be more than 3/8 inch above the surface of the concrete after installation.

# SECTION 8-15, RIPRAP

### *8-15.3(6) Quarry Spalls*

The second sentence is revised to read:

> After placement, the quarry spalls shall be compacted to be uniformly dense and unyielding.

# SECTION 8-17, IMPACT ATTENUATOR SYSTEMS

This section is revised to read:

### 8-17.1 Description

This work shall consist of furnishing, constructing, repairing, and removing permanent and temporary impact attenuator systems selected from the approved list shown in the Plans.

### 8-17.2 Materials

Sand for inertial barrier systems shall not contain more than 5% water by weight. Commercial grade urea shall be thoroughly mixed with the sand in an amount equal to 5 percent, by weight, of the sand.

Undamaged sand barrel impact attenuators that have been previously utilized may be utilized in a temporary impact attenuator array only, if inspected and approved by the WSDOT prior to use.

### 8-17.3 Construction Requirements

The assembly and installation of all attenuator systems, except those utilizing sand barrels, shall be supervised at all times by either a manufacturer's representative or an installer who has been trained and certified by the manufacturer of the system. If the supervision is provided by a trained installer, a copy of the installer certification shall be provided to the WSDOT prior to installation.

Assembly and installation shall be in accordance with the manufacturer's recommendations. This work shall include the connection to a concrete barrier, bridge abutment or a transition section identified in the Plans, construction of a steel reinforced concrete pad or concrete backup, and anchorage to the pavement, if required by the manufacturer's assembly and installation procedures.

The Contractor shall have a complete set of replacement parts on the jobsite for each type of temporary impact attenuator in use on the project and shall repair all damaged impact attenuators immediately.

When the WSDOT determines that a temporary impact attenuator is no longer needed, then the Contractor shall remove that attenuator from the project. The removed equipment shall remain the property of the Contractor.

## SECTION 8-18, MAILBOX SUPPORT

### *8-18.2 Materials*

This section is revised to read:

Materials shall meet the requirements of the following sections:

| | |
|---|---|
| Steel Posts | 9-32.1 |
| Bracket, Platform, and Anti-Twist Plate | 9-32.2 |
| Type 2 Mailbox Support | 9-32.7 |
| Timber Sign Posts | 9-28.14(1) |
| Fasteners | 9-32.5 |
| Snow Guard | 9-32.6 |
| Concrete Base | 9-32.8 |
| Steel pipe | 9-32.9 |
| U-Channel Post | 9-32.10 |

Mailboxes will be furnished by others.

### *8-18.3 Construction Requirements*

This section is supplemented with the following:

#### *8-18.3(1) Type 3 Mailbox Support*

The concrete base shall be constructed using commercial concrete, with the pipe set to the dimensions shown in the Standard Plans. The base shall be crowned so as to shed water. The concrete may be mixed on the jobsite as specified in Section 6-02.3(4)B.

The U-channel post may be driven in place provided the method of driving does not damage the post.

With the WSDOT's consent, a Type 3 Mailbox Support design, made of steel or other durable material, that meets the NCHRP 350 crash test criteria may be used in place of the design shown in the Standard Plans. In which case, the manufacturer's recommendations concerning installation shall be followed; however, the mailbox itself shall be positioned on the roadway according to the dimensions shown in the Standard Plans.

## SECTION 8-19, REDIRECTIONAL LAND FORM

This section is deleted, and the section title is revised to **VACANT**.

## SECTION 8-20,ILLUMINATION, TRAFFIC SIGNAL SYSTEMS, AND ELECTRICAL

### *8-20.3(5) Conduit*

The third sentence in the seventeenth paragraph is revised to read:

Grout shall obtain a minimum of 4000 psi compressive strength at 7 days.

### *8-20.3(6) Junction Boxes, Cable Vaults, and Pull boxes*

This section is supplemented with the following:

Where conduit and junction boxes are placed in barrier, the Prime Contractor shall coordinate the work of the Contractor constructing the barrier and the electrical Contractor so that each junction box placed in the barrier is placed in correct alignment with respect to the barrier, with the face of the box flush or uniformly chamfered within ½ inch of the barrier surface. If any point on the surface of the junction box placed in barrier is recessed more than 1/2 inch from the surface of the barrier, the Contractor shall install a box extension meeting the WSDOT's approval and grout around the extension or remove and replace the entire section of barrier.

### *8-20.3(9) Bonding, Grounding*

The first paragraph is revised to read:

All metallic appurtenances containing electrical conductors (luminaires, light standards, cabinets, metallic conduit, non-metallic conduit, etc.) shall be made mechanically and electrically secure to form a continuous systems which shall be effectively grounded. Where metallic conduit systems are employed, the conduit system constitutes the equipment grounding conductor. Where nonmetallic conduit is installed, the installation shall include an equipment ground conductor, in addition to the conductors noted in the contract. Bonding jumpers and equipment grounding conductors shall be installed in accordance with Section 9-29.3. The equipment ground conductor between the isolation switch and the sign lighter fixtures may be No. 14 AWG stranded copper conductor. Where parallel circuits are enclosed in a common conduit, the equipment grounding conductor shall be sized by the rating of the largest overcurrent device serving any circuit contained within the conduit.

### *8-20.3(11) Testing*

The fourth paragraph is revised to read:

When the project includes a traffic signal system, the Contractor shall conduct tests noted in Section 8-20.3(14)D. The Contractor shall provide the WSDOT a minimum of five days advance written notice of the proposed traffic signal turn-on date and time. The traffic signal turn-on procedure shall not begin until all required channelization, pavement markings, illumination, signs, and sign lights are substantially complete and operational unless otherwise allowed by the WSDOT. The Contractor shall provide traffic control to stop all traffic from entering the intersection. The Contracting Agency electronics technician will program the controller and enter the timing data, then turn the traffic signal system to its flash mode to verify proper flash indications. The Contracting Agency electronics technician will then conduct functional tests to demonstrate that each part of the traffic signal system functions as specified. The Contractor shall conduct functional tests to demonstrate that each part of the illumination system, or other electrical system, functions as specified. These demonstration shall be conducted in the presence of a Contracting Agency electronic technician, the Contracting Agency electrical inspector, and Regional Traffic WSDOT or his/her designee. The Contracting Agency electronics technician will then turn the traffic signal to stop-and-go operation for no less than one full cycle. Based on the results of the turn-on, the WSDOT will direct the Contracting Agency electronics technician to either turn the traffic signal on to normal stop-and-go operation, to turn the signal to flash mode for a period not to exceed five calendar days, or to turn the signal off and require the Contractor to cover all signal displays and correct all deficiencies.

## SECTION 8-22, PAVEMENT MARKING

### *8-22.3(2) Preparation of Roadway Surfaces*

This section is revised to read:

For the application of paint the pavement surface temperature and ambient temperature shall be 50° F and rising. New and existing HMA pavement shall be dry, clean and free of contaminants such as surface oils. Portland cement concrete pavement shall have a minimum compressive strength of 2500 psi and shall be dry,

clean and free of contaminants. Contaminants shall be removed by approved mechanical means.

For the application of plastic pavement marking material surface temperature and ambient temperature shall be 50° F and rising. New and existing HMA pavement shall be dry, clean, and free of contaminants such as surface oils and existing pavement marking materials. Portland cement concrete pavement shall also be free of contaminants including curing agents. Contaminants shall be removed by approved mechanical means.

Pavement surfaces shall be prepared for plastic marking application in accordance with the previous paragraph and the pavement marking material manufacturer's recommendations. Manufacturers of Type D material also require a pavement cure period prior to application. Typically, Type D material applied on hot mix asphalt pavement requires a pavement cure period of 21 days. Typically, Type D material applied on portland cement concrete pavement requires a pavement cure period of 28 days. These cure periods may be reduced if the manufacturer performs a successful bond test.

Existing pavement marking material shall be removed, measured, and paid for in accordance with the provisions in this section of the Standard Specifications.

### *8-22.3(3) Marking Application*

The first paragraph is revised to read:

Lane line and right edge line shall be white in color. Center line and left edge line shall be yellow in color. All temporary pavement markings shall be retroreflective. Paint and sprayed or extruded plastic material shall be applied with a top dressing of glass breads. Two applications of paint will be required to complete all paint markings. The time period between paint applications will vary depending on the type of pavement and paint (low VOC waterborne, high VOC solvent, or low VOC solvent) as follows:

| **Pavement Type** | **Paint Type** | **Time Period** |
|---|---|---|
| Bituminous Surface Treatment | Low VOC Waterborne | 4 hours min., 48 hours max. |
| Hot Mix Asphalt Pavement | Low VOC Waterborne | 4 hours min., 30 days max. |
| Cement Concrete Pavement | Low VOC Waterborne | 4 hours min., 30 days max. |
| Bituminous Surface Treatment | High and Low VOC Solvent | 40 min. min., 48 hrs. max. |
| Hot Mix Asphalt Pavement | High and Low VOC Solvent | 40 min. min., 30 days max. |
| Cement Concrete Pavement | High and Low VOC Solvent | 40 min. min., 30 days max. |

The ninth and tenth paragraphs are revised to read:

Profiles are defined as that portion of the plastic line that is applied at a greater thickness than the base line thickness. Profiles shall be applied using the extruded method in the same application as the base line. See the Standard Plans for details.

Embossed plastic lines are defined as a plastic line applied with a transverse groove. Embossed plastic lines may be applied with profiles. See the Standard Plans for details.

The last paragraph is revised to read:

When two or more spray applications are required to meet thickness requirements for Type A and Type D materials, top dressing with glass beads is only allowed on the last application. Any loose beads, dirt or other debris shall be swept or blown off the line prior to application of each successive application. Successive applications shall be applied squarely on top of the preceding application.

# DIVISION 9

## SECTION 9-01, PORTLAND CEMENT

### *9-01.2(1) Portland Cement*

This section is revised to read:

Portland cement shall conform to the requirements for Types I, II, or III cement of the Standard Specifications for Portland Cement, AASHTO M 85 or ASTM C 150, except that the content of alkalis shall not exceed 0.75 percent by weight calculated as Na20 plus 0.658 K20and except that the content of Tricalcium aluminate (C3A) shall not exceed 8 percent by weight calculated as 2.650A1203 minus 1.692Fe203. The total amount of processing additions used shall not exceed 1% of the weight of portland cement clinker. The type and amount of processing additions used shall be shown on mill test reports.

The time of setting shall be determined by the Vicat Test method, AASHTO T 131 or ASTM C 191.

### *9-01.2(4) Blended Hydraulic Cement*

This section is revised to read:

Blended hydraulic cement shall be either Type IP (MS), Type I (SM) (MS) or Type I (PM) (MS) cement conforming to AASHTO M 240 and meet the following additional requirements:

1. Type IP(MS) Portland - Pozzolan Cement with moderate sulfate resistance.

   This product shall be limited to Portland Cement and Pozzolan. Pozzolan shall be limited to fly ash or ground granulated blast furnace slag. Fly ash is limited between 15 percent and 35 percent by weight of the cementitious material. Ground granulated blast furnace slag is limited between 15 percent and 25 percent by weight of the cementitious material.

2. Type I(SM) (MS) Slag Modified Portland Cement with moderate sulfate resistance.

   This product shall be limited to Portland Cement and ground granulated blast furnace slag. The addition of ground granulated blast furnace slag shall be limited to a maximum of 25 percent by weight of the cementitious material.

3. Type I(PM)(MS) Pozzolan – Modified Portland Cement with moderate sulfate resistance.

The product shall be limited to Portland Cement and pozzolan. The pozzolan shall be limited to fly ash or ground granulated blast furnace slag at a maximum of 15 percent by weight of the cementitious material.

The source and weight of the fly ash or ground granulated blast furnace slag shall be certified on the cement mill test certificate and shall be reported as a percent by weight of the total cementitious material. The fly ash or ground granulated blast furnace slag constituent content in the finished cement will not vary morethan plus or minus 5 percent by weight of the finished cement from the certified value.

Fly ash shall meet the requirements of Section 9-23.9 of these Standard Specifications.

Ground granulated blast furnace slag shall meet the requirements of Section 9-23.10 of these Standard Specifications.

## SECTION 9-02, BITUMINOUS MATERIALS

### *9-02.1(3) Rapid-Curing (RC) Liquid Asphalt*

The column headings MC-70, MC-250, MC-800, and MC-3000 are revised to RC-70, RC-250, RC-800, and RC-3000 respectively.

The RC-250 requirement for "Residue of 680°F distillation % volume by difference" is revised from 67 to 65.

### *9-02.1(4)A Performance Grade (PG) Asphalt Cement*

This section including title is revised to read:

**9-02.1(4)A Performance Graded Asphalt Binder**

| Performance Grade | PG58 | | | PG64 | | | PG70 | | | PG76 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | -22 | -28 | -34 | -22 | -28 | -34 | -22 | -28 | -34 | -22 | -28 |
| **Original Binder** | | | | | | | | | | | |
| Flash point temp, AASHTO T48 Minimum °C | 230 | | | | | | | | | | |
| Viscosity, AASHTO T316 Maximum 3 Pa·s, test temp, °C | 135 | | | | | | | | | | |
| Dynamic shear, AASHTO T315 G*/sin□, minimum 1.00 kPa Test temp. @ 10 rad/s, °C | 58 | | | 64 | | | 70 | | | 76 | |
| **Rolling Thin Film Oven Residue (AASHTO T240)** | | | | | | | | | | | |
| Mass Change, Maximum, percent | 1.00 | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dynamic shear, AASHTO T315 G*/sin□, minimum 2.20 kPa Test temp. @ 10 rad/s, °C | 58 | | | 64 | | | 70 | | | 76 | |
| **Pressure Aging Vessel Residue (AASHTO R28)** | | | | | | | | | | | |
| PAV aging temperature, °C | 100 | | | | | | | | | | |
| Dynamic shear, AASHTO T315 G*sin□ maximum 5000 kPa Test temp. @ 10 rad/s, °C | 22 | 19 | 16 | 25 | 22 | 19 | 28 | 25 | 22 | 31 | 28 |
| Creep stiffness, AASHTO T313 S, maximum 300 MPa, *m* - value, minimum 0.300 Test temp. @ 60 s, °C | -12 | -18 | -24 | -12 | -18 | -24 | -12 | -18 | -24 | -12 | -18 |

All Performance Grade asphalt binders not included in this chart shall be determined by Table 1-Performance Graded Asphalt Binder Specification in AASHTO M320.

## SECTION 9-03, AGGREGATES

### *9-03.12(4) Gravel Backfill for Drains*

The percent Passing for Sieve size 3/8" square is revised from 10”- 40" to 0” - 40".

### *9-03.12(5) Gravel Backfill for Drywells*

The percent passing for sieve size 1" square is revised to "50-100".

### *9-03.14 Borrow*

This section is supplemented with the following:

### *9-03.14(1) Gravel Borrow*

Ballast may be substituted for gravel borrow for embankment construction.

### *9-03.14(4) Gravel Borrow for Geosynthetic Retaining Wall*

All backfill material used in the reinforced soil zone of the geosynthetic retaining wall shall conform to requirements of Section 9-03.14(1) and shall be free draining, free from organic or otherwise deleterious material. The material shall be substantially free of shale or other soft, poor durability particles, and shall not contain recycled materials, such as glass, shredded tires, portland cement concrete rubble, or asphaltic concrete rubble. The backfill material shall meet the following requirements:

| Property | Test Method | Allowable Test Value |
|---|---|---|
| Los Angeles Wear, 500 rev. | AASHTO T 96 | 35 percent max. |
| Degradation | WSDOT Test Method 113 | 15 min. |
| pH | AASHTO T 289-91 | ** |

** 4.5 to 9 for permanent walls and 3 to 10 for temporary walls

Wall backfill material satisfying these gradation, durability and chemical requirements shall be classified as nonaggressive.

### *9-03.21(2) Recycled Hot Mix Asphalt*

The Maximum Bitumen Content (Percent) for Gravel Borrow is revised from "0" to "1.2".

## SECTION 9-04, JOINT AND CRACK SEALING MATERIALS

### *9-04.2(2) Two Component Poured Rubber Joint Sealer*

The section title is revised to read:

### *9-04.2(2) Poured Rubber Joint Sealer*

## SECTION 9-05, DRAINAGE STRUCTURES, CULVERTS, AND CONDUITS

### *9-05.4(3) Protective Treatment*

Treatments 3, 4, and 6 are revised to read:

This treatment is no longer available.

### *9-05.4(4) Asphalt Coatings and Paved Inverts*

The second paragraph under item 2 is revised to read:

The paved invert for Treatment 2 shall consist of bituminous material applied in such a manner that one or more smooth pavements will be formed in the invert filling the corrugations for at least 40 percent of the circumference. The pavement shall have a minimum thickness of 1/8 inch above the crest of the corrugations except where the upper edges intercept the corrugation. The pavements shall be applied following the coating with asphalt . Treatment 5 may be substituted for Treatment 2, at the option of the Contractor.

### *9-05.10 Steel Storm Sewer Pipe*

The first sentence is revised to read:

> Steel storm sewer pipe shall conform to the requirements of Section 9-05.4 for steel culvert pipe, except that protective coating shall be Treatment 1 or 5, and be constructed of either helically corrugated lock seam or helically corrugated continuous welded steel pipe.

### *9-05.11 Aluminum Storm Sewer Pipe*

The first sentence is revised to read:

> Aluminum storm sewer pipe shall conform to the requirements of Section 9-05.5 for aluminum culvert pipe, except that the protective coating shall be Treatment 1 or 5, and the pipe shall be constructed of helically corrugated lock seam aluminum pipe.

### *9-05.16 Grate Inlets and Drop Inlets*

The first and second paragraphs are revised to read:

> Steel in grates, angles, and anchors for grate inlets shall conform to ASTM A 36, except structural tube shall conform to ASTM A 500, Grade B, and structural shapes may conform to ASTM A 992. After fabrication, the steel shall be galvanized in accordance with AASHTO M 111, or galvanized with a hot-sprayed (plasma flame applied) 6 mil minimum thickness plasma coating.
>
> Steel grating shall be fabricated by weld connections. Welds, welding procedures, and welding materials shall conform with the AWS D1.1/D1.1M, latest edition, Structural Welding Code.

## SECTION 9-06, STRUCTURAL STEEL AND RELATED MATERIALS

### *9-06.16 Roadside Sign Structures*

The third paragraph is revised to read:

> Posts for multiple post sign structures shall conform to either ASTM A 36 or ASTM A 992. Posts conforming to either ASTM A 588 or ASTM A 572 Grade 50 may be used as an acceptable alternate to the ASTM A 36 and ASTM A 992 posts. All steel not otherwise specified shall conform to either ASTM A 36 or ASTM A 992.

### *9-06.18 Metal Railings*

The first paragraph is revised to read:

> Metal bridge railing shall conform to the type and material specifications set forth in the Plans and Special Provisions. Steel used for metal railings, when galvanized after fabrication in accordance with AASHTO M 111, shall have a controlled silicon content of either 0.00 to 0.04 percent or 0.15 to 0.25 percent. Mill test certificates verifying the silicon content of the steel shall be submitted to both the galvanizer and the WSDOT prior to beginning galvanizing operations.

# SECTION 9-07, REINFORCING STEEL

### *9-07.3 Epoxy Coated Steel Reinforcing Bars*

This section is revised to read:

Epoxy coated rebar shall be coated according to AASHTO M 284 with the additional following modifications:

1. The list of steel reinforcing bars acceptable for coating shall include ASTM A 706.
2. The Contractor shall furnish a written certification that properly identifies the material, the number of each batch of coating material used, quantity represented, date of manufacture, name and address of manufacturer, and a statement that the supplied coating material meets the requirements of AASHTO M 284.
3. Prior to coating the bars, the Contractor shall submit to the Engineer for review, the coating material manufacturer's recommendation on the proper use and application requirements of the coating material. For Pre Approved Epoxy Coating Facilities this information will be available to the Fabrication Inspector upon request.
4. A certification stating that all bars have been coated in accordance with the coating material manufacturer's recommendations and these Specifications shall be furnished with each shipment. This certification shall include for each bar size the preheat temperatures, cure times, thickness checks, holidays detected, and test results. Two copies of these certifications shall be furnished to the Engineer.
5. The Contractor shall give advance notice to the Engineer of the coating schedule in the coating plant so that Contracting Agency inspection may be provided. The Engineer may inspect the coated bars at the coating plant for approval.
6. The patching material, compatible with the coating material and inert in concrete, shall be supplied with each shipment.
7. For projects where epoxy coated steel reinforcing bars are used in the top mat of bridge decks only, the maximum amount of damage to the coating shall not exceed 0.25 percent of the surface area of each bar.
8. The thickness of epoxy coating shall be 10 mils plus or minus 2 mils.
9. Samples, when required, shall be shipped to the Washington State Department of -Transportation, Materials Laboratory, 1655 South 2nd Ave, Tumwater, Washington 98504.

## SECTION 9-08, PAINTS

### *9-08.2 Paint Formulas – General*

The following paint formulas and associate specifications are deleted:

Formula A-6-86 Zinc Dust Zinc Oxide Primer

Formula H-2-83-White Masonry Paint for Precast Curbs

Formula H-3-83 Yellow Masonry Paint for Precast Curbs

## SECTION 9-09, TIMBER AND LUMBER

### *9-09.2 Grade Requirements*

Under "Structures", the last sentence is revised to read:

Timber lagging for soldier pile walls shall be Douglas Fir-Larch, grade No. 2 or better or Hem-Fir No. 1.

## SECTION 9-10, PILING

### *9-10.5 Steel Piling*

This section is revised to read:

The material for steel piling and pile splices shall conform to ASTM A 36 or ASTM A 992, except the material for steel pipe piling and splices shall conform to the requirements of ASTM A 252, Grade 2. Steel soldier piles, and associated steel bars and plates, shall conform to ASTM A 36 or ASTM A 992, except as otherwise noted in the Plans. All steel piling may be accepted by the WSDOT based on the Manufacturer's Certification of Compliance.

## SECTION 9-14, EROSION CONTROL AND ROADSIDE PLANTING

### *9-14.4(1) Straw*

The first sentence is revised to read:

All straw material shall be in an air dried condition free of noxious weeds and other materials detrimental to plant life.

### *9-14.4(8) Compost*

The fourth paragraph is revised to read:

Compost production and quality shall comply with the Chapter 173-305 Section 220 WAC.

Under the fifth paragraph, item 1 is revised to read:

1. Compost material shall be tested in accordance with AASHTO Test Method T87 and Section 7 of AASHTO T88.

   Compost Type 1 shall meet the following:

   100% shall pass through a 2" sieve

   90% to 100% shall pass through a 1" sieve.

   70% to 100% shall pass through a ¾" sieve.

   40% to 75% shall pass through a ¼" sieve.

   Maximum particle length of 6 inches.

   Compost Type 2 shall meet the following:

   100% shall pass through a 3" sieve

   90% to 100% shall pass through a 1" sieve.

   70% to 100% shall pass through a ¾" sieve.

   40% to 60% shall pass through a ¼" sieve.

   Maximum particle length of 6 inches.

In the seventh paragraph, the first sentence is revised to read:

Approval of sources for composted products shall be based on the following submittals by the Contractor:

This section is supplemented with the following:

Acceptance will be based upon a satisfactory Test Report from the State Materials Lab indicating that the lot (or lots) of compost meets the specification requirements.

## SECTION 9-15, IRRIGATION SYSTEM

### *9-15.2 Drip Tubing*

The second sentence is revised to read:

Drip tubing shall have a minimum wall thickness of 0.045 inch.

## SECTION 9-16, FENCE AND GUARDRAIL

### *9-16.1 Chain Link Fence and Gates*

All sub-sections under Section 9-16.1 are deleted and replaced with the following:

### 9-16.1(1) General

All material used in the construction of chain link fence and gates shall be new. Iron or steel material shall be galvanized unless specified otherwise. Material upon which serious abrasions of galvanizing occur shall not be acceptable.

### 9-16.1(1)A Post Material for Chain Link Fence

Except as noted otherwise, post material shall conform to the requirements of AASHTO M 181, Type I (zinc-coated steel), Grade 1 or 2, and shall be understood to include all round and roll-formed material (brace rails, top rails, line posts, brace posts, end posts, corner posts and pull posts).

Grade 1 post material shall conform to the weight per linear foot, minimum wall thickness and detail requirements of Standard Plan L-2. Grade 1 post material that exceeds the maximum wall thickness requirement of Standard Plan L-2 may be accepted, provided it does not interfere with the proper construction of the fence.

Grade 2 post material shall meet the organic exterior coatings requirements of AASHTO M 181 (Section 33) and the additional requirement that the interior coated surface shall be capable of resisting 300 hours of exposure to salt fog with a maximum of 5% red rust when tested in accordance with ASTM B 117.

- **Round Post Material**

  Round post material shall be Grade 1 or 2.

- **Roll Form Material**

  Roll-formed post material shall be Grade 1. Roll-formed end, corner, and pull posts shall have integral fastening loops to connect to the fabric for the full length of each post. Top rails and brace rails shall be open rectangular sections with internal flanges as shown in Standard Plan L-2.

### 9-16.1(1)B Chain Link Fence Fabric

Chain link fabric shall consist of 11 gage wire for Types 3, 4, and 6 fence, and 9 gage wire for Type 1 fence. The fabric shall be zinc-coated steel wire conforming to AASHTO M 181, Class C.

The wire shall be woven into approximately 2-inch diamond mesh. The width and top and bottom finish of the fabric shall be as specified in AASHTO M 181.

### 9-16.1(1)C Tension Wire

Tension wire shall meet the requirements of AASHTO M 181. Tension wire galvanizing shall be Class 1.

### 9-16.1(1)D Fittings and Hardware

Except where indicated, fittings shall be malleable cast iron or pressed steel and shall conform to the requirements of ASTM F626 or AASHTO M232, whichever is applicable. Fittings for any particular fence shall be those furnished by the manufacturer of the fence.

Tension truss rods shall be 3/8 inch round galvanized rods with drop forged turnbuckles or other approved type of adjustment. Couplings for tubular sections shall be outside sleeve type and shall be at least 6 inches long.

Eye bolts for attaching tension wire shall be 3/8 inch diameter and of sufficient length to fasten to the type of post being used.

Tension bars shall be 3/16 inch by 3/4 inch nominal and cross sectional area shall be 0.141 $in^2$ +/- 5%.

Hog rings shall be 12 gage galvanized steel wire. Tie wire shall be 9 gage galvanized steel wire or 9 gage aluminum wire meeting the requirements of ASTM F626.

#### 9-16.1(E) Chain Link Gates

Gate frames shall be constructed of not less that 11/2 inch (I.D.) hot-dipped galvanized pipe conforming to AASHTO M 181 Type I, Grade 1 or 2 as specified in Section 9-16.1(1)A. The corners of the gate frame shall be fastened together and reinforced with a malleable iron or pressed steel fitting designed for the purpose, or they may be welded. Welding shall conform to the requirements of Section 6-03.3(25). All welds shall be ground smooth and painted with an A-9-73 or A-11-99 primer meeting the requirements of Section 9-08.2. The paint shall be applied in one or more coats to provide a minimum dry film thickness of 3.5 mils.

Chain link fence fabric for filling the gate frame shall meet the requirements of Section 9-16.1(1)B for the fence type being furnished.

Cross trussing shall be 5/16 inch steel adjustable rods galvanized in accordance with Section 9-16.1(1)D.

Each gate shall be furnished complete with necessary hinges, latch, and drop bar locking device designed for the type of gate posts and gate used on the project. Gates shall have positive type latching devices with provisions for padlocking. Hinges, latches, and locking devices shall be galvanized in accordance with Section 9-16.1(1)D.

Gate frames constructed of steel sections, other than pipe, that are fabricated in such a manner as to form a gate of equal or better rigidity may be used provided they are approved by the WSDOT.

#### 9-16.1(1)F Concrete

All concrete for chain link fence shall be as specified in Section 6-02.3(2)B.

#### 9-16.1(2) Approval

Approval of materials for chain link fence shall be by evaluation of independent test results from a certified testing laboratory or by QPL. Independent test results for evaluation shall be submitted to the State Materials WSDOT in Tumwater WA.

### *9-16.2 Wire Fence and Gates*

All sub-sections under Section 9-16.2 are deleted and replaced with the following:

#### 9-16.2(1) General

All materials used in the construction of the wire fence shall be new. All iron or steel material shall be galvanized. Material upon which serious abrasions of galvanizing occur will not be acceptable.

#### 9-16.2(1)A Steel Post Material

- **Round Post Material**

  Round post material shall conform to AASHTO M 181, Type I, Grade 1.

- **Angle Post Material** (Channel, T, U, Y, or Other Approved Style)

  All angle post material shall be hot-dipped galvanized in accordance with the requirements of AASHTO M 111 grade 75. Galvanizing shall be 1.7 oz/ft$^2$ of surface area. Angle post used for end, corner, gate and pull post and brace shall have a minimum weight of 3.1 lb/ft.

Posts shall be not less than 7 feet in length. A tolerance of -5% on the weight of individual posts, braces or anchor plates will be permitted. One type of line post shall be used throughout the project. Line posts shall be studded, slotted, or properly adapted for attaching either wire or mesh in a manner that will not damage the galvanizing of posts, wire or mesh during the fastening. Line posts shall have a minimum weight of 1.33 lbs/ft and shall be provided with a tapered galvanized steel anchor plate. The anchor plate shall be securely attached and have a surface area of 20 +/-2 in$^2$, a minimum weight of 0.67 pounds and 1.7 oz/ft$^2$ galvanizing.

### 9-16.2(1)B Wood Fence Posts and Braces

Douglas fir, Western red cedar, hemlock, or larch shall be used in the construction of wood fence posts and braces. The material shall be of good quality and approved by the WSDOT before use. Peeler cores shall not be used for round posts. Wood fencing materials shall have sufficient sapwood in the outer periphery to obtain the specified penetration of preservative. Western red cedar will not require preservative treatment. Fencing materials shall be cut to the correct length before pressure treatment.

Line posts shall be 3 inch minimum diameter round posts or nominal 3 inch by 3 inch square sawed posts. If the posts are to be pointed for driving, they shall be pointed before treatment. Line posts shall be at least 7 feet in length.

Pull posts and brace posts shall be 6 inch diameter round posts or nominal 6 inch by 6 inch material not less than 7 feet in length.

End, gate, and corner posts, and posts at an intersecting fence shall be 6 inch diameter round posts or nominal 6 inch by 6 inch material not less than 7 feet 10 inches in length.

All sawed posts and timbers shall meet the requirements in the table under Section 9-09.2.

The preservatives used to pressuretreat wood fencing materials shall meet the requirements of Section 9-09.3.

The retention and penetration of the preservative shall be as follows:

| Minimum Retention in Pounds Per Cubic Foot | | |
|---|---|---|
| **Preservative** | **Sawed Posts** | **Round Posts** |
| Creosote | 10.00 | 8.00 |
| Pentachlorophenol | 0.50 | 0.40 |
| ACA | 0.40 | 0.40 |
| ACZA | 0.40 | 0.40 |
| ACQ | 0.40 | 0.40 |
| CCA | 0.40 | 0.40 |

Minimum Penetration

for material 5" or less - 0.40 inches penetration and 90% of sapwood

for material 5" or greater - 0.50 inches penetration and 90% of sapwood

### 9-16.2(1)C Brace Wire

Brace wire shall be 9 gage wire galvanized to meet the requirements of AASHTO M 279, Type Z, Class 1.

### 9-16.2(1)D Staples and Wire Clamps

The staples used to attach the wire fencing to wood posts shall be 9 gage wire, 1 1/2 inches long, galvanized to meet the requirements of AASHTO M 279, Type Z, Class 1.

The wire clamps used to attach the wire fencing to steel posts shall be 11 gage wire, galvanized to meet the requirements of AASHTO M 279, Type Z, Class 1.

### 9-16.2(1)E Barbed Wire

Barbed wire shall conform to the requirements of AASHTO M 280, Type Z and shall consist of two strands of 12 1/2 gage wire, twisted with four point 14 gage barbs with barbs spaced 5 inches apart (Design 12-4-5-14R). Galvanizing shall be Class 3.

### 9-16.2(1)F Wire Mesh

Wire mesh shall conform to the requirements of AASHTO M 279, Type Z and shall consist of eight horizontal wires with vertical stays spaced 6 inches apart. The top and bottom wires shall be 10 gage, and the intermediate wires and vertical stays shall be 12 1/2 gage. The mesh shall have a total width of 32 inches (Design 832-6-12 1/2). Galvanizing shall be Class 3.

The zinc coated wire as represented by the test specimens shall be capable of being wrapped in a close helix at a rate not exceeding 15 turns/minute around a cylindrical steel mandrel having a diameter the same as the specimen being tested, without cracking or flaking the zinc coating to such an extent that any zinc can be removed by rubbing with the bare fingers.

### 9-16.2(1)G Vertical Cinch Stays

Vertical cinch stays shall be 10 gage galvanized wire meeting the requirements of AASHTO M 279, Type Z, Class 1.

#### 9-16.2(1)H Miscellaneous Hardware

Bolts, nuts, hinges, latches and other miscellaneous hardware shall be galvanized in accordance with AASHTO M 232.

#### 9-16.2(1)I Wire Gates

Gate frames shall be constructed of galvanized pipe with a nominal diameter of not less than 1 inch. The pipe shall conform to the requirements of AASHTO M 181 Type I, Grade 1. Wire gates shall be not less than 48 inches in height and shall be designed to fit openings of the width called for in the Plans or as indicated by the bid items. Each gate shall be provided with two upright braces of the same material as the frame, spaced at 1/3 points in the gate. All gates shall be provided with adjustable 5/16 inch diameter galvanized diagonal truss rods from corner to corner. Galvanizing shall be in accordance with Section 9-16.2(1)H.

The gate frame shall be provided with wire mesh conforming to the requirements specified in Section 9-16.2(1)F, except that it shall consist of 10 horizontal wires and have a total width of 47 inches.

Each gate shall be furnished complete with necessary galvanized hinges and latch designed for use with the type of gate posts used on the project. The hinges shall be so designed as to be securely attached to the gate post and to enable the gate to be swing back against the fence. Double gates shall be hinged in the same manner as single gates and shall be provided with an approved galvanized drop bar locking device. Galvanizing for hinges, latches, and locking devices shall be in accordance with Section 9-16.2(1)H.

#### 9-16.2(1)J Concrete

All concrete for wire fence shall be as specified in Section 6-02.3(2)B.

#### 9-16.2(2) Approval

Approval of materials for wire fence shall be by evaluation of independent test results from a certified testing laboratory or by QPL. Independent test results for evaluation shall be submitted to the State Materials WSDOT in Tumwater WA.

### *9-16.3(1) Rail Element*

The third paragraph is revised to read:

The 6-inch channel rails and splice plates shall conform to ASTM A 36, except that the channel rails may conform to ASTM A 992. All fabrication shall be complete before galvanizing.

### *9-16.3(2) Posts and Blocks*

In the second paragraph, the treatment for Pentachlorophenol is revised from 060 lbs. pcf to 0.60 lbs. pcf.

The fourth paragraph is revised to read:

Steel posts, blocks, and base plates, where used, shall conform to either ASTM A 36 or ASTM A 992, and shall be galvanized in accordance with AASHTO M 111. Welding shall conform to Section 6-03.3(25). All fabrication shall be completed prior to galvanizing.

### *9-16.3(4) Hardware*

This section is revised to read:

Bolts, unless otherwise specified, shall comply with ASTM A 307 Grade A - specifications. High strength bolts shall conform to the requirements of AASHTO M 164. Nuts, unless otherwise specified, shall comply with ASTM A 563 Grade A specifications. Washers, unless otherwise specified, shall meet ASTM F 844 specifications. The Contractor shall submit a manufacturer's certificate of compliance for high strength bolts, nuts, and washers prior to installing any of the hardware. A307 Bolts will be accepted by field verification and documentation that bolt heads are stamped 307A.

### *9-16.3(5) Anchors*

The sixth paragraph is revised to read:

The anchor plate, W200 x 27 and metal plates shall be fabricated of steel conforming to the specifications of ASTM A 36, except that the W200 x 27 may conform to ASTM A 992.

## SECTION 9-17, FLEXIBLE GUIDE POSTS

### *9-17.1 General*

The first paragraph is revised to read:

Flexible guide posts shall be made of a flexible, nonwarping, nonmetallic, durable plastic material; shall be resistant to damage due to impact, ultraviolet light, ozone, hydrocarbons, and other effects of atmospheric weathering; shall resist stiffening with age; and shall exhibit good workmanship and be free of burns, discoloration, contamination and other objectionable marks or defects that affect appearance or serviceability. The portion of ground mounted guide post installed below ground may be the same material as the portion above ground or other durable material suitable for firmly anchoring the post in the ground. When iron or steel are used for the in ground portion, galvanize in accordance with AASHTO M 111. The top of tubular posts shall be closed to prevent moisture or debris from entering. Surface mounted guide posts shall be mounted on a base made of a rigid high impact resistant material and be resistant to ultraviolet light, ozone, and hydrocarbons. The post shall mount directly into or onto the base in a tamper proof manner and shall allow for easy replacement. Guardrail mounted guide posts shall be the same as ground mounted guide posts except the length shall be adjusted to meet the mounting height requirements in the Standard Plans. Appropriate holes shall be provided for fastening the guide post to the guard rail post.

The second sentence in the second paragraph is revised to read:

If analysis by the Materials Laboratory determines there is a change in material composition, such change shall constitute grounds for rejection and/or removal from the Qualified Products List.

The second sentence in the fifth paragraph is deleted.

Section 9-17.1 is supplemented with the following new sub-sections:

### *9-17.1(1) Dimensions*

1. Flat Type – The post has a minimum width of 3 inches of continuous flat surface with no curvature for the entire length of the post. This will allow for ridges on the outer edges and back of post intended for structural support.

2. Tubular Type – The post is tubular or round/circular in shape. This allows for a tubular post with a minimum diameter of 3 inches or a tubular post with a minimum diameter of 2 inches with a flat or flattened oval surface at least 3 inches wide and 12 inches long measured from the top for mounting reflective sheeting.

3. Non-flat and Non-tubular Type – This includes all post that do not fit into the two types indicated above. This would include convex, w-shape, oval, and other post designs. The post shall be wide enough to accept a 3 inch wide reflective sheeting. Any curvature or rounding shall not significantly reduce the brightness value of the reflective sheeting.

4. Surface Mount Guide Post Base – The base for surface mount guide posts shall be approximately 8 inches in diameter with a maximum height of 2 inches.

5. Guide posts shall be of such length to provide the required mounting height above the pavement surface in accordance with the Standard Plans.

### *9-17.1(2) Reflective Sheeting*

Reflective sheeting for guide posts shall be Type III, IV, V, or VII conforming to Section 9-28.12. The reflective panel on a flat or elliptical guidepost shall have a minimum width of 3 inches facing traffic. The reflective sheeting shall have a minimum area of 24 square inches (3 inches by 8 inches). The reflective panel on a round guidepost shall have an 8-inch minimum band of reflective sheeting visible for 360 degrees. Mount the reflective sheeting on the guide post as detailed in the Standard Plans. Sheeting shall remain in place during the life of the post.

### *9-17.2 Laboratory Tests*

This section including title is revised to read:

#### 9-17.2 Ultraviolet Resistance Test Procedure (Laboratory Test)

Two posts will be tested initially for tensile strength and elongation according to ASTM D-638 and again after 1,000 hours QUV weatherometer exposure (ASTM G53).

Six bow tie specimens shall be prepared from the delineator post samples submitted for the purpose of ultraviolet (UV) exposure. The specimens shall be cycled at 1,000 hours in a weatherometer in accordance with ASTM G 53 (3 hr. 60C UV, 3 hr. 50C

CON). Three of each type shall be used for control purposes. The remaining three shall be subjected to 1000 hours of UV exposure in the QUV weatherometer. Specimen dimensions conform to those outlined below.

The laboratory test data shall summarize the tensile strength of each, and the average tensile strength for both control and weathered samples. The data shall also summarize the elongation of each, and the average elongation for both control and weathered samples. The average values shall be used to show the percent change in tensile and elongation.

Section 9-17.2 is supplemented with the following new sub-section:

### 9-17.2 (1) Acceptance

The specimens shall show no signs of delamination, distress, or discoloration. Physical properties of tensile strength and rigidity shall be maintained within 80 percent of the unconditioned values.

## *9.17.3 Field Tests*

This section including title is revised to read:

### 9-17.3 Field Impact Test Procedure

Sample size of eight units will be tested the following way:

**Flexible Ground Mounted Posts**
Eight flexible ground mounted posts installed by the manufacturer (four installed manually and four installed mechanically). The delineators will be hit ten times (four posts for glancing bumper hits and four posts for wheel hits). A standard sedan with a bumper height of approximately 18" while traveling at a speed of 55 ± 2 mph will be used for impact testing. Five of the impacts will be at an ambient temperature of 32 ± 5□F and the remaining five impacts at an ambient temperature of 85 ±_5□F. The test vehicle shall impact four of the posts at an angle perpendicular to the front of the post and shall impact the remaining posts at an angle of 25□clockwise from the angle perpendicular to the front of the posts. The same test samples will be used for the ten hits. Two flexible posts will be used for weatherometer testing. A glancing hit is defined as one on the bumper near the vehicle headlight. The delineators shall be installed a minimum of eight hours prior to being hit.

**Flexible Surface Mounted Posts**
Eight flexible surface mounted posts installed by the manufacturer will be hit ten times (four posts for glancing bumper hits and four posts for wheel hits). A standard sedan with a bumper height of approximately 18" while traveling at a speed of 55 ± 2 mph will be used for impact testing. Five of the impacts will be at an ambient temperature of 32 ± 5□F and the remaining five impacts at an ambient temperature of 85 ± 5□F. The test vehicle shall impact four of the posts at an angle perpendicular to the front of the post and shall impact the remaining posts at an angle of 25□clockwise from the angle perpendicular to the front of the posts. The same test samples will be used for the ten hits. Two flexible posts will be used for weatherometer testing. A glancing hit is defined as one on the

bumper near the vehicle headlight. The delineators shall be installed a minimum of eight hours prior to being hit.

Section 9-17.3 is supplemented with the following new sub-sections:

### 9-17.3 (1) Test Observations

Inspect each post after each impact and document the following:

1. Any splits, cracks, breaks or other forms of deformation or distress;
2. The percent list to vertical two minutes after each impact;
3. The approximate percentage of the reflective area that is damaged after each impact to an extent it no longer performs as intended;
4. Any problems or comments associated with the installation and removal of the posts and bases. The testing agent will document any special equipment or techniques required for installing or removing the posts and bases.
5. Any problems or comments associated with the performance of each ground mounted flexible delineator post that would be of interest to the states;
6. Type of soil and impact surface.

### 9-17.3 (2) Acceptance

A failure is defined as any of the following:

1. A minimum of 50 percent of the reflective sheeting shall be retained undamaged. An area of damage greater than 50 percent is considered a failure.
2. If the guide post leans more than 10 degrees from vertical it is considered a failure.
3. Any cracking, other than surface cracking evident on only one face of the post, is considered a failure.
4. Pullout in excess of 3 inches is considered a failure.

At east six of the guide posts must pass each criteria in the 55 + 2 miles per hour series of impacts to be acceptable.

## SECTION 9-23, CONCRETE CURING MATERIALS AND ADMIXTURES

This section is supplemented with the following new sub-section:

### 9-23.10 Ground Granulated Blast Furnace Slag

Ground granulated blast furnace slag shall meet the requirements of AASHTO M 302, Grade 100 or Grade 120. The grade of the ground granulated blast furnace slag, the

source, and type of manufacturing facility shall be certified on the cement mill test certificate.

## SECTION 9-28, SIGNING MATERIALS AND FABRICATION

### *9-28.1 General*

The third sentence in the first paragraph is deleted.

### *9-28.6 Destination Sign Messages*

The second paragraph is deleted.

### *9-28.8 Sheet Aluminum Signs*

The sheet thickness chart is revised to read:

| Maximum Horizontal Dimension | Sheet Aluminum Thickness |
|---|---|
| Overlay panels | 0.050 inch |
| Up to 20 inches | 0.063 inch |
| 20 inches to 36 inches, inclusive | 0.080 inch |
| Over 36 inches (Permanent Signs) | 0.125 inch |

The fourth paragraph is revised to read:

Before placing aluminum in contact with untreated steel, the steel surfaces shall be protected by proper cleaning and painting with one coat of Zinc Primer A-9-73 or A-11-99 and two coats of aluminum paint D-1-57.

### *9-28.10 Plywood Signs*

This section is deleted.

### *9-28.11 Hardware*

The entry for hardware item "Angle and “Z” Bar" in the table in this section is revised to read:

| | |
|---|---|
| Angle and “Z” Bar | ASTM B 221 6061-T6 Aluminum |
| | ASTM A 36 or ASTM A 992 Steel |

### *9-28.14(2) Steel Structures and Posts*

This section is revised to read:

Truss chords, struts, and diagonals, end posts, and end post struts and diagonals for sign bridge structures and cantilever sign structures shall conform to either ASTM A 36 or ASTM A 53 Grade B Type E or S. The nominal pipe diameter and the pipe wall thickness shall be as shown in the Plans or Standard Plans. All other structural steel for sign bridge structures and cantilever sign structures shall conform to either

ASTM A 36 or ASTM A 992. Truss member connection hardware shall conform to Section 9-06.5(3).

Pipe members for bridge mounted sign brackets shall conform to ASTM A 53 Grade B Type E or S, and shall be Schedule 40 unless otherwise specified. All other structural steel for bridge mounted sign brackets shall conform to either ASTM A 36 or ASTM A 992. U bolts, and associated nuts and washers, shall be stainless steel conforming to Section 9-28.11, and shall be fabricated hot.

Anchor rods for sign bridge and cantilever sign structure foundations shall conform to ASTM F 1554 Grade 105, including Supplemental Requirements S2, S3, and S5. Nuts and washers for sign bridge and cantilever sign structure foundations shall conform to AASHTO M 291 Grade DH and AASHTO M 293, respectively.

Steel sign structures and posts shall be galvanized after fabrication in accordance with AASHTO M 111, unless noted otherwise in the Plans. All bolts, nuts, and washers shall be galvanized after fabrication in accordance with AASHTO M 232. Unless otherwise specified in the Plans or Special Provisions, metal surfaces shall not be painted.

Except as otherwise noted, steel used for sign structures and posts shall have a controlled silicon content of either 0.00 to 0.04 percent or 0.15 to 0.25 percent. If the Plans or Special Provisions specify painting of the galvanized steel surfaces, then the controlled silicon content requirement does not apply for those steel members. Mill test certificates verifying the silicon content of the steel shall be submitted to both the galvanizer and the WSDOT prior to beginning galvanizing operations.

Minor fabricating and modifications necessary for galvanizing will be allowed if not detrimental to the end product as determined by the WSDOT. If such modifications are contemplated, the Contractor shall submit to the WSDOT, for approval, six copies of the proposed modifications, prior to fabrication.

## SECTION 9-29, ILLUMINATION, SIGNALS, ELECTRICAL

### *9-29.3 Conductors, Cable*

Under the second paragraph, item 5 is revised to read:

5. Pole and bracket cable shall be a two-conductor cable rated for 600 volts. The individual conductors shall be one red and one black 19-strand No. 10 AWG copper, assembled parallel. The conductor insulation shall be 45-mil polyvinyl chloride or a 600 volt rated cross-linked polyethylene. The Jacketing shall be polyethylene or polyvinyl chloride not less than 45-mils thick. If luminaires with remote ballasts are specified in the contract, this same cable shall be used between luminaire and ballast for both timber and ornamental pole construction. If the luminaire requires fixture wire temperatures greater than 75°C, the outer jacket shall be stripped for that portion of the cable inside the luminaire. The single conductors shall then be sheathed with braided fiberglass sleeving of the temperature rating recommended by the luminaire manufacturer.

### *9-29.6 Light and Signal Standards*

The first paragraph is supplemented with the following:

Fabrication of light and signal standards shall conform to the applicable requirements of Section 6-03.3(14).

### *9-29.6(1) Light and Signal Standards*

This section including title is revised to read:

### *9-29.6(1) Steel Light and Signal Standards*

Steel plates and shapes for light and signal standards shall conform to ASTM A 36, except that structural shapes may conform to ASTM A 992. Shafts for light and signal standards, except Type PPB signal standards, shall conform to ASTM A 572 Grade 50. Shafts and caps for Type PPB signal standards, slipfitters for type PS I, FB, and RM signal standards, and all pipes shall conform to ASTM A 53 Grade B. Base plates for light standards shall conform to ASTM A 572, Grade 50, except as otherwise noted in the Standard plans for fixed base light standards. Base plates for signal standards shall conform to ASTM A 36. Connecting bolts shall conform to AASHTO M 164. Fasteners for handhole covers, bands on lighting brackets, and connector attachment brackets shall conform to ASTM F 593.

Light and signal standards shall be hot-dipped galvanized in accordance with AASHTO M 111 and AASHTO M 232.

Steel used for light and signal standards shall have a controlled silicon content of either 0.00 to 0.04 percent or 0.15 to 0.25 percent. Mill test certificates verifying the silicon content of the steel shall be submitted to both the galvanizer and the WSDOT prior to beginning galvanizing operations.

### *9-29.10 Luminaires*

Under the first paragraph, the third sentence in item D is revised to read:

All internal luminaire assemblies shall be assembled on or fabricated from either stainless steel or galvanized steel.

### *9-29.13 Traffic Signal Controllers*

This section is supplemented with the following:

All Traffic Signal Control Equipment Shall be Tested As Follows.

The supplier shall:

1. Seven days prior to shipping, arrange appointment for controller cabinet assembly, and testing at the WSDOT Materials Laboratory or the facility designated in the Special Provisions.
2. Assembly shall be defined as but not limited to tightening all screws, nuts and bolts, verifying that all wiring is clear of moving parts and properly secured, installing all pluggables, connecting all cables, Verify that all contract required documents are present, proper documentation is provided, and all equipment required by the contract is installed.
3. The assembly shall be done at the designated WSDOT facility in the presence of WSDOT personnel.
4. The supplier shall demonstrate that all of the functions required by this specification and the contract Plans and Special Provisions perform as intended. Demonstration shall include but not be limited to energizing

the cabinet and verifying that all 8 phases, 4 pedestrian movements, 4 overlaps (as required by the Contract Provisions) operate per Washington State Standard Specifications Section 9-29.13. The supplier shall place the controller in minimum recall with interval timing set at convenient value for testing purposes. Upon a satisfactory demonstration the controller assembly will then be accepted by WSDOT for testing.

5. If the assembly, and acceptance for testing is not complete within 5 working days of delivery, the Project WSDOT may authorize the return of the assembly to the supplier, with collect freight charges to the supplier.
6. The Contractor will be notified when the testing is complete, and where the assembly is to be picked-up for delivery to the project.
7. The supplier has 5 working days to repair or replace any components that fail during the testing process at no cost to the Contracting Agency. A failure shall be defined as a component that no longer functions as intended under the conditions required or does not meet the requirements of the Contract Specifications and is at the soul discretion of WSDOT.
8. Any part or component of the controller assembly, including the cabinet that is rejected shall not be submitted for use by WSDOT or any City or County in the State of Washington.

### *9-29.13(6) Radio Interference Suppressers*

In the first paragraph, the second sentence is revised to read:

Interference suppressers shall be of a design which will minimize interference in both broadcast and aircraft frequencies, and shall provide a minimum attenuation of 50 decibels over a frequency range of 200 kilohertz to 75 megahertz when used in connection with normal installations

### *9-29.13(7) Traffic-Actuated Controllers*

In the first paragraph, item 3 is revised to read:

3. A minimum of four overlaps.

### *9-29.13(7)B Auxiliary Equipment for NEMA Controllers*

Under the first paragraph, item 2 is supplemented with the following:

The controller cabinet shall have all cabinet wiring installed for eight vehicle phases, four pedestrian phases, four emergency pre-empts, four overlaps (OL A, B, C, D).

Under the first paragraph, item 7 is revised to read:

7. A "Display Panel" when noted in the contract. The display panel shall depict a generic eight-phase operation. The panel shall be mounted on the inside of the front cabinet door and the mounting shall be of a design that allows positioning of the panel in four orientations 90 degrees from each other. The mounting shall be removable without use of any tools. Incandescent red, yellow, green, walk and don't walk indicator lights shall be provided for each phase. The indicator lights shall be connected to the associated field terminals. The connecting cable shall be long enough to allow for any mounting orientation. No diodes will be allowed

in the display panel. A means of disconnecting all wiring entering the panel shall be provided. Switches shall be provided on the panel with labels and functions as follows:

a. Display On — Signal indicator lamps will display the operation of the intersection.

b. Test — All indicator lamps shall be energized.

c. Display Off — all signal indicator lamps shall be de-energized.

A "Detector Panel", as specified in Standard Specification Section 9-29.12(7)D, shall be installed. The panel shall be mounted on the inside of the front cabinet door. The detector panel shall be constructed as a single unit. Detector switches with separate operate, test, and off positions shall be provided for each field detector input circuit. A high intensity light emitting diode (LED) shall be provided for each switch. The lamp shall energize upon vehicle, pedestrian or test switch actuation. The test switch shall provide a spring loaded momentary contact that will place a call into the controller. When in the OFF position, respective detector circuits will be disconnected. In the operate position, each respective detector circuit shall operate normally. Switches shall be provided on the panel with labels and functions as follows:

a. Display On — Detector indicator lights shall operate consistent with their respective switches.

b. Display Off — detector indicator lights shall be de-energized.

A means of disconnecting all wiring entering the panel shall be provided. The disconnect shall include a means to jumper detection calls when the display panel is disconnected. All switches on the panel shall be marked with its associated plan detector number. All markers shall be permanent.

### *9-29.13(7)D NEMA Controller Cabinets*

This section is revised to read:

Each traffic-actuated NEMA controller shall be housed in a weatherproof cabinet conforming to the following requirements:

1. Construction shall be of 0.073-inch minimum thickness series 300 stainless steel or 0.125 minimum thickness 5052 H32 ASTM B209 alloy aluminum. The stainless steel shall be annealed or one-quarter-hardness complying with ASTM A666 stainless steel sheet. Cabinets may be finished inside with an approved finish coat of exterior white enamel. If no other coating is specified in the Contract Provisions the exterior of all cabinets shall be bare metal. All controller cabinets shall be furnished with front and rear doors.

2. The cabinet shall contain shelving, brackets, racks, etc., to support the controller and auxiliary equipment. All equipment shall set squarely on shelves or be mounted in racks and shall be removable without turning, tilting, or rotating or relocating one device to remove another. A 24 slot rack or racks shall be installed. The rack(s) shall be wired for 2 channel loop detectors and as follows. Slots 1 & 2 phase 1 loop detectors. Slots 3, 4, & 5 phase 2 loop detectors. Slots 6 & 7 phase 3 loop detectors. Slots 8, 9, & 10

phase 4 loop detectors. Slots 11 & 12 phase 5 loop deterctors. Slots 13, 14, & 15 phase 6 loop detectors. Slots 16 & 17 phase 7 loop detectors. Slots 18, 19 & 20 phase 8 loop detectors. Slot 21 upper phase 1 loop detector. Slot 21 lower phase 5 detector. Slot 22 wired for a 2 channel discriminator channels A, C. Slot 23 wired for a 2 channel discriminator, channels B, D. Slot 24 wired for a 4 channel discriminator, wired for channel A, B, C, D. All loop detector slots shall be wired for presence/ pulse detection/ extension. If an external power supply is required in order for the entire racks(s) to be powered it shall be installed. All rack(s) slots shall be labeled with engraved identification strips.

3. Additional detection utilizing the "D" connector shall be installed in accordance with the contract. The cabinet shall be of adequate size to properly house the controller and all required appurtenances and auxiliary equipment in an upright position with a clearance of at least 3 inches from the vent fan and filter to allow for proper air flow. In no case shall more than 70 percent of the cabinet volume be used. There shall be at least a 2-inch clearance between shelf mounted equipment and the cabinet wall or equipment mounted on the cabinet wall.
4. The cabinet shall have an air intake vent on the lower half of the front door, with a 12 inch by 16 inch by 1 inch removable throw away filter, secured in place with a spring-loaded framework.
5. The cabinet door(s) shall be provided with:
   a. Spring loaded construction core locks capable of accepting a Best type CX series six segment (core installed by others) shall be installed in each door with the exception of the police panel door. Cabinet doors shall each have a three point latch system.
   b. A police panel assembly shall be installed in the front door and shall have a stainless steel hinge pin and a police panel lock. Two police keys with shafts a minimum of 1 3/4 inches long shall be provided with each cabinet.
   c. All doors and police panel door shall have one piece closed cell, neoprene gaskets.
   d. A two position doorstop assembly. Front and rear interior light control switches.

### *9-29.13(7)E Type 170E, 170E-HC-11, 2070, 2070 Lite, ATC Controller Cabinets*

This section is revised to read:

The above controllers shall be housed in a Models 332, **Double 332**, 336, 336S, 303 **ITS/ATC** cabinets, or as specified in the contract. Each door shall be furnished with a construction core lock conforming to Standard Specifications 9-29.13 (7)D 5a, b and c above. A police panel with door, stainless steel hinge pin and lock shall be provided. Two police keys with shafts a minimum of 1 3/4" long shall be provided with each cabinet. Each of these cabinets shall be furnished with auxiliary equipment described in Standard Specification 9-29.13(7)C. Type 334 cabinets for traffic data station controller furnished shall meet current Caltrans 170E specifications, as stated in Standard Specification 9-29.13(7) and as follows. Camera control and DMS local

control cabinets shall contain the equipment shown in the Plans. The cabinet shall have the same external physical dimensions and appearance of Model 334 cabinets.

1. The cabinet shall be fabricated of stainless steel or sheet aluminum in accordance with Section 9-29.13(7)D, Item number 1. Painted steel, painted or anodized aluminum is not allowed.
2. Cabinet doors shall have a three-point latch and two-position stop assembly with spring loaded construction core lock capable of accepting a Best lock company type, with 6-pin CX series core. The Contractor shall supply construction cores. Upon contract completion, the Contractor shall deliver two master keys to the WSDOT.
3. Field wire terminals shall be labeled in accordance with the Field Wiring Chart.
4. A shatterproof fluorescent interior cabinet lights with self-starting ballast shall be furnished, one fixture mounted on the rear rack near the top and the second mounted at the top of the front rack. Door switches shall automatically turn on both lights when either door is opened.
5. One controller unit shelf, which attaches to the front rails of the EIA rack, shall be provided in lieu of the two controller unit support angles. The shelf shall be fabricated from aluminum and shall be installed such that it does not interfere with access to any terminal block. The shelf shall contain a rollout flip-top drawer for storage of wiring diagrams and manuals.

A disposable paper filter element of at least 180 square inches shall be provided in lieu of a metal filter.

All traffic data and ramp meter cabinets shall include the following accessories:

1. Each cabinet shall be equipped with a fully operable controller equipped as specified in the Contract Provisions.
2. Two input files, except on Type 303 and 336 cabinet shall be supplied, each using 133 millimeters of rack height.
3. Power Distribution Assembly shall be PDA #3 as detailed in the January 1989 Caltrans 170 specification, with all current amendments.

   The PDA #3 shall contain three Model 200 Load Switches.

   A transient voltage protection device shall be provided, which plugs into the controller unit receptacle and in turn accepts the controller plug and meets the electrical requirements of Section 9-29.13(7)B(3) item e.

   A second transfer relay, Model 430, shall be mounted on the rear of the PDA #3 and wired as shown in the Plans.
4. Police Panel shall contain only one DPDT toggle switch. The switch shall be labeled POLICE CONTROL, ON-OFF.
5. Display Panel

   A. General

   Each cabinet shall be furnished with a display panel. The panel shall be mounted, showing and providing detection for inputs and specified controller outputs, at the top of the front rack above the controller unit.

The display panel shall be fabricated from brushed aluminum and constructed according to the detail in the Plans.

B. Text

All text on the display panel shall be black in color and silk screened directly to the panel except the Phenolic detector and cabinet nameplates. A nameplate for each loop shall be engraved with a 1/4 inch nominal text according to the ITS Field Wiring Charts. The nameplates shall be permanently affixed to the display panel.

C. LEDs

The LEDs for the display panel shall meet the following specifications:

| | |
|---|---|
| Case size | T 1-3/4 |
| Viewing angle | 50° minimum |
| Brightness | 8 Milli candelas |

LEDs with RED, YELLOW or GREEN as part of their labels shall be red, yellow or green in color. All other LEDs shall be red. All LEDs shall have tinted diffused lenses.

D. Detector Display Control Switch

Each display panel shall be equipped with one detector display control switch on the panel with labels and functions as follows:

ON

Detector display LEDs shall operate consistent with their separate switches.

OFF

All detector indicator LEDs shall be de-energized. Detector calls shall continue to reach the controller.

TEST

All detector indicator LEDs shall illuminate and no calls shall be placed to the controller.

E. Advance Warning Sign Control Switch

Each display panel shall be equipped with one advance warning sign control switch on the panel with labels and functions as follows:

AUTOMATIC

Sign Relay shall energize upon ground true call from controller.

SIGN OFF

Sign Relay shall de-energize.

SIGN ON

Sign Relay shall energize.

F. Sign Relay

The sign relay shall be plugged into a socket installed on the rear of the display panel. The relay shall be wired as shown in the Plans. The relay coil shall draw (or sink) 50 milliamperes ± 10% from the 170E controller and have a DPDT contact rating not less than 10 amperes. A 1N4004 diode shall be placed across the relay coil to suppress voltage spikes. The anode terminal shall be connected to terminal #7 of the relay as labeled in the Plans. The relay shall energize when the METERING indicator LED is lit.

G. Detector Input Indicators

One display LED and one spring-loaded two-position SPST toggle switch shall be provided for each of the 40 detection inputs. These LEDs and switches shall function as follows:

TEST

When the switch is in the test position, a call shall be placed to the controller and energize the associated LED. The switch shall automatically return to the run position when it is released.

RUN

In the run position the LEDs shall illuminate for the duration of each call to the controller.

H. Controller Output Indicators

The display panel shall contain a series of output indicator LEDs mounted below the detection indicators. The layout shall be according to the detail in the Plans. These LEDs shall illuminate upon a ground true output from the controller via the C5 connector.

The output indicator LEDs shall have resistors in series to drop the voltage from 24 volts DC to their rated voltage and limit current below their rated current. The anode connection of each LED to +24 VDC shall be wired through the resistor.

I. Connectors

Connection to the display panel shall be made by three connectors, one pin (labeled P2) and one socket (labeled P1) and one labeled C5. The P1 and P2 connectors shall be 50-pin cannon D series, or equivalent 50 pin connectors and shall be compatible such that the two connectors can be connected directly to one another to bypass the input detection. Wiring for the P1, P2 and C5 connectors shall be as shown in the Plans.

The Contractor shall install wire connectors P1, P2, C1P, C2, C4, C5 and C6 according to the pin assignments shown in the Plans.

6. Model 204 Flasher Unit

Each Model 334 ramp meter cabinet shall be supplied with one Model 204 sign flasher unit mounted on the right rear side panel. The flasher shall be powered from T1-2. The outputs from the flasher shall be wired to T1-5 and T1-6.

7. Fiber Optic Patch Panel

The Contractor shall provide and install a rack-mounted fiber optic patch panel as identified in the Plans.

**Cabinet Wiring**

1. Terminal blocks TB1 through TB9 shall be installed on the Input Panel. Layout and position assignment of the terminal blocks shall be as noted in the Plans.

Terminals for field wiring in traffic data and/or ramp metering controller cabinet shall be labeled, numbered and connected in accordance with the following:

| Terminal Block Pos. | Terminal and Wire Numbers | Connection Identification |
|---|---|---|
| TBS | 501-502 | AC Power, Neutral |
| T1-2 | 641 | Sign on |
| T1-4 | 643 | Sign off |
| T1-5 | 644 | Flasher Output NC |
| T1-6 | 645 | Flasher Output NO |
| T4-1 | 631 | Lane 3 - Red |
| T4-2 | 632 | Lane 3 - Yellow |
| T4-3 | 633 | Lane 3 - Green |
| T4-4 | 621 | Lane 2 - Red |
| T4-5 | 622 | Lane 2 - Yellow |
| T4-6 | 623 | Lane 2 - Green |
| T4-7 | 611 | Lane 1 - Red |
| T4-8 | 612 | Lane 1 - Yellow |
| T4-9 | 613 | Lane 1 - Green |

Loop lead-in cables shall be labeled and connected to cabinet terminals according to the ITS Field Wiring Chart. This chart will be provided by the WSDOT within 20 days of the Contractor's request.

### *9-29.16(2)A Optical Units*

Under the first paragraph, number 4 (warranty) is deleted.

### *9-29.19 Pedestrian Push Buttons*

The third paragraph is deleted

### *9-29.21 Flashing Beacon*

This section is revised to read:

Flashing beacons shall be installed as detailed in the Plans, as specified in the Special Provisions, and as described below:

Controllers for flashing beacons shall be as specified in Section 9-29.15.

Beacons shall consist of single section, 8-inch or 12-inch traffic signal heads, three or four-way adjustable, meeting all of the applicable requirements of Section 9-29.16. Displays (red or yellow) may be either LED type or incandescent. 12 inch yellow displays shall be dimmed 50% after dark.

Mounting brackets, mountings, and installation shall meet all applicable requirements of Section 9-29.17.

Lenses shall be either red or amber, glass or polycarbonate as noted in the Plans or as determined by the WSDOT.

### *9-29.24 Service Cabinets*

Under the first paragraph, item F is revised to read:

F. The minimum size of control circuit conductors used in service cabinets shall be No. 14 AWG stranded copper.

All electrical contactors shall have the loadside terminals toward the front (door side) of the service cabinet.

Under the first paragraph, the fourth sentence of item I is revised to read:

No electrical devices shall be connected to the dead front panel.

### *9-29.25 Amplifier, Transformer, and Terminal Cabinets*

Under the first paragraph, the fourth sentence of item 3 is revised to read:

The Contractor shall supply construction cores with two master keys. The keys shall be delivered to the WSDOT.

## SECTION 9-30, WATER DISTRIBUTION MATERIALS

### *9-30.6(1) Saddles*

The first sentence is revised to read:

Saddles shall be ductile iron, bronze, brass, or stainless steel.

### *9-30.6(2) Corporation Stops*

The first sentence is revised to read:

Corporation stops shall be made of bronze or brass alloy.

### *9-30.6(4) Service Fittings*

The first sentence is revised to read:

Fittings used for service connections shall be made of bronze or brass alloy.

# SECTION 9-32, MAILBOX SUPPORT

### *9-32.2 Bracket, Platform and Anti-Twist Plate*

This section is revised to read:

The bracket, platform, and anti-twist plate shall be 16 gage sheet steel, conforming to ASTM A 36.

### *9-32.4 Wood Posts*

This section is revised to read:

Wood posts shall meet the requirements of Section 9-28.14(1) or western red cedar.

Section 9-32 is supplemented with the following:

#### 9-32.8 Concrete Base

The concrete in the concrete base shall meet or exceed the requirements of Section 6-02.3(2)B.

#### 9-32.9 Steel pipe

The requirements for commercially available, Schedule 40, galvanized steel pipe, elbows, and couplings shall be met for all parts not intended to be bent or welded. Welded and bent parts shall be galvanized after fabrication in accordance with AASHTO M 111.

#### 9-32.10 U-Channel Post

U-channel posts shall meet the requirements of ASTM A 29, weigh a minimum of 3 pounds per linear foot, and shall be galvanized according to AASHTO M 111.

# SECTION 9-33, CONSTRUCTION GEOTEXTILE

This section including title is revised to read:

# SECTION 9-33, CONSTRUCTION GEOSYNTHETIC

### *9-33.1 Geosynthetic Material Requirements*

The term geosynthetic shall be considered to be inclusive of geotextiles, geogrids, and prefabricated drainage mats.

Geotextiles, including geotextiles attached to prefabricated drainage core to form a prefabricated drainage mat, shall consist only of long chain polymeric fibers or yarns formed into a stable network such that the fibers or yarns retain their position relative to each other during handling, placement, and design service life. At least 95 percent by weight of the material shall be polyolefins or polyesters. The material shall be free from

defects or tears. The geotextile shall also be free of any treatment or coating which might adversely alter its hydraulic or physical properties after installation.

Geogrids shall consist of a regular network of integrally connected polymer tensile elements with an aperture geometry sufficient to permit mechanical interlock with the surrounding backfill. The long chain polymers in the geogrid tensile elements, not including coatings, shall consist of at least 95 percent by mass of the material of polyolefins or polyesters. The material shall be free of defects, cuts, and tears.

Prefabricated drainage core shall consist of a three dimensional polymeric material with a structure that permits flow along the core laterally, and which provides support to the geotextiles attached to it.

The geosynthetic shall conform to the properties as indicated in Tables 1 through 8 in Section 9-33.2, and additional tables as required in the Special Provisions for each use specified in the Plans. Specifically, the geosynthetic uses included in this section and their associated tables of properties are as follows:

| **Geotextile Application** | **Applicable Property Tables** |
|---|---|
| Underground Drainage, Low Survivability, | |
| Classes A, B, and C | Tables 1 and 2 |
| Underground Drainage, Moderate Survivability, | |
| Classes A, B, and C | Tables 1 and 2 |
| Separation | Table 3 |
| Soil Stabilization | Table 3 |
| Permanent Erosion Control, Moderate Survivability, | |
| Classes A, B, and C | Tables 4 and 5 |
| Permanent Erosion Control, High Survivability | |
| Classes A, B, and C | Tables 4 and 5 |
| Ditch Lining | Table 4 |
| Temporary Silt Fence | Table 6 |
| Permanent Geosynthetic Retaining Wall | Table 7 |
| Temporary Geosynthetic Retaining Wall | Table 7 |
| Prefabricated Drainage Mat | Table 8 |

For geosynthetic retaining walls that use geogrid reinforcement, the geotextile material placed at the wall face to retain the backfill material as shown in the Plans shall conform to the properties for Construction Geotextile for Underground Drainage, Moderate Survivability, Class A.

Thread used for sewing geotextiles shall consist of high strength polypropylene, polyester, or polyamide. Nylon threads will not be allowed. The thread used to sew permanent erosion control geotextiles, and to sew geotextile seams in exposed faces of

temporary or permanent geosynthetic retaining walls, shall also be resistant to ultraviolet radiation. The thread shall be of contrasting color to that of the geotextile itself.

### *9-33.2 Geosynthetic Properties*

### *9-33.2(1) Geotextile Properties*

**Table 1:** Geotextile for underground drainage strength properties for survivability.

| | | **Geotextile Property Requirements[1]** | |
|---|---|---|---|
| | | **Low Survivability** | **Moderate Survivability** |
| **Geotextile Property** | **Test Method [2]** | **Woven/Nonwoven** | **Woven/Nonwovan** |
| Grab Tensile Strength, min. in machine and x-machine direction | ASTM D4632 | 180 lbs./115 lbs. min. | 250 lbs./160 lbs. min. |
| Grab Failure Strain, in machine and x-machine direction | ASTM D4632 | <50%/≥50% | <50%/≥50% |
| Seam Breaking Strength | ASTM D4632[3] | 160 lbs./100 lbs. min. | 220 lbs./140 lbs. min. |
| Puncture Resistance | ASTM D4833 | 67 lbs./40 lbs. min. | 80 lbs./50 lbs. min. |
| Tear Strength, min. in machine and x-machine direction | ASTM D4533 | 67 lbs/40 lbs. min. | 80 lbs./50 lbs. min. |
| Ultraviolet (UV) Rediation stability | ASTM D4355 | 50% strength retained min., after 500 hrs. in weatherometer | 50% strength retained min., after 500 hrs. in weatherometer |

**Table 2**: Geotextile for underground drainage filtration properties.

| | | **Geotextile Property Requirements[1]** | | |
|---|---|---|---|---|
| **Geotextile Property** | **Test Method[2]** | **Class A** | **Class B** | **Class C** |

| | | | | |
|---|---|---|---|---|
| AOS | ASTM D4751 | .43 mm max. (#40 sieve) | .25 mm max. (#60 sieve) | .18 mm max. (#80 sieve) |
| Water Permittivity | ASTM D4491 | .5 $sec^{-1}$ min. | .4 $sec^{-1}$ min. | .3 $sec^{-1}$ min. |

**Table 3:** Geotextile for separation or soil stabilization.

| | | **Geotextile Property Requirements[1]** | |
|---|---|---|---|
| | | **Separation** | **Soil Stabilization** |
| **Geotextile Property** | **Test Method [2]** | **Woven/Nonwoven** | **Woven/Nonwovan** |
| AOS | ASTM D4751 | .60 mm max. (#30 sieve) | .43 mm max. (#40 sieve) |
| Water Permittivity | ASTM D4491 | .02 $sec^{-1}$ min. | .10 $sec^{-1}$ min. |
| Grab Tensile Strength, min. in machine and x-machine direction | ASTM D4632 | 250 lbs./160 lbs. min. | 315 lbs./200 lbs. min. |
| Grab Failure Strain, in machine and x-machine direction | ASTM D4632 | <50%/≥50% | <50%/≥50% |
| Seam Breaking Strength | ASTM D4632[2] | 220 lbs./140 lbs. min. | 270 lbs./180 lbs. min. |
| Puncture Resistance | ASTM D4833 | 80 lbs./50 lbs. min. | 112 lbs./79 lbs. min. |
| Tear Strength, min. in machine and x-machine direction | ASTM D4533 | 80 lbs/50 lbs. min. | 112 lbs./79 lbs. min. |
| Ultraviolet (UV) Rediation stability | ASTM D4355 | 50% strength retained min., after 500 hrs. in weatherometer | 50% strength retained min., after 500 hrs. in weatherometer |

**Table 4:** Geotextile for permanent erosion control and ditch lining.

| | | Geotextile Property Requirements[1] | | |
|---|---|---|---|---|
| | | Permanent Erosion Control | | Ditch Lining |
| | | Moderate Servicability | High Servicability | |
| **Geotextile Property** | **Test Method [2]** | **Woven/Nonwoven** | **Woven/Nonwovan** | **Woven/Nonwovan** |
| AOS | ASTM D4751 | See Table 5 | See Table 5 | .60 mm max (#30 sieve) |
| Water Permittivity | ASTM D4491 | See Table 5 | See Table 5 | .02 $sec^{-1}$ min. |
| Grab Tensile Strength, min. in machine and x-machine direction | ASTM D4632 | 250 lbs./160 lbs. min. | 315 lbs./200 lbs. min. | 250 lbs./160 lbs. min. |
| Grab Failure Strain, in machine and x-machine direction | ASTM D4632 | 15%-50%/≥50% | 15%-50%/≥50% | <50%/≥50% |
| Seam Breaking Strength | ASTM D4632[2] | 220 lbs./140 lbs. min. | 270 lbs./180 lbs. min. | 220 lbs./140 lbs. min. |
| Burst Strength | ASTM D3785 | 400 pse/190 psi min. | 500 psi/320 psi min. | |
| Puncture Resistance | ASTM D4833 | 80 lbs./50 lbs. min. | 112 lbs./79 lbs. min. | 80 lbs./50 lbs. min. |
| Tear Strength, min. in machine and x-machine direction | ASTM D4533 | 80 lbs/50 lbs. min. | 112 lbs./79 lbs. min. | 80 lbs./50 lbs. min. |
| Ultraviolet (UV) Rediation stability | ASTM D4355 | 70% strength retained min., after 500 hrs. in weatherometer | 70% strength retained min., after 500 hrs. in weatherometer | 70% strength retained min., after 500 hrs. in weatherometer |

**Table 5**: Filtration properties for geotextile for permanent erosion control.

| | | Geotextile Property Requirements[1] | | |
|---|---|---|---|---|
| **Geotextile Property** | **Test Method[2]** | **Class A** | **Class B** | **Class C** |
| AOS | ASTM D4751 | .43 mm max. | .25 mm max. | .22 mm max. |

| | | | | |
|---|---|---|---|---|
| | | (#40 sieve) | (#60 sieve) | (#70 sieve) |
| Water Permittivity | ASTM D4491 | .7 $sec^{-1}$ min. | .4 $sec^{-1}$ min. | .2 $sec^{-1}$ min. |

**Table 6:** Geotextile for temporary silt fence.

| | | **Geotextile Property Requirements[1]** | |
|---|---|---|---|
| **Geotextile Property** | **Test Method [2]** | **Unsupported Between Posts** | **Supported Between Posts with Wire or Polymeric Mesh** |
| AOS | ASTM D4751 | .60 mm max. for slit film wovens (#30 sieve) .30 mm max. for all other geotextile types (#50 sieve) .15 mm min. (#100 sieve) | .60 mm max. for slit film wovens (#30 sieve) .30 mm max. for all other geotextile types (#50 sieve) .15 mm min. (#100 sieve) |
| Water Permittivity | ASTM D4491 | .02 $sec^{-1}$ min. | .02 $sec^{-1}$ min. |
| Grab Tensile Strength, min. in machine and x-machine direction | ASTM D4632 | 180 lbs. min. in machine direction, 100 lbs. min. in x-machine direction | 100 lbs. min. |
| Grab Failure Strain, in machine and x-machine direction | ASTM D4632 | 30% max. at 180 lbs. or more | |
| Ultraviolet (UV) Rediation stability | ASTM D4355 | 70% strength retained min., after 500 hrs. in weatherometer | 70% strength retained min., after 500 hrs. in weatherometer |

[1]All geotextile properties in Tables 1 through 6 are minimum average roll values (i.e., the test result for any sampled roll in a lot shall meet or exceed the values shown in the table).

[2]The test procedures used are essentially in conformance with the most recently approved ASTM geotextile test procedures, except for geotextile sampling and specimen conditioning, which are in accordance with WSDOT Test Methods 914 and 915, respectively. Copies of these test methods are available at the State Materials Laboratory in Tumwater.

[3]With seam located in the center of 8-inch long specimen oriented parallel to grip faces.

### *9-33.2(2) Geosynthetic Properties For Retaining Walls and Reinforced Slopes*

All geotextile properties provided in Table 7 are minimum average roll values. The average test results for any sampled roll in a lot shall meet or exceed the values shown in the table. The test procedures specified in the Table are in conformance with the most recently approved ASTM geotextile test procedures, except for geotextile sampling and specimen conditioning, which are in accordance with WSDOT Test Methods 914 and 915, respectively.

**Table 7:** Minimum properties required for geotextile reinforcement used in geosynthetic reinforced slopes and retaining walls.

| | | **Geotextile Property Requirements** |
|---|---|---|
| **Geotextile Property** | **Test Method** | **Woven/Nonwoven** |
| Water Permittivity | ASTM D4491 | .02 sec.$^{-1}$ min. |
| AOS | ASTM D4751 | .84 mm max. (No. 20 Sieve) |
| Grab Tensile Strength, min. in machine and x-machine direction | ASTM D4632 | 200 lbs/120 lbs min. |
| Grab Failure Strain, in machine and x-machine direction | ASTM D4632 | < 50% / ≥ 50% |
| Seam Breaking Strength[1] | ASTM D4632 | 160 lbs/100 lbs min. |

| | | |
|---|---|---|
| Puncture Resistance | ASTM D4833 | 63 lbs/50 lbs min. |
| Tear Strength, min.<br>in machine and x-machine direction | ASTM D4533 | 63 lbs/50 lbs min. |
| Ultraviolet (UV) Radiation Stability | ASTM D4355 | 70% (for polypropylene and polyethyelene) and 50% (for polyester) Strength Retained min., after 500 Hr. in weatherometer |

[1]Applies only to seams perpendicular to the wall face.

The ultraviolet (UV) radiation stability, ASTM D4355, shall be a minimum of 70% strength retained after 500 hours in the weatherometer for polypropylene and polyethylene geogrids and geotextiles, and 50% strength retained after 500 hours in the weatherometer for polyester geogrids and geotextiles.

### *9-33.2(3) Prefabricated Drainage Mat*

Prefabricated drainage mat shall have a single or double dimpled polymeric core with a geotextile attached and shall meet the following requirements:

**Table 8:** Minimum properties required for prefabricated drainage mats.

| Property | Test Method | Prefabricated Drainage Material/Geotextile Property Requirements |
|---|---|---|
| Width | | 12 inches min. |
| Thickness | ASTM D 5199 | 0.4 inches min. |
| Compressive Strength at Yield | ASTM D 1621 | 100 psi min. |
| In Plan Flow Rate<br>Gradient = 0.1,<br>Pressure = 5.5 psi | ASTM D 4716 | 5.0 gal. /min./ft. |

| | | |
|---|---|---|
| Gradient = 1.0, | | |
| Pressure = 14.5 psi | | 15.0 gal. /min./ft. |
| Geotextile - AOS | ASTM D 4751 | #60 US Sieve max. |
| Geotextile - Permittivity | ASTM D 4491 | > 0.4 $SEC^{-1}$ |
| Geotextile - Grab Strength | ASTM D 4632 | Nonwoven - 110 lb. min. |

Prefabricated drainage mats will be accepted based on the manufacturer's certificate of compliance that the material furnished conforms to these specifications. The Contractor shall submit the manufacturer's certificate of compliance to the WSDOT in accordance with Section 1-06.3.

### *9-33.3 Aggregate Cushion of Permanent Erosion Control Geotextile*

Aggregate cushion for permanent erosion control geotextile, Class A shall meet the requirements of Section 9-03.9(2). Aggregate cushion for permanent erosion control geotextile, Class B or C shall meet the requirements of Section 9-03.9(3) and 9-03.9(2).

### *9-33.4 Geosynthetic Approval and Acceptance*

### *9-33.4(1) Source Approval*

The Contractor shall submit to the WSDOT the following information regarding each geosynthetic proposed for use:

Manufacturer's name and current address,

Full product name,

Geotextile structure, including fiber/yarn type,

Geosynthetic polymer type(s) (for temporary and permanent geosynthetic retaining walls), and

Proposed geotextile use(s).

If the geosynthetic source has not been previously evaluated, or is not listed in the current WSDOT Qualified Products List (QPL), a sample of each proposed geosynthetic shall be submitted to the State Materials Laboratory in Tumwater for evaluation. After the sample and required information for each geosynthetic type have arrived at the State Materials Laboratory in Tumwater, a maximum of 14 calendar days will be required for this testing. Source approval will be based on conformance to the applicable values from Tables 1 through 8 in Section 9-33.2 and additional tables as specified in the Special Provisions. Source approval shall not be the basis of acceptance of specific lots of material unless the lot sampled can be clearly identified and the number of samples tested and approved meet the requirements of WSDOT Test Method 914.

Geogrid and geotextile products that are qualified for use in permanent geosynthetic retaining walls and reinforced slopes (Classes 1, 2, or both) are listed in the current WSDOT QPL.

For geogrid and geotextile products proposed for use in permanent geosynthetic retaining walls or reinforced slopes that are not listed in the current QPL, the Contractor shall submit test information and the calculations used in the determination of $T_{al}$ performed in accordance with WSDOT Standard Practice T925 to the State Materials Laboratory in Tumwater for evaluation. The Contracting Agency will require up to 30 calendar days after receipt of the information to complete the evaluation.

### *9-33.4(3) Acceptance Samples*

Samples will be randomly taken by the WSDOT at the job site to confirm that the geosynthetic meets the property values specified.

Approval will be based on testing of samples from each lot. A "lot" shall be defined for the purposes of this specification as all geosynthetic rolls within the consignment (i.e., all rolls sent the project site) that were produced by the same manufacturer during a continuous period of production at the same manufacturing plant and have the same product name. After the samples have arrived at the State Materials Laboratory in Tumwater, a maximum of 14 calendar days will be required for this testing.

If the results of the testing show that a geosynthetic lot, as defined, does not meet the properties required for the specified use as indicated in Tables 1 through 8 in Section 9-33.2, and additional tables as specified in the Special Provisions, the roll or rolls which were sampled will be rejected. Geogrids and geotextiles for temporary geosynthetic retaining walls shall meet the requirements of Table 7, and Table 10 in the Special Provisions. Geogrids and geotextiles for permanent geosynthetic retaining wall shall meet the requirements of Table 7, and Table 9 in the Special Provisions, and both geotextile and geogrid acceptance testing shall meet the required ultimate tensile strength $T_{ult}$ as provided in the current QPL for the selected product(s). If the selected product(s) are not listed in the current QPL, the result of the testing for $T_{ult}$ shall be greater than or equal to $T_{ult}$ as determined from the product data submitted and approved by the State Materials Laboratory during source approval.

Two additional rolls for each roll tested which failed from the lot previously tested will then be selected at random by the WSDOT for sampling and retesting. If the retesting shows that any of the additional rolls tested do not meet the required properties, the entire lot will be rejected. If the test results from all the rolls retested meet the required properties, the entire lot minus the roll(s) that failed will be accepted. All geosynthetic that has defects, deterioration, or damage, as determined by the WSDOT, will also be rejected. All rejected geosynthetic shall be replaced at no additional expense to the Contracting Agency.

### *9-33.4(4) Acceptance by Certificate of Compliance*

When the quantities of geosynthetic proposed for use in each geosynthetic application are less than or equal to the following amounts, acceptance shall be by Manufacturer's Certificate of Compliance:

| Application | Geotextile Quantity |
|---|---|
| Underground Drainage | 600 sq. yards |
| Soil Stabilization and Separation | 1,800 sq. yards |

| | |
|---|---|
| Permanent Erosion Control | 1,200 sq. yards |
| Temporary Silt Fence | All quantities |
| Temp. or Perm. Geosynthetic Retaining Wall | Not required |
| Prefabricated Drainage Mat | All quantities |

The Manufacturer's Certificate of Compliance shall include the following information about each geosynthetic roll to be used:

Manufacturer's name and current address,

Full product name,

Geosynthetic structure, including fiber/yarn type,

Polymer type (for all temporary and permanent geosynthetic retaining walls only),

Geosynthetic roll number,

Proposed geosynthetic use(s), and

Certified test results.

### *9-33.4(5) Approval of Seams*

If the geotextile seams are to be sewn in the field, the Contractor shall provide a section of sewn seam which can be sampled by the WSDOT before the geotextile is installed.

The seam sewn for sampling shall be sewn using the same equipment and procedures as will be used to sew the production seams. If production seams will be sewn in both the machine and cross-machine directions, the Contractor must provide sewn seams for sampling which are oriented in both the machine and cross-machine directions. The seams sewn for sampling must be at least 2 yards in length in each geotextile direction. If the seams are sewn in the factory, the WSDOT will obtain samples of the factory seam at random from any of the rolls to be used. The seam assembly description shall be submitted by the Contractor to the WSDOT and will be included with the seam sample obtained for testing. This description shall include the seam type, stitch type, sewing thread type(s), and stitch density.

## SECTION 9-34, PAVEMENT MARKING MATERIAL

### *9-34.5 Temporary Pavement Marking Tape*

This section is supplemented with the following:

Pavement marking masking tape shall conform to ASTM D 4592 Type 1 (removable), except that material shall be black, non-retroreflective and non-glaring.

# SECTION 9-35, TEMPORARY TRAFFIC CONTROL MATERIALS

Temporary traffic control materials in this section consist of various traffic communication, channelization and protection items described in Section 1-10 and listed below:

Stop/Slow Paddles

Construction Signs

Wood Sign Posts

Sequential Arrow Signs

Portable Changeable Message Signs

Barricades

Traffic Safety Drums

Barrier Drums

Traffic Cones

Tubular Markers

Warning Lights and Flashers

Truck-Mounted Attenuator

The basis for acceptance of temporary traffic control devices and materials shall be visual inspection by the WSDOT's representative. No sampling or testing will be done except that deemed necessary to support the visual inspection. Requests for Approval of Material and Qualified Products List submittals are not required. Certification for crashworthiness according to NCHRP 350 will be required as described in Section 1-10.2(3).

"MUTCD," as used in this section, shall refer to the current edition of the *Manual on Uniform Traffic Control Devices for Streets and Highways*. In the event of conflicts between the MUTCD and the contract provisions, then the provisions shall govern.

## *9-35.1 Stop/Slow Paddles*

Paddles shall conform to the requirements of the MUTCD, except that the minimum width shall be 24 inches.

## *9-35.2 Construction Signs*

Construction signs shall conform to the requirements of the MUTCD and shall meet the requirements of NCHRP Report 350 for Category 2 devices. Except as noted below, any sign/sign stand combination that satisfies these requirements will be acceptable.

Where aluminum sheeting is used to fabricate signs, it shall have a minimum thickness of 0.080 inches and a maximum thickness of 0.125 inches.

All orange background signs shall be fabricated with Type X reflective sheeting. All post-mounted signs with Type X sheeting shall use a nylon washer between the twist fasteners (screw heads, bolts or nuts) and the reflective sheeting.

Soft, fabric, roll-up signs will not be acceptable. Any fabric sign which otherwise meets the requirements of this section and was purchased prior to July 1, 2004, may be utilized until December 31, 2007. If a fabric sign is used, it shall have been fabricated with Type VI reflective sheeting.

### *9-35.3 Wood Sign Posts*

Use the charts below to determine post size for construction signs.

**One Post Installation**

| Post Size | Min. Sign Sq. Ft. | Max. Sign Sq. Ft. |
|---|---|---|
| 4x4 | - | 16.0 |
| 4x6 | 17.0 | 20.0 |
| 6x6 | 21.0 | 25.0 |
| 6x8 | 26.0 | 31.0 |

**Two Post Installation**

(For signs 5 feet or greater in width)

| Post Size | Min. Sign Sq. Ft. | Max. Sign Sq. Ft. |
|---|---|---|
| 4x4 | - | 16.0 |
| 4x6 | 17.0 | 36.0 |
| 6x6 | 37.0 | 46.0 |
| 6x8 | 47.0 | 75.0 * |

* The WSDOT shall determine post size for signs greater than 75 square feet.

Sign posts shall conform to the grades and usage listed below. Grades shall be determined by the current standards of the West Coast Lumber Inspection Bureau (WCLIB) or the Western Wood Products Association (WWPA).

| | |
|---|---|
| 4 x 4 | Construction grade (Light Framing, Section 122-b WCLIB) or (Section 40.11 WWPA) |
| 4 x 6 | No. 1 and better, grade (Structural Joists and Planks, Section 123-b WCLIB) or (Section 62.11 WWPA) |
| 6 x 6, 6 x 8, 8 x 10 | No. 1 and better, grade (Posts and Timbers, Section 131-b WCLIB) or (Section 80.11 WWPA) |

| | |
|---|---|
| 6 x 10, 6 x 12 | No. 1 and better, grade (Beams and Stringers, Section 130-b WCLIB) or (Section 70.11 WWPA) |

### *9-35.4 Sequential Arrow Signs*

Sequential Arrow Signs shall meet the requirements of the MUTCD supplemented with the following:

Sequential arrow signs furnished for this project shall be Type C.

The color of the light emitted shall be yellow.

The dimming feature shall be automatic, reacting to changes in light without a requirement for manual adjustment.

### *9-35.5 Portable Changeable Message Signs*

Portable Changeable Message Signs (PCMS) shall meet the requirements of the MUTCD and the following:

The PCMS shall employ one of the following technologies:

1. Fiber optic/shutter
2. Light emitting diode
3. Light emitting diode/shutter
4. Flip disk

Regardless of the technology, the PCMS shall meet the following general requirements:

- Be light emitting and must not rely solely on reflected light. The emitted light shall be generated using fiber optic or LED technology.
- Have a display consisting of individually controlled pixels no larger than 2 1/2 inch by 2 1/2 inch. If the display is composed of individual character modules, the space between modules must be minimized so alphanumeric characters of any size specified below can be displayed at any location within the matrix.
- When activated, the pixels shall display a yellow or orange image. When not activated, the pixels shall display a flat black image that matches the background of the sign face.
- Be capable of displaying alphanumeric characters that are a minimum of 18 inches in height. The width of alphanumeric characters shall be appropriate for the font. The PCMS shall be capable of displaying three lines of eight characters per line with a minimum of one pixel separation between each line.
- The PCMS message, using 18-inch characters, shall be legible by a person with 20/20 corrected vision from a distance of not less than 800 feet centered on an axis perpendicular to the sign face.
- The sign display shall be covered by a stable, impact resistant polycarbonate face. The sign face shall be non-glare from all angles and shall not degrade due to exposure to ultraviolet light.

- Be capable of simultaneously activating all pixels for the purpose of pixel diagnostics. Any sign that employs flip disk or shutter technology shall be programmable to activate the disks/shutters once a day to clean the electrical components. This feature shall not occur when the sign is displaying an active message.
- The light source shall be energized only when the sign is displaying an active message.

The PCMSpanels and related equipment shall be permanently mounted on a trailer with all controls and power generating equipment.

The PCMS shall be operated by a controller that provides the following functions:

1. Select any preprogrammed message by entering a code.
2. Sequence the display of at least five messages.
3. Blank the sign.
4. Program a new message, which may include animated arrows and chevrons.
5. Mirror the message currently being displayed or programmed.

### *9-35.6 Barricades*

Barricades shall conform to the requirements of the MUTCD supplemented by the further requirements of Standard Plan H-2.

### *9-35.7 Traffic Safety Drums*

Traffic safety drums shall conform to the requirements of the MUTCD and the following:

The drums shall have the following additional physical characteristics:

| | |
|---|---|
| Material | Fabricated from low-density polyethylene that meets the requirements of ASTM D 4976 and is UV stabilized. |
| Overall Width | 18-inch minimum in the direction(s)of traffic flow. |
| Shape | Rectangular, hexagonal, circular, or flat-sided semi-circular. |
| Color | The base color of the drum shall be fade resistant safety orange. |

The traffic safety drums shall be designed to accommodate at least one portable light unit. The method of attachment shall ensure that the light does not separate from the drum upon impact.

Drums and light units shall meet the crashworthiness requirements of NCHRP 350 as described in Section 1-10.2(3).

When recommended by the manufacturer, drums shall be treated to ensure proper adhesion of the reflective sheeting.

### *9-35.8 Barrier Drums*

Barrier drums shall be small traffic safety drums, manufactured specifically for traffic control purposes to straddle a concrete barrier and shall be fabricated from low-density polyethylene that meets the requirements of ASTM D 4976 and is UV stabilized.

The barrier drums shall meet the following general specifications:

| | |
|---|---|
| Total height | 22 in., ± 1 in. |
| Cross-section | hollow oval |
| | 10 in. X 14 in., ± 1 in. |
| Formed support legs length | 13 in., ± 1 in. |
| Space between legs | 6 1/4 in. min. |
| (taper to fit conc. barrier) | |
| Weight | 33 lb. ± 4 lb. |
| | with legs filled with sand. |
| Color | Fade resistant safety orange. |

Barrier drums shall have three 4-inch reflective white stripes, (one complete and two partial). Stripes shall be fabricated from Type III or Type IV reflective sheeting.

When recommended by the manufacturer, barrier drums shall be treated to ensure proper adhesion of the reflective sheeting.

### *9-35.9 Traffic Cones*

Cones shall conform to the requirements of the MUTCD, except that the minimum height shall be 28 inches.

### *9-35.10 Tubular Markers*

Tubular markers shall conform to the requirements of the MUTCD, except that the minimum height shall be 28 inches.

Pavement-mounted tubular markers shall consist of a surface-mounted assembly which uses a separate base with a detachable tubular marker held in place by means of a locking device.

### *9-35.11 Warning Lights and Flashers*

Warning lights and flashers shall conform to the requirements of the MUTCD.

### *9-35.12 Truck-Mounted Attenuator*

The Truck-Mounted Attenuator (TMA) shall be selected from the approved units listed on the Qualified Products List. The TMA shall be mounted on a vehicle with a minimum weight of 15,000 pounds and a maximum weight in accordance with the manufacturer's recommendations. Ballast used to obtain the minimum weight requirement, or any other object that is placed on the vehicle shall be securely anchored such that it will be retained on the vehicle during an impact. The Contractor shall provide certification that the unit complies with NCHRP 230 or 350 requirements. Units fabricated after 1998 must comply with NCHRP 350 requirements.

The TMA shall have an adjustable height so that it can be placed at the correct elevation during usage and to a safe height for transporting. If needed, the Contractor shall install additional lights to provide fully visible brake lights at all times.

The TMA unit shall have a chevron pattern on the rear of the unit. The standard chevron pattern shall consist of 4-inch yellow stripes, alternating non-reflective black and reflective yellow sheeting, slanted at 45 degrees in an inverted "V" with the "V" at the center of the unit.