

Division 8 Miscellaneous Construction

8-01 Erosion Control and Water Pollution Control

8-01.1 Description

This Work consists of furnishing, installing, maintaining, removing and disposing of best management practices (BMPs), as defined in the Washington Administrative Code (WAC) 173-201A, to manage erosion and water quality in accordance with these Specifications and as shown in the Plans or as designated by the Engineer.

The Contracting Agency may have a National Pollution Discharge Elimination System Construction Stormwater General Permit (CSWGP) as identified in the Contract Special Provisions. The Contracting Agency may or may not transfer coverage of the CSWGP to the Contractor when a CSWGP has been obtained. The Contracting Agency may not have a CSWGP for the project but may have another water quality related permit as identified in the Contract Special Provisions or the Contracting Agency may not have water quality related permits but the project is subject to applicable laws for the Work. Section 8-01 covers all of these conditions.

8-01.1(1) Definitions

1. pH Affected Stormwater
 - a. Stormwater contacting green concrete (concrete that has set/stiffen but is still curing), recycled concrete, or engineered soils (as defined in the Construction Stormwater General Permit (CSWGP)) as a natural process
 - b. pH monitoring shall be performed in accordance with the CSWGP, or Water Quality Standards (WQS in accordance with WAC 173-201A (surface) or 173-200C (ground)) when the CSWGP does not apply
 - c. May be neutralized and discharged to surface waters or neutralized and infiltrated
2. pH Affected Non-Stormwater
 - a. Conditionally authorized in accordance with CSWGP Special Condition S.1.C., uncontaminated water contacting green concrete, recycled concrete, or engineered soils (as defined in the CSWGP)
 - b. Shall not be categorized as cementitious wastewater/concrete wastewater, as defined below
 - c. Shall be managed and treated in accordance with the CSWGP, or WQS when the CSWGP does not apply
 - d. pH adjustment and dechlorination may be necessary, as specified in the CSWGP or in accordance with WQS when the CSWGP does not apply
 - e. May be neutralized, treated, and discharged to surface waters or neutralized and infiltrated in accordance with the CSWGP, with the exception of water-only shaft drilling slurry. Water-only shaft drilling slurry may be treated, neutralized, and infiltrated but not discharged to surface waters (refer to Special Conditions S1.C. Authorized Discharges and S1.d Prohibited Discharges of the CSWGP)
3. Cementitious Wastewater/Concrete Wastewater
 - a. All water that comes into contact with fine cementitious particles or slurry; water used in the production, placement and/or clean-up of cementitious products; water used to cut, grind, wash, or otherwise modify cementitious products

- b. When water, including stormwater, commingles with cementitious wastewater/ concrete wastewater, the resulting water is considered cementitious wastewater/ concrete wastewater and shall be managed to prevent discharge to waters of the State, including ground water
- c. CSWGP Examples include: water used for or resulting from concrete truck/ mixer/pumper/tool/chute rinsing or washing, concrete saw cutting and surfacing (sawing, coring, grinding, roughening, hydro-demolition, bridge and road surfacing)
- d. Cannot be neutralized and discharged or infiltrated

8-01.2 **Materials**

Materials shall meet the requirements of the following sections:

Corrugated Polyethylene Drain Pipe	9-05.1(6)
Quarry Spalls	9-13.1(5)
Seed	9-14.3
Mulch and Amendments	9-14.5
Tackifier	9-14.5(7)
Erosion Control Devices	9-14.6
Plant Materials	9-14.7
Construction Geotextile	9-33

Cementitious materials shall not be used for Work defined in Section 8-01, unless otherwise indicated.

8-01.3 **Construction Requirements**

8-01.3(1) **General**

Adaptive management shall be employed throughout the duration of the project for the implementation of erosion and water pollution control permit requirements for the current condition of the project site. The adaptive management includes the selection and utilization of BMPs, scheduling of activities, prohibiting unacceptable practices, implementing maintenance procedures, identifying and addressing sources of erosion and sedimentation, and other managerial practices that, when used singularly or in combination, prevent or reduce the release of pollutants to waters of the State. The adaptive management shall use the means and methods identified in this section and means and methods identified in the Washington State Department of Transportation's *Temporary Erosion and Sediment Control Manual* or the Washington State Department of Ecology's *Stormwater Management Manuals* for construction stormwater.

The Contractor shall install a high visibility fence along the lines shown in the Plans or as instructed by the Engineer.

Throughout the life of the project, the Contractor shall preserve and protect the delineated preservation area, acting immediately to repair or restore all damaged or removed high visibility fencing.

All discharges to surface waters shall comply with surface water quality standards as defined in Washington Administrative Code (WAC) Chapter 173-201A. All discharges to groundwater shall comply with groundwater quality standards WAC Chapter 173-200. The Contractor shall comply with the CSWGP when the project is covered by the CSWGP.

Work, at a minimum, shall include the implementation of:

1. Sediment control measures prior to and throughout ground disturbing activities to ensure all discharges from construction areas receive treatment prior to discharging from the site.
2. Flow control measures to prevent erosive flows from developing.

- 3. Water management strategies and pollution prevention measures to prevent contamination of waters that have the potential to be discharged offsite, including to surface waters or the ground.
- 4. Erosion control and water management strategies to limit contamination of water within the project limits.
- 5. Erosion control measures to stabilize erodible earth not undergoing active work.
- 6. Maintenance of BMPs to ensure continued compliant performance.
- 7. Immediate corrective action if evidence suggests construction activity is not in compliance. Evidence includes sampling data, olfactory or visual evidence such as the presence of suspended sediment, turbidity, discoloration, oil sheen, or any accumulation of water within proximity to pH-modifying substances within the project and prior to discharge.

The Contractor shall coordinate this Work with permanent drainage and roadside restoration Work the Contract requires.

Clearing, grubbing, excavation, borrow, or fill within the Right of Way shall never expose more erodible earth than as listed below:

Western Washington (West of the Cascade Mountain Crest)	
May 1 through September 30	17 Acres
October 1 through April 30	5 Acres

Eastern Washington (East of the Cascade Mountain Crest)	
April 1 through October 31	17 Acres
November 1 through March 31	5 Acres

The Engineer may increase or decrease the limits based on project conditions.

Erodible earth is defined as a surface where soils, grindings, or other materials may be capable of being displaced and transported by rain, wind, or surface water runoff.

For the purpose of this section, active work is considered ongoing construction activities in which land disturbing operations are taking place, including clearing, grading or excavation.

At a minimum, unworked erodible earth, whether at final grade or not, shall be covered with erosion control BMPs within the specified time period (see the table below) and in advance of forecasted wet weather.

Western Washington (West of the Cascade Mountain Crest)	
October 1 through April 30	2 days maximum
May 1 to September 30	7 days maximum

Eastern Washington (East of the Cascade Mountain Crest)	
October 1 through June 30	5 days maximum
July 1 through September 30	10 days maximum

When applicable, the Contractor shall be responsible for all Work required for compliance with CSWGP including annual permit fees.

If the Engineer, under Section 1-08.6, orders the Work suspended, the Contractor shall continue to comply with this division during the suspension.

8-01.3(1)A Submittals**8-01.3(1)A1 Temporary Erosion and Sediment Control Plan**

Temporary Erosion and Sediment Control (TESC) Plans consist of a narrative section and plan sheets that meets Ecology's Stormwater Pollution Prevention Plan (SWPPP) requirement in the CSWGP. For projects that do not require a CSWGP but have the potential to discharge to surface waters of the state, an abbreviated TESC plan shall be used, which may consist of a narrative and/or plan sheets and shall demonstrate compliance with applicable codes, ordinances and regulations, including the water quality standards for surface waters, Chapter 173-201A of the Washington Administrative Code (WAC) and water quality standards for groundwaters in accordance with Chapter 173-200 WAC.

The Contractor shall either adopt the TESC Plan in the Contract or develop a new TESC Plan. If the Contractor adopts the TESC Plan in scenarios in which the CSWGP is transferred to the Contractor, the Contractor shall modify the TESC Plan to match the Contractor's schedule, method of construction, and to include all areas that will be used to directly support construction activity such as equipment staging yards, material storage areas, or borrow areas. TESC Plans shall include all high visibility fence shown in the Plans. All TESC Plans shall meet the requirements of the current edition of the WSDOT *Temporary Erosion and Sediment Control Manual* M 3109 and be adaptively managed throughout construction based on site inspections and required sampling to maintain compliance with the CSWGP, or WQS when no CSWGP applies. The Contractor shall develop a schedule for implementation of the TESC work and incorporate it into the Contractor's progress schedule.

The Contractor shall submit their TESC Plan (either the adopted plan or new plan) as Type 2 Working Drawings. The Contractor shall not proceed with ground disturbing Work until comments from the Engineer have been addressed. At the request of the Engineer, updated TESC Plans shall be submitted as Type 1 Working Drawings.

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

The Contractor shall identify the ESC Lead at the preconstruction discussions and in the TESC Plan. 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 the Washington State Department of Ecology. The ESC Lead must be onsite or on call at all times throughout construction. The ESC Lead shall be listed on the Emergency Contact List required under Section 1-05.13(1).

The ESC Lead shall implement the TESC Plan. Implementation shall include, but is not limited to:

1. Installing, adaptively managing, and maintaining all temporary erosion and sediment control BMPs to assure continued performance of their intended function. Damaged or inadequate BMPs shall be corrected immediately. Impacts beyond the project perimeter shall be immediately corrected.
2. Updating the TESC Plan to reflect current field conditions.
3. Discharge sampling and submitting Discharge Monitoring Reports (DMRs) to Ecology in accordance with the CSWGP.
4. Develop and maintain the Site Log Book as defined in the CSWGP. When the Site Log Book or portion thereof is electronically developed, the electronic documentation must be accessible onsite.
5. Develop and maintain a BMP tracking table to show that identified TESC compliance issues are fully resolved within 10 calendar days. The table shall include the date an issue was identified, the date corrective actions commenced, a description of how it was resolved, and the date the issue was fully resolved. The BMP tracking table shall be included as part of the Site Log Book.

The ESC Lead shall inspect all areas disturbed by construction activities, all on-site erosion and sediment control BMPs, and all stormwater discharge points at least once every calendar week and in advance of wet weather.

The ESC Lead shall additionally inspect for signs of erosion, sedimentation, and discharges from the project limits within 24 hours following discrete storm events that may have caused onsite erosion or a need to maintain onsite BMPs.

Inspections of temporarily stabilized inactive sites may be reduced to once every calendar month following confirmation from the Contracting Agency that temporary BMPs installation is consistent with the Standard Plans and are performing in accordance with Contract requirements.

For projects with a CSWGP, the Washington State Department of Ecology's Erosion and Sediment Control Site Inspection Form, located at <https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits/Construction-stormwater-permit> shall be completed for each inspection and a copy shall be submitted to the Engineer no later than the end of the next working day following the inspection.

8-01.3(1)C Water Management

Unless site water is to be managed in accordance with the conditions of a waste discharge permit from a local permitting authority, site water shall be managed as follows:

8-01.3(1)C1 Disposal of Dewatering Water

To manage turbid dewatering water encountered onsite, it must pass through BMPs to reduce sedimentation prior to discharging to a sediment trap or sediment pond. Turbid dewatering water disposal options may include sheet flow dispersion and infiltration within vegetation onsite, transport in a vehicle for off-site legal disposal, Ecology-approved on-site chemical treatment, sanitary or combined sewer discharge with local sewer district approval, or use of a sedimentation bag that discharges to a ditch or swale for small volumes of localized dewatering. Highly turbid or contaminated dewatering water must be handled separately from stormwater.

Clean and non-turbid dewatering water may be discharged to systems tributary to or directly into surface waters of the state provided it does not cause erosion or flooding of receiving waters, in accordance with the CSWGP and water quality standards in WAC 173-201A.

8-01.3(1)C2 Process Wastewater

Wastewater generated on-site as a byproduct of a construction process shall not be discharged to surface waters of the State. Some sources of process wastewater may be infiltrated in accordance with the CSWGP. Some sources of process wastewater may be disposed via independent disposal and treatment alternatives in compliance with the applicable WACs and permits.

8-01.3(1)C3 Shaft Drilling Slurry Wastewater

Wastewater generated on-site during shaft drilling activity shall be managed and disposed of in accordance with the requirements below. No shaft drilling slurry wastewater shall be discharged to surface waters of the State. Neither the sediment nor liquid portions of the shaft drilling slurry wastewater shall be contaminated, as detectable by visible or olfactory indication (e.g., chemical sheen or smell).

1. Water-only shaft drilling slurry or water slurry with accepted flocculants may be infiltrated on-site. Flocculants used shall meet the requirements of Section 9-14.6(1) or shall be chitosan products listed as General Use Level Designation (GULD) on the Department of Ecology's stormwater treatment technologies webpage for construction treatment. Infiltration is permitted if the following requirements are met:

- a. Wastewater shall have a pH of 6.5 – 8.5 prior to discharge.
- b. The amount of flocculant added to the slurry shall be kept to the minimum needed to adequately settle out solids. The flocculant shall be thoroughly mixed into the slurry.
- c. The slurry removed from the shaft shall be contained in a leak proof cell or tank for a minimum of 3 hours.
- d. The infiltration rate shall be reduced if needed to prevent wastewater from leaving the infiltration location. The infiltration site shall be monitored regularly during infiltration activity. All wastewater discharged to the ground shall fully infiltrate and discharges shall stop before the end of each work day.
- e. Drilling spoils and settled sediments remaining in the containment cell or tank shall be disposed of in accordance with Section 6-19.3(4)F.
- f. Infiltration locations shall be in upland areas at least 150 feet away from surface waters, wells, on-site sewage systems, aquifer sensitive recharge areas, sole source aquifers, well head protection areas, and shall be marked on the plan sheets before the infiltration activity begins.
- g. Prior to infiltration, the Contractor shall submit a Shaft Drilling Slurry Wastewater Management and Infiltration Plan as a Type 2 Working Drawing. This Plan shall be kept on-site, adapted if needed to meet the construction requirements, and updated to reflect what is being done in the field. The Working Drawing shall include, at a minimum, the following information:
 - i. Plan sheet showing the proposed infiltration location and all surface waters, wells, on-site sewage systems, aquifer-sensitive recharge areas, sole source aquifers, and well-head protection areas within 150 feet.
 - ii. The proposed elevation of soil surface receiving the wastewater for infiltration and the anticipated phreatic surface (i.e., saturated soil).
 - iii. The source of the water used to produce the slurry.
 - iv. The estimated total volume of wastewater to be infiltrated.
 - v. The accepted flocculant to be used (if any).
 - vi. The controls or methods used to prevent surface wastewater runoff from leaving the infiltration location.
 - vii. The strategy for removing slurry wastewater from the shaft and containing the slurry wastewater once it has been removed from the shaft.
 - viii. The strategy for monitoring infiltration activity and adapting methods to ensure compliance.
 - ix. A contingency plan that can be implemented immediately if it becomes evident that the controls in place or methods being used are not adequate.
 - x. The strategy for cleaning up the infiltration location after the infiltration activity is done. Cleanup shall include stabilizing loose sediments on the surface within the infiltration area generated as a byproduct of suspended solids in the infiltrated wastewater or soil disturbance associated with BMP placement and removal.
2. Shaft drilling mineral slurry, synthetic slurry, or slurry with polymer additives not allowed for infiltration shall be contained and disposed of by the Contractor at an accepted disposal facility in accordance with Section 3-03.3(7)C. Spoils that have come into contact with mineral slurry shall be disposed of in accordance with Section 6-19.3(4)F.

8-01.3(1)C4 Management of Off-Site Water

Any offsite water that enters the project limits must be managed in accordance with the Permit.

Prior to clearing and grubbing and throughout the life of the Project, the Contractor shall intercept all sources of off-site surface water and overland flow that will run-on to the project. Off-site surface water run-on shall be diverted through or around the project in a way that does not introduce construction related pollution. It shall be diverted to its preconstruction discharge location in a manner that does not increase preconstruction flow rate and velocity and protects contiguous properties and waterways from erosion. The Contractor shall submit a Type 2 Working Drawing consisting of the method for performing this Work.

8-01.3(1)C5 Water Management for In-Water Work Below Ordinary High Water Mark (OHWM)

Work over surface waters of the state (defined in WAC 173-201A-010) or below the OHWM (defined in RCW 90.58.030) shall comply with water quality standards for surface waters of the state of Washington.

8-01.3(1)C6 Environmentally Acceptable Hydraulic Fluid

All equipment containing hydraulic fluid that extends from a bridge deck over surface waters of the state or below the OHWM, shall be equipped with a biodegradable hydraulic fluid. The fluid shall achieve either a Pw1 Environmental Persistence Classification stated in ASTM D6046 ($\geq 60\%$ biodegradation in 28 days) or equivalent standard. Alternatively, hydraulic fluid that meets International Organization for Standardization (ISO 15380), the European Union Ecolabel, or equivalent certification will also be accepted.

The Contractor shall submit a Type 1 Working Drawing consisting of a manufacturer catalog cut of the hydraulic fluid used.

The designation of biodegradable hydraulic fluid does not mean fluid spills are acceptable. The Contractor shall respond to spills to land or water in accordance with the Contract, the associated SPCC Plan, and all applicable local, state, and federal regulations.

8-01.3(1)C7 Turbidity Curtain

All Work for the turbidity curtain shall be in accordance with the manufacturer's recommendations for the site conditions. Removal procedures shall be developed and used to minimize silt release and disturbance of silt. The Contractor shall submit a Type 2 Working Drawing, detailing product information, installation and removal procedures, equipment and workforce needs, maintenance plans, and emergency repair/replacement plans.

Turbidity curtain materials, installation, and maintenance shall be sufficient to comply with water quality standards.

The Contractor shall notify the Engineer 10 days in advance of removing the turbidity curtain. All components of the turbidity curtain shall be removed from the project.

8-01.3(1)D Dispersion/Infiltration

Water shall be conveyed only to dispersion or infiltration areas away from slopes adjacent to surface waters, as designated in the TESC Plan or to sites approved by the Engineer. Water shall be conveyed to designated dispersion areas at a rate such that, when runoff leaves the area and enters waters of the State, turbidity standards are achieved. Water shall be conveyed to designated infiltration areas at a rate that does not produce surface runoff and discharges from the construction site. Source control shall be implemented when water is visibly turbid to ensure ongoing infiltration capabilities. pH-affected stormwater and conditionally authorized non-stormwater shall be neutralized prior to dispersion and infiltration.

8-01.3(1)E Detention/Retention Pond Construction

Permanent or temporary, ponds shall be constructed before beginning other grading and excavation Work in the area that drains into that pond. Detention/retention ponds may be constructed concurrently with grading and excavation when allowed by the Engineer. Ponds shall be located away from slopes adjacent to surface waters. Stabilized temporary conveyances shall be installed concurrently with grading in accordance with the TESC Plan so that newly graded areas drain to the pond as they are exposed. Source control shall be implemented when water is visibly turbid to ensure ongoing infiltration capabilities. pH-affected stormwater and conditionally authorized non-stormwater shall be neutralized prior entering detention/retention ponds.

8-01.3(2) Temporary Seeding and Mulching**8-01.3(2)A Preparation for Application**

A cleated roller, crawler tractor, or similar equipment, which forms longitudinal depressions at least 2 inches deep shall be used for compaction and preparation of the surface to be seeded. The entire area shall be uniformly covered with longitudinal depressions formed perpendicular to the natural flow of water on the slope. The soil shall be conditioned with sufficient water so the longitudinal depressions remain in the soil surface until completion of the seeding.

Prior to temporary mulching, the surface to be mulched shall be prepared in a way that ensures the mulch will remain in place and achieve its intended erosion and sediment control function.

8-01.3(2)B Temporary Seeding

Temporary grass seed shall be a commercially prepared mix, made up of low growing grass species that will grow without irrigation at the project location, and accepted by the Engineer. The application rate shall be two pounds per 1000 square feet.

The Contractor shall notify the Engineer not less than 24 hours in advance of seeding operations and shall not begin the Work until areas prepared or designated for seeding have been accepted. Following the Engineer's acceptance, seeding of the accepted slopes shall begin immediately.

Temporary seeding may be sown at any time allowed by the Engineer. Temporary seeding shall be sown by one of the following methods:

1. A hydro seeder that utilizes water as the carrying agent and maintains continuous agitation through paddle blades. It shall have an operating capacity sufficient to agitate, suspend, and mix into a homogeneous slurry the specified amount of seed and water or other material. Distribution and discharge lines shall be large enough to prevent stoppage and shall be equipped with a set of hydraulic discharge spray nozzles that will provide a uniform distribution of the slurry.
2. Blower equipment with an adjustable disseminating device capable of maintaining a constant, measured rate of material discharge that will ensure an even distribution of seed at the rates specified.
3. Power-drawn drills or seeders.
4. Areas in which the above methods are impractical may be seeded by hand methods.

When seeding by hand, the seed shall be incorporated into the top $\frac{1}{4}$ inch of soil by hand raking or other method that is allowed by the Engineer.

Tracer used in conjunction with seed applied using a hydroseeder shall not be harmful to plant, aquatic, or animal life. If Short-Term Mulch is used as a tracer, the application rate shall not exceed 250 pounds per acre. Seed shall not be used as an erosion control BMP unless combined with an approved mulch material.

8-01.3(2)C Vacant**8-01.3(2)D Temporary Mulching**

Temporary mulch shall be straw, wood strand, or HECF mulch and shall be used for the purpose of erosion control by protecting bare soil surface from particle displacement. Mulch shall not be applied below the anticipated water level of ditch slopes, pond bottoms, and stream banks. At a minimum, HECF mulch shall not be used within the 100 year water surface elevation (WSE). When HECF mulch contains tackifiers, placement considerations shall be in accordance with Section 8-01.3(2)E. Non-HECF mulches applied below the anticipated water level shall be removed or anchored down so that it cannot move or float, at no additional expense to the Contracting Agency.

Straw or wood strand mulch shall be applied at a rate to achieve at least 95 percent visual blockage of the soil surface. Straw mulch shall be suitable for spreading with mulch blower equipment.

Short Term Mulch shall be hydraulically applied at the rate of 2500 pounds per acre and may be applied in one lift. Short-Term Mulch shall not be used in conjunction with permanent seeding.

Moderate Term Mulch and Long Term Mulch shall be hydraulically applied at the rate of 3500 pounds per acre with no more than 2000 pounds applied in a single lift. Moderate-Term Mulch shall not be used in conjunction with permanent seeding.

HECF mulch shall be applied to prepared soil and protected from concentrated flow, including overland flow.

Mulch sprayed on signs or sign Structures shall be removed the same day.

Areas not accessible by mulching equipment shall be mulched by accepted hand methods.

8-01.3(2)E Tackifiers

Tackifiers applied using a hydroseeder shall have a mulch tracer added to visibly aid uniform application. This tracer shall not be harmful to plant, aquatic, or animal life. Tackifier used for erosion control shall be combined with soil covering BMPs. A minimum of 125 pounds per acre and a maximum of 250 pounds per acre of Short-Term Mulch shall be used as a tracer. Tackifier shall be mixed and applied in accordance with the manufacturer's recommendations. Tackifier shall not be applied directly to water or allowed to enter surface water, including on slopes that flow to surface water.

Soil Binding Using Polyacrylamide (PAM) – The PAM shall be applied on bare soil completely dissolved and mixed in water or applied as a dry powder. Dissolved PAM shall be applied at a rate of not more than $\frac{3}{4}$ pound per 1,000 gallons of water per acre. A minimum of 200 pounds per acre of Short-Term Mulch shall be applied with the dissolved PAM. Dry powder applications may be at a rate of 5 pounds per acre using a hand-held fertilizer spreader or a tractor-mounted spreader.

PAM shall be applied only to areas that drain to completed sedimentation control BMPs in accordance with the TESC Plan. PAM may be reapplied on actively worked areas after a 48-hour period.

PAM shall not be applied during rainfall or to saturated soils.

8-01.3(3) Placing Erosion Control Blanket

Erosion Control Blankets are used as an erosion prevention device and to enhance the establishment of vegetation. Erosion control blankets shall be installed according to the manufacturer's recommendations.

When used to enhance the establishment of seeded areas, seeding shall be done prior to blanket installation.

Select erosion control blanket material for an area based on the intended function: slope or ditch stabilization, and site specific factors including soil, slope gradient, rainfall, and flow exposure. Erosion Control Blankets shall not be used on slopes or in ditches that exceed the manufacturer's recommendations and shall consist entirely of natural plant fibers uncontaminated by synthetic materials.

8-01.3(4) Placing Compost Blanket

Compost blankets are used for erosion control. Compost blanket shall only be placed on ground surfaces that are steeper than 3-foot horizontal and 1-foot vertical though steeper slopes shall be broken by wattles or compost socks placed according to the [Standard Plans](#). Compost shall be placed to a depth of 3 inches over bare soil. An organic tackifier shall be placed over the entire composted area when dry or windy conditions are present or expected. The tackifier shall be applied immediately after the application of compost to prevent compost from leaving the composted area. When compost is combined with tackifier, the requirements specified in Section 8-01.3(2)E apply.

Medium compost shall be used for the compost blanket. Compost may serve the purpose of soil amendment as specified in Section 8-02.3(6).

8-01.3(5) Plastic Covering

Plastic covering shall only be used when permeable soil covering BMPs are not feasible or prohibited.

Erosion Control – Plastic coverings used to temporarily cover stockpiled materials, slopes or bare soils shall be installed and maintained in a way that prevents water from intruding under the plastic and prevents the plastic cover from being damaged by wind. Plastic coverings shall be placed with at least a 12-inch overlap of all seams and be a minimum of 6 mils thick. Soil stabilization and energy dissipation BMPs shall be used along the base of slopes and stockpiles to minimize the erosive energy flows coming off the plastic (e.g., toe of slope). The Contractor shall prevent clean runoff from plastic from eroding bare soil. Flows from plastic shall be directed to stabilized outlet areas.

Containment – Plastic coverings used to line concrete washout areas, contain wastewaters, or used in secondary containment to prevent spills, shall be seamless to prevent infiltration and be a minimum of 10 mils thick.

Vegetation Management – Plastic covering shall be clear when placed over areas that have been seeded and shall be black when placed over areas where vegetation growth is to be inhibited. Plastic covering for vegetation management shall be a minimum of 4 mils thick.

8-01.3(6) Check Dams

Check dams are used as an erosion and sediment control device in channels or conveyance areas. Check dams shall be installed as soon as construction will allow, or when directed by the Engineer. The Contractor may substitute a different check dam material, in lieu of what is specified in the contract, with approval of the Engineer. Straw bales and straw wattles shall not be used as check dams. The check dam is a temporary or permanent structure, built across a minor channel placed perpendicular to the flow of water. Water shall not flow freely through the check dam structure. Check dams shall be constructed in a manner that creates a ponding area upstream of the dam to allow pollutants to settle, with water from increased flows channeled over a spillway in the check dam. The check dam shall be constructed to prevent erosion in the area below the spillway. The outer edges shall extend up the sides of the conveyance to prevent water from going around the check dam. Check dams shall be of sufficient height to maximize detention, without causing water to leave the ditch.

Coir logs and compost socks used as check dams shall not be trenched in and shall be installed as shown in the [Standard Plans](#).

When wattles, coir logs, and compost socks are used as check dams they shall be measured and paid as check dam in accordance with Section 8-01.4 and 8-01.5.

8-01.3(6)A Coir Log

Coir logs are used as erosion and sediment control or bank stabilizing device. Coir logs shall be laid out, spaced, staked, and installed in accordance with the [Standard Plans](#).

Live stakes can be used in addition to, but not as a replacement for, wooden stakes.

8-01.3(7) Stabilized Construction Entrance

Temporary stabilized construction entrance shall be constructed in accordance with the [Standard Plans](#), prior to construction vehicles entering the roadway from locations that generate sediment track out on the roadway. Material used for stabilized construction entrance shall be free of pH modifying and extraneous materials that may cause or contribute to track out or turbid water discharges.

When the stabilized entrance no longer prevents track out of sediment or debris or turbid water discharges, the Contractor shall either rehabilitate the existing entrance to original condition, or construct a new entrance.

When the Contract requires a tire wash in conjunction with the stabilized entrance, the Contractor shall include details for the tire wash and the method for containing and treating the turbid runoff as part of the TESC Plan. All vehicles leaving the site shall stop and wash sediment from their tires. Tire wash or wheel wash water must be managed in accordance with Section 8-01.3(1)C2 and shall not discharge or infiltrate.

8-01.3(8) Street Cleaning

Self-propelled pickup street sweepers shall be used to remove and collect residual sediment and other debris from the Roadway. The street sweeper shall effectively collect these materials and prevent them from being washed or blown off the Roadway or into waters of the State. Street sweepers shall not generate fugitive dust and shall be designed and operated in compliance with applicable air quality standards. When street cleaning is implemented, the Contractor shall immediately initiate source control adaptive management strategies to address and rectify the contributing erosion and sedimentation factors.

Material collected by the street sweeper shall be disposed of in accordance with Section 3-03.3(7)C.

When allowed by the Engineer, power broom sweepers may be used in non-sensitive areas. The broom sweeper shall sweep dirt and other debris from the roadway into the work area. The swept material shall be prevented from entering or washing into waters of the State.

Street washing with water will require the concurrence of the Engineer.

8-01.3(9) Sediment Control Barriers

Sediment control barriers shall be installed in accordance with TESC Plan or manufacturer's recommendations in the areas of clearing, grubbing, earthwork or drainage prior to starting those activities. The Contractor shall prioritize the use of natural sediment control barriers, such as topsoil berms or compost socks.

The sediment control barriers shall be maintained until the soils are stabilized.

8-01.3(9)A Fencing**8-01.3(9)A1 High Visibility Fencing**

High visibility fencing (HVF) shall be orange in color and installed along the site preservation lines shown in the Plans or as specified by the Engineer. Post spacing and attachment of the fencing material to the posts shall be as shown in the [Standard Plans](#). The HVF shall not be fastened to trees.

8-01.3(9)A2 Silt Fence

Silt fence shall perform as a sediment control device to prevent sediment and turbid water from leaving project boundaries, to manage stormwater within the site, or to create small detention areas. Silt fence shall be installed at locations that do not receive concentrated water flow, as shown in the Plans. Geosynthetic silt fence shall be black in color. Fencing shall be securely attached to the posts and support system in accordance with manufacturer's guidelines and in a manner that reduces the potential for tearing. Post spacing and attachments shall be as shown in the Standard Plans.

Fence material shall be sewn together at the point of manufacture, or at a location approved by the Engineer, to form material lengths as required and in a manner that prevents turbid water from escaping the seam. All sewn seams and overlaps shall be located at a support post.

Posts shall be either wood or steel. Wood posts shall have minimum dimensions of 1¼ by 1¼ inches by the minimum length shown in the Plans and shall be free of defects such as knots, splits, or gouges.

When water and sediment deposits reach approximately ⅓ the height of the silt fence, the deposits shall be removed and the soil stabilized in accordance with Section 8-01.3(15).

If trenching is not feasible due to rocky soils or not advisable due to proximity to a downslope sensitive area, a different sediment control device that does not require trenching shall be used in place of silt fence.

Backup support is needed for silt fence in areas where extra strength may be required, such as the toe of steep cut or fill slopes or areas where equipment may push excessive soils toward the fence. When backup support is used, wire shall have a maximum mesh spacing of 2 inches, and the plastic mesh shall be as resistant to ultraviolet radiation as the geotextile it supports. The strength of the wire or plastic mesh shall be equivalent to or greater than as required in Section 9-33.2(1), Table 6, for unsupported geotextile (i.e., 180 lbs. grab tensile strength in the machine direction). Post spacing and attachments shall be as shown in the [Standard Plans](#).

8-01.3(9)A3 High Visibility Silt Fence

High visibility silt fence (HVSF) shall be orange in color and only be used for the dual purpose of demarcating site preservation lines and a sediment control device in a location where high visibility mesh fence and black silt fence would otherwise be used together at same location. If use of HVSF is allowed the geotextile material shall meet the material requirements of Section 9-33.2(1), Table 6. Fencing shall be securely attached to the posts and support system in accordance with manufacturer's guidelines and in a manner that reduces the potential for tearing. Post spacing and attachments shall be as shown in the [Standard Plans](#). HVSF shall be no less than 48 inches above ground level and a minimum of 4 inches of fabric shall be trenched below ground level to prevent water and sediment from bypassing beneath the fencing.

Posts shall be either wood or steel, 1¼ by 1¼ inches by the minimum length shown in the Plans, and shall be free of defects such as knots, splits, or gouges. Backup support is needed for high visibility silt fence (HVSF) in areas where extra strength may be required, such as the toe of steep cut or fill slopes or areas where equipment may push excessive soils toward the sensitive or protected areas. When backup support is used, wire shall

have a maximum mesh spacing of 2 inches, and the plastic mesh shall be as resistant to ultraviolet radiation as the geotextile it supports. The strength of the wire or plastic mesh shall be equivalent to or greater than as required in Section 9-33.2(1), Table 6, for unsupported geotextile (i.e., 180 lbs. grab tensile strength in the machine direction). Post spacing shall be as shown in the [Standard Plans](#).

When water and sediment deposits reach approximately $\frac{1}{2}$ the height of the HVSF, or 8 inches whichever is lower, the deposits shall be removed and the soil stabilized in accordance with Section 8-01.3(15).

High Visibility Silt Fence shall not be used within the Critical Root Zone (CRT, as defined in the Standard Plans) of trees identified to be protected. High Visibility Silt fence shall not be installed at locations that receive concentrated water flow.

8-01.3(9)B Gravel Filter, Wood Chip, Topsoil, or Compost Berm

Filter berms shall retain sediment and direct flows. The gravel filter berm shall be a minimum of 1 foot in height and shall be maintained at this height for the entire time they are in use. Rock material used for filter berms shall meet the grading requirements in Section 9-03.9(2), but shall not include recycled materials as outlined in Section 9-03.21.

The wood chip berm shall be a minimum of 2 feet in height and shall be maintained at this height for the entire time they are in use.

The Compost and Topsoil Berm shall be constructed in accordance with the detail in the Plans. Compost shall be Medium Compost.

8-01.3(9)C Vacant

8-01.3(9)D Inlet Protection

Inlet protection shall be installed below or above, or as a prefabricated cover at each inlet grate, as shown in the Plans. Inlet protection devices shall be installed prior to beginning clearing, grubbing, or earthwork activities.

Geotextile fabric in all prefabricated inlet protection devices shall meet or exceed the requirements of Section 9-33.2, Table 1, for Moderate Survivability, and the minimum filtration properties of Table 2.

When the depth of accumulated sediment and debris reaches approximately $\frac{1}{2}$ the height of an internal device or $\frac{1}{3}$ the height of the external device (or less when so specified by the manufacturers), or as designated by the Engineer, the deposits shall be removed and stabilized on-site in accordance with Section 8-01.3(16). The Contractor shall immediately implement source control BMP adaptive management when accumulated sediment is observed within inlet protection to prevent further erosion and sedimentation impacts.

Below Inlet Grate

Below Inlet Grate devices shall be prefabricated units specifically designed for inlet protection and shall remain securely attached to the drainage Structure when fully loaded with sediment and debris, or at the maximum level of sediment and debris specified by the manufacturer.

Above Inlet Grate

Above Inlet Grate devices may be silt fence, sandbags, or prefabricated units specifically designed for inlet protection.

The device shall remain securely in place around the drainage Structure under all conditions.

Inlet Grate Cover

Inlet Grate Cover devices shall be prefabricated units specifically designed for inlet protection and have the following features:

1. Be a sewn geotextile fabric unit fitted to the individual grate and completely enclosing the grate.
2. Have built-in lifting devices to allow manual access of the stormwater system.
3. Utilize an orange monofilament geotextile fabric.

Check dams or functionally equivalent devices may be used as inlet protection devices with the approval of the Engineer.

8-01.3(10) Wattles

Wattles are used as a flow control and sediment control device in areas receiving sheet flow and shall not be used in areas receiving concentrated flow. Wattles shall be installed as soon as construction will allow or when designated by the Engineer. Wattle installation and trenching shall begin from the base of the slope and work uphill prior to topsoil or compost placement. Excavated material from trenching shall be spread evenly along the uphill slope and be compacted using hand tamping or other method approved by the Engineer. On gradually sloped or clay-type soils trenches shall be 2 to 3 inches deep. On loose soils, in high rainfall areas, or on steep slopes, trenches shall be 3 to 5 inches deep, or half the thickness of the wattle, whichever is greater.

Wattles shall be laid out, spaced, and staked in accordance with the [Standard Plans](#). Live stakes can be used in addition to, but not as a replacement for, wooden stakes. If trenching and staking is not possible due to rocky soils, compost socks shall be used instead of wattles.

The Contractor shall exercise care when installing wattles to ensure the method of installation minimizes the disturbance of waterways and prevents sediment or pollutant discharge into water bodies.

8-01.3(11) Outlet Protection

Outlet protection shall prevent scour at the outlets of ponds, pipes, ditches or other conveyances. All quarry spall material used for outlet protection shall be free of extraneous material and meet the gradation requirements in Section 9-13.1(5).

8-01.3(12) Compost Sock

Compost socks are used to disperse flow and sediment. Compost socks shall be installed as soon as construction will allow but before flow conditions create erosive flows or discharges from the site. Compost socks shall be installed prior to mulching or compost placement. Compost socks shall be laced together end-to-end with coir rope or ends shall be securely overlapped to create a continuous length. Terminal ends of the continuous length shall be curved 2 to 4 feet upward into the slope to prevent concentrated flows from going around the terminal ends. Finished grades shall be of a natural appearance with smooth transitions. Compost for compost socks shall be Medium Compost.

Compost socks shall be laid out, spaced and staked in accordance with the [Standard Plans](#). Live stakes can be used in addition to, but not as a replacement for, wooden stakes. If staking is not possible or if the compost sock is being used on concrete, heavy blocks or an equivalent item shall be used to weigh down and secure the sock.

The Contractor shall exercise care when installing compost socks to ensure that the method of installation minimizes disturbance of waterways and prevents sediment or pollutant discharge into water bodies. Stakes shall be removed to minimize soil disturbance.

8-01.3(13) Temporary Curb

Temporary curbs shall divert or redirect water around erodible soils.

Temporary curbs shall be installed along pavement edges to prevent runoff from flowing onto erodible slopes. Water shall be directed to areas where erosion can be controlled. Temporary curbs shall be a minimum of 4 inches in height. Temporary curb shall be installed so that ponding does not occur in the adjacent roadway.

8-01.3(14) Temporary Pipe Slope Drain

Temporary pipe slope drain shall be Corrugated Polyethylene Drain Pipe and shall be constructed in accordance with the Plans.

Water interceptor dikes or temporary curbs shall be used to direct water into pipe slope drain. The entrance to the drain may consist of a prefabricated funnel device specifically designed for application, rock, sand bags, or as approved by the Engineer.

The pipe fittings shall be water tight and the pipe secured to the slope with metal posts, wood stakes, or sand bags.

The water shall be discharged to a stabilized conveyance, sediment trap, stormwater pond, rock splash pad, or vegetated strip, in a manner to prevent erosion and maintain water quality compliance.

8-01.3(15) Maintenance

Erosion and sediment control BMPs shall be maintained or adaptively managed as required by the CSWGP until the Engineer determines they are no longer needed. When deficiencies in functional performance are identified, the deficiencies shall be rectified immediately.

The BMPs shall be inspected on the schedule outlined in Section 8-01.3(1)B for damage and sediment deposits. Damage to or undercutting of BMPs shall be repaired immediately.

In areas where the Contractor's activities have compromised the erosion control functions of the existing grasses, the Contractor shall overseed at no additional cost to the Contracting Agency.

The quarry spalls of construction entrances shall be refreshed, replaced, or screened to maintain voids between the spalls for collecting mud and dirt.

Unless otherwise specified, when the depth of accumulated sediment and debris reaches approximately $\frac{1}{2}$ the height of the BMP the deposits shall be removed. Debris or contaminated sediment shall be disposed of in accordance with Section 3-03.3(7)C. Clean sediments may be stabilized on-site using BMPs as allowed by the Engineer.

8-01.3(16) Removal

The Contractor shall remove all temporary BMPs, all associated hardware and associated accumulated sediment deposition from the project limits prior to Physical Completion unless otherwise allowed by the Engineer. When the temporary BMP materials are made of natural plant fibers unaltered by synthetic materials the Engineer may allow leaving the BMP in place.

The Contractor shall remove BMPs and associated hardware in a way that minimizes soil disturbance. The Contractor shall permanently stabilize all bare and disturbed soil after removal of BMPs. If the installation and use of the erosion control BMPs have compacted or otherwise rendered the soil inhospitable to plant growth, such as construction entrances, the Contractor shall take measures to rehabilitate the soil to facilitate plant growth. This may include, but is not limited to, ripping the soil, incorporating soil amendments, or seeding with the specified seed.

At the request of the Contractor and at the sole discretion of the Engineer the CSWGP may be transferred back to the Contracting Agency. Approval of the Transfer of Coverage request will require the following:

1. All other Work required for Contract Completion has been completed.
2. All Work required for compliance with the CSWGP has been completed to the maximum extent possible. This includes removal of BMPs that are no longer needed and the site has undergone all Stabilization identified for meeting the requirements of Final Stabilization in the CSWGP.
3. An Equitable Adjustment change order for the cost of Work that has not been completed by the Contractor.
4. Submittal of the Washington State Department of Ecology Transfer of Coverage form (Ecology Form ECY 020-87a) to the Engineer.

If the Engineer approves the transfer of coverage back to the Contracting Agency the requirement in Section 1-07.5(3) for the Contractor's submittal of the Notice of Termination form to Ecology will not apply.

8-01.4 Measurement

8-01.4(1) Lump Sum Bid for Project (No Unit Items)

When the Bid Proposal contains the item "Erosion Control and Water Pollution Prevention" there will be no specified unit of measurement for Work defined in Section 8-01 except as described in Sections 8-01.4(3) and 8-01.4(4). Also, except as described in Section 8-01.4(3), all of Section 8-01.4(2) is deleted.

8-01.4(2) Item Bids

ESC lead will be measured per day for each day that an inspection is made and a report is filed.

Erosion control blanket and plastic covering will be measured by the square yard along the ground slope line of surface area covered and accepted.

Turbidity curtains will be measured by the linear foot along the ground line of the installed curtain.

Check dams will be measured per linear foot one time only along the ground line of the completed check dam. No additional measurement will be made for check dams that are required to be rehabilitated or replaced due to wear.

Stabilized construction entrances will be measured by the square yard by ground slope measurement for each entrance constructed.

Tire wash facilities will be measured per each for each tire wash installed.

Street cleaning will be measured by the hour for the actual time spent cleaning pavement, refilling with water, dumping and transport to and from cleaning locations within the project limits, as authorized by the Engineer. Time to mobilize the equipment to or from the project limits on which street cleaning is required will not be measured.

Inlet protections will be measured per each for each initial installation at a drainage structure.

Silt fence, gravel filter, compost berms, and wood chip berms will be measured by the linear foot along the ground line of the completed barrier.

Wattles and compost socks will be measured by the linear foot.

Temporary curbs will be measured by the linear foot along the ground line of the completed installation.

Temporary pipe slope drains will be measured by the linear foot along the flow line of the pipe.

Coir logs will be measured by the linear foot along the ground line of the completed installation.

Outlet protections will be measured per each initial installation at an outlet location.

Temporary seeding, temporary mulching, and tackifiers will be measured by the acre by ground slope measurement.

Compost blanket will be measured by the square yard by ground slope surface area covered and accepted.

8-01.4(3) Reinstating Unit Items with Lump Sum Erosion Control and Water Pollution Prevention

The Bid Proposal may establish the project as lump sum, in accordance with Section 8-01.4(1) and also include one or more of the items included in Section 8-01.4(2). When that occurs, the corresponding measurement provision in Section 8-01.4(2) is not deleted and the Work under that item will be measured as specified.

8-01.4(4) Items not included with Lump Sum Erosion Control and Water Pollution Prevention

Compost blanket will be measured by the square yard by ground slope surface area covered and accepted.

Temporary mulch will be measured by the acre by ground slope surface area covered and accepted.

High visibility fence and high visibility silt fence will be measured by the linear foot along the ground line of the completed fence.

8-01.5 Payment

8-01.5(1) Lump Sum Bid for Project (No Unit Items)

Payment will be made for the following Bid item when it is included in the Proposal:

"Erosion Control and Water Pollution Prevention", lump sum.

The lump sum Contract price for "Erosion Control and Water Pollution Prevention" shall be full pay to perform the Work as described in Section 8-01 except for costs compensated by other Bid Proposal items as described in Section 8-01.4(2). Progress payments for the lump sum item "Erosion Control and Water Pollution Prevention" will be made as follows:

1. The Contracting Agency will pay 15 percent of the bid amount for the initial set up for the item. Initial set up includes the following:
 - a. Acceptance of the TESC Plan provided by the Contracting Agency or submittal of a new TESC Plan,
 - b. Submittal of a schedule for the installation of the BMPs,
 - c. Identifying water quality sampling locations, and
2. Seventy percent of the bid amount will be paid in accordance with Section 1-09.9.
3. Once the project is physically complete and copies of the all reports submitted to Ecology have been submitted to the Engineer, and, if applicable, transference of the CSWGP back to the Contracting Agency is complete, the remaining 15 percent of the bid amount shall be paid in accordance with Section 1-09.9.

When the Bid Proposal contains the item "Erosion Control and Water Pollution Prevention", except as described in Section 8-01.5(3), all of Section 8-01.5(2) is deleted.

8-01.5(2) Item Bids

Payment will be made for the following Bid items when they are included in the Proposal:

"ESC Lead", per day.

"Turbidity Curtain", per linear foot.

"Erosion Control Blanket", per square yard.

"Plastic Covering", per square yard.

"Check Dam", per linear foot.

"Inlet Protection", per each.

"Gravel Filter Berm", per linear foot.

"Stabilized Construction Entrance", per square yard."

"Tire Wash", per each.

"Street Cleaning", per hour.

"Silt Fence", per linear foot.

"Wood Chip Berm", per linear foot.

"Compost Berm", per linear foot.

"Wattle", per linear foot.

"Compost Sock", per linear foot.

"Coir Log", per linear foot.

"Temporary Curb", per linear foot.

"Temporary Pipe Slope Drain", per linear foot.

"Temporary Seeding", per acre.

"Temporary Mulching", per acre.

"Compost Blanket", per square yard.

"Outlet Protection", per each.

"Tackifier", per acre.

"Erosion/Water Pollution Control", by force account as provided in Section 1-09.6.

Maintenance and removal of erosion and water pollution control devices including removal and disposal of sediment, stabilization and rehabilitation of soil disturbed by these activities, and all additional Work deemed necessary by the Engineer to control erosion and water pollution will be paid by force account in accordance with Section 1-09.6.

To provide a common Proposal for all Bidders, the Contracting Agency has entered an amount in the Proposal to become a part of the Contractor's total Bid.

8-01.5(3) Reinstating Unit Items with Lump Sum Erosion Control and Water Pollution Prevention

The Bid Proposal may establish the project as lump sum, in accordance with Section 8-01.5(1) and also include one or more of the items described in Section 8-01.4(2). When that occurs, the corresponding payment provision in Section 8-01.5(2) is not deleted and the Work under that item will be paid as specified.

8-01.5(4) Items not included with Lump Sum Erosion Control and Water Pollution Prevention

Payment will be made for the following Bid item when it is included in the Proposal:

"High Visibility Fence", per linear foot.

"High Visibility Silt Fence", per linear foot.

The unit contract price per linear foot for "High Visibility Fence" and "High Visibility Silt Fence" shall be full pay for all costs to obtain, install, maintain, and remove the fence as specified. Once removed, the fencing shall remain the property of the Contractor.

8-02 Roadside Restoration

8-02.1 Description

This Work consists of preserving, maintaining, establishing and augmenting vegetation on the roadsides and within mitigation or sundry site areas. It includes vegetation preservation, weed and pest control, furnishing and placing topsoil, compost, and soil amendments, and furnishing and planting seed, sod and plants of all forms and container types. It includes performing plant establishment activities and soil bioengineering. Work shall be performed in accordance with these Specifications and as shown in the Plans or as designated by the Engineer.

Trees, whips, shrubs, ground covers, cuttings, live stakes, live poles, live branches, rhizomes, tubers, rootstock, and seedlings will hereinafter be referred to collectively as "plants" or "plant material". Grass, wildflowers, and other plant materials installed in seed form will hereinafter be referred to collectively as "seed".

8-02.2 Materials

Materials shall meet the requirements of the following sections:

Topsoil	9-14.2
Seed	9-14.3
Fertilizer	9-14.4
Mulch and Amendments	9-14.5
Erosion Control Devices	9-14.6
Plant Materials	9-14.7
Stakes, Guys, and Wrapping	9-14.8
Water	9-25.2

Botanical identification and nomenclature of plant materials shall be based on descriptions by Hitchcock and Cronquist in "Flora of the Pacific Northwest". Botanical identification and nomenclature of plant material not found in "Flora" shall be based on Bailey in "Hortus Third" or superseding editions and amendments or as referenced in the Plans.

8-02.3 Construction Requirements

8-02.3(1) Responsibility During Construction

The Contractor shall prepare, install, and ensure adequate and proper care of all roadside seeded, planted, and lawn areas on the project until all plant establishment periods required by the Contract are complete or until Physical Completion of the project, whichever is last.

Adequate and proper care shall include, but is not limited to, keeping all plant material in a healthy, growing condition by watering, pruning, and other actions deemed necessary for plant health. This Work shall include keeping the project area free from insect infestation, weeds or unwanted vegetation, litter, and other debris along with retaining the finished grades and mulch in a neat uniform condition.

Existing desirable vegetation shall be saved and protected unless removal is required by the Contract or allowed by the Engineer.

The Contractor shall have sole responsibility for the maintenance and appearance of the roadside restoration.

All temporary construction impacts, including areas related to temporary access and staging areas, shall be restored. When a temporary access or staging area is not designated in the Plans and Contractor-initiated, restoration will be at no additional cost to the Contracting Agency.

8-02.3(2) Work Plans

Three Work Plan submittals under this section:

1. **Roadside Work Plan:** This plan is required when Work will disturb the roadside beyond 20 feet from the pavement or where trees or native vegetation will be removed. The Contractor shall submit a Type 3 Working Drawing within 15 calendar days prior to any earth disturbing activities.
2. **Weed and Pest Control Plan:** This plan is required when the proposal requires the use of chemicals, weed control activities or when the proposal contains the item "Project Area Weed and Pest Control". The Contractor shall submit for approval the Weed and Pest Control Plan as a Type 3 Working Drawing. The plan shall be submitted at the same time as the Roadside Work Plan. The plan will require approval prior to beginning the following additional activities: selective clearing, surface preparation, application of chemical pesticides, or any weed control activities.
3. **Plant Establishment Plan:** This plan is required when the proposal contains the item "PSIPE__", and prior to completion of Initial Planting. The Contractor shall submit a Type 2 Working Drawing.

8-02.3(2)A Roadside Work Plan

The Roadside Work Plan shall define the expected impacts to the roadside and restoration resulting from Work necessary to meet all Contract requirements. The Contractor shall define how the roadside restoration Work included in the Contract will be phased and coordinated with project Work such as earthwork, staging, access, erosion and water pollution control, irrigation, etc. The Roadside Work Plan shall include the following:

1. Limiting impacts to roadsides:
 - a. Limits of Work including locations of staging or parking.
 - b. Means and methods for vegetation protection (in accordance with Section 1-07.16(2)) and tree protection details as shown in the Plans.
 - c. Locations outside of clearing limits where vegetation shall be removed to provide access routes or other needs to accomplish the Work.
 - d. Plans for removal, preservation and stockpile of topsoil or other native materials, if outside of clearing and grubbing limits and within the project limits.
2. Roadside Restoration:
 - a. Plan for propagation and procurement of plants, ground preparation for planting, and installation of plants.
 - b. Means and methods to limit soil compaction where seeding and planting are to occur, such as steel plates, hog fuel access roads, wood mats for sensitive areas (including removal) and decompaction for unavoidable impacts.
 - c. Plan and timing to incorporate or remove erosion control items.
3. Lawn Installation:
 - a. Schedule for lawn installation Work.
 - b. Establishment and maintenance of lawns.

8-02.3(2)B Weed and Pest Control Plan

The Weed and Pest Control Plan shall describe all weed and pest control needs for the project.

The plan shall be prepared and signed by a licensed Commercial Operator or Commercial Pest Control Consultant. The plan for control of weeds and pests on the Contract in accordance with Section 8-02.3(3) shall include the following:

1. Names of plan preparer and pesticide operators, including contact information. The Contractor shall provide the Engineer evidence that all operators are licensed with appropriate endorsements, and that the pesticide used is registered for use by the Washington State Department of Agriculture.
2. Means and methods of weed control, including mechanical and/or chemical. The Contractor shall provide a site plan indicating where the noted methods of weed control will be implemented. The plan shall include project site specific restrictions, such as avoidance of surface waters and permit condition related requirements.
3. Schedule and timing for weed control including worker safety for re-entry times for pesticide application by pesticide type.
4. Proposed pesticide use in accordance with Section 8-02.3(3)A: name, application rate, and Safety Data Sheets of all proposed pesticides. The Contractor shall provide a copy of the current product label for each pesticide to be used.
5. Plan to ensure worker safety until pesticide re-entry periods are met.
6. Site management and control protocol for all anticipated pests including herbivory (browse and girdling), fungal and insect infestations, and all applicable aquatic invasive species per RCW 77.135.010. Document equipment cleaning and/or sterilization protocols in accordance with Section 1-05.9, including provisions to prevent the spread of listed species.
7. The Contractor shall provide a copy of the Traffic Control Plan for accessing the site to ensure the safety of all staff during the process of taking materials on and off the site.

8-02.3(2)C Plant Establishment Plan

The Plant Establishment Plan shall describe activities necessary to ensure continued health and vigor of planted, seeded and sod areas in accordance with the requirements of Sections 8-02.3(12) and 8-02.3(13). Should the plan become unworkable at any time during the first-year plant establishment, the Contractor shall submit a revised plan prior to proceeding with further Work. The Plant Establishment Plan shall include:

1. Proposed scheduling of joint inspection meetings, activities, materials, equipment to be utilized for the first-year plant establishment.
2. Proposed adaptive management activities to ensure successful establishment of seeded, sodded, and planted areas.
3. A contact person for the duration of the contract.
4. Management of the irrigation system or watering plan. When an irrigation system is proposed, the plan shall include timing of removal or transferring to the Contracting Agency at the end of the plant establishment period.

8-02.3(3) Weed and Pest Control

The Contractor shall control weed and pest species within the project area using integrated pest management principles consisting of mechanical, biological, and chemical controls that are outlined in the Weed and Pest Control Plan or as designated by the Engineer. Controlling weeds consists of killing and removing weeds by chemical, mechanical, and hand methods.

8-02.3(3)A Chemical Pesticides

Chemical pesticides include, but are not restricted to, any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest, including but not limited to, insecticides, herbicides, fungicides, adjuvants, and additives, including plant regulators, defoliants and desiccants. The Contractor shall apply chemical pesticides in accordance with the label recommendations, the Washington State Department of

Ecology, local sensitive area ordinances, and Washington State Department of Agriculture laws and regulations. Only those pesticides listed in the table Herbicides Approved for Use on WSDOT Rights of Way and accepted as part of the Weed and Pest Control Plan or by written authorization from the Engineer may be used (<https://wsdot.wa.gov/construction-planning/protecting-environment/maintaining-vegetation-along-our-highways/using-herbicides>).

All personnel applying chemical pesticides within the project limits, including off-site mitigation, staging, and stockpile areas, shall be licensed by the State of Washington as a Commercial Applicator or Commercial Operator, with additional endorsements as required by the Special Provisions, physical work locations, or the proposed Weed and Pest Control Plan. All licenses and endorsements shall be current and in good standing for the duration of the project. All chemical pesticides shall be delivered to the job site in the original containers, or if pre-mixed off-site, a certification of the components and formulation from the supplier is required. The licensed applicator or operator shall complete WSDOT Form 540-509, Commercial Pesticide Application Record, each day the pesticide is applied and furnish a copy to the Engineer by the following business day.

The Contractor shall ensure confinement of the chemicals within the designated areas. The use of spray chemical pesticides shall require the use of anti-drift and activating agents and a spray pattern indicator unless otherwise allowed by the Engineer.

The Contractor shall assume all responsibility for rendering any area unsatisfactory for planting by reason of chemical application. Damage to adjacent areas, either on or off the Highway Right of Way, shall be repaired to the satisfaction of the Engineer or the property owner at no additional cost to the Contracting Agency.

8-02.3(3)B Roadside Seeding, Planting and Lawn Area Weed Control

Seeding, planting, sod and lawn area weed control consists of controlling weeds and pests in seeded, planted, sod and lawn areas shown in the Plans. Weeds include noxious and nuisance weeds of any Class designated by authorized State or County officials. Noxious weeds include non-native, invasive grasses, flowering plants, shrubs, trees and aquatic plants. This Work is included in the bid items for seeding, planting, sod and lawn installation.

All seeding, planting, sod and lawn areas shall be prepared so that they are weed and debris free at the time of planting and until completion of the project. The planting areas shall include the entire ground surface, regardless of cover, areas around plants, and those areas shown in the Plans.

Within seeding, planting, sod or lawn areas, all species that are not shown in the Plans are unwanted and shall be controlled unless specifically allowed by the Engineer to remain.

Grass growing within the mulch ring of a plant, including grass applied in accordance with Sections 8-01.3(2), 8-02.3(9) or 8-02.3(10), shall be considered a weed and shall be controlled on the project in accordance with the weed and pest control plan.

All applications of post-emergent herbicides shall be made while green and growing tissue is present. Residual herbicides shall not be used where rhizomatous species or perennial species are indicated.

Should unwanted vegetation reach the flowering and seed stage in violation of these Specifications, the Contractor shall physically remove and bag the seed heads prior to seed dispersion. All physically removed vegetation and seed heads shall be disposed of off-site at no cost to the Contracting Agency.

8-02.3(3)C Project Area Weed and Pest Control

When the Bid Item "Project Area Weed and Pest Control" is included in the Contract the Contractor shall control all noxious weeds as directed by the Engineer within the project limits and not otherwise covered in Section 8-02.3(3)B. Noxious weeds are specified by the Washington State Department of Agriculture, the local Weed District, or the County Noxious Weed Control Board.

8-02.3(4) Topsoil

Topsoil shall not be worked or placed when the ground or topsoil is frozen, or excessively wet.

The Contractor shall protect topsoil stockpiled for project use to prevent erosion and weed growth. Weed growth on topsoil stockpile sites shall be immediately eliminated in accordance with the accepted Weed and Pest Control Plan and Section 8-02.3(3).

The subsoil where topsoil is to be placed shall be decompacted as specified in the Special Provisions or the Plans. Topsoil of the type specified shall be evenly spread over the specified areas to the depth shown in the Plans or as otherwise ordered by the Engineer. Topsoil depths greater than 6 inches shall be placed in lifts no more than 6 inches in depth. The first lift of topsoil shall be incorporated with sub-soil to a depth of 12 inches and subsequent lifts placed and lightly tamped between lifts.

8-02.3(4)A Topsoil Type A

Topsoil Type A shall be as specified in the Special Provisions. The Contractor shall submit a certification by the supplier that the contents of the Topsoil meet the requirements in the Special Provisions.

8-02.3(4)B Topsoil Type B

Topsoil Type B shall be taken from within the project limits. Topsoil Type B shall be taken from areas shown in the Plans to the designated depth and stockpiled at locations that will not interfere with the construction of the project, and outside of sensitive areas, as allowed by the Engineer. The general limits of the material to be utilized for topsoil will be indicated in the Plans or in the Special Provisions. The Engineer will make the final determination of the areas where the most suitable material exists within these general limits. Material for Topsoil Type B shall not be taken from a depth greater than 1 foot from the existing ground unless otherwise designated by the Engineer. Prior to topsoil removal, the Contractor shall reduce the native vegetation to a height not exceeding 1 foot. A minimum of two weeks prior to excavation of Topsoil Type B, the Contractor shall pre-treat the vegetation on the designated Topsoil Type B areas according to the Weed and Pest Control Plan. Areas beyond the slope stakes shall be disturbed as little as possible in the above operations and under no circumstances shall Topsoil Type B be stockpiled within critical root zones of any existing tree or vegetation area designated to be saved and protected. The Contractor shall protect topsoil stockpile from weed infestation.

The Contractor shall set aside sufficient material to satisfy the needs of the project.

Upon completion of topsoil placement, the Contractor shall dispose of remaining stockpiled Topsoil Type B not required for use on the project at no additional expense to the Contracting Agency in accordance with Section 3-03.3(7)C.

Should a shortage of Topsoil Type B occur, and the Contractor has wasted or otherwise disposed of topsoil material, the Contractor shall furnish Topsoil Type A or C at no additional expense to the Contracting Agency.

8-02.3(4)C Topsoil Type C

Topsoil Type C shall be naturally occurring topsoil obtained from a source provided by the Contractor outside of the Contracting Agency-owned Right of Way. Topsoil Type C shall meet the requirements of Sections 8-02.3(4) and 8-02.3(4)B. The Contractor shall not begin removal of Topsoil Type C from the proposed source until the material has been allowed for use by the Engineer.

8-02.3(5) Roadside Seeding, Lawn and Planting Area Preparation

This Work includes preparing worked areas for the installation of all types of permanent erosion control vegetation. Work shall be conducted so the flow lines in drainage channels are maintained. Material displaced by the Contractor's operations that interferes with drainage shall be removed from the channel and disposed of as allowed by the Engineer.

Any areas impacted by construction activities including areas related to temporary access and staging areas, not in accordance with the Roadside Work Plan shall be decompacted. Where decompaction occurs on slopes steeper than 2(H) to 1(V), additional BMPs may be required. Decompaction of fill supporting roadway embankment are not required.

Soil preparation shall not be permitted under unsuitable conditions. Unsuitable conditions include, but are not limited to, frozen soil, freezing weather, saturated soil, standing water, heavy rains, and high water levels.

8-02.3(5)A Seeding Area Preparation

The Contractor shall prepare roadside seeding areas as follows:

1. Prepare seeding area to a weed free and bare condition in accordance with Section 8-02.3(3)B.
2. When indicated in the Plans or Special Provisions, subsoil shall be decompacted to the required depth and returned to uniform grade even with surrounding areas, leaving no holes or mounds over 3 inches in depth or height.
3. Remove all excess material, debris, stumps, and rocks greater than 3 inches in diameter and remove from site.
4. Soil decompaction and removal of excess material shall be completed prior to installation of topsoil, soil amendments, or compost.
5. Install topsoil, soil amendments, or compost as shown in the Plans. Do not till any slopes steeper than 2(H) to 1(V).
6. Compact to provide a reasonably firm but friable seedbed; tractor walk to uniformly cover the surface with longitudinal depressions at least 2 inches deep formed perpendicular to the natural flow of water on the slope. Condition the soil with sufficient water so the longitudinal depressions remain in the soil surface until completion of the seeding.
7. If seeding cannot be completed within 2 days of the final seeding preparation work, the contractor shall stabilize the areas and perform weed control activities in accordance with Section 8-02.3 until permanent seeding can occur. All weed control activities performed in the interim to the permanent seeding application is at no cost to the Contracting Agency.

8-02.3(5)B Lawn Area Preparation

The Contractor shall prepare lawn areas as follows:

1. Prepare lawn area to a weed free and bare condition in accordance with Section 8-02.3(3)B.
2. When indicated in the Plans or Special Provisions, subsoil shall be decompacted to the required depth and returned to uniform grade even with surrounding areas, leaving no holes or mounds over 3 inches in depth or height.

3. Remove excess material, stumps, wood or rocks over 3 inches in diameter and remove from site.
4. Soil decompaction and removal of excess material shall be completed prior to installation of topsoil, soil amendments, or compost.
5. Install topsoil, soil amendments or compost as indicated in the Plans and in accordance with Section 8-02.3(4) and 8-02.3(6).
6. Till to a 12-inch depth, rake to a smooth even grade without low areas that trap water, and compact with a 50-pound roller. The finished grade of the soil shall be 1 inch below the top of all curbs, junction and valve boxes, walks, driveways, and other Structures.
7. If seeding or sodding cannot be completed within 2 days of the final lawn preparation work, the contractor shall stabilize the areas and perform weed control activities in accordance with Section 8-02.3 until permanent seeding or sodding can occur. All weed control activities performed in the interim to the permanent seeding installation or sod installation is at no cost to the Contracting Agency.

8-02.3(5)C Planting Area Preparation

The Contractor shall prepare planting areas as follows:

1. Prepare planting area to a weed free and bare condition in accordance with Section 8-02.3(3)B.
2. When indicated in the Plans or Special Provisions, subsoil shall be decompacted to the required depth and returned to uniform grade even with surrounding areas, leaving no holes or mounds over 3 inches in depth or height.
3. Remove excess material, stumps, wood or rocks over 3 inches in diameter and remove from site.
4. Soil decompaction and removal of excess material shall be completed prior to installation of topsoil, soil amendments, or compost.
5. Install topsoil, soil amendments or compost as indicated in the plans and in accordance with Sections 8-02.3(4) and 8-02.3(6).
6. Till topsoil, soil amendments or compost when indicated in the Plans or Special Provisions to provide a reasonably firm but friable planting area. Do not till any slopes steeper than 2(H) to 1(V).
7. Return soil to a uniform finished grade, 1 inch, or the specified depth of mulch plus 1 inch, below walks, curbs, junction and valve boxes, catch basins, and driveways, unless otherwise specified.
8. If planting cannot be completed within 2 days of the final planting area preparation work, the Contractor shall stabilize the areas and perform weed control activities in accordance with Section 8-02.3 until planting can occur. All weed control activities performed in the interim to the planting work is at no cost to the Contracting Agency.

8-02.3(6) Mulch and Amendments

The Contractor shall place soil amendments of the type, quality, and quantities specified where shown in the Plans or as specified in the Special Provisions. Areas receiving soil amendments shall be bare soil or vegetation free prior to application. All soil amendments shall be installed as shown in the Plans within 30 calendar days after delivery to the project site.

8-02.3(6)A Compost

The Contractor shall place compost of the type and depth specified where shown in the Plans or as specified in the Special Provisions. Soil amendment shall be Fine Compost unless otherwise designated in the Plans.

The Contractor shall complete final grading prior to placement of compost. Areas receiving compost shall be bare soil or vegetation free before application, except where trees and other plants are specifically identified in the Plans or designated by the Engineer to be saved and protected. Compost shall be placed to a uniform non-compacted depth of 3 inches over all planting areas unless otherwise specified.

Compost shall be installed within 30 calendar days after delivery to the project site.

When compost blanket is used for temporary erosion control, the compost blanket may be incorporated into the soil immediately prior to planting when used as compost soil amendment. The area shall be prepared in accordance with Section 8-02.3(5) prior to placing compost.

Any contamination of the compost due to the Contractor's operations, including sourcing, shall be corrected at no additional cost to the Contracting Agency. Compost placed to a thickness greater than specified shall be at no additional cost to the Contracting Agency.

8-02.3(6)B Fertilizers

The Contractor shall apply fertilizer in the form, mixture, and rate specified in the Special Provisions or as directed by the Engineer. Application procedures shall be in accordance with the manufacturer's recommendations unless otherwise specified in the Special Provisions.

The Contractor shall submit a guaranteed fertilizer analysis label for the selected product a minimum of one week prior to application for acceptance. Following the Engineer's acceptance, fertilizing of the accepted ground or vegetated surfaces shall begin immediately.

In seeding and lawn areas to be fertilized, the fertilizer shall be applied concurrently with the seed. When fertilizer is hydraulically applied, the fertilizer shall be suitable for application with seeding as specified in Section 8-02.3(9)C. If hydroseeding, the fertilizer shall be placed in the hydroseeder tank no more than 1 hour prior to application.

Fertilizers for planting areas shall be applied concurrently with compost and applied prior to incorporation, unless tablet form fertilizer is specified. Where tablet form fertilizer is specified, fertilizer shall be applied concurrently with plant installation.

Fertilizer sprayed on signs or sign structures shall be removed the same day.

Areas not accessible by fertilizing equipment shall be fertilized by allowed hand methods.

Second Application: A second application of fertilizer shall be applied as specified in the Special Provisions at the locations designated in the Plans. The fertilizer shall be applied during the months of March, April, or May of the following year after the initial seeding, planting, or lawn installation. The fertilizer shall be dry granular pellets or pearls and applied in accordance with the manufacturer's recommendations or as specified in the Special Provisions.

8-02.3(7) Layout of Planting, Lawn and Seeding Areas

The Contractor shall lay out and prepare planting and lawn areas and receive the Engineer's acceptance of layout and preparation prior to any installation activities. The Contractor shall stake the location of all trees larger than 1-inch caliper and the perimeter of all planting areas for acceptance by the Engineer prior to any installation activities.

Tree locations shown in the Plans shall be considered approximate unless shown with stationing and offset distance. In irrigated areas, trees shall be located so their trunk is a minimum of $\frac{1}{3}$ of the spray radius away from the nearest sprinkler head.

Unless otherwise shown, planting areas located adjacent to Roadways shall begin 6 feet from the edge of shoulder on roadway fills and begin 5 feet up on the back slope from the bottom on roadway cut sections. Plants within planting areas shall be located such that mature branching pattern will not block sight distance, signs, or other traffic-related devices. No trees shall be placed where the mature canopy will grow to within 10 feet of existing power lines. Where roadside ditches are present, planting areas shall begin 5 feet from the centerline of the ditch unless shown otherwise in the Plans.

8-02.3(8) Planting

8-02.3(8)A Dates and Conditions for Planting

The Contracting Agency will make an inspection of plant material at the source when requested by the Engineer. However, such preliminary approval shall not be considered as final acceptance for payment. Final inspection and approval (or rejection) will only occur when the plant material has been delivered to the Contract site. The Contractor shall notify the Engineer, not less than 48 hours in advance, of plant material delivery to the project.

No plant material shall be planted until it has been inspected and accepted for planting by the Engineer. Rejected material shall be removed from the project site immediately. All plants for the project or a sufficient quantity to plant one acre of the site, whichever is less, shall be received on site prior to the Engineer beginning inspection of the plants.

Plants delivered as a single unit of 25 or less of the same size, species, and variety, shall be clearly marked and tagged. Plants delivered in large quantities of more than 25 must be segregated as to variety, grade, and size; and one plant in each 25, or fraction thereof, of each variety, grade, and size shall be tagged. Within 30 calendar days of Execution of Contract, the Contractor shall provide written evidence to the Engineer that plant materials have been contracted or procured. No substitution of plant material, species or variety, will be permitted unless evidence is submitted in writing to the Engineer that a specified plant cannot be obtained and has been unobtainable since the Award of the Contract. If substitution is permitted, it can be made only with written approval by the Engineer. The nearest variety, size, and grade, as approved by the Engineer, shall then be furnished.

Container or balled and burlapped plant material may be substituted for bare root plant material. Container grown plant material may be substituted for balled and burlapped plant materials. When substitution is allowed, use current ASNS standards to determine the correct rootball volume (container or balled and burlapped) of the substituted material that corresponds to that of the specified material. These substitutions shall be approved by the Engineer and be at no cost to the Contracting Agency.

Plants stored under temporary conditions prior to installation shall be the responsibility of the Contractor.

Plants stored on the project shall be protected at all times from extreme weather conditions by insulating the roots, root balls, or containers with sawdust, soil, compost, bark or wood chips, or other approved material and shall be kept moist at all times prior to planting.

Cuttings shall continually be shaded and protected from wind. Cuttings shall be protected from drying at all times and shall be heeled into moist soil or other insulating material or placed in water if not installed within 8 hours of cutting. Cuttings to be stored for later installation shall be bundled, laid horizontally, and completely buried under 6 inches of water, moist soil or placed in cold storage at a temperature of 34°F and 90 percent humidity. Cuttings that are not planted within 24 hours of cutting shall be soaked in water

for 24 hours prior to planting. Cuttings taken when the temperature is higher than 50°F shall not be stored for later use. Cuttings that already have developed roots shall not be used.

Under no circumstances will planting be permitted during unsuitable soil or weather conditions as determined by the Engineer. Unsuitable conditions may include frozen soil, freezing weather, saturated soil, standing water, compacted soils, drought, high winds, heavy rains, and high water levels. All planting shall be accomplished during the following periods:

1. Non-Irrigated Plant Material

Western Washington (West of the Cascade Mountain Crest)	Eastern Washington (East of the Cascade Mountain Crest)
October 1 through March 1	October 1 through November 15

2. Irrigated Plant Material

In irrigated areas, plant material shall not be installed until the irrigation system is fully operational and accepted by the Engineer. Trees and shrubs may be planted in irrigated areas during the non-irrigated planting window before the irrigation system is functional with the written concurrence of the Engineer only if the irrigation system is guaranteed to be operational prior to the end of the non-irrigated planting window.

8-02.3(8)B Plant Installation

The Contractor shall handle plant material in the following manner:

1. Root systems shall be kept covered and damp at all times. Plant material shall be kept in containers until the time of planting.
2. Roots shall not be bunched, curled, twisted, or unreasonably bent when placed in the planting hole. Bare root plant material shall be dormant at the time of harvesting and planting. The root systems of all bare root plant material shall be dipped in a slurry immediately prior to planting.
3. Plant material supplied in wrapped balls shall not be removed from the wrapping until the time of planting at the planting location. The root system of balled plant material shall be moist at the time of planting. Root balls shall be loosened prior to planting. All burlap, baskets, string, wire and other such materials shall be removed from the hole when planting balled plants.
4. Plant cutting material shall be dormant at the time of cutting and planting. All cuttings shall be installed immediately if buds begin to swell.
5. Plants shall be placed with the crown at the finished grade. In their final position, plants shall have their top true root (not adventitious root) no more than 1 inch below the final soil surface, no matter where that root was located in the original root ball or container. The backfill material, including container and root ball soil, shall be thoroughly watered on the same day that planting occurs regardless of season.
6. When installing plants, the Contractor shall dig planting holes three times the diameter of the container or root ball size. Any glazed surface of the planting hole shall be roughened prior to planting.

8-02.3(8)C Pruning, Staking, Guying, and Wrapping

Plants shall be pruned at the time of planting only to remove minor broken or damaged twigs, branches or roots. Pruning shall be performed with a sharp tool and shall be done in such a manner as to retain or to encourage natural growth characteristics of the plants. All other pruning shall be performed only after the plants have been in the ground at least 1 year and when plants are dormant.

Trees shall only be staked when so noted in the Plans. Each tree shall be staked or guyed before completion of the backfilling in accordance with the details shown in the Plans.

All stakes and guying material shall be removed at the end of the first year of plant establishment period, unless otherwise directed.

Commercial plant ties may be used in lieu of hose and wire guying upon concurrence of the Engineer. Trees shall be wrapped when so noted in the Plans.

8-02.3(9) Seeding, Fertilizing, and Mulching

8-02.3(9)A Dates for Application of Seed

Unless otherwise allowed by the Engineer, the Contractor shall apply seed for permanent erosion control during the following periods:

Western Washington¹ (West of the Cascade Mountain Crest)	Eastern Washington (East of the Cascade Mountain Crest)
March 1 through May 15 September 1 through October 1	October 1 through November 15

¹Seeding may be allowed outside these dates when allowed by the Engineer.

All roadway excavation and embankment ground surfaces that are completed to final grades shall be prepared and seeded during the first available seeding window. When environmental conditions are not conducive to satisfactory results, the Engineer may suspend the seeding Work until such time that the desired results are likely to be obtained. If seeding is suspended, temporary erosion control methods according to Section 8-01 shall be used to protect the bare soil until seeding conditions improve.

8-02.3(9)B Seeding and Fertilizing

The Contractor shall prepare the seeding area in accordance with Section 8-02.3(5)A and apply seed at the rate and mix specified in the Special Provisions. The Contractor shall notify the Engineer within 5 days in advance of any seeding operation and shall not begin the Work until areas prepared or designated for seeding have been accepted. Following the Engineer’s acceptance, seeding of the accepted ground surfaces shall begin immediately.

Seeding shall not be done during windy weather or when the ground is frozen, or excessively wet.

When seeding by hand, the seed shall be incorporated into the top ¼ inch of soil by hand raking or other method that is allowed by the Engineer.

Seed applied as a separate operation using a hydroseeder may have a tracer added to visibly aid uniform application. The tracer shall be HECF Short-Term Mulch applied at a rate of 200 to 250 pounds per acre and the tracer shall carry the measured specified seeding rate.

8-02.3(9)C Seeding with Fertilizers and Mulches

When the Proposal includes any variation of seeding, fertilizing, and mulching, the seed and fertilizer shall be applied in one application followed by mulching. West of the Cascade Mountains, seed, fertilizer, and mulch may be completely applied in one application. East of the Cascades, seeding, fertilizing, and mulching shall not be applied as a single application unless allowed by the Engineer in writing prior to application. The fertilizing and mulching shall meet the requirements of Sections 8-02.3(6) and 8-02.3(11).

8-02.3(9)D Inspection

Seeded areas will be inspected upon completion of seeding, fertilizing, and mulching. The Work in any area will not be measured for payment until a uniform distribution of the materials is accomplished at the specified rate. Areas that have not received a uniform application of seed, fertilizer, and mulch at the specified rate, as determined by the Engineer, shall be re-seeded, re-fertilized, or re-mulched prior to payment for seeding within a designated area at no additional cost to the Contracting Agency.

8-02.3(9)E Protection and Care of Seeded Areas

The Contractor shall install and establish a stable and weed free stand of grass as specified within all designated permanent seeding areas. A stable stand of grass shall meet the following requirements:

1. A dense and uniform canopy cover, 70 percent for Western Washington and 50 percent for Eastern Washington, of specified species covers all seeded areas after 3 months of active growth following germination during the growing season. Canopy cover is defined as the cover of living and vigorous grass blades, leaves, and shoots of specified species. Volunteer species, weeds, woody plants, or other undesirable vegetation shall not factor into the canopy cover. Growth and establishment may require supplemental irrigation to meet cover requirements.
2. Stand health is evident by vigorously growing planted species having a uniform rich-green appearance and with no dead patches or major gaps of growth. A stand of grass that displays rusting, wilting, stunted growth, disease, yellowing or browning of leaves, or bare patches does not meet the stand health requirement.
3. The Contractor shall establish a stable stand of grass free of all weeds, non-specified grasses, and other undesirable vegetation. Weed control shall be in accordance with the Weed and Pest Control Plan and occur on a monthly basis during the establishment period and through the life of the Contract.
4. Remove all trash, rocks, construction debris, and other obstructions that may be detrimental to the continued establishment of future seeding.

In addition to the requirements of Section 1-07.13, restoration of eroded areas including clean up, removal, and proper disposal of eroded material, filling and raking of eroded areas with Topsoil Type A or fine compost, and re-application of the specified seed, fertilizer, and mulch shall occur at no additional cost to the Contracting Agency.

8-02.3(10) Lawn Installation

8-02.3(10)A Dates and Conditions for Lawn Installation

In irrigated areas, lawn installation shall not begin until the irrigation system is fully operational.

Unless otherwise allowed by the Engineer, seeded lawn installation shall be performed during the following time periods at the location shown:

Western Washington (West of the Cascade Mountain Crest)	Eastern Washington (East of the Cascade Mountain Crest)
March 1 through May 15 September 1 through October 1	October 1 through November 15
When irrigation system is operational March 1 through October 1	When irrigation system is operational March 1 through November 1

8-02.3(10)B Lawn Seeding and Sodding

The Contractor shall prepare the lawn area in accordance with Section 8-02.3(5) and apply seed at the mix and rate of application as specified in the Special Provisions.

The Contractor shall have the option of sodding in lieu of seeding for lawn installation at no additional expense to the Contracting Agency. The available grass mixtures on the current market shall be submitted to the Engineer for selection and acceptance. Seeding in lieu of sodding will not be allowed.

Seed placed by hand shall be raked into the soil. Following raking, the seeded soil shall be rolled with a smooth 50-pound roller. Sod strips shall be placed within 48 hours of being cut. Placement shall be without voids and have the end joints staggered. Following placement, the sod shall be rolled with a smooth roller to establish contact with the soil.

Barriers shall be erected, with warning signs where necessary, to preclude pedestrian traffic access to the newly placed lawn during the establishment period.

8-02.3(10)C Lawn Establishment

Lawn establishment shall consist of caring for all new lawn areas within the limits of the project.

The lawn establishment period shall begin immediately after the lawn seeding or sodding has been accepted by the Engineer and shall extend to the end of the Contract or the first-year plant establishment, whichever is last.

During the lawn establishment period, the Contractor shall ensure the continuing healthy growth of the turf. This care shall include keeping the project in a presentable condition including, but not limited to, removal of litter, mowing, trimming, removal of grass clippings, edging, fertilization, insecticide and fungicide applications, weed control, watering, repairing the irrigation system, and repair and reseeding all damaged areas.

Lawn mowings shall be done in accordance with Section 8-02.3(10)D.

Temporary barriers shall be removed only when directed by the Engineer.

All Work performed under lawn establishment shall comply with established turf management practices.

Acceptance of lawn planting as specified will be based on a uniform stand of grass and a uniform grade at the time of final inspection. The Contractor shall recultivate, re-grade, reseed, and refertilize areas that are bare or have a poor stand of grass or not having a uniform grade through any cause before final inspection at no additional cost to the Contracting Agency.

8-02.3(10)D Lawn Mowing

Lawn mowing shall begin immediately after the lawn establishment period has been accepted by the Engineer.

The Contractor shall accomplish the following minimum requirements:

1. Mow, trim, and edge as often as conditions dictate, at a minimum, once per week between April and September. Maximum height of lawn shall not exceed 3 inches. The cutting height shall be 2 inches. Cuttings, trimmings, and edgings shall be disposed of off the project site. When the Engineer allows the use of a mulching mower, trimmings may be left in place.
2. Water as often as conditions dictate depending on weather and soil conditions.
3. Provide fertilizer, weed control, water, soil amendments and other measures as necessary to establish and maintain a healthy stand of grass.

8-02.3(11) Mulch

Mulches associated with seeding and planting shall be of the type specified in the Special Provisions or as indicated in the Plans. The Contractor shall evenly apply mulch at the rates indicated in the Plans. Mulches shall not be placed below the anticipated water level of ditch slopes, pond bank slopes, and stream banks, or in areas of standing or flowing water.

8-02.3(11)A Mulch for Seeding Areas

The Contractor shall furnish and evenly apply Hydraulically Applied Erosion Control Product (HECP) Long Term Mulch at the rates indicated and in accordance with the Manufacturer's specifications unless otherwise specified. Application in two passes in perpendicular patterns may be required to achieve a uniform distribution.

HECP Long Term Mulch shall be hydraulically applied at the rate of 3500 pounds per acre with no more than 2000 pounds applied in any single lift. HECP mulch shall not be used within the Ordinary High Water Mark.

Mulch sprayed on signs or sign Structures shall be removed the same day.

Areas not accessible by mulching equipment shall be mulched by accepted hand methods.

HECP Long Term Mulch may be applied with seed and fertilizer West of the summit of the Cascade Range. East of the summit of the Cascade Range, seed and fertilizer shall be applied in a single application followed by the application of mulch.

8-02.3(11)B Bark or Woodchip Mulch

The Contractor shall apply bark or wood chip mulch of the type and depth specified where shown in the Plans or as specified in the Special Provisions.

The Contractor shall complete final grading and placement/incorporation of topsoil and soil amendments within the planting area prior to placement of mulch. Areas receiving bark mulch shall be bare soil or vegetation free before application, except where trees and other plants are specifically identified in the Plans or designated by the Engineer to be saved and protected.

Bark or wood chip mulch shall be placed to a uniform non-compacted depth of 3 inches over all planting areas unless otherwise specified. Mulch shall be feathered to the base of the plant and 1 inch below the top of junction and valve boxes, curbs, and pavement edges.

Any contamination of the mulch due to the Contractor's operations, including sourcing, shall be corrected at no additional cost to the Contracting Agency. Mulch placed to a thickness greater than specified shall be at no additional cost to the Contracting Agency.

The Contractor shall keep plant material crowns, runners, and branches free of mulch at all times.

8-02.3(11)C Bark or Woodchip Mulch Rings

The Contractor shall apply mulch rings around plants installed within existing vegetation areas or within seeded areas as shown in the Plans. Bark or wood chip mulch rings shall be applied to the surface of vegetation free areas in the isolated plant locations where shown in the Plans or as specified in the Special Provisions. Bark or wood chip mulch shall be placed to a uniform non-compacted depth of 3 inches to a radius of 2 feet around all plants within interplanted plant locations.

8-02.3(12) Inspection and Completion of Initial Planting

Upon completion of the initial planting within a designated area, the Engineer will make an inspection of all planting areas. The Contractor shall be present at the inspection of planting areas. The Engineer will notify the Contractor, in writing, of any replacements or corrective action necessary to meet the plant installation requirements. The Contractor shall replace all materials rejected or missing and correct unsatisfactory conditions.

Completion of the initial planting within a designated area includes the following conditions:

1. 100 percent of each of the plant material categories are installed as shown in the Plans.
2. Planting Area is cleaned up.
3. Repairs are completed, including but not limited to, full operation of the irrigation system.
4. Mulch coverage is complete.
5. All weeds are controlled.

8-02.3(13) Plant Establishment

Plant establishment consists of caring for all plants and planting areas within the project limits. The provisions of Sections 1-07.13(2) and 1-07.13(3) do not apply to this section.

When the Proposal includes the bid item PSIFE_____ (Plant Selection Including Plant Establishment), that bid item includes one year of plant establishment Work. The first year of plant establishment shall begin immediately upon written notification from the Engineer of the completion of initial planting for the project. The first-year plant establishment period shall be a minimum 12-month period. The first-year plant establishment shall be extended an amount equal to any periods where the Contractor does not comply with the plant establishment requirements and plan.

During the first-year plant establishment period, the Contractor shall perform all Work necessary to ensure the resumption and continued growth of the transplanted material. This Work shall include, but is not limited to, applying water, removing foreign, dead, or rejected plant material, maintaining all planting areas in a weed-free condition, and replacing all unsatisfactory plant material planted under the Contract. If plants are stolen or damaged by the acts of others, the Contracting Agency will pay invoice cost only for the replacement plants with no mark-up and the Contractor will be responsible for the labor to install the replacement plants.

During the first year of plant establishment, the Contractor shall meet monthly or at an agreed upon schedule with the Engineer for the purpose of joint inspection of the planting material. The Contractor shall correct all unsatisfactory conditions identified by the Engineer within a 10-day period immediately following the inspection. If plant replacement is required, the Contractor shall, within the 10-day period, submit a plan and schedule for the plant procurement and replacement to occur during the planting period as designated in Section 8-02.3(8). At the end of the plant establishment period, plants that do not show normal growth shall be replaced and all staking and guying that remain on the project shall be removed unless otherwise allowed by the Engineer.

All automatic irrigation systems shall be operated fully automatic during the plant establishment period and until final acceptance of the Contract. Payment for water used to water in plants, or hand watering of plant material or lawn areas unless otherwise specified, is the responsibility of the Contractor during the first-year plant establishment period.

Subsequent year plant establishment periods shall begin immediately at the completion of the preceding year's plant establishment period. Each subsequent plant establishment period shall be one full calendar year in duration.

During the plant establishment period(s) after the first-year plant establishment, the Work necessary for the continued healthy and vigorous growth of all plants material shall be performed as directed by the Engineer.

Payment for water used to water plants during the subsequent year(s) of plant establishment will be paid under the plant establishment item.

8-02.3(14) Plant Replacement

The Contractor shall be responsible for growing or arrange to provide sufficient plants for replacement of all plant material rejected through first-year plant establishment. All replacement plant material shall be inspected and accepted by the Engineer prior to installation. All rejected plant material shall be replaced with acceptable plants meeting the specifications and installed according to the requirements of this section at dates allowed by the Engineer.

All replacement plants shall be of the same species as the plants they replace and meet the requirements of Section 9-14.7 unless otherwise allowed by the Engineer. Plants may vary in size reflecting one full season of growth should the Contractor elect to hold plant material under nursery conditions for an additional year to serve as replacement plants. Replacement plant material larger than specified in the Plans shall meet the applicable section requirements of the ASNS for container class, ball size, spread, and branching characteristics.

8-02.3(15) Bioengineering

Bioengineering consists of using plant materials for the purpose of streambank or earthen slope construction and surface stabilization. This Work may include installing woody plant material in various forms as well as part of streambank or earthen slope construction.

8-02.3(15)A Live Fascines

Live fascines shall be constructed of live and dead stake cuttings bundled together with a diameter of 8 to 18 inches. Live stake cuttings shall be from plant species designated in the Plans. Dead branches may be cuttings from any woody, non-invasive plant native to the project area. Dead branches may be placed within the live fascine and on the side exposed to the air. Live branches shall be placed in contact with the soil along their entire length. Each live fascine must contain a minimum of eight live branches. Dead branches shall constitute no more than 40 percent of the total fascine content.

The total length of each live fascine shall be a minimum of 5 feet. Branches shall be bundled into log-like forms and bound with biodegradable twine spaced at 1 foot intervals along the entire length of the live fascine. Live fascines shall be installed horizontally in a trench whose depth shall be $\frac{3}{4}$ the diameter of the live fascine. Secure the live fascine with wood stakes 3 feet in length and 2 inch in diameter placed at 18-inch intervals. A minimum of 3 wood stakes shall be used per fascine. The wood stakes shall be driven through the live fascine vertically into the slope. The ends of live fascines shall be woven together so that no gap remains between the two sections of the live fascine.

Prior to being covered with soil, the fascine shall be thoroughly watered. Once the fascine is covered with 6 inches of soil, the fascine shall be thoroughly watered.

When used to remedy erosion areas, live fascines shall extend a minimum of 2 feet beyond the visible area of erosion and soil disturbance. The locations for live fascines and live stake rows shall be identified in the field for review and acceptance by the Engineer. The Engineer may require adjustment of fascine locations prior to installation in order to best accomplish the intended functions.

Plant replacement during plant establishment for "PSIPE Live Fascine" will be required for any section void of live shoots for a length of 3 feet or more. Replacement shall consist of installing live stakes, spaced 1 foot apart above the fascine within the area void of live shoots. Live stakes shall be of the same species as the live fascine and shall have a minimum length of 3 feet and a minimum diameter of $\frac{3}{4}$ inch. The requirements of Section 8-02.3(8) apply to PSIPE Live Fascine.

8-02.3(15)B Live Brush Mattress

Live brush mattress shall be constructed of live branch cuttings, live poles, jute rope and topsoil. The live branch cuttings and live poles shall be from the plant species designated in the Plans. Live branch cuttings shall be placed with the cut ends oriented down slope as shown in the Plans. Cuttings shall overlap from side to side and from top to bottom as each layer is constructed. The live branches in each succeeding upper layer shall overlap the adjacent lower layer by a minimum of 6 inches. A maximum of 20 percent of the branches may be dead branches, but the live branches shall be distributed evenly to provide even rooting and growth over the entire area of the brush mattress.

The Contractor shall anchor the live brush mattress to the slope using stakes and jute rope as shown in the Plans. Initially, the stakes shall be installed to protrude above the live brush mattress. The Contractor shall attach the jute rope to the stakes and tighten the rope by tamping the stakes further into the bank, pulling the live brush mattress tight against the soil surface. The Contractor shall cover the live brush mattress with sufficient stockpiled topsoil to ensure good soil contact with the live plant material.

Plant replacement during plant establishment for "PSIPE Live Brush Mattress" will be required for any section void of live shoots for an area of 25 square feet or more. Replacement shall consist of installing live stakes, spaced 3 feet apart in a triangular pattern within the area void of live shoots. Live stakes shall be of the same species as the live brush mattress and shall have a minimum length of 3 feet and a minimum diameter of $\frac{3}{4}$ inch. The requirements of Section 8-02.3(8) apply to PSIPE Brush Mattress.

8-02.3(15)C Brush Layer

Brush layers shall be constructed of live branch cuttings, randomly mixed, from the plant species as designated in the Plans. The number of branches required will vary depending on the average branch diameter and layer thickness.

Brush layers shall be placed in a trench dug at a 45-degree incline into the slope or stream bank. Two-thirds to three-fourths of the length of the live branches shall be buried. Soil shall be firmly tamped in place. Succeeding layers shall be spaced as detailed in the Plans. Brush layer placed in stream banks shall be angled downstream.

Plant replacement during plant establishment for "PSIPE Brush Layer" will be required for any section void of live shoots for a length of 3 feet or more. Replacement shall consist of installing live stakes, spaced 1 foot apart within the area void of live shoots. Live stakes shall be of the same species as the brush layer and shall have a minimum length of 3 feet and a minimum diameter of $\frac{3}{4}$ inch. The requirements of Section 8-02.3(8) apply to PSIPE.

8-02.3(16) Roadside Maintenance Under Construction

When the Contract includes the item, Roadside Maintenance Under Construction, this Work includes roadside mowing and ditch maintenance, and noxious weed control outside of planting areas according to Section 8-02.3(3).

8-02.3(16)A Roadside Mowing

The Contractor shall mow designated roadside grass areas to the limits designated by the Engineer. Roadside mowing is limited to slopes not steeper than 3(H) to 1(V).

The Contractor shall mow according to the following requirements:

1. Trim around traffic equipment, structures, planting areas, or other features extending above ground preceding or simultaneously with each mowing.
2. Maintain grass between 4 and 12 inches in height.
3. Operate mowing equipment with suitable guards to prevent throwing rocks or debris onto the traveled way or off of the Contracting Agency property. Power driven equipment shall not cause ruts, deformation, and compaction of the vegetated soil.
4. Removing clippings is required on the traveled way, shoulders, walkways, or Structures.
5. Restore soil rutting to a smooth and even grade at the direction of the Engineer.

8-02.3(16)B Ditch Maintenance

The Contractor shall maintain drainage for the duration of the Contract according to the following requirements:

1. Maintain flow lines in drainage channels and roadside ditches.
2. Cutting or trimming vegetation within drainage channels to maintain positive flow.
3. Remove dirt and debris from inside of culverts or any drainage area where runoff has allowed accumulations and re-seed for erosion control.
4. Restore channels to previous operational condition.

8-02.4 Measurement

Topsoil, bark or woodchip mulch and soil amendments will be measured by the acre or the square yard along the grade and slope of the area covered after acceptance.

Bark or woodchip mulch rings will be measured per each.

Compost will be measured by the acre or the square yard along the grade and slope of the area covered immediately after application.

Seeding, fertilizing, and mulching will be measured by the acre or the square yard by ground slope measurement or through the use of design data.

Seeding and fertilizing by hand will be measured by the square yard. No adjustment in area size will be made for the vegetation free zone around each plant.

Seeded lawn, sod installation, and lawn mowing will be measured along the ground slope and computed in square yards of actual lawn completed, established, and accepted.

Plant selection will be measured per each.

PSIPE __ (Plant Selection Including Plant Establishment) will be measured per each.

Live Pole will be measured per each.

Live Stake Row will be measured by the linear foot along the ground slope line.

The pay quantities for plant materials will be determined by count of the number of satisfactory plants in each category accepted by the Engineer.

Live Fascine and PSIPE Live Fascine will be measured by the linear foot along the ground slope line.

Live Brush Mattress and PSIPE Live Brush Mattress will be measured by the surface square yard along the ground slope line.

Brush Layer and PSIPE Brush Layer will be measured by the linear foot along the ground slope line.

Water will be measured in accordance with Section 3-06.4.

8-02.5 Payment

Payment will be made for each of the following listed Bid items that are included in the Proposal:

“Project Area Weed and Pest Control” will be paid in accordance with Section 1-09.6.

For the purpose of providing a common Proposal for all Bidders, the Contracting Agency entered an amount for “Project Area Weed and Pest Control” in the Proposal to become a part of the total Bid by the Contractor. Payment under this item will be made only when the Work is not already covered by other items.

“Topsoil Type ____”, per acre or per square yard.

The unit Contract price for “Topsoil Type ____” shall be full payment for all costs including weed control pre-treatment of topsoil areas, excavation, and stockpiling for the specified Work.

“Fine Compost”, per acre or per square yard.

“Medium Compost”, per acre or per square yard.

“Coarse Compost”, per acre or per square yard.

The unit Contract price for “Fine Compost”, “Medium Compost” or “Coarse Compost” shall be full pay for furnishing and spreading the compost onto the existing soil.

“Soil Amendment”, per acre or per square yard.

The unit Contract price for “Soil Amendment” shall be full pay for furnishing and incorporating the soil amendment into the existing soil.

“Plant Selection ____”, per each.

The unit Contract price for “Plant Selection ____”, per each shall be full pay for all Work to perform the work as specified within the planting area prior to planting for weed control, planting area preparation and installation of plants with initial watering.

As the plants that do not include plant establishment are obtained, propagated, and grown, partial payments will be made as follows:

Payment of 15 percent of the unit Contract price per each when the plant materials have been contracted, propagated, and are growing under nursery conditions. The Contractor shall provide the Engineer with certification that the plant material has been procured or contracted for delivery to the project for planting within the time limits of the project. The certification shall state the location, quantity, and size of all material.

Payment will be increased to 100 percent of the unit Contract price per each for contracted plant material at the completion of the initial planting.

All partial payments shall be limited to the actual number of healthy vigorous plants that meet the stage requirements, limited to plan quantity. Previous partial payments made for materials rejected or missing will be deducted from future payments due the Contractor.

“PSIPE ____”, per each.

The unit Contract price for “PSIPE ____”, per each, shall be full pay for all Work to perform as specified within the planting area for weed control and planting area preparation, planting, staking, cleanup, and water necessary to complete planting operations as specified to the end of first year plant establishment.

As the plants that include plant establishment are obtained, propagated, and grown, partial payments will be made as follows after inspection by the Engineer:

Payment of 5 percent of the unit Contract price, per each, when the plant materials have been contracted, propagated, and are growing under nursery conditions. The Contractor shall provide the Engineer with certification that the plant material has been procured or contracted for delivery to the project for planting within the time limits of the project. The certification shall state the location, quantity, and size of all material.

Payment will be increased to 15 percent of the unit Contract price, per each, upon completion of the initial weed control and planting area preparation Work.

Payment will be increased to 60 percent of the unit Contract price per each for the contracted plant material in a designated unit area when planted.

Payment will be increased to 70 percent of the unit Contract price per each for contracted plant material at the completion of the initial planting.

Payment will be increased to the appropriate percentage upon reaching the following plant establishment milestones:

June 30 th	80 percent
September 30 th	90 percent
Completion of first-year plant establishment or after all replacement plants have been installed, whichever is later	100 percent

Plant establishment milestones are achieved when planting areas meet conditions described in Section 8-02.3(13).

"Seeding, Fertilizing and Mulching", per acre or per square yard.

"Seeding and Fertilizing", per acre or per square yard.

"Seeding and Fertilizing by Hand", per square yard.

"Second Application of Fertilizer", per acre.

"Seeding and Mulching", per acre.

"Seeded Lawn Installation", per square yard.

"Sod Installation", per square yard.

"Lawn Mowing", per square yard.

The unit Contract price per square yard for "Seeded Lawn Installation" or "Sod Installation" shall be full pay for all costs necessary to prepare the area, plant or sod the lawn, erect barriers, control weeds, and establish lawn areas and for furnishing all labor, tools, equipment, and materials necessary to complete the Work as specified and shall be paid in the following sequence for healthy, vigorous lawn:

Completion of Lawn Planting	60 percent of individual areas
Mid Lawn Establishment (after 2 mowings)	85 percent of individual areas
Completion of Lawn Establishment (after 4 mowings)	100 percent of individual areas

"Plant Establishment - ___ Year" will be paid in accordance with Section 1-09.6.

For the purpose of providing a common Proposal for all Bidders, the Contracting Agency entered an amount for "Plant Establishment - ___ Year" in the Proposal to become a part of the total Bid by the Contractor.

"Live Pole", per each.

"Live Stake Row", per linear foot.

"Bark or Wood Chip Mulch", per acre or per square yard.

The unit Contract price for "Bark or Wood Chip Mulch" shall be full pay for furnishing and spreading the mulch onto the existing soil.

"Bark or Wood Chip Mulch Rings", per each.

The unit Contract price "Bark or Wood Chip Mulch Rings" shall be full pay for furnishing and spreading the mulch onto the existing soil.

"Live Fascines" and "PSIPE Live Fascine", per linear foot.

"Live Brush Mattress" and "PSIPE Live Brush Mattress", per square yard.

"Brush Layer" and "PSIPE Brush Layer", per linear foot.

When PSIPE is included with Fascine, Brush Mattress, or Brush Layer, the payment schedule for PSIPE ____ will apply.

"Roadside Maintenance under Construction" will be paid in accordance with Section 1-09.6.

For the purpose of providing a common Proposal for all Bidders, the Contracting Agency has entered an amount for "Roadside Maintenance Under Construction" in the Proposal to become a part of the total Bid by the Contractor.

Water will be paid for in accordance with Section 3-06.5.

8-03 Irrigation Systems

8-03.1 Description

This Work consists of installing irrigation systems in accordance with these Specifications and the details shown in the Plans or as approved by the Engineer.

8-03.1(1) Definitions

Catch Can Test – A test utilizing containers spaced at regular intervals for collecting water for use in a water audit.

Critical Root Zone – The International Society of Arboriculture (ISA) defines CRZ as an area equal to 1 foot radius from the base of the tree's trunk for each 1 inch of the tree's diameter at 4.5 feet above grade (referred to as diameter at breast height).

Drip Irrigation – A system of irrigation involving the controlled delivery of water directly to individual plants through a network of tubes or pipes and emitters.

Emitters – Low volume emission devices including but not limited to pressure compensating emitters, self-flushing emitters, non-flow restricting barbed couplers or in-line drip emitter tubing.

Flushing – A cleansing by causing large quantities of water to pass through the pipe or conduit.

Hydrostatic Pressure Testing – A test used to determine the integrity of the pipeline after installation before it's placed into service.

Irrigation Audit – Procedure to collect and present information concerning the uniformity of application, precipitation rate, and general condition of an irrigation system and its components.

Irrigation Head – Nozzle or device, which may or may not rotate for distributing water under pressure through the air including but not limited to impact drive, rotor, or spray head.

Irrigation Sleeve – Casing, pipe or conduit that is installed under hardscapes or structures for the purpose of running irrigation piping or wiring.

Lateral Lines – All supply pipe and fittings between the irrigation control valves and the connections to the irrigation heads. Swing joints, thick-walled PVC or polyethylene (poly) pipe, flexible risers, rigid pipe risers, and associated fittings are not considered part of the lateral line but incidental components of the sprinkler heads.

Main Lines – All supply pipe and fittings between the water meter and the irrigation control valves.

Sprinkler Irrigation System – Type of irrigation using mechanical devices with above ground or pop-up irrigation heads to distribute by converting water to a high velocity discharge stream or streams.

8-03.1(2) Regulations and Code

Cross-Connections – WAC 246-290-490

Section 8-20.1(1), Illumination, Traffic Signal Systems, Intelligent Transportation Systems, and Electrical – Regulation and Code

Section 8-20.1(2), Illumination, Traffic Signal Systems, Intelligent Transportation Systems, and Electrical – Industry Codes and Standards

Waterworks Operator Certification – WAC 246-292

8-03.2 Materials

Materials shall meet the requirements of the following sections:

Sand	9-03.2(1)
Crushed Surfacing	9-03.9(3)
Gravel Backfill for Dry Wells	9-03.12(5)
Irrigation Materials	9-15
Electrical Wire and Splices	9-15.17
Detectable Warning Tape	9-15.18
Electrical Systems	9-29
Steel Casing	9-29.1(7)

8-03.3 Construction Requirements**8-03.3(1) General Requirements**

Location of pipe, tubing, irrigation heads, emitters, valves, cross-connection devices, irrigation sleeves and other equipment shall be as shown in the Plans and shall be of the size and type indicated.

Potable water supplies shall be protected against cross-connections in accordance with applicable regulations for the Washington State Department of Health and the local health authority.

Construction of irrigation electrical systems shall conform to applicable portions of Sections 8-20.

8-03.3(2) Submittals

When required, the Contractor shall submit the following:

1. **Staging Plan** – A Type 2 Working Drawing consisting of a material staging plan, should the Contractor propose Contracting Agency-owned property for staging areas.
2. **Cable Vault Installation Plan** – A Type 2 Working Drawing consisting of a cable vault installation plan showing the exact proposed installation location by roadway station, offset and the scheduled sequence for each cable vault installation.
3. **Pit Plan** – A Type 2 or 2E Working Drawing consisting of a pit plan, for each boring or jacking pit, depicting the protection of traffic and pedestrians, pit dimensions, shoring, bracing, struts, walers, sheet piles, conduit skids, and means of attachment, casing type, and casing size. A Type 2E Working Drawing is only required where shoring, bracing, struts, walers, sheet piles, or casing are used.
4. **Boring, Jacking, or Directional Drilling Plan** – A Type 2 or 2E Working Drawing consisting of a boring, jacking directional drilling plan depicting the boring, jacking, or directional drilling system and entire support system. A Type 2E Working Drawing is only required if a support system is used.
5. **Construction lock-out/tag-out procedures** – A Type 1 Working drawing detailing construction lock-out/tag out procedures.
6. **Maintenance and Operations Manual** – A Type 1 working drawings transmitting the Maintenance and Operation Manual in accordance with Section 8-03.3(13)B.
7. **Irrigation Audit Report** – A Type 1 working drawings transmitting the Irrigation Audit Report in accordance with Section 8-03.3(12).

8-03.3(3) Layout of Irrigation System

The irrigation system shall be installed within planting areas unless otherwise indicated in the Plans. Prior to installation, the Contractor shall stake the irrigation system following the schematic design shown in the Plans for approval by the Engineer. Minor alterations and changes in the layout may be allowed in order to conform to ground conditions and to obtain full and adequate coverage of plant material. However, no changes in the system as planned shall be made without prior authorization by the Engineer.

8-03.3(3)A Locating Irrigation Sleeves

All buried pipe under structures, vehicular and pedestrian surfaces and as indicated in the Plans shall be protected by irrigation sleeving. Irrigation sleeves placed during general construction prior to installation of the irrigation system shall be marked at both ends with a 2 by 4 wood stake extending a minimum of 6 inches above finish grade and painted blue on the exposed end. At any point during construction, the stake shall be embedded 24-inches. Irrigation sleeving shall extend a minimum 2 feet beyond the limits of pavement, curb, or pedestrian surface.

Existing underground irrigation sleeve ends shall be located by potholing.

8-03.3(4) Irrigation Water Service

All water meter(s) shall be installed by the serving utility.

It shall be the Contractor's responsibility to:

1. Contact the Engineer to schedule the water meter(s) installation;
2. Provide a minimum of 60 calendar days' notice to the Engineer for the Contracting Agency to arrange installation of the water meter(s) by the serving utility; and
3. Connect the irrigation system to the water meter.

Construction activities for irrigation water service connections shall be in accordance with the serving utility's Service Agreement. A copy of the Service Agreement can be obtained from the Engineer.

The Contracting Agency will be responsible for all costs for the installation of the water meter(s) by the serving utility and water consumption needed for irrigation system installation including initial flushing and testing. Costs for water consumption after initial testing of the system will be the responsibility of the Contractor through Physical Completion.

8-03.3(5) Irrigation Electrical Service

All electrical service(s) shall be installed by the serving utility.

It shall be the Contractor's responsibility to:

1. Contact the Engineer to schedule the electrical service(s) installation;
2. Provide a minimum of 60 calendar days' notice to the Engineer for the Contracting Agency to arrange installation of the electrical service(s) by the serving utility; and
3. Splice and run conduit and wire from the electrical service connection(s) or service cabinet to the automatic electrical controller and connect the conductors to the circuit(s) in accordance with the controller manufacturer's diagrams or recommendations.

The installation of conduits and wire for the electrical power service shall be in accordance with the serving utility's Service Agreement and Section 8-20. A copy of the Service Agreement may be obtained from the Engineer.

The Contracting Agency will be responsible for all costs for the installation of the electrical service(s) by the serving utility. Costs for consumption of energy shall be in accordance with Section 8-20.3(10).

8-03.3(6) Excavation**8-03.3(6)A Trenches****8-03.3(6)A1 General**

Pipe trenches shall be no wider at any point than is necessary to lay the pipe or install equipment. Trench bottoms shall be relatively smooth and consist of sand or other suitable material free from rocks, stones, or any material that might damage the pipe. Trenches through rock or other material unsuitable for trench bottoms and sides shall be excavated 6-inches below the required depth and shall be backfilled in accordance with Section 8-03.3(11).

8-03.3(6)A2 Within Critical Root Zone

Mechanical trenching within the Critical Root Zone of existing trees shall not be allowed.

8-03.3(6)A3 Detectable Marking Tape

Detectable marking tape shall be placed in all trenches 6 inches directly above, parallel to, and along the entire length of all nonmetallic water pipes, sleeving, wiring, conduits, and casing pipes. Detectable marking tape shall meet the requirements of Section 9-15.18.

8-03.3(6)B Trenchless Construction

All jacking, directional drilling or boring operations shall be performed in accordance with an approved plan as indicated in Section 8-03.3(2). Construction shall be in accordance with the requirements of Section 8-20.3(5)E3, Section 8-20.3(5)E4 and Section 8-20.3(5)E5.

8-03.3(7) Piping**8-03.3(7)A Irrigation Piping**

All irrigation pipe shall be a minimum of 18 inches below finished grade measured from the top of the pipe or as shown in the Plans. Where possible, mains and laterals shall be placed in the same trench. All lines shall be placed a minimum of 3 feet from the edge of concrete sidewalks, curbs, guardrails, walls, fences, and traffic barriers. Pipe pulling will not be allowed for installation and placement of irrigation pipe.

Pipe trenches shall not be backfilled until hydrostatic pressure testing is completed and accepted by the Engineer.

All plastic materials shall be protected from direct sunlight in accordance with Section 1-06.4.

8-03.3(7)B Irrigation Sleeves

Irrigation sleeving shall be Schedule 80 PVC unless otherwise indicated in the Plans. The minimum diameter of the sleeve shall be twice as large as the proposed piping size being buried. When the plans indicate a sleeve larger than twice the diameter, the larger sleeve shall be installed. Irrigation wiring shall be sleeved in separate sleeving or conduit unless indicated otherwise in the Plans.

Irrigation sleeving installed under existing pavement shall use steel casing in lieu of Schedule 80 PVC sleeves and shall be installed in accordance with Section 8-20.3(5)E3, Section 8-20.3(5)E4 or Section 8-20.3(5)E5.

8-03.3(8) Jointing

During construction, pipe ends shall be capped to prevent entry of foreign objects.

8-03.3(8)A Joining Similar Materials

All galvanized steel pipe shall have sound, clean cut, standard pipe threads well fitted. All pipes shall be reamed to the full diameter and burrs removed before assembly. Threaded galvanized steel joints shall be constructed using either a nonhardening, non-seizing multipurpose sealant, PTFE pipe thread tape or paste as recommended by the pipe manufacturer or as shown in the Plans. Threaded galvanized steel joints shall be constructed using either a nonhardening, non-seizing multipurpose sealant, PTFE pipe thread tape or paste as recommended by the pipe manufacturer. All threaded joints shall be made tight with wrenches without the use of handle extensions. Joints that leak shall be cleaned and remade with new material. Caulking or thread cement to make joints tight shall not be permitted.

PVC pipe, couplings, and fittings shall be handled and installed in accordance with the manufacturer's recommendation. PVC pipe ends shall be cut 90 degrees to their longitudinal axis, cleaned of all cutting burrs and free of dirt prior to solvent welding. Pipe and fittings shall be joined by solvent welding utilizing a two-step solvent/cement process according to the manufacturer's recommendation. Solvents used must penetrate the surface at both pipe and fitting, which shall result in complete fusion at the joint. Use solvent and cement as recommended by the pipe manufacturer. Before hydrostatic pressure testing the system, all solvent welded joints shall be fully cured following the solvent weld manufacturer's recommendation.

Threaded PVC joints shall be assembled using PTFE pipe thread tape as recommended by the pipe manufacturer.

Polyethylene pipe, tubing and associated fittings shall be installed in accordance with the manufacturer's recommendations. The ends of the polyethylene pipe shall be cut square, reamed smooth inside and out, and inserted to the full depth of the fitting. Clamps for insert fittings shall be stainless steel and have a tightening mechanism.

8-03.3(8)B Joining Dissimilar Materials

On PVC or polyethylene-to-metal connections, complete the metal connection first. Use a nonhardening compound on threaded connections. Connections between metal and PVC or polyethylene are to be threaded using female threaded PVC adapters with threaded Schedule 80 PVC nipples only.

8-03.3(9) Irrigation System Installation**8-03.3(9)A General**

The Contractor shall coordinate new irrigation water service connections with the serving utility. The Contractor shall follow the serving utilities' standards for connections from meter through cross-connection control device. Cross-connections devices and enclosures shall be installed according to the Plans.

8-03.3(9)B Irrigation Heads

Unless otherwise indicated in the Plans, final position of irrigation heads shall be flush with the finished grade in grass or mulch areas as measured from the top of the irrigation head. All irrigation heads adjacent to walks, curbs, and pavement shall be placed as shown in the Plans. Polyethylene (poly) pipe for connections to irrigation heads shall be with fittings recommended by the manufacturer of the poly pipe to produce a flexible swing joint assembly between the lateral line and the irrigation head. The length of thick-walled poly pipe at each flexible swing joint assembly shall be 18 inches minimum to 36 inches maximum. Risers shall be sized as shown in the Plans.

8-03.3(9)C Valve, Valve Boxes, Hose Bibs

All automatic control valves, quick coupler valves, hose bibs, flow control valves, ball valves and pressure reducing valves shall be installed in accordance with manufacturer's recommendations unless otherwise indicated in the Plans. Valve boxes shall have a minimum 3 inches and maximum 18 inches of clearance on sides and lid. There shall be one valve or irrigation component for each valve box unless approved by the Engineer. The bottom of all valve boxes shall be set firmly on crushed surfacing base course. Extensions designed for use with the valve box consistent with matching manufacturer shall be used to reach the required surface elevation. Install double-sided valve identification tags on each valve. Stamped tag number to match zone valve number on controller and in as-built drawings.

Final elevation of valve boxes and quick coupler valves shall be between $\frac{1}{2}$ and 1 inch above finished grade or bark or wood chip mulch surface, or as shown in the Plans.

Quick coupler valves and hose bibs shall be installed in valve boxes, either separately or within a control valve assembly box upstream of the control valves. Valves, quick couplers, and hose bibs shall have 3 inches of clearance on all sides within the valve box.

8-03.3(9)D Drip Irrigation

Drip irrigation tubing, emitter tubing and associated drip tubing fittings shall be installed in accordance with the manufacturer's recommendations and as shown on the Plans. Drip tubing shall be installed horizontal to the ground contours to make a parallel distribution pattern. Drip tubing shall be secured to the ground using commercially available wire stakes every 5 feet and at each fitting or change of direction unless otherwise shown in the Plans.

Drip tubing shall be free from kinks or damage. Single kinks shall be cut out and undamaged sections of drip tubing coupled using approved fittings. Drip tubing runs with multiple, regular kinks as determined by the Engineer shall be replaced. Install drain valves, when specified at the lowest point of each zone in a minimum 10 inch diameter round valve box over 2 cubic feet of gravel backfill for dry wells.

8-03.3(9)E Controller

Locate automatic controller pedestals and container cabinets as shown in the Plans and in accordance with the manufacturer's recommendations. Provide three galvanized metal or PVC electrical wire conduits through the base and 3 inches minimum beyond the edge or side of the base, both inside and outside of the pedestal. Conduits shall be sized to accommodate all wires according to Section 8-20. Conduit shall not be smaller than 1 inch diameter.

8-03.3(9)F Cross-Connection Control Device Installation

Cross-connection control devices shall be installed and inspected, and then tested by a certified cross-connection control specialist or designee in accordance with applicable portions of WAC 246-290-490 and other applicable regulations as set forth by the Washington State Department of Health and local authority.

Inspections and tests shall be conducted at the time of initial installation, after repairs, and annually each Spring prior to reactivation of the irrigation system. These inspections and tests shall be completed, and the results recorded by a licensed Backflow Assembly Tester (BAT). The inspection shall document that the devices are in good operating condition prior to flushing and testing of any downstream water lines. Devices that are defective shall be repaired or replaced and retested.

Inspection and test results shall be recorded on the Backflow Prevention Assembly Test Report (WSDOT Form 540-02) and other forms as may be required by the serving utility. The completed forms shall be submitted to the appropriate health authority, the serving utility and the Engineer.

8-03.3(9)G Electrical Wire Installation

All electrical work shall be performed in accordance with Section 8-20. Electrical wiring between the automatic controller and automatic valves shall be direct burial and may share a common neutral wire. Separate control conductors shall be run from the automatic controller to each valve. When more than one automatic controller is required, a separate common neutral wire shall be provided for each controller and the automatic valves it controls. Electrical wire shall be installed in the trench adjacent to or above the irrigation pipe, but no less than 12 inches deep. Plastic tape or nylon tie wraps shall be used to bundle wires together at 10 foot intervals. If it is necessary to run electrical wire in a separate trench from the irrigation pipe, the wire shall be placed at a minimum depth of 18 inches and “snaked” from side to side in the trench. Each circuit shall be identified at both ends and at all splices with a permanent marker identifying zone and/or station.

Wiring placed under pavement and walls, or through walls, shall be placed in an electrical conduit or within an irrigation sleeve. Electrical conduit shall not be less than 1 inch in diameter.

Splices will be permitted only in electrical junction boxes, valve boxes, pole bases, or within control equipment boxes or pedestals. A minimum of 18 inches of excess conductor shall be left at all splices, terminals, and control valves to facilitate inspection and future splicing. The excess wire shall be neatly coiled to fit easily into the boxes.

All 120-volt electrical conductors and conduit shall be installed by a licensed electrician, including all wire splices and wire terminations.

All wiring shall be tested in accordance with Section 8-20.3(11). Circuits below 115 volts nominal shall follow the procedure described for circuits below 115 volts nominal, with a minimum insulation resistance of not less than 2 megohms to ground for 24-volt direct burial circuits.

8-03.3(10) Flushing and Testing**8-03.3(10)A General Testing Requirements**

All gauges used in the testing of water pressures shall be certified as accurate by an independent testing laboratory immediately prior to use on the project, with documentation submitted to the Engineer for verification. Gauges shall be retested when required by the Engineer.

The automatic controller shall be tested for a period of two weeks under normal operating conditions. The Contractor shall make all necessary adjustments or corrections according to the manufacturer's recommendations and retested until its operation is accepted by the Engineer.

8-03.3(10)B Mainline or Lateral Flushing

All main lines shall receive two fully open flushings to remove debris that may have entered the line during construction: the first before the placement of valves and the second after placement of valves and prior to hydrostatic pressure testing.

All lateral lines shall receive one fully open flushing prior to placement of irrigation heads, emitters, and drain valves. The flushing shall be of sufficient duration to remove all dirt or debris that has entered the lateral lines during construction.

8-03.3(10)C Mainline or Lateral Hydrostatic Pressure Testing

All main lines shall be purged of air and tested with a minimum hydrostatic water pressure of 150 psi for 60 minutes without the introduction of additional service or pumping pressure. Testing shall be done with one pressure gauge installed on the line, in the location approved by the Engineer. For systems using a pump, an additional pressure gauge shall be installed at the pump. Lines that show leaks or loss of pressure exceeding 5 psi at the end of specified test periods will be rejected.

All lateral lines shall be purged of air and tested in place at operating line pressure with a pressure gauge and with all fittings capped or plugged. The operating line pressure shall be maintained for 30 minutes with valves closed and without the introduction of additional service or pumping pressure. Lines that show leaks or loss of pressure exceeding 5 psi at the end of specified test periods will be rejected. The Contractor shall correct and retest main and lateral line installations that have been rejected.

Throughout the life of the Contract, the Contractor shall repair, flush, and test all main and lateral lines that have sustained a break or disruption of service. Upon restoration of the water service, the affected lines shall be brought up to operating pressure. The Contractor shall then conduct a thorough inspection of all irrigation heads, emitters, or other components located downstream of the break or disruption of service and make all needed repairs to ensure the entire irrigation system is operating properly.

8-03.3(10)D Drip Line Testing

All Polyethylene Pipe and Drip Tubing shall be capped, purged of air, and tested in place at operating line pressure with a pressure gauge prior to the installation of all distribution tubing, drip emitters, or other emission devices. The operating line pressure shall be maintained for 30 minutes with valves closed and without the introduction of additional service or pumping pressure. Lines that show leaks in the pipe or fittings, or loss of pressure exceeding 5 psi at the end of specified test periods will be rejected. The Contractor shall correct and retest Polyethylene Pipe or Drip Tubing installations that have been rejected.

8-03.3(11) Backfill

Backfill shall not be allowed until all piping has been inspected, tested, and accepted in writing by the Engineer except where roots are encountered as described in Section 8-03.3(6)A2, after which backfilling shall be completed as soon as possible. All backfill material placed within 6 inches of the pipe shall be sand or other approved material free of rocks, roots, concrete, and construction debris that might cut or otherwise damage the pipe. Backfill shall not contain material one inch or greater in diameter. Backfill from the bottom of the trench to approximately 6 inches above the pipe shall be compacted in a manner that will not damage pipe or wiring and shall proceed evenly on both sides of the pipe. The remainder of the backfill shall be compacted, except that heavy equipment shall not be used within 18 inches of any pipe. Backfill shall be placed and compacted in layers not to exceed 12 inches. Backfill shall be compacted to a minimum of 85 percent of the maximum density and may be tested at the discretion of the Engineer. The top 6 inches of the backfill shall be of topsoil material or the first 6 inches of material removed in the excavation.

8-03.3(12) Adjusting System

Before final inspection, the Contractor shall adjust and balance all irrigation heads or emitters to provide adequate and uniform coverage. Spray patterns shall be balanced by adjusting individual irrigation heads with the adjustment screws or replacing nozzles to produce a uniform pattern. Overspray onto impervious surfaces, signs or other structures will not be allowed.

Irrigation Sprinkler Systems shall receive a landscape irrigation audit performed by a Certified Landscape Irrigation Auditor (CLIA) in good standing with the Irrigation Association (IA). The audit shall be conducted in accordance with the current edition of the IA's Irrigation Auditor Guidelines. The audit report shall include the following information:

1. A plan of the irrigation system that shows station numbers, station locations, irrigation head locations, nozzle size, distances between irrigation heads, and catch can test locations.

2. Flow rates, static and dynamic system pressures, and catch can test results for each zone.
3. Pressure readings, distribution uniformity, and precipitation rates for each zone.

All fixed spray systems shall have a minimum distribution uniformity of 55 percent for radial spray heads and 70 percent for rotors as documented by the audit through catch can test results. All zones not meeting these minimums shall be corrected by the Contractor and retested until they meet these Specifications as documented in the audit report.

The results of the audit shall be submitted to the Engineer in a Type 1 Working Drawing prior to acceptance of the irrigation system. The Contractor shall use the results of the irrigation audit to set watering frequency and timing for each irrigation zone.

8-03.3(13) As-Built Plans, M&O Manuals, and Operating Tools

8-03.3(13)A As-Built

The Contractor shall submit as-built Plans consisting of corrected shop drawings, schematic circuit diagrams, zoning chart, timing schedule and other details necessary to show the Work as constructed. Locations of all irrigation system(s) equipment including, but not limited to, water meters, cross-connection control devices, electrical services, pipe and wire runs, irrigation sleeves, splice boxes, controllers, valves, heads, emitters, and other equipment shall be clearly shown and labeled on the as-built Plans. All buried pipe and wires shall be labeled with layout dimensions locating trenches from visible site features (curb, edge of pavement, valve box, etc.). Grouping of pipe(s) and wire(s) shall be identified when located in the same trench. The as-built Plans shall include all notes pertaining to damage, repairs, and maintenance to the system during installation and operation through the end of the Plant Establishment period. In the event that repairs, or adjustment are made after the initial submittal of the as-built plans, the notes pertaining to those damage, repair or maintenance shall be submitted as a supplement.

These drawings shall be on sheets conforming in size to the provisions of Section 1-05.3. All drawings must be complete and legible.

All corrections ordered by the Engineer shall be made by the Contractor prior to acceptance.

8-03.3(13)B Maintenance & Operations Manuals

The Contractor shall provide the Engineer with an electronic pdf and one copy of the system operations manual. The manual shall include a parts list, catalog cuts, equipment manuals, a summary of operations with startup/winterize techniques, controller programming, valve cleaning requirements, irrigation head or emitter adjustment instructions, backflow device catalog cut and other applicable instructions to ensure normal operation after Physical Completion.

8-03.3(13)C Operating Tools

All locks or locking devices shall be keyed alike, and three sets of keys shall be provided to the Engineer prior to Physical Completion.

Three sets of keys shall be provided for all components requiring keys, including automatic controller valves, drain valves, and manual control valves. Three sets of specialty keys or manufacturer provided tools for operating components shall be provided.

When handles are included as an integral part of a three-way valve, the Contractor shall remove them and give them to the Engineer.

Laminated copies of the timing and valve schedule shall be placed in the controller boxes or in locations specified by the Engineer.

8-03.3(14) System Operation

8-03.3(14)A General

The irrigation system shall be completely installed, tested, and automatically operable prior to planting in a unit area except where otherwise specified in the Plans or approved by the Engineer. The Contractor shall be fully responsible for all maintenance, repair, testing, inspecting, and automatic operation of the entire system until all Work is considered complete as determined by the final inspection specified in Section 1-05.11. This responsibility shall include, but not be limited to, draining the system prior to winter and reactivating the system in the spring and at other times as required by the Engineer. The final inspection of the irrigation system will coincide with Physical Completion or the end of first-year plant establishment, whichever is later.

The Contractor shall be responsible for having annual inspections and tests performed on all cross-connection control devices as required the Washington State Department of Health through Physical Completion. Inspections and tests shall be conducted at the time of initial activation and each spring prior to reactivating the irrigation system. Potable water shall not flow through the cross-connection control device to any downstream component until tested and approved for use by the local health authority in accordance with Section 8-03.3(9)F.

The irrigation system shall be deactivated and drained for winterization. Storage of components during the winterized period shall be the responsibility of the Contractor for the life of the Contract. Winterization includes evacuation of all water in main, lateral, and drip lines, opening of drain valves, insulation or temporary removal and storage of the backflow devices, and closure of all ball valves upstream of the master valve in the Backflow Assembly. Winterizing the irrigation system shall occur between the following periods.

Western Washington ¹ (West of the Cascade Mountain Crest)	Eastern Washington (East of the Cascade Mountain Crest)
October 1 through October 15	October 1 through November 15

¹Winterizing may be allowed outside these dates when allowed by the Engineer.

In the spring, when the irrigation system is in full operation, the Contractor shall make a full inspection of all valves, controllers, emitters and irrigation heads. This shall involve visual inspection under operating conditions. All adjustments, flushing, or replacements to the system shall be made at this time to ensure the proper operation of all irrigation components. The Contractor shall activate the irrigation system between March 15th and March 31st of each year through Physical Completion, unless allowed otherwise by the Engineer. Activation includes backflow inspection, testing, repair, and reporting, an annual system inspection with the Engineer, all required system repairs, annual battery replacement in all battery-operated controller units, and reprogramming for specific site conditions. Start up or resumption of fully automatic system operation shall be May 1st, or as allowed by the Engineer.

Automatic controllers shall be programmed according to the Plans or as allowed by the Engineer.

8-03.3(14)B Irrigation System Orientation Meeting

An irrigation system orientation meeting shall be held when the irrigation system is complete, and the system is operational. The purpose of the meeting is to discuss system operation and maintenance procedures and demonstrate and confirm functionality of irrigation components including the Contracting Agency's central control system where applicable. The meeting shall be conducted by the Contractor or irrigation contractor at the project site.

Those attending shall include:

1. (Representing the Contractor) The superintendent and irrigation contractor.
2. (Representing the Contracting Agency) The Engineer and representatives from the WSDOT Area Maintenance Office.

8-03.4 Vacant

8-03.5 Payment

Payment will be made for the following Bid items when included in the Proposal:

"Irrigation System", lump sum.

All costs for furnishing, installing, and operating the irrigation system as detailed in the Plans shall be included in the lump sum price for the complete irrigation system. This includes all costs for initial and annual inspections, tests performed on cross-connection control devices, electrical wire testing during the life of the Contract, system maintenance and repair, annual winterization and startup, irrigation audits, and as-built Plans as shown in the Plans. When the plans indicate connections to existing irrigation, sleeves or other components, potholing shall be included in the lump sum price for irrigation system.

As the irrigation system is installed, the payment schedule will be as follows:

1. Payment will be made in proportion to the amount of Work performed up to 85 percent of the unit Contract price for irrigation system when the irrigation system is completed, tested, inspected, fully operational, and upon delivery of the As-builts, M&O Manuals and Operating Tools.
2. Payment shall be increased to 95 percent of the unit Contract price for irrigation system upon completion and acceptance of initial planting.
3. Payment shall be increased to 100 percent of the unit Contract price for irrigation system upon completion and acceptance of the first-year plant establishment and acceptance of all supplements to the Asbuilts or M&O Manuals. When there is no first-year plant establishment or when the Contract is completed, payment will be increased to 100 percent of the unit Contract price for irrigation system upon completion and acceptance of the requirements of Section 8-03.3(13).

8-04 **Curbs, Gutters, and Spillways**

8-04.1 **Description**

This Work consists of the construction of cement concrete curbs, curbs and gutters, gutters, spillways, hot mix asphalt curbs, gutters, spillways, and metal spillways, of the kind and design specified, at the locations shown in the Plans or where designated by the Engineer in accordance with these Specifications and in conformity to the lines and grades as staked.

8-04.2 **Materials**

Materials shall meet the requirements of the following sections:

Cement	9-01
Aggregates	9-03
Premolded Joint Filler	9-04.1
Drain Pipe	9-05.1
Steel Culvert Pipe and Pipe Arch	9-05.4
Aluminum Culvert Pipe	9-05.5
Structural Steel and Related Materials	9-06
Reinforcing Steel	9-07
Hand Placed Riprap	9-13.1(4)

Hot Mix Asphalt (HMA) curbs, gutters, and spillways shall be constructed of an HMA mix that will have a dense, uniform surface and will fully retain its shape, grade, and line after placement. The mix components shall meet applicable requirements for asphalt concrete specified in Section 5-04 and shall be approved by the Engineer.

8-04.3 **Construction Requirements**

8-04.3(1) **Cement Concrete Curbs, Gutters, and Spillways**

Cement concrete curb, curb and gutter, gutter, and spillway shall be constructed with air entrained concrete Class 3000 conforming to the requirement of Section 6-02 except at driveway entrances. Cement concrete curb or curb and gutter along the full width of a driveway entrance shall be constructed with air entrained concrete Class 4000 conforming to the requirements of Section 6-02. Roundabout truck apron cement concrete curb and gutter shall be constructed with air entrained concrete Class 4000 conforming to the requirements of Section 6-02.

The foundation for curbs, gutters, and spillways shall be thoroughly compacted and required side forms shall rest throughout their length on firm ground. Side forms for straight sections shall be full depth of the curb. They shall be either metal of suitable gage for the Work or surfaced "construction" grade lumber not less than 2 inches (commercial) in thickness. Forms used more than one time shall be thoroughly cleaned and forms that have become worn, splintered, or warped shall not be used again.

The foundation shall be watered thoroughly before the concrete is placed, and the concrete shall be well tamped and spaded or vibrated in the forms. The exposed surfaces shall be finished full width with a trowel and edger. Within 24 hours after the concrete is placed, the forms of the Roadway face of curbs shall be removed, and the concrete treated with a float finish. The top and face of the curb shall receive a light brush finish, and the top of the gutter shall receive a broom finish.

Expansion joints in the curb or curb and gutter shall be spaced as shown in the Plans, and placed at the beginning and ends of curb returns, drainage Structures, bridges, and cold joints with existing curbs and gutters. The expansion joint shall be filled to full cross-section with $\frac{3}{8}$ -inch premolded joint filler. When curb or curb and gutter is placed adjacent to portland cement concrete pavement, a $\frac{3}{8}$ -inch thick, 6 inch deep premolded joint filler shall be installed between the two vertical surfaces to prevent cracking. When noted in the Plans, the Contractor shall install the catch basin gutter pan at drainage Structures abutting the curb and gutter.

The concrete shall be cured for 72 hours by one of the methods specified for cement concrete pavement in Section 5-05. The concrete shall not be exposed to traffic until it reaches 2500 psi in accordance with Section 5-05.3(17).

At the option of the Contractor, the curb and gutter may be constructed using approved slip-form equipment. The curb and gutter shall be constructed to the same requirements as the cast-in-place curb and gutter.

A water-reducing admixture conforming to the requirements of Section 9-26 may be used provided the finished curb and gutter shall retain its line and shape.

8-04.3(1)A Extruded Cement Concrete Curb

Extruded cement concrete curb shall be placed, shaped, and compacted true to line and grade with an approved extrusion machine. The extrusion machine shall be capable of shaping and thoroughly compacting the concrete to the required cross section.

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 reinforcing bars 1 foot on each side of every joint.

Steel reinforcing bars shall meet the dimensions shown in the [Standard Plans](#).

Joints in the curb shall be spaced at 10-foot intervals. Joints shall be cut vertically and to the depth shown in the [Standard Plans](#).

All other requirements for cement curb and cement concrete curb and gutter shall apply to extruded cement concrete curb.

The Contractor may substitute extruded cement concrete curb for extruded HMA concrete curb upon receiving written permission from the Engineer. There will be no change in unit Contract price if this substitution is allowed.

8-04.3(1)B Roundabout Cement Concrete Curb and Gutter

Roundabout cement concrete curb and gutter and roundabout splitter island nosing curb shall be shaped and finished to match the shape of the adjoining curb as shown in the Plans. All other requirements for cement concrete curb and cement concrete curb and gutter shall apply to roundabout cement concrete curb and gutter.

8-04.3(2) Extruded Asphalt Concrete Curbs and Gutters

Asphalt concrete curbs, gutters, and spillways shall be constructed of Commercial HMA as specified in Section 5-04. The HMA will have a dense, uniform surface and will fully retain its shape, grade, and line after placement. Just prior to placing the curb, a tack coat of asphalt shall be applied to the existing pavement surface at the rate ordered by the Engineer.

Set forms will not be required for forming gutter if slip-form equipment of a type approved by the Engineer is used. Gutter shall be shaped and compacted to the required line, grade, and cross section. Connections to any type of outlet shall be constructed so as to form a watertight joint.

8-04.3(3) Vacant

8-04.3(4) Metal Spillways

Round metal spillways shall be plain metal drain pipe 8-inch diameter and when specified in the Contract, the joints shall be sealed with rubber gaskets conforming to the requirements of Section 9-04.4(4). Half round metal spillways shall be half round metal culvert pipe of the size, kind, and thickness shown in the Plans.

In the construction of metal spillways, sufficient bands, elbows, and joints shall be furnished and placed by the Contractor to permit the construction and connection of the spillways as indicated in the Plans so as to carry the drainage from gutters to the inlets and spillways without percolation of the water under and around the Structure.

Spillway pipe shall be laid in a trench in the embankment slope and shall not be placed until after the embankment slopes have been completed and dressed to the lines prescribed by the Engineer. The lower end of the pipe spillway shall be adequately protected and supported by hand placed riprap, concrete, or by other means as may be shown in the Plans. After the spillway pipe has been placed and connected, the trench shall be backfilled, thoroughly compacted, and the embankment slopes restored to their original condition.

8-04.3(5) Spillways at Bridge Ends

Where spillways are required to be constructed at bridge ends, they shall be constructed in the embankment slopes as described above and arranged so that they will connect to the bridge drains. The pipe shall be plain metal drain pipe 8-inch diameter and the joints shall be sealed with rubber gaskets conforming to the requirements of Section 9-04.4(4).

8-04.4 Measurement

All curbs, gutters, and spillways will be measured by the linear foot along the line and slope of the completed curbs, gutters, or spillways, including bends. Measurement of cement concrete curb and cement concrete curb and gutter, when constructed across driveways or sidewalk ramps, will include the width of the driveway or sidewalk ramp.

Roundabout splitter island nosing curb will be measured per each.

Except for metal spillways, excavation for these Structures shall be incidental to the items involved. Structure excavation required for the installation of metal spillways will be measured in accordance with the provisions of Section 3-07.

Hand placed riprap will be measured in accordance with Section 8-15.4.

8-04.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

“Cement Conc. Traffic Curb and Gutter”, per linear foot.

“Cement Conc. Traffic Curb”, per linear foot.

“Mountable Cement Conc. Traffic Curb”, per linear foot.

“Dual-Faced Cement Conc. Traffic Curb and Gutter”, per linear foot.

“Dual-Faced Cement Conc. Traffic Curb”, per linear foot.

“Cement Conc. Pedestrian Curb”, per linear foot.

“Roundabout Central Island Cement Concrete Curb”, per linear foot.

“Roundabout Truck Apron Cem. Conc. Curb and Gutter”, per linear foot.

“Roundabout Cement Concrete Curb and Gutter”, per linear foot.

The unit Contract price per linear foot for “Roundabout Cement Concrete Curb and Gutter” shall be full payment for all costs for the specified Work including transitioning the roundabout cement concrete curb and gutter to the adjoining curb shape.

"Roundabout Splitter Island Nosing Curb", per each.

The unit Contract price per each for "Roundabout Splitter Island Nosing Curb" shall be full payment for all costs for the specified Work including transitioning the roundabout splitter island nosing curb to the adjoining curb shape.

"Extruded Curb", per linear foot.

"Cement Conc. Gutter", per linear foot.

"Cement Conc. Spillway", per linear foot.

"Asphalt Conc. Gutter", per linear foot.

"Asphalt Conc. Spillway", per linear foot.

"Drain Pipe ___ In. Diam.", per linear foot.

"Half Round Plain St. Culv. Pipe ___ In. Th. ___ In. Diam.", per linear foot.

"Half Round Tr. 1 St. Culv. Pipe ___ In. Th. ___ In. Diam.", per linear foot.

"Half Round Plain Al. Culv. Pipe ___ In. Th. ___ In. Diam.", per linear foot.

"Half Round Tr. 1 Al. Culv. Pipe ___ In. Th. ___ In. Diam.", per linear foot.

"Hand Placed Riprap", per cubic yard.

Hand placed riprap will be paid for as provided in Section 8-15.5.

When catch basin gutter pans are required in the Plans, all costs for providing the widened area of gutter pan shall be included in the curb and gutter Bid item.

8-05 Vacant

8-06 Cement Concrete Driveway Entrances**8-06.1 Description**

This Work shall consist of constructing the types of cement concrete driveway entrances shown in the Plans and in accordance with these Specifications and the *Standard Plans*. The widths of the entrances shall be as noted in the Plans. When no width is noted in the Plans, the entrance shall be constructed to the minimum dimensions shown in the *Standard Plans*.

8-06.2 Materials

Materials shall meet the requirements of the following sections:

Cement	9-01
Aggregates	9-03
Premolded Joint Filler	9-04.1

8-06.3 Construction Requirements

Cement concrete driveway approaches shall be constructed with air entrained concrete Class 4000 conforming to the requirements of Section 6-02 or Portland Cement or Blended Hydraulic Cement Concrete Pavement conforming to the requirements of Section 5-05.

Driveway entrance concrete may be placed, compacted, and finished using hand methods. The tools required for these operations shall be approved by the Engineer. After troweling and before edging, the surface of the driveway entrance shall be brushed in a transverse direction with a stiff bristled broom. Curing of the concrete shall be in accordance with Section 5-05.3(13). The driveway entrances may be opened to traffic in accordance with Section 5-05.3(17).

When noted in the Plans, the Contractor shall construct the driveway entrance in two or more segments to permit access to an existing driveway. At these locations, the Contractor shall provide a well-graded and drained temporary approach suitable for vehicular traffic from the abutting Roadway to the existing driveway and a firm surface for pedestrians crossing the approach. When the concrete in this segment of the entrance has reached the desired compressive strength, the Contractor shall route traffic over it, remove the temporary approach, and construct the remaining driveway entrance segment or segments. The joints between segments shall be filled to full cross-section with $\frac{3}{8}$ -inch premolded joint filler.

8-06.4 Measurement

Cement concrete driveway entrances will be measured by the square yard of finished surface.

8-06.5 Payment

Payment will be made for the following Bid item when it is included in the Proposal:

"Cement Conc. Driveway Entrance Type ____", per square yard.

All costs in constructing the driveway entrance in segments and installing and removing the temporary approach shall be included.

8-07 Precast Traffic Curb**8-07.1 Description**

This Work consists of furnishing and installing precast sloped mountable curb, or dual faced sloped mountable curb of the design and type and location shown in the Plans in accordance with these Specifications and the [Standard Plans](#) or as staked by the Engineer.

8-07.2 Materials

Materials shall meet the requirements of the following sections:

Portland Cement	9-01.2(1)
Blended Hydraulic Cement	9-01.2(1)B
Aggregate	9-03.1, 9-03.2
Reinforcing Steel	9-07
Mortar	9-20.4
Water Repellent Compound	9-23.3
Sodium Metasilicate	9-23.4
Paint	9-34.2

8-07.3 Construction Requirements**8-07.3(1) Aggregates and Proportioning**

The cement concrete mix design for precast concrete curb shall meet the requirements of Section 6-02.3 for concrete class 4000 with a 4,000 psi compressive strength at 28 days and an air content between 4.5% and 7.5%. Aggregates used in the manufacture of precast concrete traffic curb shall conform to the requirements of Section 9-03 and shall have a coarse aggregate nominal maximum size of $\frac{3}{4}$ inch. The precast concrete mix shall contain sufficient fine fractions to achieve the type of surface finish specified herein.

8-07.3(2) Mixing

The mixers shall be kept in good repair and be equipped with an automatic timing device and a positive device for regulating the quantity of water added to each batch. Such a device must be authorized by the Engineer before use.

After all materials, including water, have been placed in the mixer, the materials shall be mixed for a period of not less than $1\frac{1}{4}$ minutes, or as much longer as may be necessary to produce a thorough and uniform mixture of the concrete. No water shall be added to any batch after the completion of the initial mixing period. Each batch of concrete shall be completely emptied from the mixer before placing more materials in it. A batch which has not been placed within 30 minutes from the time water was first added shall not be used.

The amount of water in the concrete shall be kept at a minimum consistent with the manufacture of dense curb, free from air bubbles and surface defects in excess of the tolerance limits specified.

8-07.3(3) Forms

Forms shall be of concrete or steel. The use of forms or molds made of plaster of paris, wood, or other absorptive material will not be permitted.

Bulkheads shall be tight fitting so that there is no leakage of mortar between the bulkhead and form.

The materials and methods used for lubricating the forms shall be such that they will not result in discoloration of the curb at any time. A minimum quantity of lubricant shall be used and all excess lubricant shall be removed.

8-07.3(4) Placing Concrete

The concrete shall be consolidated by external vibration, or by other means if allowed by the Engineer, to produce a dense concrete throughout, having a minimum of air bubbles and honeycombing.

Reinforcing steel shall be placed and maintained in its proper position as shown in detail drawings.

Curb shall not be manufactured in an atmospheric temperature of less than 50°F.

8-07.3(5) Removal of Forms

The curb shall be removed from the molds or forms in accordance with the instructions or by some other method acceptable to the Engineer.

The loosening of the curb from the molds shall be carefully performed to avoid excessive shock and straining of the curb. When, in the opinion of the Engineer, undue shock is required to remove the curb from the molds, the stripping operation shall be deferred until such time as the curb may be removed without breakage.

8-07.3(6) Curing Concrete

Immediately after the concrete has been placed and consolidated in the mold, each unit shall be placed in a curing room fitted with water sprays and maintained at a relative humidity of not less than 90 percent and a temperature of not less than 60°F, nor more than 100°F. Each unit shall remain in the curing room for a period of not less than 10 days, except that if Type III cement is used, the period in the curing room may be reduced to 5 days.

8-07.3(7) Finish

The curb shall have a smooth, glassy finish on all exposed surfaces.

Excess honeycombing in the back of the curb may be cause for rejection of the curb. Honeycombing areas in the back of the curb which, in the opinion of the Engineer, are not detrimental to the curb need not be patched. The workmanship of the bottom finish shall be such that no mechanical interlocking of the mortar bed and the curb bottom or anchor groove will occur.

8-07.3(8) Surface Treatment

As soon as the units have been taken out of the curing room and thoroughly surface dried to a depth of at least $\frac{1}{4}$ inch, two coats of a water repellent compound, meeting the requirements of Section 9-23.3, shall be brush applied. When the first coat has dried, the second coat of water repellent compound shall be applied.

8-07.3(9) Dimensions and Shape

The curb shall conform to the dimensions and shape shown in the Plans within a tolerance of $\frac{1}{4}$ inch in length and $\frac{1}{8}$ inch in alignment.

8-07.3(10) Curb Lengths

Curb lengths shall be in accordance with the Standard Plans, except in special cases where different lengths are specified. Circular curbing shall be made only for such radii as called for in the detail plans.

8-07.3(11) Defective Curb

Not more than 2 percent of the top area in any one piece of curb shall be defective, and not more than 5 percent of the total length of the top corners of reflecting faces in any one piece of curb shall be broken or rounded. There shall be not more than 50 holes in any linear foot of curb. All curb having defects in excess of any of the above will be rejected immediately upon inspection after removal from the forms. However, failure to reject the curb at that time will not ensure its final acceptance. Ninety percent of the curb laid shall not have more than 10 percent of the maximum allowable number of defects specified above.

An air hole shall be defined as any hole $\frac{1}{8}$ inch or larger in diameter or depth.

All defects within the limits permitted, apparent upon removal of forms, shall be repaired immediately.

The sum of the length of the lines of discoloration caused by a cracked mold in any one piece of curb shall not exceed 50 percent of the length of the curb, and the maximum length of any single line of discoloration shall not exceed 18 inches. 75 percent of the curb laid shall be entirely free from lines of discoloration. The employment of heat to obliterate lines of discoloration will not be permitted. The process used to obliterate lines of discoloration shall be subject to the approval of the Engineer.

The repairing of molds which are chipped or broken shall be done in a manner that the broken or chipped areas will not be apparent on the curb made in those molds.

All curb in which surface checking develops during the first five days after manufacture will be rejected.

Hidden air holes at or immediately below the exposed surface of the curb, in excess of the limits specified that are disclosed by testing the surface by means of a rubber hammer will be cause for rejection of the curb.

All curb in which cracking is in evidence immediately after removal from the molds will be rejected. A crack is defined as any separation of the concrete of a continuous length greater than 3 inches.

All curb which varies in dimensions, alignment, or surface contour in excess of the tolerance specified will be rejected.

Failure to comply with the Plans, Specifications, or instructions of the authorized representative of the Contracting Agency in the manufacture and laying of any curb will be cause for rejection of such curb.

8-07.3(12) Repairing Curb

Curb having defects which are not sufficient cause for its rejection shall be neatly repaired immediately after removal from the molds in a manner subject to the approval of the Engineer. However, no patching or other repairs shall be made without the permission of the Engineer. Patches shall be undercut if, in the opinion of the Engineer, this operation is necessary to achieve a satisfactory patch.

All holes larger than $\frac{1}{16}$ -inch diameter in the exposed surface of acceptable curb or buttons shall be filled with cement mortar.

8-07.3(13) Identification Marking

The date of manufacture, the length, and identification number corresponding to the detail layout shall be marked in black paint on the back or end of each piece of curb.

Rejected curb shall be marked on the back or end surfaces in a practical and semi-permanent manner to identify each cause of rejection.

8-07.3(14) Shipping

No unit of curb shall be shipped from the manufacturing plant prior to 21 days after manufacture, except, however, that if Type III cement has been used, the units may be shipped 14 days after manufacture.

8-07.3(15) Sampling and Inspection

The Contractor shall submit, for the acceptance of the Engineer, an advance sample of curb which shall be at least equivalent in color, surface texture, and bottom finish to the standard as set forth in these Specifications. No repairing of any kind shall be done on the advance sample. Upon approval, the advance sample shall be stored at the plant or site of manufacture in a location readily accessible to the Inspector where there is adequate daylight for examination. The advance sample shall be protected from damage and discoloration and shall be used as a standard of comparison for color, surface texture, and bottom finish for all curb manufactured. All curb furnished shall be equivalent in the foregoing respects.

The inspection at the plant will be made just prior to shipment, at which time examination will be made of the alignment, contour, color, cracks, surface damage or discoloration, broken corners or edges, and any other defects which may have developed, and to check the laboratory test reports for strength. However, intermediate inspections may be made to determine surface checking and hidden air holes if it is impractical to examine for these defects at the final inspection.

8-07.3(16) Installing Curbs

The curb shall be firmly bedded for its entire length and breadth on a mortar bed conforming to Section 9-20.4(3) composed of one part Portland cement or blended hydraulic cement and two parts sand. The anchor grooves in the bottom of the curb shall be entirely filled with the mortar.

Before the cement mortar bed is laid, all dirt shall be cleaned from the pavement surface by washing.

All old pavements and any portion of new pavements constructed under this Contract, which are covered with oil or grease within the curb limits, shall be further cleaned as follows:

1. The pavement shall be flushed with water.
2. While the pavement is still wet, sodium metasilicate, complying with the requirements as specified elsewhere herein, shall be evenly distributed over the pavement surface at a rate of 1 to 2 pounds per 100 square feet of pavement surface.
3. The sodium metasilicate shall remain on the pavement for at least 15 minutes. Where patches of oil, tar, or grease occur, these areas shall be scrubbed with a brush or broom.
4. The pavement surface shall then be thoroughly rinsed.

All joints between adjacent pieces of curb except joints for expansion and/or drainage as designated by the Engineer shall be filled with mortar composed of one part portland cement or blended hydraulic cement and two parts sand.

The alignment and the top surface of adjoining sections of curb shall be true and even with a maximum tolerance of $\frac{1}{16}$ inch.

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(17) Painting of Curbs

Precast 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 Engineer. The paint can be applied by brush or spray. The second coat shall have glass traffic paint beads sprinkled in the wet paint at the rate of 12 pounds per 100 linear feet of curbing. The beads shall conform to the requirements of Section 9-34.4.

8-07.4 Measurement

Precast sloped mountable curb will be measured by the linear foot along the front face of the curb. Precast dual faced sloped mountable curb will be measured by the linear foot of tapered block and nosing block installed. Only one face of dual faced curb will be measured.

8-07.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

“Precast Sloped Mountable Curb”, per linear foot.

“Precast Dual Faced Sloped Mountable Curb”, per linear foot.

8-08 Rumble Strips**8-08.1 Description**

This Work consists of constructing centerline and shoulder rumble strips by grinding hot mix asphalt. The Work shall include cleanup and disposal of cuttings and other resultant debris. The [Standard Plans](#) show the patterns and construction details for the centerline rumble strip and the four types of shoulder rumble strips.

8-08.2 Vacant**8-08.3 Construction Requirements**

The equipment shall have a rotary type cutting head or series of cutting heads capable of grinding one or more recesses in the hot mix asphalt as detailed in the [Standard Plans](#). The difference in the surface texture between the high and low surfaces from the grinding shall not exceed $\frac{1}{8}$ inch.

Rumble strips shall not be constructed on bridge decks, bridge approach slabs, or cement concrete surfaces. In areas where monuments, drainage structures, induction loop lead-ins, pavement markings or other features will not allow the rumble strips to be constructed as detailed, the rumble strips shall be eliminated or relocated as approved by the Project Engineer.

The traveled lanes shall be kept free of cuttings and other construction debris at all times. All cuttings, grinding debris, dust, and other loose materials shall become the property of the Contractor and, upon completion of rumble strip grinding, shall be immediately removed and disposed of outside the project limits. Cuttings and other debris shall not be allowed to enter waterways.

When shown in the Plans, the rumble strips shall be fog sealed in accordance with the requirements of Section 5-02, following the completion of the rumble strips. All pavement markings, junction boxes, drainage structures, and similar objects shall not be fog sealed.

The accumulative error in the longitudinal spacing of the rumble strips and the gaps, when required, shall not exceed plus or minus 5 percent.

8-08.4 Measurement

Centerline and shoulder rumble strips will be measured to the nearest 0.01 mile along the mainline roadway for centerline or each shoulder. No deductions will be made for required gaps shown on the [Standard Plans](#) or for the elimination of rumble strips across bridge decks, bridge approach slabs, cement concrete areas, or other areas approved by the Engineer.

Fog sealing, when shown in the Plans, will be measured as asphalt for fog seal in accordance with Section 5-02.4.

8-08.5 Payment

"Shoulder Rumble Strip Type __", per mile.

"Centerline Rumble Strip", per mile.

Layout of the rumble strip pattern on the centerline or shoulders for grinding purposes is the responsibility of the Contractor. All costs involved in this Work shall be included in the appropriate Bid item.

Payment for fog sealing the rumble strip on the centerline or shoulder, when shown in the Plans, shall be paid as asphalt for fog seal in accordance with Section 5-02.5.

8-09 Raised Pavement Markers**8-09.1 Description**

This Work shall consist of furnishing and installing pavement markers of the type specified in the Plans, in accordance with these Specifications, and at the locations indicated in the Plans or where designated by the Engineer. This Work also includes cleanup and disposal of cuttings and other resultant debris. The color of pavement markers shall conform to the color of the marking for which they supplement, substitute for, or serve as a positioning guide for.

8-09.2 Materials

Raised pavement marker (RPM) shall meet the requirements of the following sections:

RPM Type 1	9-21.1
RPM Type 2	9-21.2
RPM Type 3	9-21.3
Adhesive	9-02.1(8), 9-26.2

8-09.3 Construction Requirements**8-09.3(1) Preliminary Spotting**

The Engineer will provide necessary control points at intervals agreed upon with the Contractor to assist in preliminary spotting of the lines before marker placement begins. The Contractor shall be responsible for preliminary spotting of the lines to be marked. The color of the material used for spotting shall match the color of the raised pavement markers. Approval by the Engineer is required before marking begins.

Markers shall not be placed over longitudinal or transverse joints in the pavement surface.

8-09.3(2) Surface Preparation

All sand, dirt, and loose extraneous material shall be swept or blown away from the marker location and the cleaned surface prepared by one of the following procedures:

When deemed necessary by the Engineer all surface dirt within areas to receive markers shall be removed. Large areas of tar, grease, or foreign materials may require sandblasting, steam cleaning, or power brooming to accomplish complete removal.

When markers are placed on new cement concrete pavement, any curing compound shall be removed in accordance with the requirements of this section. All liquid membrane-forming compounds shall be removed from the portland cement concrete pavement to which Raised Pavement Markers are to be bonded. Curing compound removal shall not be started until the pavement has attained sufficient flexural strength before opening to traffic. The Contractor shall submit a Type 2 Working Drawing consisting of the proposed removal method.

The pavement shall be surface dry. When applying Epoxy Adhesives in cool weather the pavement surface shall be heated by intense radiant heat (not direct flame) for a sufficient length of time to warm the pavement areas of marker application to a minimum of 70°F.

Application of markers shall not proceed until final authorization is received from the Engineer.

8-09.3(3) Marker Preparation

Type 2 markers may be warmed prior to setting by heating to a maximum temperature of 120°F for a maximum of 10 minutes.

8-09.3(4) Adhesive Preparation

Epoxy adhesive shall be maintained at a temperature of 60°F to 85°F before use and during application.

Component A shall be added to component B just before use and mixed to a smooth uniform blend. The unused mixed adhesive shall be discarded when polymerization has caused stiffening and reduction of workability.

Flexible bituminous pavement marker adhesive shall be indirectly heated in an applicator with continuous agitation or recurring circulation. Adhesive temperature shall not exceed the maximum safe heating temperature stated by the manufacturer. The Contractor shall provide the Engineer with manufacturers written instruction for application temperature and maximum safe heating temperature.

8-09.3(5) Application Procedure

8-09.3(5)A Epoxy Adhesives

Epoxy adhesive shall conform to the requirements of Section 9-26.2.

The marker shall be affixed to the prepared pavement area with sufficient adhesive so as to squeeze out a small bead of adhesive around the entire periphery of the marker.

The sequence of operations shall be as rapid as possible. Adhesive shall be in place and the marker seated in not more than 30 seconds after the removal of the pavement preheat or warm air blast. The marker shall not have cooled more than 1 minute before seating.

The length of the pavement preheat or warming shall be adjusted so as to ensure bonding of the marker in not more than 15 minutes. Bonding will be considered satisfactory when adhesive develops a minimum bond strength in tension of not less than 800 grams per square inch or a total tensile strength of 25 pounds.

On Roadway sections which are not open to public traffic, the preheating of the markers by dry heating before setting will not be required provided the adhesive develops the required bond strength of 800 grams per square inch in less than 3 hours. If the Roadway section is carrying public traffic during the installation of the markers, the 15 minute set-to-traffic provision will be enforced, and necessary flagging and traffic control will be required.

8-09.3(5)B Flexible Bituminous Pavement Marker Adhesives

The flexible bituminous pavement marker adhesive shall conform to the requirements of Section 9-02.1(8).

The adhesive shall be applied at temperatures recommended by the manufacturer.

The marker shall be affixed to the prepared pavement area with sufficient adhesive so as to squeeze out a small bead of adhesive around the entire periphery of the marker. Markers shall be placed immediately after application of the adhesive.

8-09.3(6) Recessed Pavement Marker

The Contractor shall construct recesses for pavement markers by grinding the pavement in accordance with the dimensions shown in the [Standard Plans](#). The Contractor shall ensure that grinding of the pavement does not result in any damage, (e.g. chipping, spalling or raveling) to the pavement to remain. The Contractor shall prepare the surface in accordance with Section 8-09.3(2), and install Type 2 markers in the recess in accordance with the [Standard Plans](#) and Section 8-09.3(4).

Recessed pavement markers shall not be constructed on bridge decks or on bridge approach slabs.

8-09.3(7) Tolerances for Pavement Markers

Markers shall be spaced and aligned as shown in the [Standard Plans](#) and as specified by the Engineer. A displacement of not more than ½ inch left or right of the established guideline will be permitted. The Contractor shall remove and replace all improperly placed markers at no expense to the Contracting Agency.

8-09.4 Measurement

Measurement of markers will be by units of 100 for each type of marker furnished and set in place.

8-09.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

“Raised Pavement Marker Type 1”, per hundred.

“Raised Pavement Marker Type 2”, per hundred.

“Raised Pavement Marker Type 3-_____ In.”, per hundred.

“Recessed Pavement Marker”, per hundred.

The unit Contract price per hundred for “Raised Pavement Marker Type 1”, “Raised Pavement Marker Type 2”, “Raised Pavement Marker Type 3-_____ In.”, and “Recessed Pavement Marker” shall be full pay for furnishing and installing the markers in accordance with these Specifications.

8-10 Guide Posts and Barrier Delineators

8-10.1 Description

This Work shall consist of furnishing and placing flexible guide posts and barrier delineators of the type specified in the Plans in accordance with these Specifications and the [Standard Plans](#), at the locations indicated in the Plans or where designated by the Engineer.

8-10.2 Materials

Materials shall meet the requirements of the following sections:

Flexible Guide Posts	9-17
Barrier Delineators	9-18
Adhesives for Flexible Guide Posts	9-02.1(8), 9-26.2
Miscellaneous Hardware	9-16.2(1)H
Reflective Sheeting	9-28.12

Adhesives for barrier delineators shall be in accordance with the manufacturer's recommendations.

8-10.3 Construction Requirements

8-10.3(1) Flexible Guide Posts

Flexible guide posts shall be installed as shown in the Standard Plans and the manufacturer's recommendations. Delineator color shall be white on the right of traffic and yellow on the left of traffic. The posts shall be installed plumb, plus or minus 1½ degrees. Surface mounted guide posts shall be bonded to the pavement surface.

The Contractor shall submit a Type 1 Working Drawing consisting of the manufacturer's recommended installation procedures. Only one type of ground mount or guardrail mount flexible guide post shall be used on each project.

When a guide post is installed on new cement concrete pavement, all curing and liquid membrane-forming compounds shall be removed prior to installation. Curing compound removal shall not be started until the pavement has attained sufficient flexural strength to avoid damage to the concrete. The Contractor shall submit a Type 2 Working Drawing consisting of the recommended removal method.

If the ground adjacent to the posts is disturbed in any manner, it shall be backfilled to the level of the existing surface and thoroughly compacted. The surface of the ground adjacent to the post shall be replaced with like materials, including bituminous treatment if previously existent.

When the Plans requires a guide post with concurrent guardrail runs, the Contractor shall either drive the flexible guide post in line with the guardrail posts, or mount a shorter flexible guide post onto the guardrail post in accordance with the Standard Plans.

When the Plans requires a guide post with concurrent concrete barrier runs, the Contractor shall mount barrier delineators where guide posts are required.

8-10.3(2) Barrier Delineators

Barrier delineators shall be installed as shown in the Standard Plans or as specified by the Engineer. Spacing shall be as shown in the Plans. Delineator color shall be white on the right of traffic and yellow on the left of traffic. The Contractor shall submit a Type 1 Working Drawing consisting of the Manufacturer's recommended installation procedures.

Barrier delineators shall be attached to the barrier with an adhesive recommended by the manufacturer. The attachment point on the barrier surface shall be free of dirt, curing compound, moisture, paint, or any other matter that would adversely affect the adhesive bond.

8-10.4 Measurement

Flexible guide posts will be measured by the unit for each post furnished and installed.

Barrier delineators will be measured by the unit for each delineator furnished and installed.

8-10.5 Payment

Payment will be made for the following Bid item when included in the Proposal:

“Flexible Guide Post”, per each.

“Barrier Delineator”, per each.

8-11 Guardrail

8-11.1 Description

This Work consists of constructing, modifying, removing, and resetting guardrail and anchors of the kind and type specified in accordance with the Plans, these Specifications, and the [Standard Plans](#) in conformity with the lines and grades as staked.

8-11.2 Materials

Materials shall meet the requirements of the following sections:

Beam Guardrail	9-16.3
Rail Element	9-16.3(1)
Posts and Blocks	9-16.3(2)
Galvanizing	9-16.3(3)
Hardware	9-16.3(4)
Anchors	9-16.3(5)

8-11.3 Construction Requirements

8-11.3(1) Beam Guardrail

8-11.3(1)A Erection of Posts

Posts shall be set to the true line and grade of the Highway after the grade is in place and compaction is completed. If the ends of a section of guardrail are curved outward or downward, the posts shall be set to accommodate the curve. The length of posts and post spacing shall be as shown in the Plans. All posts for standard runs of guardrail shall be of the same material, whether timber or steel. When lengthening an existing guardrail run, the new standard run guardrail posts shall be the same material as the existing guardrail run post type that it is connecting to, whether timber or steel.

Posts may be placed in dug or drilled holes. Ramming or driving will be permitted only if approved by the Engineer and there is no resulting damage to the pavement, shoulders, and adjacent slopes.

In broken rock embankments, the pre-punching of holes will be permitted only prior to final Shoulder or median compaction, surfacing, and paving.

When there is an underground conflict, such as a utility line, drainage structure, or other type of obstruction; the Contractor may submit an RFI in accordance with Section 1-05.1(2) for omission of a post(s). One post may be omitted from a Type 31 guardrail run every 56.25 feet (or every 9th post with standard 6.25-foot post spacing). However, restrictions apply regarding the omission of posts depending on the proximity to anchors, transitions, or other specialty guardrail configurations. The omission of posts is not allowed for guardrail runs with posts placed less than 2 feet from the slope break point, or guardrail placed behind curb or curb and sidewalk. RFIs submitted for omission of posts shall detail proximity to the obstruction, fixed objects, roadway features, and other guardrail features such as transitions or anchors.

In locations where posts are installed through asphalt or concrete pavement, first install openings in the pavement material called leave-outs. The leave-out opening shall either be a 15" x 15" square or a 15" diameter circle. Install the posts aligned centered in the leave-out opening except that a minimum 7" space from the back edge of the leave-out to the back of the post shall be provided. Backfill around the post in the leave-out with base course material. Tamp backfill manually so that the top of the compacted backfill is $\frac{1}{2}$ " below the pavement surface. Fill the remaining $\frac{1}{2}$ " of the leave-out with a polymer modified asphalt mastic that is level with the pavement surface. The polymer modified asphalt mastic shall meet the material requirements of Section 5-03.2 and be installed as specified in Section 5-03.3. Payment for this Work shall be incidental to and included in the various guardrail items in the Contract.

Rail elements shall be attached to the posts during the same working shift or protected by a method approved by the Engineer.

8-11.3(1)B Erection of Rail

All metal work shall be fabricated in the shop. No punching, cutting, or welding shall be done in the field, except that holes necessary when additional posts are required or for special details in exceptional cases may be drilled in the field when approved by the Engineer. The rail shall be erected so that the bolts at expansion joints will be located at the centers of the slotted holes. All holes shall be painted with two coats of paint conforming to Section 9-08.1(2)B.

Rail plates shall be assembled with the splice joints lapping in the direction of the traffic.

When nested W-beam or thrie beam is specified, two sections of guardrail, one set inside of the other shall be installed. The inside and outside rail elements shall not be staggered.

Galvanized steel rail plates shall be fastened to the posts with galvanized bolts, washers, and nuts of the size and kind shown in the Plans.

All bolts, except where otherwise required at expansion joints, shall be drawn tight. Bolts through expansion joints shall be drawn up as tight as possible without being tight enough to prevent the rail elements from sliding past one another longitudinally. Bolts shall be sufficiently long to extend at least $\frac{1}{4}$ inch beyond the nuts. Except where required for adjustments, bolts shall not extend more than $\frac{1}{2}$ inch beyond the nuts.

8-11.3(1)C Terminal and Anchor Installation

All excavation and backfilling required for installation of terminals or anchors shall be performed in accordance with Section 3-07.3. In locations where guardrail terminals or anchors are installed on asphalt or concrete pavement, construct leave-outs around the posts in accordance with Section 8-11.3(1)A.

Bolts shall be tightened to the tension specified. The anchor cable or nosing cable anchor shall be tightened sufficiently to eliminate all slack. When tightening, the anchor cable or nosing cable anchor shall be restrained to prevent twisting of the cable.

When foundation tubes used with the Wood Breakaway Post are driven, they shall be driven prior to installing the wood post.

Type 2 concrete anchors may either be precast or cast-in-place at the option of the Contractor.

Assembly and installation of Beam Guardrail Non-flared Terminals for Type 31 guardrail shall be supervised at all times by a manufacturer's representative, or an installer who has been trained and certified by the manufacturer within the last 5 years and for the specific device(s) being installed. A copy of the installer's certification shall be provided to the Engineer prior to installation. Assembly and installation shall be in accordance with the manufacturer's recommendations. The manufacturer's representative or certified installer shall complete a manufacturer's terminal assembly/inspection checklist for each terminal installed. The original completed checklist, signed by the manufacturer's representative or certified installer, shall be provided to the Engineer on the same day that the terminal installation is completed.

When the manufacturer allows it, guardrail terminals may be installed on asphalt or concrete pavement. Guardrail terminals installed on asphalt or concrete pavement shall have leave-outs constructed around the posts. Leave-outs shall be constructed in accordance with Section 8-11.3(1)A.

Beam Guardrail Non-flared Terminals for Type 31 guardrail shall meet the crash test and evaluation criteria in the Manual for Assessing Safety Hardware (MASH).

8-11.3(1)D Removing Guardrail and Guardrail Anchor

Removal of the various types of guardrail shall include removal of the rail, cable elements, hardware, and posts, including transition sections, expansion sections, terminal sections and the rail element of anchor assemblies. Removal of the various types of guardrail anchors shall include removal of the anchor assembly including concrete bases, rebar, steel tubes, and all other appurtenances in the anchor assembly. All holes resulting from the removal of the guardrail posts and anchors shall be backfilled with granular material in layers no more than 6 inches thick and compacted to a density similar to that of the adjacent material. The removed guardrail items shall become the property of the Contractor.

The embedded anchors attaching guardrail posts and guardrail terminal sections specified for removal to existing concrete Structures shall be removed to a minimum of 1 inch beneath the existing concrete surface. The void left by removal of the embedded anchors shall be coated with epoxy bonding agent and filled with mortar conforming to Section 9-20.4(2). The epoxy bonding agent shall be Type II, conforming to Section 9-26.1, with the grade and class as recommended by the epoxy bonding agent manufacturer.

8-11.3(1)E Raising Guardrail

For raising guardrail anchors and raising guardrail terminals, the existing guardrail posts shall be raised to attain the guardrail height shown in the Plans, measured from the top of the rail to the finished Shoulder surface. The material around each post shall be tamped to prevent settlement of the raised post.

For raising all other guardrail, the existing guardrail posts shall not be raised to attain the new mounting height. The existing rail elements and blocks shall be removed from the guardrail post. The Contractor shall field drill new $\frac{3}{4}$ -inch diameter holes in the existing posts to accommodate the $\frac{5}{8}$ -inch diameter button head bolts. When existing guardrail posts are galvanized steel, the new drill holes shall be painted with two coats of paint, conforming to Section 9-08.1(2)B. The Contractor shall then reinstall the guardrail block and rail element at the new mounting height shown in the Plans, measured from the top of the rail to the finished Shoulder surface. The new position of the top of the block shall not be more than 4 inches above the top of the guardrail post.

The Contractor shall remove and replace all existing guardrail posts and blocks that are not suited for re-use, as staked by the Engineer. The void caused by removal of the post shall be backfilled and compacted. The Contractor shall then furnish and install a new guardrail post to provide the necessary mounting height.

8-11.3(1)F Removing and Resetting Beam Guardrail

The Contractor shall remove and reset existing guardrail posts, rail element, hardware and blocks to the location shown in the Plans. The mounting height of reset rail element shall be at the height shown in the Plans.

The Contractor shall remove and replace all existing guardrail posts and blocks that are not suited for re-use, as staked by the Engineer. The void caused by the removal of the post shall be backfilled and compacted. The Contractor shall then furnish and install a new guardrail post to provide the necessary mounting height.

8-11.3(1)G Vacant

8-11.3(1)H Guardrail Construction Exposed to Traffic

Sections of beam guardrail that are removed for modification shall be completely reassembled back in place within 5 calendar days of the date the guardrail is removed.

The Contractor's operations shall be conducted in such a manner that fixed objects previously protected by barrier or newly installed shall be protected from traffic at all times by a method approved by the Engineer.

Rail elements shall be attached to the posts during the same working shift or protected by a method approved by the Engineer.

At the end of each work shift, guardrail sections having an exposed end toward oncoming traffic shall have a Type C terminal end section bolted securely in place.

8-11.4 Measurement

Measurement of beam guardrail and beam guardrail with long posts will be by the linear foot measured along the line of the completed guardrail, including expansion section, and will also include the end section for F connections.

Measurement of beam guardrail transition sections will be per each for the type of transition section installed. End sections, except for F connections, will be considered part of the transition section and will be included in the measurement of the transition section.

Measurement of beam guardrail _____ terminal and beam guardrail bull nose terminal Type 2 will be per each for the completed terminal.

Measurement of beam guardrail Type 31 buried terminal Type 2 will be per linear foot for the completed terminal.

Measurement of beam guardrail anchor Type 11 will be per each for the completed anchor, including the attachment of the anchor to the guardrail.

Measurement of removal of guardrail will be by the linear foot measured along the line of guardrail removed including transition sections, expansion sections, guardrail anchor rail elements and terminal sections.

Measurement of removal of guardrail anchors will be per each.

Measurement of raising beam guardrail and removing and resetting beam guardrail will be by the linear foot measured along the line of guardrail actually raised or removed and reset. This will include transition sections, expansion sections, anchors, and terminal sections.

Measurement of beam guardrail post used for raising beam guardrail will be per each.

Measurement of beam guardrail blocks used for raising beam guardrail will be per each.

8-11.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

"Beam Guardrail Type _____", per linear foot.

"Beam Guardrail Type 1- _____ Ft. Long Post", per linear foot.

"Beam Guardrail Type 31-_____ Ft. Long Post", per linear foot.

The unit Contract price per linear foot for "Beam Guardrail Type _____", "Beam Guardrail Type 1- _____ Ft. Long Post", and "Beam Guardrail Type 31-_____ Ft. Long Post", shall be full payment for all costs to obtain and provide materials and perform the Work as described in Sections 8-11.3(1)A and 8-11.3(1)B, including costs for additional rail elements when nested rail is required, when connections to concrete masonry Structures are required, and when constructing leave-outs for guardrail installed in asphalt or concrete pavement.

"Beam Guardrail Transition Section Type ____", per each.

The unit Contract price per each for "Beam Guardrail Transition Section Type ____" shall be full payment for all costs to obtain and provide materials and perform the Work as described in Sections 8-11.3(1)A and 8-11.3(1)B, including costs for additional rail elements when nested rail is required, when connections to concrete masonry Structures are required, and when constructing leave-outs for guardrail transitions installed in asphalt or concrete pavement.

"Beam Guardrail Anchor Type 11", per each.

"Beam Guardrail ____ Terminal", per each.

"Beam Guardrail Bull Nose Terminal Type 2", per each.

The unit Contract price per each for "Beam Guardrail Anchor Type ____", "Beam Guardrail ____ Terminal" and "Beam Guardrail Bull Nose Terminal Type 2" shall be full payment for all costs to obtain and provide materials and perform the Work as described in Section 8-11.3(1)C including costs when constructing leave-outs for guardrail terminals or anchors installed in asphalt or concrete pavement.

"Beam Guardrail Type 31 Buried Terminal Type 2", per linear foot.

The unit Contract price per linear foot for "Beam Guardrail Type 31 Buried Terminal Type 2" shall be full payment for all costs to obtain and provide materials and perform the Work as described in Section 8-11.3(1)C, including costs when constructing leave-outs for guardrail terminals or anchors installed in asphalt or concrete pavement.

"Removing and Resetting Beam Guardrail", per linear foot.

The unit Contract price per linear foot for "Removing and Resetting Beam Guardrail" shall be full payment for all costs to perform the Work as described in Section 8-11.3(1)F, except for replacement posts and blocks.

"Raising Existing Beam Guardrail", per linear foot.

The unit Contract price per linear foot for "Raising Existing Beam Guardrail" shall be full payment for all costs to perform the Work as described in Section 8-11.3(1)E, except for replacement posts and blocks.

"Removing Guardrail", per linear foot.

The unit Contract price per linear foot for "Removing Guardrail" shall be full payment for all costs to perform the Work as described in Section 8-11.3(1)D.

"Removing Guardrail Anchor", per each.

The unit Contract price per each for "Removing Guardrail Anchor" shall be full payment for all costs to perform the Work as described in Section 8-11.3(1)D, including rail removal, if there isn't a Bid item for Removing Guardrail in the run of guardrail connecting to the anchor.

"Beam Guardrail Post", per each.

"Beam Guardrail Block", per each.

The unit Contract price per each for "Beam Guardrail Post" and "Beam Guardrail Block" shall be full payment for all costs for furnishing and installing new posts and blocks, removal and disposal of the existing posts and blocks, and backfilling and compacting the void created by post removal when new posts or blocks are required for the Work described in Sections 8-11.3(1)E and 8-11.3(1)F.

8-12 Chain Link Fence and Wire Fence

8-12.1 Description

This Work consists of furnishing and constructing chain link fence and wire fence of the types specified in accordance with the Plans, these Specifications, and the [Standard Plans](#) at the locations shown in the Plans and in conformity with the lines as staked.

Chain link fence shall be of diamond woven wire mesh mounted on steel posts.

Wire fence shall be of barbed wire or barbed wire combined with wire mesh fastened to posts. Steel posts and steel braces, or wood posts and wood braces may be used, provided only one type shall be selected for use in any Contract.

Gates shall consist of a steel frame or frames covered with chain link or wire mesh.

8-12.2 Materials

Materials shall meet the requirements of the following sections:

Concrete	6-02
Threaded Anchor Rods, Nuts, and Resin Bonding Material	9-06.4
Paint	9-08.1(2)B
Chain Link Fence and Gates	9-16.1
Wire Fence and Gates	9-16.2
Cable Fence	9-16.7
Grout	9-20.3

8-12.3 Construction Requirements

Clearing of the fence line will be required. Clearing shall consist of the removal and disposal of all trees, brush, logs, upturned stumps, roots of down trees, rubbish, and debris.

For chain link type fences, the clearing width shall be approximately 10 feet. For wire type fences, the clearing width shall be approximately 3 feet. Grubbing will not be required except where short and abrupt changes in the ground contour will necessitate removal of stumps in order to properly grade the fence line. All stumps within the clearing limits shall be removed or close cut.

Grading of the fence line sufficient to prevent short and abrupt breaks in the ground contour that will improve the aesthetic appearance of the top of the fencing when installed shall be required. It is expected that in the performance of this Work, machine operations will be required for chain link fencing, and handwork will be required for wire fencing except where sufficient width exists for machine work.

The fence shall be constructed close to and inside the Right of Way line unless otherwise directed by the Engineer or shown in the Plans. Deviations in alignment to miss obstacles will be permitted only when approved by the Engineer and only when such deviation will not be visible to the traveling public or adjacent property owners.

8-12.3(1) Chain Link Fence and Gates

8-12.3(1)A Posts

Posts shall be placed in a vertical position and, except where otherwise directed by the Engineer, shall be spaced at 10-foot centers. Spacing will be measured parallel to the slope of the ground.

All posts, except line posts, shall be set in concrete to the dimensions shown in the Plans. All concrete footings shall be crowned so as to shed water. Line posts fences shall be set in undisturbed earth either by driving or drilling, except as specified. Driving shall be accomplished in such a manner as not to damage the post. Voids around the post shall be backfilled with suitable material and thoroughly tamped.

Concrete footings shall be constructed to embed the line posts at grade depressions where the tension on the fence will tend to pull the post from the ground.

Where solid rock is encountered without an overburden of soil, line posts shall be set a minimum depth of 14 inches, and end, corner, gate, brace, and pull posts a minimum of 20 inches into the solid rock. The holes shall have a minimum width 1 inch greater than the largest dimension of the post section to be set. The posts shall be cut before installation to lengths that will give the required length of post above ground, or if the Contractor so elects, an even length of post set at a greater depth into the solid rock may be used.

After the post is set and plumbed, the hole shall be filled with Grout Type 4. The grout shall be thoroughly worked into the hole so as to leave no voids. The grout shall be crowned to carry water from the post.

Where solid rock is covered by an overburden of soil or loose rock, the posts shall be set to the full depth shown in the Plans unless penetration into solid rock reaches the minimum depths specified above, in which case the depth of penetration may be terminated. Concrete footings shall be constructed from the solid rock to the top of the ground. After the post is set and plumbed, the hole in the portion of the post in solid rock shall be filled with Grout Type 4. The grout shall be thoroughly worked into the hole so as to leave no voids.

Gate and pull posts shall be braced to the adjacent brace, end, or corner post(s) in the manner shown in the Plans. Changes in line amounting to 2-foot tangent offset or more between posts shall be considered as corners for all types of fence.

Steep slopes or abrupt topography may require changes in various elements of the fence. It shall be the responsibility of the Contractor to provide all posts of sufficient length to accommodate the chain link fabric.

All round posts shall have approved top caps fastened securely to the posts. The base of the top cap fitting for round posts shall feature an apron around the outside of the posts.

8-12.3(1)B Vacant

8-12.3(1)C Tension Wire

Tension Wires shall be attached to the posts as detailed in the Plans or as approved by the Engineer.

8-12.3(1)D Chain Link Fabric

Chain link fabric shall be attached after the cables and wires have been properly tensioned.

Chain link fabric shall be placed on the face of the post away from the Highway, except on horizontal curves where it shall be placed on the face on the outside of the curve unless otherwise directed by the Engineer.

Chain link fabric shall be placed approximately 1 inch above the ground and on a straight grade between posts by excavating high points of ground. Filling of depressions will be permitted only upon approval of the Engineer.

The fabric shall be stretched taut and securely fastened to the posts. Fastening to end, gate, corner, and pull posts shall be with stretcher bars and fabric bands spaced at intervals of 15 inches or less or by weaving the fabric into the fastening loops of roll formed posts. Fastening to posts shall be with tie wire, metal bands, or other approved method attached at 14-inch intervals. The top and bottom edge of the fabric shall be fastened with hog rings to the top and bottom tension wires as may be applicable, spaced at 24-inch intervals.

Rolls of wire fabric shall be joined by weaving a single strand into the ends of the rolls to form a continuous mesh.

8-12.3(1)E Chain Link Gates

Chain link fabric shall be fastened to the end bars of the gate frame by stretcher bars and fabric bands and to the top and bottom bars of the gate frames by tie wires in the same manner as specified for the chain link fence fabric, or by other standard methods if approved by the Engineer.

Welded connections on gate frames where the galvanized coating has been burned shall be thoroughly cleaned by wire brushing and all traces of the welding flux and loose or cracked galvanizing removed. The clean areas shall then be painted with two coats of paint, conforming to Section 9-08.1(2)B.

8-12.3(2) Wire Fence and Gates**8-12.3(2)A Posts**

Line posts shall be spaced at intervals not to exceed 14 feet. All intervals shall be measured center to center of posts. In general, in determining the spacing of posts, measurements will be made parallel to the slope of the existing ground, and all posts shall be placed in a vertical position except where otherwise directed by the Engineer.

Line posts may be driven in place provided the method of driving does not damage the post. Steel corner, gate, and pull posts shall be set in concrete footings to the dimensions shown in the Plans and crowned at the top to shed water.

Concrete footings shall be constructed to embed the lower part of steel line posts, and wood anchors shall be placed on wood posts at grade depressions wherever the tension on the line wires will tend to pull the post from the ground. The concrete footings shall be 3 feet deep by 12 inches in diameter and crowned at the top.

Where solid rock is encountered without an overburden of soil, line posts shall be set a minimum depth of 14 inches and end, corner, gate, and pull posts a minimum depth of 20 inches into the solid rock. The hole shall have a minimum dimension 1 inch greater than the largest dimension of the post section to be set. The posts shall be cut before installation to lengths that will give 4½ feet of post above ground, or if the Contractor so elects, 6-foot posts set 18 inches into the solid rock may be used.

After the post is set and plumbed, the hole shall be filled with Grout Type 4. The grout shall be thoroughly worked into the hole so as to leave no voids. The grout shall be crowned to carry water away from the post. Where posts are set in the above manner, anchor plates and concrete footings will not be required.

Where solid rock is covered by an overburden of soil or loose rock, the posts shall be set to the full depth of 2½ feet unless the penetration into solid rock reaches the minimum depths specified above, in which case the depth of penetration may be terminated. When the depth of the overburden is greater than 12 inches, anchor plates will be required on the steel line posts, and concrete footings shall be constructed from the solid rock to the top of the ground on steel end, gate, corner, and pull posts. When the depth of overburden is 12 inches or less, anchor plates and concrete footings will not be required. After the post is set and plumbed, the hole in the portion of the post in solid rock shall be filled with Grout Type 4. The grout shall be thoroughly worked into the hole so as to leave no voids.

Steel braces shall be anchored to soil or loose rock with a commercial concrete footing not less than 18 inches on any one side and set in solid rock to a minimum depth of 10 inches in the same manner as specified above for posts. The braces shall be set on the diagonal as shown in the Plans and connected to the post with an approved connection.

Wood braces shall be dapped ¼ inch into the posts and shall be fastened to each post with three 20d galvanized nails.

Wire braces shall consist of a 9-gage wire passed around the wood posts to form a double wire. The wire shall be fastened to each post with two staples and fastened together to form a continuous wire. The wires shall then be twisted together until the wire is in tension.

Where the new fence joins an existing fence, the two shall be attached in a manner satisfactory to the Engineer, and end or corner posts shall be set as necessary.

Changes in alignment of 30 degrees or more shall be considered as corners, and corner posts shall be installed. Where it is deemed by the Engineer that a change in alignment of less than 30 degrees will materially lessen the strength of the fence, the line post at the angle shall be supported by the addition of braces or wires in a manner satisfactory to the Engineer.

8-12.3(2)B Barbed Wire and Wire Mesh

After the pull posts have been placed and securely braced, the barbed wire and mesh shall be pulled taut to the satisfaction of the Engineer, and each longitudinal wire shall be cut and securely fastened to the pull post with devices customarily used for the purpose. Wire or mesh shall not be carried past a pull post, but shall be cut and fastened to the pull post independently for the adjacent spans.

After the tensioning of the wire or mesh between two pull posts, all longitudinal wires shall be properly fastened at proper height to each intervening line post.

Wire mesh and barbed wire shall be placed on the face of the post which is away from the highway, except that on horizontal curves, the mesh and wires shall be fastened to the face on the outside of the curve unless otherwise directed by the Engineer.

Where unusual ground depressions occur between posts, the fence shall be guyed to the ground by means of a 9-gage galvanized wire attached to a gravity anchor of approximately 100 pounds buried 2 feet in the ground. The guy wire shall be securely attached to each strand of barbed wire and to the top and bottom wires of the wire mesh fabric in a manner to maintain the entire fence in its normal shape. If necessary to guy the fence in solid rock, the guy wire shall be grouted in a hole 2 inches in diameter and 10 inches deep. The operation of guying shall leave the fence snug with the ground.

8-12.3(2)C Vertical Cinch Stays

Vertical cinch stays shall be installed midway between posts on both types of fence. The wire shall be twisted in such a manner as to permit weaving into the horizontal fence wires to provide rigid spacing. All barbed wires and the top, middle, and bottom wire of the wire mesh shall be woven into the stay.

8-12.3(2)D Wire Gates

The wire mesh fabric shall be taut and securely tied to the frame and stays in accordance with recognized standard practice for wire gate construction.

Welded connections on gate frames shall be treated as specified for chain link fence gates.

The drop bar locking device for double wire gates shall be provided with a footing of commercial concrete 12 inches in diameter and 12 inches deep, crowned on top and provided with a hole to receive the locking bar. The diameter and depth of the hole in the footing shall be as specified by the manufacturer of the locking device.

8-12.3(2)E Access Control Gate

Access control gates shall be placed to line and grade as shown in the Plans or as staked. After the posts have been set, the holes shall be backfilled. The postholes shall be of sufficient dimension to allow placement and thorough compaction of selected backfill material completely around the post. Selected backfill material shall consist of earth or fine sandy gravel, free from organic matter, with no individual particles exceeding 1½ inches in diameter.

8-12.3(3) Cable Fence

The Contractor shall field measure the slope of the top of the existing retaining wall at each location of cable fence end post and intermediate brace.

The Contractor shall install resin bonded anchors in accordance with Section 6-02.3(18).

The cable shall be tensioned to 400 pounds with six inches minimum of take up still available in the turnbuckle.

The Contractor shall clean, prepare, and shop paint or powder coat all exposed galvanized surfaces of the cable fence post assemblies in accordance with Section 6-07.3(11). The color of the finish coat, when dry, shall match SAE AMS Standard 595 Color No. 20045. After installation of the cable fence posts, any surfaces with paint or powder coating damage shall be repaired in accordance with Section 6-07.3(10)P or Section 6-07.3(11)B6, respectively.

8-12.3(3)A Submittals

The Contractor shall submit Type 1 Working Drawings consisting of the tabulated field measured slope data.

The Contractor shall submit shop drawings of the cable fence in accordance with Section 6-03.3(7). The shop drawings shall include, at a minimum, the following:

1. Plan, elevation, and section views of the cable fence and all components, with dimensions and tolerances.
2. Material designations for all components.
3. Socketing procedure for the spelter sockets.
4. Erection plan for installing the posts, installing, and connecting the cable to the posts, and tensioning the cable.

8-12.4 Measurement

Chain link fence and wire fence will be measured by the linear foot of completed fence, along the ground line, exclusive of openings.

Cable fence will be measured by the linear foot along the line and slope at the base of the completed fence.

End, gate, corner, and pull posts for chain link fence will be measured per each for the posts furnished and installed complete in place.

Gates will be measured by the unit for each type of gate furnished and installed.

Access control gates will be measured per each.

8-12.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

"Chain Link Fence Type ____", per linear foot.

The unit Contract price per linear foot for "Chain Link Fence Type ____" shall be full payment for all costs for the specified Work including brace post installation and all other requirements of Section 8-12 for Chain Link Fence, unless covered in a separate Bid Item in this section.

Payment for clearing of fence line for "Chain Link Fence Type ____" shall be in accordance with Section 3-01.5.

"Cable Fence", per linear foot.

The unit Contract price per linear foot for "Cable Fence" shall be full payment for all costs for the specified Work.

"End, Gate, Corner, and Pull Post for Chain Link Fence", per each.

The unit Contract price per each for "End, Gate, Corner, and Pull Post for Chain Link Fence" shall be full payment for all costs for the specified Work.

"Double 14 Ft. Chain Link Gate", per each.

"Double 20 Ft. Chain Link Gate", per each.

"Single 6 Ft. Chain Link Gate", per each.

The unit Contract price per each for "Double 14 Ft. Chain Link Gate", "Double 20 Ft. Chain Link Gate", and "Single 6 Ft. Chain Link Gate", shall be full payment for all costs for the specified Work.

"Wire Fence Type ____", per linear foot.

The unit Contract price per each for "Wire Fence Type ____" shall be full payment for all costs for the specified Work including payment for clearing of the fence line.

"Single Wire Gate 14 Ft. Wide", per each.

"Double Wire Gate 20 Ft. Wide", per each.

The unit contract price per each for "Single Wire Gate 14 Ft. Wide" and "Double Wire Gate 20 Ft. Wide" shall be full payment for all costs for the specified Work.

"Access Control Gate", per each.

The unit contract price per each for "Access Control Gate" shall be full payment for all costs to perform the specified work.

8-13 Monument Cases

8-13.1 Description

This Work consists of furnishing, placing and adjusting monument cases and covers, in accordance with the [Standard Plans](#) and these Specifications and in conformity with the lines and locations shown in the Plans or as staked.

8-13.2 Materials

Materials shall meet the requirements of the following sections:

Commercial Concrete	6-02
Crushed Surfacing Base Course	9-03.9(3)
Monument Cases and Covers	9-22.1

8-13.3 Construction Requirements

8-13.3(1) Monument Case and Cover

The concrete base shall be placed on a well compacted foundation. The placing of the monument case and base shall be performed in a manner that will not disturb the monument.

The monument case shall be installed by the Contractor after the final course of HMA has been placed. After the monument case has been in place for a minimum of 3 days, the Roadway surface shall be patched in accordance with Section 5-04.3(7).

When the monument case and cover are placed in cement concrete pavement, the concrete base will not be required.

The monument will be furnished and set by the Engineer.

8-13.3(2) Adjust Monument Case and Cover

8-13.3(2)A Removing and Lowering Monument Case and Cover

The existing monument cases and covers shall be lowered prior to planing and adjusted to the finished grade after the HMA overlay is complete.

The Contractor shall reference the location of each monument case to be adjusted. The Contractor may use location devices, offsets, or any locating method approved by the Engineer.

Monument cases and covers shall be lowered sufficiently to allow the planer to maintain a continuous profile and grade. Whenever lowered or removed, existing cases and covers shall be thoroughly cleaned for re-installation at the new elevation. The Contractor shall exercise care in removing the existing monument cases and covers so as not to disturb the monument or damage the case.

The Contractor shall backfill and compact all voids resulting from lowering and adjusting the monument cases and covers. Backfill material shall be Crushed Surfacing Base Course (CSBC). The basis for acceptance of CSBC shall be visual inspection by the Engineer's representative.

The use of monument case riser rings will not be permitted. Debris from lowering and adjusting the monument cases and covers shall be removed from the project.

8-13.3(2)B Reinstalling Monument Case and Cover

The adjusted or reinstalled monument case and cover shall be reset to ¼-inch above the finished pavement as indicated in the plans and in accordance with the following additional requirements:

1. The HMA shall be cut and removed to a neat circle, the diameter of which shall be equal to the outside diameter of the monument case plus 2-feet. The base materials shall be removed, the monument case set, and Commercial Concrete Class 3000 placed in the void between the case and the HMA, up to the finished pavement surface.
2. Prior to opening to traffic, the concrete shall have attained a minimum compressive strength of 2000 psi determined by WSDOT FOP for C 805.

The concrete shall be cured by one of the following methods:

1. Covered with wet burlap for 24 hours.
2. Covered with white polyethylene sheeting for 24 hours.
3. Sprayed with liquid curing compound.

8-13.4 Measurement

Measurement of monument case and cover will be by the unit for each monument case and cover furnished and set.

Measurement for adjust monument case and cover will be by the unit for each monument case and cover adjusted.

8-13.5 Payment

Payment will be made for the following Bid item when included in the Proposal:

“Monument Case and Cover”, per each.

“Adjust Monument Case and Cover”, per each.

8-14 Cement Concrete Sidewalks**8-14.1 Description**

This Work consists of constructing cement concrete sidewalks and detectable warning surfaces in accordance with details shown in the Plans and these Specifications and in conformity to lines and grades shown in the Plans or as established by the Engineer.

8-14.2 Materials

Materials shall meet the requirements of the following sections:

Cement	9-01
Aggregates	9-03
Premolded Joint Filler	9-04.1
Detectable Warning Surface	9-19
Concrete Curing Materials and Admixtures	9-23

8-14.3 Construction Requirements

The concrete in the sidewalks and curb ramps shall be air entrained concrete Class 3000 in accordance with the requirements of Section 6-02.

8-14.3(1) Excavation

Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the forms. The foundation shall be shaped and compacted to a firm even surface conforming to the section shown in the Plans. All soft and yielding material shall be removed and replaced with acceptable material.

8-14.3(2) Forms

Forms shall be of wood or metal and shall extend for the full depth of the concrete. All forms shall be straight, free from warp, and of sufficient strength to resist the pressure of the concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal. After the forms have been set to line and grade, the foundation shall be brought to the grade required and thoroughly wetted approximately 12 hours before placing the concrete.

8-14.3(3) Placing and Finishing Concrete

The concrete shall be placed in the forms and struck off with an approved straightedge. As soon as the surface can be worked, it shall be troweled smooth with a steel trowel.

After troweling and before installing the contraction joints or perimeter edging, the walking surfaces of the sidewalk and curb ramps shall be brushed with a stiff bristled broom. Brush strokes shall be perpendicular to the travel direction of the sidewalk.

Expansion and contraction joints shall be constructed as shown in the Plans. When the sidewalk abuts a cement concrete curb or curb and gutter, the expansion joints in the sidewalk shall have the same spacing as the curb. The expansion joint shall be filled to full cross-section of the sidewalk with $\frac{3}{4}$ inch premolded joint filler.

Curb ramps shall be of the type specified in the Plans and shall include the cast-in-place detectable warning surface.

8-14.3(4) Curing

Concrete sidewalks shall be cured for at least 72 hours. Curing shall be by means of moist burlap or quilted blankets or other approved methods. During the curing period, all traffic, both pedestrian and vehicular, shall be excluded. Vehicular traffic shall be excluded for such additional time as the Engineer may specify.

8-14.3(5) Detectable Warning Surface**8-14.3(5)A General**

The detectable warning surface shall be located as shown in the Plans. The detectable warning surface shall have the truncated dome shape shown in the Plans.

8-14.3(5)B Cast-in-Place Detectable Warning Surfaces

Placement of the cast-in-place detectable warning surfaces shall be in accordance with the manufacturer's recommendation for placement in fresh concrete, before the concrete has reached initial set, or on a hardened cement concrete surface or asphalt pavement surface.

Vertical edges of the detectable warning surface shall be flush with the adjoining surface to the extent possible (not more than $\frac{1}{4}$ inch above the surface of the pavement) after installation.

Embossing or stamping the wet concrete to achieve the truncated dome pattern or using a mold into which a catalyst-hardened material is applied shall not be allowed.

8-14.3(5)C Surface Applied Detectable Warning Surfaces

When surface applied detectable warning surfaces are applied, placement shall be in accordance with the manufacturer's recommendation; however glued or stick down applications are prohibited for permanent installations. They shall be weather resistant and durable to normal pedestrian wear and maintenance activities, and show no appreciable fading, lifting, or shrinkage. The units shall be capable of molding or fitting itself to the contours, breaks, and faults of HMA or PCC surfaces, and show no significant tearing, rollback, lifting, or other signs of poor adhesion. Permanent installations of surface applied detectable warning surfaces shall be secured with mechanical fasteners.

8-14.4 Measurement

Cement concrete sidewalks will be measured by the square yard of finished surface and will not include the surface area of the curb ramps.

Cement concrete curb ramp type _____ will be measured per each for the complete curb ramp type installed and includes construction of cast-in-place detectable warning surfaces.

Detectable warning surfaces will be measured by the square foot of surface applied detectable warning surfaces constructed as shown in the Plans.

8-14.5 Payment

Payment will be made for the following Bid items when included in the Proposal:

"Cement Conc. Sidewalk", per square yard.

"Cement Conc. Sidewalk with Raised Edge", per square yard.

"Monolithic Cement Conc. Curb and Sidewalk", per square yard.

"Cement Conc. Curb Ramp Type ____", per each

The unit Contract price per each for "Cement Conc. Curb Ramp Type____" shall be full pay for construction of the curb ramp as specified, including the cast-in-place detectable warning surfaces.

Payment for excavation of material not related to the construction of the sidewalk but necessary before the sidewalk can be placed, when and if shown in the Plans, will be made in accordance with the provisions of Section 3-03. Otherwise, the Contractor shall make all excavations including haul and disposal, regardless of the depth required for constructing the sidewalk and curb ramps to the lines and grades shown and shall include all costs thereof in the unit Contract price per square yard for "Cement Conc. Sidewalk", "Cement Conc. Sidewalk with Raised Edge", "Monolithic Cement Conc. Curb and Sidewalk", or the unit contract price per each for "Cement Conc. Curb Ramp Type ____".

"Detectable Warning Surface", per square foot.

The unit Contract price per square foot of "Detectable Warning Surface", shall be full pay for surface applied detectable warning surfaces.

8-15 Riprap**8-15.1 Description**

This Work consists of furnishing and placing riprap protection of the type specified at the locations and in conformity with the lines and dimensions shown in the Plans or established by the Engineer.

Riprap will be classified as heavy loose riprap, light loose riprap, and hand placed riprap.

8-15.2 Materials

Materials shall meet the requirements of the following sections:

Filter Blanket ____ (shall meet the gradation requirements for Permeable Ballast)	9-03.9(2)
Gravel Backfill for Drains	9-03.12(4)
Heavy Loose Riprap	9-13
Light Loose Riprap	9-13
Hand Placed Riprap	9-13
Quarry Spalls	9-13

8-15.3 Construction Requirements**8-15.3(1) Excavation for Riprap**

The foundation for riprap shall be excavated below probable scour or to the elevation shown in the Plans, and no stone shall be laid or concrete placed until the footing is approved by the Engineer. Excavation below the level of the intersection of the slope to be protected and the adjacent original ground or the channel floor or slope shall be classified, measured, and paid for as channel excavation or ditch excavation in accordance with Section 3-03. All excavation or backfill above the level of the above described intersection and all dressing of the slope to be protected shall be included in the Contract price for the class of riprap to be placed. Before placing riprap, the slopes shall be dressed to the lines and grades as staked.

8-15.3(2) Loose Riprap

Loose riprap shall be placed in such a manner that all relatively large stones shall be essentially in contact with each other, and all voids filled with the finer materials to provide a well graded compact mass. The stone shall be dumped on the slope in a manner that will ensure the riprap attains its specified thickness in one operation. When dumping or placing, care shall be used to avoid disturbing the underlying material. Placing in layers parallel to the slope will not be permitted. A 12-inch tolerance for loose riprap will be allowed from slope plane and grade line in the finished surface.

8-15.3(3) Hand Placed Riprap

The stones shall be laid by hand on prepared slopes to such thickness as may be ordered by the Engineer. The riprap shall be started at the toe of the embankment by digging a trench and placing a course of the largest stones therein. Each stone shall be placed so that it shall rest on the slope of the embankment and not wholly on the stone below, and it shall be thoroughly tamped or driven into place. The exposed face of all hand placed riprap shall be made as smooth as the shape and size of the stones will permit and shall not vary more than 3 inches from a plane surface on the required slope.

8-15.3(4) Vacant**8-15.3(5) Vacant**

8-15.3(6) Quarry Spalls

Quarry spalls shall be placed in ditches and on slopes to be protected, in accordance with the Plans or as staked by the Engineer. After placement, the quarry spalls shall be compacted to be uniformly dense and unyielding.

8-15.3(7) Filter Blanket

When required, a filter blanket shall be placed on the prepared slope or area to the full thickness specified in the Plans using methods which will not cause segregation of particle sizes within the bedding. The surface of the finished layer shall be even and free from mounds or windrows. Additional layers of filter material, when required, shall be placed using methods that will not cause mixing of the materials in the different layers.

8-15.4 Measurement

Loose riprap will be measured by the ton or per cubic yard of riprap actually placed.

Hand placed riprap will be measured by the cubic yard of riprap actually placed.

Filter blanket will be measured by the ton or cubic yard of filter blanket actually placed.

Quarry spalls will be measured by the ton or per cubic yard of spalls actually placed.

Channel excavation will be measured by the cubic yard as specified in Section 3-03.

Ditch excavation will be measured by the cubic yard as specified in Section 3-03.

Excavation for toe walls and trenches will be measured by the cubic yard as ditch excavation in accordance with the provisions of Section 3-03.

8-15.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

“Heavy Loose Riprap”, per ton or per cubic yard.

“Light Loose Riprap”, per ton or per cubic yard.

“Hand Placed Riprap”, per cubic yard.

The unit Contract price per ton or per cubic yard for the class or kind of riprap specified above shall be full pay for furnishing all labor, tools, equipment, and materials required to construct the riprap protection, except for excavation. When it is necessary to dump and sort individual loads, payment will be made only for that portion accepted by the Engineer.

“Quarry Spalls”, per ton or per cubic yard.

The unit Contract price per ton or per cubic yard for “Quarry Spalls” shall be full pay for all costs in furnishing, placing, and compacting spalls.

“Ditch Excavation”, per cubic yard.

“Filter Blanket”, per cubic yard or per ton.

The unit price for “Filter Blanket” shall be full payment for all costs incurred to perform the work in Section 8-15.3(7).

“Channel Excavation”, per cubic yard.

“Channel Excavation Incl. Haul”, per cubic yard.

“Ditch Excavation Incl. Haul”, per cubic yard.

“Payment for “Channel Excavation”, “Channel Excavation Incl. Haul”, “Ditch Excavation” and “Ditch Excavation Incl. Haul” is described in Section 3-03.5.

8-16 Concrete Slope Protection

8-16.1 Description

This Work consists of constructing concrete slope protection, in accordance with these Specifications and the details shown in the Plans, at the locations and in conformity with the lines, grades, and dimensions as staked.

Concrete slope protection shall consist of reinforced cement concrete poured or pneumatically placed upon the slope with a rustication joint pattern or semi-open concrete masonry units placed upon the slope closely adjoining each other.

8-16.2 Materials

Materials shall meet the requirements of the following sections:

Commercial Concrete	6-02.3(2)B
Concrete Slope Protection	9-13.5
Semi-Open Concrete Masonry Units Slope Protection	9-13.5(1)
Poured Portland Cement or Blended Hydraulic Cement	
Concrete Slope Protection	9-13.5(2)
Pneumatically Placed Portland Cement or Blended Hydraulic	
Cement Concrete Slope Protection	9-13.5(3)

8-16.3 Construction Requirements

8-16.3(1) Footing and Preparation of Slope

The footing for the slope protection shall be constructed in accordance with Sections 3-07 and 6-02.

The construction of the footing will be incidental to the slope protection, and no separate measurement or payment will be made.

The surface on which application is to be made shall be thoroughly compacted and neatly trimmed to line and grade as necessary to conform to the detail in the Plans.

8-16.3(2) Placing Semi-Open Concrete Masonry Units

The concrete masonry units shall be placed in a uniform plane and in such a manner that they rest firmly and evenly against the slope with no rocking. The concrete masonry units shall be placed in horizontal parallel courses, and successive courses shall break joints with the preceding course to form a running bond.

8-16.3(3) Poured in Place Cement Concrete

The wire mesh shall lap a minimum of one mesh spacing, and laps shall be securely fastened at the ends. During the placement of the concrete, the reinforcement shall be held so as to provide a minimum of 1¼ inch of cover.

Where commercial concrete is to be placed upon the slope, the method of depositing and compacting shall result in a compact, dense, and impervious concrete which will show a uniform plane surface.

The newly constructed concrete shall be finished by means of a wood float and shall be striated with a rustication joint as shown in the Plans.

Curing shall be performed in accordance with Section 5-05.3(13).

8-16.3(4) Pneumatically Placed Concrete

Workers – Only workers experienced in pneumatically placed concrete shall be employed; and satisfactory evidence of such experience shall be furnished when requested by the Engineer.

Equipment – The Contractor shall furnish the Engineer with two copies of the manufacturer's Specifications and operating instructions for the equipment used. Before placement of any portion of the slope protection, the type of equipment and method of operation shall be approved by the Engineer.

Proportions of Materials – The sand/cement ratio shall be 4½ parts sand to one part cement based on loose dry volume.

Water shall be maintained at a constant pressure that shall be at least 15 psi above atmospheric pressure at the nozzle. For lengths of hose up to 100 feet, pneumatic pressure at the gun shall be 45 psi or greater. Pressure shall be increased 5 psi for each additional 5 feet of hose required. A steady pressure shall be maintained.

Method of Application – Portland cement and sand shall be mixed dry, passed through a cement gun and conveyed by air through a flexible tube, hydrated at a nozzle at the end of the flexible tube, and deposited in place by air pressure.

All surfaces are to be wetted, but application shall not be made on any surface on which free water exists.

Reinforcement – The wire mesh shall lap a minimum of one mesh spacing, and laps shall be securely fastened at the ends. During the placement of the concrete, the reinforcement shall be held so as to provide a minimum of 1¾ inch of cover at the recess.

Finishing – The newly constructed concrete shall be finished by means of a wood float and shall be striated with a rustication joint as shown in the Plans.

Curing – Curing shall be in accordance with Section 5-05.3(13).

Protection of Facilities – During the construction, the Contractor shall protect all retaining walls, columns and Structures from concrete splash or overspray. Suitable covering shall be provided if such protection is deemed necessary by the Engineer.

Test Cylinders – Two test cylinders shall be made for each full day's operation. The Contractor shall furnish cylinders 6 inches in diameter and 12 inches high made of ¾-inch mesh hardware cloth. The test cylinder shall be filled with concrete by utilizing the same pneumatic application described above.

The cylinders shall develop a minimum compressive strength of 3,000 psi at the age of 28 days.

8-16.4 Measurement

Measurement for concrete slope protection will be by the square yard and will include the actual area of the slope covered excluding the footings. The area will be computed on the basis of slope measurements.

8-16.5 Payment

Payment will be made for the following Bid item when included in the Proposal:

"Conc. Slope Protection", per square yard.

8-17 Impact Attenuator Systems

8-17.1 Description

This Work consists 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

Materials for inertial sand barrel systems shall be provided and installed in conformance with the manufacturer's instructions and specifications.

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 Engineer 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 certified by the manufacturer of the system. If the supervision is provided by a certified installer, the certification shall be within the previous 5 years and for the specific system(s) being installed. A copy of the installer certification shall be provided to the Engineer prior to installation.

Attenuator 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 concrete foundation or concrete backstop shall be as specified by the manufacturer. Anchorage to the pavement will follow the manufacturer's assembly and installation procedures.

Unless otherwise specified by the manufacturer, concrete foundations and backstops:

1. Shall be made of Class 4000 concrete meeting the requirements of Section 6-02.
2. Shall be cured and finished in accordance with Section 6-02.3(11).

Attenuators shall not be installed on concrete foundations and/or attached to concrete backstops until the concrete has cured for at least 72 hours.

The manufacturer's representative or certified installer shall complete a manufacturer's attenuator assembly/inspection checklist for each attenuator installed. The original completed checklist, signed by the manufacturer's representative or certified installer, shall be provided to the Engineer on the same day that the attenuator installation is completed.

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 Engineer 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.

Permanent impact attenuators shall meet the crash test and evaluation criteria of the Manual for Assessing Safety Hardware (MASH), except as otherwise noted in the Plans or Special Provisions. Temporary impact attenuators shall meet the crash test and evaluation criteria of MASH or the National Cooperative Highway Research Project Report 350 (NCHRP 350) as specified in Section 2-04.3(3).

8-17.4 Measurement

Temporary and permanent impact attenuators will be measured per each for each installation. Only the maximum number of temporary impact attenuators installed at any one time within the project limits will be measured for payment.

Resetting impact attenuators will be measured per each for each installation that is adjusted or reset to a new location on the project. The Contracting Agency will not measure resetting impact attenuators when it is for the benefit of the Contractor's operations.

8-17.5 Payment

Payment will be made for the following Bid items when they are included in the Proposal:

"Temporary Impact Attenuator", per each.

The unit Contract price for "Temporary Impact Attenuator" shall be full pay for all Work associated with the installation, maintenance, and the final removal of the temporary impact attenuator.

"Permanent Impact Attenuator", per each.

The unit Contract price for "Permanent Impact Attenuator" shall be full pay for all Work associated with furnishing, installing and all other costs involved with installing the impact attenuator in accordance with the manufacturer's recommendations.

"Resetting Impact Attenuator", per each.

The unit Contract price for "Resetting Impact Attenuator" shall be full pay for all Work associated with the removing, transporting, and resetting an impact attenuator.

If an impact attenuator is damaged by a third party, repairs shall be made in accordance with Section 1-07.13(4) under the Bid item "Reimbursement For Third Party Damage". No payment will be made for repair of impact attenuators damaged by the Contractor's operations.

8-18 Mailbox Support

8-18.1 Description

This Work consists of removing, maintaining in temporary locations during construction, and reinstalling in permanent locations, all mailboxes affected by Construction work in accordance with the Plans, these Specifications, and the [Standard Plans](#).

8-18.2 Materials

Materials shall meet the requirements of the following sections:

Type 1 Mailbox Supports (Steel Posts)	9-32.1
Bracket, Platform, and Anti-Twist Plate	9-32.2
Type 2 Mailbox Support	9-32.7
Fasteners	9-32.5
Concrete Base	9-32.8
Steel Pipe	9-32.9

Mailboxes will be furnished by others.

8-18.3 Construction Requirements

Mailbox supports shall be as shown in the [Standard Plans](#).

During construction the mailboxes shall be moved to a temporary location where their usefulness will not be impaired. The boxes shall be reinstalled at the original location or at locations determined by the Engineer in accordance with the [Standard Plans](#).

The existing mailboxes shall be reinstalled on new mailbox supports, in accordance with the [Standard Plans](#), within 24 hours of being removed. The existing mailbox posts shall be removed and disposed of off the project site.

Excavation for new mailbox supports shall be backfilled with adjacent native material and compacted to the satisfaction of the Engineer.

When a newspaper tube is attached to an existing mailbox installation, it shall be removed and attached under the mailbox on the new support, to the satisfaction of the Engineer.

8-18.4 Measurement

Mailbox supports will be measured by the unit for each kind of mailbox support furnished and installed in its permanent location.

8-18.5 Payment

Payment will be made for the following Bid item when it is included in the Proposal:

"Mailbox Support Type ____", per each.

8-19 Vacant

8-20 Illumination, Traffic Signal Systems, Intelligent Transportation Systems, and Electrical**8-20.1 Description**

This Work consists of furnishing, installing and field testing all materials and equipment necessary to complete in place, fully functional system(s) of any of the following types, including modifications to an existing system, partial removal of an existing system, or complete removal of an existing system, all in accordance with approved methods, the Plans, the Special Provisions, and these Specifications:

1. Traffic Signal System
2. Illumination System
3. Intelligent Transportation Systems (ITS)

Unless otherwise noted, the location of signals, controllers, standards, and appurtenances shown in the Plans are approximate; and the exact location will be established by the Engineer in the field.

8-20.1(1) Regulations and Code

All electrical equipment shall conform to the standards of the National Electrical Manufacturers Association (NEMA), Electric Utility Service Equipment Requirements Committee (EUSERC), and California Department of Transportation document entitled Transportation Electrical Equipment Specifications (TEES). Traffic signal control equipment shall conform to the Contract and these *Standard Specifications*: EIA Electronic Industries Alliance, IEEE Institute of Electrical and Electronics Engineers, the American Society for Testing and Materials (ASTM), the American Association of State Highway and Transportation Officials (AASHTO), the American National Standards Institute (ANSI), whichever is applicable, and to other codes listed herein. In addition to the requirements of these Specifications, the Plans, and the Special Provisions, all material and Work shall conform to the requirements of the National Electrical Code, hereinafter referred to as the Code, and all WACs and local ordinances, that apply.

Wherever reference is made in these Specifications or in the Special Provisions to the Code, the rules, or the standards mentioned above, the reference shall be construed to mean the code, rule, or standard that is in effect on the Bid advertisement date.

In accordance with RCW 39.06.010, the Contractor need not be registered or licensed if the Contractor has been prequalified as required by RCW 47.28.070.

Safe wiring labels normally required by the Department of Labor and Industries will not be required on electrical Work within the Rights-of-Way of Contracting Agency Highways as allowed in RCW 19.28.141.

Persons performing electrical Work shall be certified in accordance with and supervised as required by RCW 19.28.161. Proof of certification shall be worn at all times in accordance with WAC 296-46B-942. Persons failing to meet these certification requirements may not perform any electrical work, and shall stop all active electrical work, until their certification is provided and worn in accordance with this section.

8-20.1(2) Industry Codes and Standards

The following electrical industry codes and standard procedures are listed for reference purposes:

Air Movement and Control Association (AMCA), 30 West University Drive, Arlington Heights, IL 60004.

American Association of State Highway and Transportation Officials (AASHTO), 444 North Capitol Street NW, Suite 225, Washington, D.C. 20001.

American National Standards Institute (ANSI), 70 East 45th Street, New York, NY.

American Society for Testing and Materials (ASTM), 1916 Race Street,
Philadelphia, PA.

American Wood Protection Association (AWPA), 836 Seventeenth Street,
Washington, D.C.

Bell Company Research and Evaluation (Bellcore) 31220 La Baya DR, Westlake Village,
CA 91362.

Edison Electric Institute (EEI), 420 Lexington Avenue, New York, NY.

Electronics Industries Alliance (EIA), 101 Pennsylvania Avenue, Washington, D.C.

Electric Utility Service Equipment Requirements Committee (EUSERC).

Federal Communications Commission (FCC), 445 12th SW, Washington, D.C. 20554.

International Municipal Signal Association (IMSA), PO Box 539, 1115 North Main
Street, Newark, NY 14513.

Institute of Electrical and Electronics Engineers (IEEE), 17th Floor, New York,
NY 10016

International Telephony Communications Union (ITU) Place des Nations CH
1211 Geneva 20 Switzerland.

Institute of Transportation Engineers (ITE), 2029 K Street, Washington, D.C. 20005.

Insulated Power Cable Engineers' Association (IPCEA), 283 Valley Road, Montclair, NJ.

National Electrical Manufacturers' Association (NEMA), 155 East 44th Street, New
York, NY.

National Fire Protection Association – National Electrical Code (NEC), 470 Atlantic
Avenue, Boston, MA.

National Television Standards Committee (NTSC), 445 12th SW, Washington, D.C.
20554.

National Transportation Communications for ITS Protocol (NTCIP).

Rural Utilities Service (RUS), 1400 Independence Avenue, Washington, D.C.

Underwriters' Laboratories (UL), 207 East Ohio Street, Chicago, IL.

8-20.1(3) Permitting and Inspections

Electrical installations are subject to electrical inspection in accordance with RCW 19.28.101. Electrical inspections may only be performed by an electrical inspector meeting the requirements of RCW 19.28.321. Electrical installations will not be accepted until they have been inspected and approved by an electrical inspector as required by this Section.

An electrical inspection shall be required for construction of all new electrical systems or alteration to an existing electrical system. Inspections are required prior to energizing all new or altered existing circuit. An inspection is required even if there is no new electrical service or new electrical meter being installed in the Contract.

Installations within WSDOT right of way are subject to inspection by a WSDOT certified electrical inspector as allowed by RCW 19.28.141. A separate permit is not required for electrical installations within WSDOT right of way. Additional inspections may be required at the discretion of the Engineer.

Installations outside of WSDOT right of way are subject to permitting and inspection in accordance with RCW 19-28.101 by the Washington State Department of Labor and Industries (L&I) or a local jurisdiction approved for that location by L&I. Approved local jurisdictions and their contacts can be found on the L&I website at <https://lni.wa.gov/licensing-permits/electrical/electrical-permits-fees-and-inspections/city-electrical-permits-inspections>.

8-20.2 Materials

Materials shall meet the requirements of Section 9-29. Unless otherwise indicated in the Plans or specified in the Special Provisions, all materials shall be new.

Electronic equipment shall be kept powered during storage to ensure that associated environmental controls maintain the equipment properly or shall be stored in a climate-controlled environment. Electronic equipment with any noticeable damage due to condensation or similar environmental control failures will be rejected.

Where existing systems are to be modified, the existing material shall be incorporated in the revised system, salvaged, or abandoned as specified in the Contract documents, or as ordered by the Engineer.

Materials for temporary systems do not need to be new, with the exception of bulbs for any equipment that requires them, such as lighting or traffic signal displays. Used materials shall be structurally sound and fully functional for the application designated. LED equipment such as lighting and traffic signal displays shall have all LEDs fully operational. To be considered a temporary system, the system shall be both installed and removed as part of this Contract.

8-20.2(1) Equipment List and Drawings

Within 20 days following execution of the Contract, the Contractor shall submit to the Engineer a completed "Request for Approval of Material" that describes the material proposed for use to fulfill the Plans and Specifications.

If required to do so, the Contractor shall submit Type 2 Working Drawings consisting of supplemental data, sample articles, or both, of the material proposed for use. Supplemental data includes such items as catalog cuts, product Specifications, shop drawings or wiring diagrams.

The Contractor shall submit for approval a Type 3E Working Drawing in accordance with Section 1-05.3 for each of the following types of standards called for on this project:

1. Light standards without preapproved plans.
2. Signal standards with or without preapproved plans.

The Contractor will not be required to submit shop drawings for approval for light and traffic signal standards conforming to the preapproved plans listed in the Special Provisions. The Contractor may use preapproved plans posted on the WSDOT website with a more current revision date than stamped in the Special Provisions.

The Engineer's acceptance of submitted documentation shall in no way relieve the Contractor from compliance with the safety and performance requirements as specified herein.

Submittals required shall include but not be limited to the following:

1. A Type 2 Working Drawing consisting of a material staging plan, should the Contractor propose Contracting Agency-owned property for staging areas.
2. A Type 2 Working Drawing consisting of a cable vault installation plan showing the exact proposed installation location by Roadway station, offset and the scheduled sequence for each cable vault installation.
3. A Type 2 or 2E Working Drawing consisting of a pit plan, for each boring pit, depicting the protection of traffic and pedestrians, pit dimensions, shoring, bracing, struts, walers, sheet piles, conduit skids, and means of attachment, casing type, and casing size. A Type 2E Working Drawing is only required where shoring, bracing, struts, walers, sheet piles, or casing are used.

4. A Type 2 or 2E Working Drawing consisting of a boring plan depicting the boring system and entire support system. A Type 2E Working Drawing is only required if a support system is used.
5. Construction lock-out/tag-out procedures shall be submitted as Type 1 Working Drawings.

8-20.3 Construction Requirements

8-20.3(1) General

All Work shall be completed in neat, skilled, and professional manner accordance with the current industry standards.

No Work shall be performed on an energized power circuit. Working Drawings for construction lock-out/tag-out procedures shall be accepted prior to the start of Work on power circuits. Work on energized signal and data circuits shall be kept to the absolute minimum necessary and shall normally be performed with the circuit deenergized.

Work shall be so scheduled that each electrical system is operational prior to opening the corresponding section of Roadway to traffic.

Existing electrical systems, traffic signal or illumination, or approved temporary replacements, shall be kept in effective operation during the progress of the Work, except when shutdown is permitted to allow for alterations or final removal of the system.

Illumination system shutdowns shall not interfere with the regular lighting schedule, unless permitted by the Engineer. The Contractor shall notify the Engineer prior to performing Work on existing systems.

Traffic signals shall not be placed in operation for use by the public until all required channelization, pavement markings, illumination, signs, and sign lights are substantially complete and operational unless otherwise allowed by the Engineer. New signal systems may not be turned on any sooner than the next working day following the completion of test number 4 of Section 8-20.3(11).

When field repair of existing conduit, innerduct or outerduct is required, the repair kits shall be installed per manufacturer's recommendations. Repair kits and each connection point between the repair kit and the existing raceway system shall be sealed to prevent air leakage during future cable installation.

All costs incurred by the Contractor for providing effective operation of existing electrical systems shall be included in the associated electrical Bid items.

8-20.3(1)A Maintenance During Construction

The Contractor is responsible for maintenance of all new, existing, and temporary systems included in the work, starting from the first on-site working day and ending upon final acceptance of the system.

For existing systems where only part of an existing system is included in the work, the responsibility for maintenance shall be determined between the Contractor and the Engineer as part of the preconstruction conference. Normally, this will be based on whether a majority of the system is included in the work.

Maintenance responsibilities for these systems includes the following:

1. For all system types, the Contracting Agency is responsible for performing the first set of locates for any existing agency systems, and the Contractor is responsible for performing all other locates for all underground portions of all systems for which the Contractor has maintenance responsibility. Locate requests for these systems will be provided to the Contractor by the Contracting Agency.

2. For illumination and power distribution systems (power connections from a service or transformer cabinet to a system cabinet), the Contractor is responsible for all work necessary to maintain required lighting operational, including providing and replacing lamps and responding to electrical outages.
3. For traffic signal systems, the Contractor is responsible for all equipment outside of the controller cabinet, up to and including the landing of field wiring in the controller cabinet. The Contracting Agency shall retain maintenance responsibility for all equipment inside the traffic signal controller cabinet.
4. For ITS equipment, the Contractor is responsible for all equipment outside of the ITS cabinet, up to and including the landing of field wiring or cables in the cabinet. The Contracting Agency is responsible for all equipment inside the ITS cabinet.

8-20.3(1)B Communication System Repairs

If a portion of an existing communication conduit system is damaged due to the Contractor's activities, the affected system shall be restored to original condition. Conduit shall be repaired. Communication cables shall be replaced and the communication system shall be made fully operational within 24 hours of being damaged.

Damaged communication cable shall be replaced between existing termination or splice points. No additional termination or splice points will be allowed. An existing termination or splice point is defined as a location where all existing fiber strands or twisted pair wires are terminated or spliced at one point. Communication cable shall be defined as either copper twisted pair or fiber optic cables. The Contractor may use temporary splices to restore WSDOT communication systems until the permanent communication cable system is restored.

When damage to an existing communication system has occurred, the Contractor shall perform the following in addition to other restoration requirements:

1. Inspect the communication raceway system including locate wire or tape to determine the extent of damage.
2. Contact the Engineer for Fiber Optic Cable and Twisted Pair (TWP) Copper Cable acceptance testing requirements and communication system restoration requirements.
3. Initially perform the acceptance tests to determine the extent of damage and also perform the acceptance tests after repairs are completed. Provide written certification that the communication cable system, including the locate wire or tape, is restored to test standard requirements.

Communication cables shall be restored by Contractor personnel that are WSDOT prequalified for communication installation work. Restoration shall be considered electrical work when the path of the communication system interfaces with electrical systems. Electrical work of this nature shall be performed by Contractor personnel that are WSDOT prequalified for work on both electrical and communication systems.

If the Contractor or subcontractors are unable or unqualified to complete the restoration work, the Engineer may have the communication or electrical systems restored by other means and subtract the cost from the money that will be or is due the Contractor.

8-20.3(1)C Removal of Embedded Anchors

Where embedded anchors attaching existing electrical, illumination, and traffic signal systems to concrete Structures are specified for removal, they shall be removed a minimum of 1 inch beneath the existing concrete surface. The void left by removal of the embedded anchors shall be coated with epoxy bonding agent and filled with mortar conforming to Section 9-20.4(2). The epoxy bonding agent shall be Type II, conforming to Section 9-26.1, with the grade and class as recommended by the epoxy bonding agent manufacturer. The mortar shall consist of cement and fine aggregate mixed in the proportions to match the color of the existing concrete surface as near as practicable.

8-20.3(2) Excavating and Backfilling

The excavations required for the installation of conduit, foundations, poles and other accessories shall be performed in a manner that prevents damage to the streets, sidewalks, and other improvements. The trenches shall not be excavated wider than necessary for the proper installation of the electrical accessories and foundations. Excavating shall not be performed until immediately before installation of conduit and other accessories. The material from the excavation shall be placed where the least interference to vehicular and pedestrian traffic, and to surface drainage, will occur.

All surplus excavated material shall be removed and disposed of by the Contractor in accordance with Section 3-03, or as ordered by the Engineer in accordance with Section 1-04.4 and Section 8-20.3(5)E1.

The excavations shall be backfilled in conformance with the requirements of Section 3-07.3(1)E, Structure Excavation.

At the end of each day's Work and at all other times when construction operations are suspended, all equipment and other obstructions shall be removed from that portion of the Roadway open for use by public traffic.

Excavations in the street or Highway shall be performed in such a manner that not more than one traffic lane is restricted in either direction at any time unless otherwise approved by the Engineer.

8-20.3(3) Removing and Replacing Improvements

Improvements such as sidewalks, curbs, gutters, Portland cement concrete and hot mix asphalt pavement, bituminous surfacing, base material, and all other improvements removed, broken, or damaged by the Contractor, shall be replaced or reconstructed with the same kind of materials as found on the Work or with other materials satisfactory to the Engineer.

Whenever a part of a square, slab, or section of existing concrete sidewalk, curb, gutter or driveway is broken or damaged, the entire square, slab or section, curb, gutter, driveway shall be removed and the concrete reconstructed as specified above.

The outline of all areas to be removed in Portland cement concrete sidewalks and pavements and hot mix asphalt pavements shall be cut to a minimum depth of 3 inches with a saw prior to removing the sidewalk, driveway, slabs and pavement material. The cut for the remainder of the required depth may be made by a method satisfactory to the Engineer. Cuts shall be neat and true with no shatter outside the removal area.

8-20.3(4) Foundations

Foundation concrete shall conform to the requirements for the specified class, be cast-in-place concrete and be constructed in accordance with Sections 6-02.2 and 6-02.3. Concrete for Type II, III, IV, V, and CCTV signal standards and light standard foundations shall be Class 4000P and does not require air entrainment. Concrete for pedestals and cabinets, Type PPB, PS, I, FB, and RM signal standards and other foundations shall be Class 3000. Concrete placed into an excavation where water is present shall be placed using an approved tremie. If water is not present, the concrete shall be placed such that the free-fall is vertical down the center of the shaft without hitting the sides, the steel reinforcing bars, or the steel reinforcing bar cage bracing. The Section 6-02.3(6) restriction for 5-feet maximum free-fall shall not apply to placement of Class 4000P concrete into a shaft. Steel reinforcing bars for foundations shall conform to Section 9-07.

The bottom of concrete foundations shall rest on firm ground. If the portion of the foundation beneath the existing ground line is formed or cased instead of being cast against the existing soil forming the sides of the excavation, then all gaps between the existing soil and the completed foundation shall be backfilled and compacted in accordance with Section 3-07.3(1)E.

Foundations shall be cast in one operation where practicable. The exposed portions shall be formed to present a neat appearance.

The top edges of the luminaire foundation, traffic signal standard foundations, electrical service foundations, traffic signal controller cabinets, Transformer cabinets, ITS Standards, and ITS cabinets shall have a $\frac{1}{4}$ -inch chamfer on the top edge of the foundation. Where one or more of the above foundations directly abut each other, no chamfer shall be permitted.

Where soil conditions are poor, the Engineer may order the Contractor to extend the foundations shown in the Plans to provide additional depth. Such additional Work will be paid for according to Section 1-04.4.

When slip bases are installed the conduit, anchor bolts, and other obstructions shall terminate at a height below the elevation of the top of the bottom slip plate. The galvanized surfaces of the slip plates, the keeper plate and the luminaire base plate shall be smooth, without irregularities, to reduce friction and to prevent slacking of bolt tension due to flattening of the irregularities. Slip base luminaire foundations shall have a maximum conduit size of 1-inch.

Forms shall be true to line and grade. Tops of foundations for posts and standards, except special foundations, shall be finished to ground line or sidewalk grade, unless otherwise noted in the Plans.

Forms shall be rigid and securely braced in place. Conduit ends and anchor bolts shall be plumbed and rigidly placed in proper position and to proper height prior to placing concrete and shall be held in place by means of a template until the forms are removed.

Anchor bolts shall be installed so that two full threads extend above the top of the top heavy-hex nut, except that slip base anchor bolt extensions shall conform to the specified slip base clearance requirements. Anchor bolts shall be installed plumb, plus or minus 1 degree. Anchor bolts shall be verified at the correct height and plumb in accordance with this Section and Section 8-20.3(13)A before placing concrete. Anchor bolt straps and templates shall not be cut or otherwise modified from the approved shop drawing design.

See Section 8-20.3(9) for additional grounding requirements.

Plumbing of standards shall be accomplished by adjusting leveling nuts. Shims or other similar devices for plumbing or raking will not be permitted except on power installed hot dipped galvanized steel luminaire foundations.

The top heavy-hex nuts of light standards and signal standards shall be tightened in accordance with Section 6-03.3(33), and as follows:

1. The top heavy-hex nuts for all clamping bolts of slip base light standards and Type RM and FB signal standards, shall be tightened using a torque wrench to the torque specified in Sections 8-20.3(13)A and 8-20.3(14)E, respectively.
2. The top heavy-hex nuts for type ASTM F1554 grade 105 anchor bolts shall be tightened by the Turn-of-Nut Tightening Method to a minimum rotation of $\frac{1}{4}$ turn (90 degrees) and a maximum rotation of $\frac{1}{2}$ turn (120 degrees) past snug tight. Permanent marks shall be set on the base plate and nuts to indicate nut rotation past snug tight.
3. The top hex nuts for type ASTM F1554 grade 55 anchor bolts shall be tightened by the Turn-of-Nut Tightening Method to a minimum rotation of $\frac{1}{8}$ turn (45 degrees) and a maximum rotation of $\frac{1}{2}$ turn (60 degrees) past snug tight. Permanent marks shall be set on the base plate and nuts to indicate nut rotation past snug tight.

Both forms and ground which will be in contact with the concrete shall be thoroughly moistened before placing concrete; however, excess water in the foundation excavation will not be permitted. Foundations shall have set at least 72 hours prior to the removal of the forms. All forms shall be removed, except when the Plans or Special Provisions specifically allow or require the forms or casing to remain.

Class 2 surface finish shall be applied to exposed surfaces of concrete in accordance with the requirements of Section 6-02.3(14)B.

Where obstructions prevent construction of planned foundations, the Contractor shall construct an effective foundation satisfactory to the Engineer.

The combined height of the light standard concrete foundation plus the anchor bolt stub height shall not exceed 4-inches above the ground line.

8-20.3(5) Conduit

8-20.3(5)A General

The ends of all conduit, metallic and nonmetallic, shall be reamed to remove burrs and rough edges. Field cuts shall be made square and true. The ends of unused conduits shall be capped. When conduit caps are removed, the threaded ends of metal conduit shall be provided with approved conduit bushings and non-metal conduit shall be provided with end bells.

Conduits shall use factory bends or bends matching typical factory bend dimensions. Where conduit contains fiber-optic cable, the conduit bend radius shall be equal or greater than the minimum bending radius of the fiber-optic cable.

Conduits entering open bottom junction boxes shall use sweeps and shall terminate no less than 6 inches and no more than 10 inches from the underside of the box lid. Conduits entering solid bottom boxes and vaults shall enter through knockouts and shall extend no more than 4 inches into the box. The termination point of each conduit is the end of the end bell or ground end bushing.

Reducing couplings will not be permitted.

Existing conduit in place scheduled for installation of new conductor(s) shall first have all existing conductor(s) removed and a cleaning mandrel shall be pulled through. The existing conduit shall then be prepared subject to the same requirements outlined in this paragraph, for new conduit and innerduct, unless otherwise indicated in the Plans. All new conduit and all innerduct shall be blown clean with compressed air. Then in the presence of the Engineer, an 80 percent sizing mandrel, correctly sized for the raceway, shall be pulled through to ensure that the raceway has not been deformed. This shall be done prior to pulling wire or fiber optic cable and after final assembly is in place. Existing conductor(s) shall be reinstalled unless otherwise indicated in the Plans.

Immediately after the sizing mandrel has been pulled through, install an equipment grounding conductor if applicable (see Section 8-20.3(9)) and all new or existing wire or cable as specified in the Plans.

All conduits shall include a pull tape with the equipment grounding conductor. The pull tape shall be attached to the conduit near the end bell or grounded end bushing, or to duct plugs or caps if present, at both ends of the conduit.

8-20.3(5)A1 Fiber Optic Conduit

Where conduit to contain fiber optic cable or conduit identified to contain future fiber optic cable is installed by open trenching, Detectable Underground Warning Tape shall be placed 12-inches above the conduit unless otherwise detailed in the Plans. Detectable Underground Warning Tape shall extend 2-feet into boxes or vaults. Splicing of the tape shall be per the tape manufacturer's recommended materials and procedures.

8-20.3(5)A2 ITS and Cabinet Outer and Innerduct Conduit

ITS conduit and both ends of conduit runs entering cabinets, with the exception of the ½-inch grounding conduit, shall be sealed with self expanding water proof foam or mechanical plugs; unless otherwise required. At other locations conduit shall be sealed with Duct Seal.

Outer-duct conduit with non factory assembled innerduct shall be sealed around the innerduct with self-expanding waterproof foam. Outer-duct conduit with factory assembled innerduct shall be sealed around the innerduct with a multiplex expansion plug. Innerduct containing one cable shall be plugged using an expandable split plug. Innerduct with multiple cables shall be sealed with self-expanding waterproof foam. Duct plugs shall be installed in all unused inner-ducts (those that are specified as empty) at the time of conduit installation. Duct plugs shall be installed in all used inner-ducts (as specified in the Plans), at the time of conduit installation, unless cable pulling for those inner-ducts will commence within 48-hours. Installation shall conform to the manufacturer's recommendations.

Foam sealant shall be installed with the following additional requirements:

1. Penetration of the sealant into the conduit or duct shall be limited using a high temperature backer rod material or rag.
2. Penetration of the sealant into the conduit shall be limited to 1-inch.
3. The foam sealant shall not project outside the end of the conduit or duct.

Where open trenching is allowed and conduit with innerduct is installed, a maximum of 1000-feet of continuous open trench will be allowed unless otherwise approved by the Engineer.

8-20.3(5)B Conduit Type

Conduit shall be rigid polyvinyl chloride (PVC), high density polyethylene (HDPE), rigid metal (RMC) or liquid-tight flexible metal (LFMC) depending on the application.

RMC shall be installed at the following locations:

1. Within railroad right of way.
2. All exposed conduit, with the exception of pole risers. Does not include conduit stubs entering boxes and vaults or conduits entering strut-mounted service cabinets from standard concrete pads.
3. All runs within slip form placed concrete.
4. Conduits connecting a service or transformer cabinet to a grounding electrode system, unless otherwise specified in the Plans.

Unless otherwise required by the owning utility:

1. Service lateral runs shall be Schedule 80 PVC or Schedule 80 HDPE.
2. Pole risers shall be Schedule 80 PVC.

PVC and HDPE conduits shall be Schedule 80 unless installed as innerduct.

LMFC is allowed only at locations called for in the Plans.

Except as described under Non-Metallic Conduit, unless otherwise indicated in the Plans or [Standard Plans](#), the same type of conduit shall be used for the entire length of the run, including conduits for grounding electrode systems, from outlet to outlet.

Innerduct shall have a smooth wall non ribbed interior surface, with factory pre-lubricated coating.

Innerduct within the Traveled Way or Shoulders and innerduct which is not factory installed shall be Schedule 40 HDPE. The innerduct shall be continuous with no splices. Innerduct which is pulled into the outer duct in the field shall be installed with an extra 2 feet of conduit beyond each end of the outer-duct and shall be allowed to finish contracting for 21 calendar days before it is terminated. Innerduct shall be terminated with end bells flush to ¼-inch out of the outer-duct and the space between the outer-duct and innerduct shall be sealed with rodent and moisture resistant foam designed for this application and installed per manufacturer's recommendations.

8-20.3(5)B1 Rigid Metal Conduit

Slip joints or running threads will not be permitted for coupling metallic conduit; however, running threads will be permitted in traffic signal head spiders and rigid metal conduit (RMC) outer-duct. When installing RMC, if a standard coupling cannot be used, an approved three-piece coupling shall be used. Conduit bodies, fittings and couplings for RMC shall be cleaned first and then painted with one coat of paint conforming to Section 9-08.1(2)B. The paint shall have a minimum wet film thickness of 3-mils. The painted coating shall cover the entire coupling or fitting. The threads on all metal conduit shall be rust-free, clean, and painted with colloidal copper suspended in a petroleum vehicle before couplings are made. All metallic couplings shall be tightened so that a good electrical connection will be made throughout the entire length of the conduit run. If the conduit has been moved after assembly, it shall be given a final tightening from the ends prior to backfilling.

RMC ends shall be terminated with grounded end bushings. RMC entering cable vaults or pull boxes shall extend 2-inches beyond the inside wall face (for the installation of grounded end bushing and bonding).

RMC entering concrete shall be wrapped in 2-inch-wide pipe wrap tape with a minimum 1-inch overlap for 12-inches on each side of the concrete face. Pipe wrap tape shall be installed per the manufacturer's recommendations.

RMC bends shall have a radius consistent with the requirements of Code Article 344.24 and other articles of the Code. Where factory bends are not used, conduit shall be bent, using an approved conduit bending tool employing correctly sized dies, without crimping or flattening, using the longest radius practicable.

Where the coating on galvanized conduit has been damaged in handling or installing, such damaged areas shall be thoroughly painted with paint conforming to Section 9-08.1(2)B.

Metal conduit ends shall be threaded and protected with a snug fitting plastic cap that covers the threads until wiring is started.

8-20.3(5)B2 Non-Metallic Conduit

Where non-metallic conduit is installed, care shall be used in excavating, installing, and backfilling, so that no rocks, wood, or other foreign material will be left in a position to cause possible damage.

PVC conduit ends shall be terminated with end bell bushings. PVC or HDPE conduit entering cable vaults and pull boxes shall terminate with the end bell flush with the inside walls of the Structure.

Non-metallic conduit bends, where allowed, shall conform to Article 352.24 of the Code. Eighteen-inch radius elbows shall be used for PVC conduit of 2-inch nominal diameter or less. Standard sweep elbows shall be used for PVC conduit with greater than 2-inch nominal diameter unless otherwise specified in the Plans. In nonmetallic conduit less than 2-inch nominal diameter, pull ropes or flat tapes for wire installation shall be not less than ¼-inch diameter or width. In nonmetallic conduit of 2-inch nominal diameter or larger, pull ropes or flat tapes for wire installation shall be not less than ½-inch diameter or width. When HDPE conduit is used for directional boring, it shall be continuous, with no joints, for the full length of the bore. The conduit run shall be extended to the associated outlets with the same schedule HDPE or PVC conduit. Entry into associated junction box outlets shall be with the same schedule PVC conduit and elbows. The same requirements apply for extension of an existing HDPE conduit crossing.

PVC conduit and elbows shall be connected to HDPE conduit with an approved mechanical coupling. The connection shall have minimum pullout strength of 700-pounds. Prior to installation of a mechanical coupling, the HDPE conduit shall first be prepared with a clean, straight edge. A water-based pulling lubricant may be applied to the threaded end of the mechanical coupling before installation. Solvent cement or epoxy shall not

be used on the threaded joint when connecting the HDPE conduit to the mechanical coupling. The mechanical coupling shall be rotated until the HDPE conduit seats approximately $\frac{3}{4}$ of the distance into the threaded coupling depth.

For PVC installation through a directional bore, the PVC shall be in rigid sections assembled to form a watertight bell and spigot-type mechanical joint with a solid retaining ring around the entire circumference of the conduit installed per the manufacturer's recommendations. The conduit run shall be extended beyond the length of the bore, to the associated outlets with the same mechanical coupled PVC or with standard PVC conduit of the same schedule. The same requirements apply for extension of an existing PVC conduit Roadway crossing.

PVC conduit shall be assembled using the solvent cement specified in Section 9-29.1.

Conduit ends shall be protected with a snug fitting plastic cap until wiring is started.

Conduit caps, end bells and the section of PVC between the coupling and end bell bushing in cabinet foundations shall be installed without glue.

8-20.3(5)C Conduit Size

The size of conduit used shall be as shown in the Plans. Conduits smaller than 1-inch electrical trade size shall not be used unless otherwise specified, except that grounding conductors at service points may be enclosed in $\frac{1}{2}$ -inch-diameter conduit.

Conduit between light standards, PPB, PS, or Type 1 poles and the nearest junction box shall be the diameter specified in the Plans. Larger size conduit is not allowed at these locations. At other locations it shall be the option of the Contractor, at no expense to the Contracting Agency, to use larger size conduit if desired, provided that junction box or vault capacity is not exceeded. Where larger size conduit is used, it shall be for the entire length of the run from outlet to outlet.

Conduit runs with innerduct, shall have 4-inch outer-duct and shall be installed with four 1-inch innerduct unless otherwise indicated in the Plans.

8-20.3(5)D Conduit Placement

Conduit shall be laid so that the top of the conduit is a minimum depth of:

1. 24-inches below the bottom of curb in the sidewalk area.
2. 24-inches below the top of the untreated surfacing on a Roadbed.
3. 48-inches below the bottom of ties under railroad tracks unless otherwise specified by the railroad company.
4. 36-inches below finish grade when installed using conduit plowing method.
5. 24-inches below the finish grade in all other areas.

Conduit entering through the bottom of a junction box shall be located near the end walls to leave the major portion of the box clear. At all outlets, conduit shall enter from the direction of the run, terminating 6 to 8-inches below the junction box lid and within 3-inches of the box wall nearest its entry location.

Conduit runs shown in the Plans are for Bidding purposes only and may be relocated with approval of the Engineer, to avoid obstructions.

8-20.3(5)D1 Surface Mounting

Where surface mounting of conduit is required, supports shall consist of channel with clamps sized for the conduit. Support spacing shall comply with the Code, with the exception that spacing of channel supports for conduit shall not exceed 5-feet.

The minimum distance between adjacent clamps and between the clamp and the end of the channel supports shall be 1-inch. Channel supports shall be installed with stops, to prevent clamps from sliding out of the ends.

8-20.3(5)D2 Structures

All conduits attached to or routed within bridges, retaining walls, and other structures shall be equipped with approved expansion, deflection, and/or combination expansion/deflection fittings at all expansion joints and at all other joints where structure movement is anticipated, including locations where the Contractor, due to construction method, installs expansion and/or construction joints with movement. All conduit fittings shall have movement capacity appropriate for the anticipated movement of the Structure at the joint. Approved deflection fittings shall also be installed at the joint between the bridge end and the retaining wall end, and the transition from bridge, wall, or other structure to the underground section of conduit pipe.

8-20.3(5)E Method of Conduit Installation

Conduit shall be placed under existing pavement by approved directional boring, jacking, or drilling methods at locations approved by the Engineer. The pavement shall not be disturbed unless allowed in the Plans or with the approval of the Engineer in the event obstructions or impenetrable soils are encountered. High density polyethylene (HDPE) conduit runs, which enter the traveled way or shoulders, shall be installed using the directional boring method.

Conduit used with a specific method of installation shall be certified for use with that method of installation.

8-20.3(5)E1 Open Trenching

When open trenching is allowed, trench construction shall conform to the following:

1. The pavement shall be saw-cut a minimum of 3-inches deep. The cuts shall be parallel to each other and extend 2-feet beyond the edge of the trench.
2. Pavement shall be removed in an approved manner.
3. Trench depth shall provide a minimum cover for conduit of 24-inches below the top of the roadway base.
4. Trench width shall be 8-inches or the conduit diameter plus 2-inches, whichever is larger.
5. Trenches located within paved Roadway areas shall be backfilled with Controlled density fill (CDF) meeting the requirements of Section 3-07.3(1)E, or lean concrete Type 1 meeting the requirements of Section 6-02.3(2)D, with the following additional requirement: maximum nominal aggregate size shall be $\frac{3}{4}$ inch. The controlled density fill shall be placed level to, and at the bottom of, the existing pavement. The pavement shall be replaced with paving material that matches the existing pavement.
6. On new construction, conduit shall be placed prior to placement of base course pavement.

8-20.3(5)E2 Conduit Plowing

All conduit plowing shall be supervised by a licensed electrical Contractor.

The starting point shall be anchored or held such that conduit movement at the start of the plowing operation is kept to a minimum. Conduit shall be fed from in front of the plow or a mounted reel such that conduit movement is kept to a minimum once it is in the ground. Use of a stationary reel or any other method that results in the conduit being pulled through the plow trench is not allowed.

The feed shoe shall have rollers which conform to the conduit at a radius of not less than 15 times the diameter of the conduit. The conduit will not be permitted to pass over stationary guides nor over rollers or sheaves, which will permit a bend radius of less than 15 times conduit diameter. If the Contractor can demonstrate that such a roller, guide, chute, or sheave is not available, the diameter of the equipment may be reduced to the following for conduits up to 4-inches in diameter:

1. For conduits 2-inches in diameter or smaller, no bend radius less than 10 times the diameter of the conduit.
2. For conduits larger than 2-inches in diameter up to 4-inches in diameter, no bend radius less than 13 times the diameter of the conduit.

The width of the tooth and feed shoe shall not exceed the conduit diameter by more than two-inches.

The conduit shall be installed using a continuous reel, with no joints, for the full length of the conduit run, unless conduit splicing is allowed as indicated below.

If an obstruction is encountered that cannot be plowed through, the following remedies shall be attempted in order:

1. Contractor shall stop the plowing operation and attempt to remove the obstruction. If the obstruction is removed, plowing operations shall continue along the approved path.
2. Deviations of up to one foot from the projected path may be authorized by the Engineer, provided the new route does not result in total conduit run bends exceeding NEC requirements. Deviations in excess of one foot from the projected path are not allowed and the maximum taper rate is 1-inch per linear foot of conduit.
3. The Contractor may request approval to intercept the installed conduit and route another section of HDPE to avoid the obstruction, provided the new route does not result in total conduit run bends exceeding NEC requirements. Connection between the sections shall be accomplished using an approved fusion splicing method, which is compatible with the conduit manufacturer's recommendations.
4. Where none of the above remedies are successful, all conduit installed so far in that run shall be removed and a new plow path established to avoid the obstruction.

In the event of a breakage, all conduit installed in that run shall be removed.

The conduit run shall be extended to the associated outlets, subject to the same requirements indicated when HDPE is installed using the directional boring method.

The depth of installation shall be continually adjusted as necessary to compensate for changes in terrain.

Plowed conduit shall be laid so that the top of the conduit is a minimum depth of 36-inches below the finish grade with the exception that the conduit shall be swept up to enter the knock outs of associated pull boxes or cable vaults.

The plow placing the conduit shall be marked at a proper distance above the plow's conduit exit point to indicate when the minimum installation depth is not met. The mark shall be visible from a safe distance from the plowing operation when it is exposed above ground. While plowing this mark must remain below ground level at all times, with the exception of the entry and exit points at the end of the run, in order to ensure that minimum burial depth of the conduit is achieved.

If the depth mark on the plow comes above ground, the Contractor shall stop the plowing operation and attempt to correct the placement depth. If the conduit depth can be verified to meet the minimum burial requirements at the location where the depth mark came above ground, the plowing operation shall resume subject to the Engineers approval. If multiple conduits are installed, regardless of the method of placement in the plow trench, all conduits placed must meet minimum burial requirements.

The compacted surface shall be firm, non-yielding, and result in a finished surface that matches the lines and grades of the terrain prior to plowing.

8-20.3(5)E3 Boring

Bore pits shall be backfilled and compacted in accordance with Section 3-07.3(1)E.

Directional boring, jacking or drilling pits shall be a minimum of 2-feet from the edge of any type of pavement, unless otherwise approved by the Engineer. Excessive use of water that might undermine the pavement or soften the Subgrade will not be permitted.

When approved by the Engineer, small test holes may be cut in the pavement to locate obstructions. When the Contractor encounters obstructions or is unable to install conduit because of soil conditions, as determined by the Engineer, additional Work to place the conduit will be paid in accordance with Section 1-04.4.

8-20.3(5)E4 Directional Boring

Directional boring for electrical installations shall be supervised by a licensed electrical contractor in accordance with Section 8-20.1(1).

Where directional boring is called for, conduit shall be installed using a surface-launched, steerable drilling tool. Drilling shall be accomplished using a high-pressure fluid jet tool-head. The drilling fluid shall be used to maintain the stability of the tunnel, reduce drag on the conduit, and provide backfill between the conduit and tunnel.

A guidance system that measures the depth, lateral position, and roll shall be used to guide the tool-head when creating the pilot hole. Once the pilot hole is established, a reamer and swivel shall be used to install the conduit. Reaming diameter shall not exceed 1.5 times the diameter of the conduits being installed.

Conduit that is being pulled into the boring shall be installed in such a manner that the conduit is not damaged during installation. The pullback force on the conduit shall be controlled to prevent damage to the conduit.

A vacuum spoils extraction system shall be used to remove excess spoils generated during the installation. Excess drilling fluid and spoils shall be disposed of. The method and location used for disposal of excess drilling fluid and spoils shall be subject to the Engineer's approval. Drilling fluid returns (caused by fracturing of formations) at locations other than the entry and exit points shall be minimized. Drilling fluid that surfaces through fracturing shall be cleaned up immediately. Mobile spoils-removal equipment capable of quickly removing spoils from entry or exit pits and areas with returns caused by fracturing shall be used as necessary during drilling operations.

8-20.3(5)E5 Boring with Casing

Where boring with casing is called for, the casing shall be placed using an auger inside the casing to remove the soil as the casing is jacked forward. The auger head shall proceed no more than 4-inches ahead of the pipe being jacked. Boring operations shall be conducted to prevent caving ahead of the pipe. Installed casing pipe shall be free from grease, dirt, rust, moisture, and all other deleterious contaminants.

The space between the conduit and casing shall be plugged with sandbags and a grout seal 12-inches thick at each end of the casing. Casing abandoned due to an encountered obstruction shall be grout sealed in the same manner. Grout shall conform to Section 9-20.3(4).

In lieu of sandbags and grout, unopened prepackaged concrete and grout may be used to seal the casing.

Material shall not be removed from the boring pit by washing or sluicing.

All joints shall be welded by a Washington State certified welder. Welding shall conform to AWS D 1.1-80 Structural Welding Code, Section 3, Workmanship.

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

Standard Duty and Heavy-Duty junction boxes, pull boxes, and cable vaults shall be installed at the locations shown in the Plans - junction boxes may be field adjusted within approximately 3 feet in any direction as necessary for proper installation. The Contractor may install, at no expense to the Contracting Agency, such additional boxes as may be desired to facilitate the Work. Junction box installation shall conform to details in the [Standard Plans](#).

Cable vaults and pull boxes shall be installed in accordance with the following:

1. Excavation shall be performed in accordance with Section 3-07.
2. Cable vaults and pull boxes shall be installed on 6-inches of crushed surfacing, in accordance with Section 9-03.9(3), placed on a compacted or undisturbed level foundation.
3. Conduits shall only enter through knockouts. All openings around conduits shall be sealed and filled with grout in accordance with Sections 6-02.3(20), and 9-20.3(4) to prevent water and debris from entering the vaults or pull boxes.
4. Backfilling around the Work shall not be allowed until the concrete or mortar has set.
5. Pull boxes shall be installed in accordance with Plans and details.
6. Pull boxes shall be configured such that the tensile and bending limitations of the fiber optic and other cables are not compromised. Pull boxes shall be configured to mechanically protect the fiber optic and other cables against installation force as well as inert forces after cable pulling operations.
7. Upon acceptance of Work, cable vaults, and pull boxes shall be free of debris and ready for cable installation. All grounding requirements shall be met prior to cable installation.
8. Where installed near steel casings, the pull boxes and cable vaults shall be offset 3 feet, minimum, from the centerline of the casing. Factory bends shall be used to route the conduits to the cable vault or pull box.

Adjustments involving raising or lowering the junction boxes shall require conduit modification if the resultant clearance between the top of the conduit and the junction box lid becomes less than 6 inches or more than 10 inches in accordance with the Plans.

Cable vaults and pull boxes shall be adjusted to final grade using risers or rings manufactured by the cable vault and pull box manufacturer. Cable vaults and pull boxes with traffic bearing lids shall be raised to final grade using ring risers to raise the cover only. All voids resulting from the adjustment shall be backfilled with materials matching adjacent surfacing material and compacted in accordance with Section [3-07.3\(1\)E](#).

Damage to the junction boxes, pull boxes, cable vaults and the associated conduit system, or wiring resulting from the Contractor's operations, shall be repaired to the Engineer's satisfaction at no additional cost to the Contracting Agency.

Both existing and new junction boxes, pull boxes, and cable vaults shall be adjusted to be flush with the finished grade as well as with the grade during the various construction stages proposed in the Contract.

Where conduit and junction boxes are placed in barrier, the 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 $\frac{1}{8}$ inch of the barrier surface. If any point on the surface of the junction box placed in barrier is recessed more than $\frac{1}{8}$ inch from the surface of the barrier, the Contractor shall install a box extension meeting the Engineer's approval and grout around the extension or remove and replace the entire section of barrier.

Standard Duty pull boxes, cable vaults, and junction boxes installed in sidewalks, walkways, and shared-use paths shall have slip-resistant surfaces, be flush with the surface, and match the grade of the sidewalk, walkway, and Pathways. The boxes, vaults, and junction boxes shall not be placed in curb ramps, curb ramp landings, or the gutter areas associated with the curb ramps.

8-20.3(6)A Junction Box Security Collars

Type 1, 2, and 8 junction boxes shall only include security collars when specified in the Contract. Where collars are required, collars may be cast in place on-site or precast as either a separate unit or directly to the junction box.

Cast in place collars may be used in slopes provided that no more than half of the collar width will be covered by material from above and no more than 2-inches of the collar will extend above the grade at any point. Precast security collars may only be used where the ground is at a 2:1 slope or flatter.

Precast collars shall be fully intact upon completion of the work, with no cracks crossing any corner or greater than 2-inches on any flat surface. Precast collars may include lifting eyes or other items to support lifting, transport, and placement of the collars.

Where collars are cast to the junction box by the Contractor, a Contracting Agency inspector must verify any fabrication inspection stamps and mark the interior of the box with a durable marker such as a paint pen or grease pencil, such that the mark can be verified on site after final installation, prior to placing concrete for the collars.

Where precast collars are provided separately and placed in the field, the void between the box and the collar shall be filled with Grout Type 2 or Grout Type 4 as described in Section 9-20.3.

Site preparation for locations where security collars are required shall include excavation and placement of crushed surfacing base course (CSBC) over the entire area to be covered by the box and collar (not including conduit stub outs). Backfill shall be placed around the collar until flush, or within 2-inches of the top face of the collar where the surrounding grade is not level.

8-20.3(7) Messenger Cable, Fittings

Messenger cable shall be secured to steel strain poles by means of pole bands, and to timber poles by means of single strand guy eye bolts. Pole bands and eyebolts shall be installed as detailed in the Plans.

Messenger cable shall be secured to eye bolts or strain clamps at poles by the use of approved self-locking cable clamp type dead-ending devices. Messenger cable shall be secured to bull rings and anchors by two approved U-bolt connectors and guy thimbles.

Traffic signal control cable shall be secured to the messenger cable by cable ties. The ties shall be black nylon with ultraviolet protection and rated at 120-pound minimum unlocking strength.

Down guy assemblies shall be installed as detailed in the [Standard Plans](#).

8-20.3(8) Wiring

All wiring shall use copper conductors unless aluminum conductors are specifically designated in the Contract or elsewhere in this Section. Where aluminum wire is used on WSDOT projects, wire stripping and crimping are subject to the following additional requirements:

1. Each individual Contractor Electrician shall be certified to install aluminum splices for each Contract – this certification cannot be carried over to other Contracts. Certification consists of observation of no less than three quality splice installations by a WSDOT certified electrical inspector as described in Section 8-20.1(3) and in

the presence of the Engineer. Additional splice installations may be observed for the purposes of certification as agreed between the Contracting Agency and the Contractor.

2. Wire stripping and crimping tools shall be approved by as part of the certification process. Stripping tools may not nick or otherwise damage the aluminum conductor and shall be specifically designed for stripping wire (no utility knives, pocketknives, or similar items).
3. If any installer is observed using an unapproved stripping or crimping tool, all aluminum splices installed as part of the Contract shall be replaced at the Contractor's expense.

Aluminum wires shall not have any nicks, scoring, or other damage on the conductor strands as a result of insulation removal. Any nicked conductors shall be cut off and the wire stripped again without damage. All exposed aluminum conductors at all splices and terminals shall be coated with anti-oxidant compound for electrical circuits in accordance with the anti-oxidant compound manufacturer's instructions.

All underground wiring shall be installed in conduit unless specifically noted otherwise in the Contract. All wiring in conduit shall be installed with a lubricant recommended by cable/conductor manufacturer. When wiring is noted for future connection, the ends of each wire or cable shall be sealed with an approved heat shrink end cap.

Induction loop circuits, magnetometer circuits and illumination circuits may have splices as required here and in the [Standard Plans](#). All other wiring shall run continuously, without splices, from a terminal located in a cabinet, compartment, pedestrian pushbutton assembly, or signal head to a similarly located terminal. Terminal connections may not be installed below grade such as in junction boxes or vaults.

If loop lead splices are not installed immediately after the installation of the loop leads into the adjacent junction box, the ends of the two conductor "home run" cable shall be sealed with heat shrink end caps to prevent entry of moisture into the two-conductor cable. All coaxial cables shall have heat shrink end caps installed prior to aerial or underground installation of the cables to prevent moisture entry into the cable.

Multiconductor cable for signal displays shall be installed entirely through the mounting fitting. The outer insulation shall extend a minimum of 1 inch inside the signal display housing before being stripped back for the connection of individual conductors to the terminal block.

Installation of coaxial or coaxial/Siamese cable or data cables with a 600 VAC rating will be allowed in the same raceway with 480 VAC illumination cable.

All termination for traffic signal control systems shall follow the conductor sequence color code as shown in the following table.

Conductor Number	Color Code	Color Trace	Use
1	R	Red	Red or Don't Walk
2	O	Orange	Yellow or Spare
3	G	Green	Green or Walk
4	W	White	Neutral
5	B	Black	Ped Call or Spare
6	Wb	White/Black	Neutral or Spare
7	Bl	Blue	Ped Call or Spare
8	Rb	Red/Black	Red or Don't Walk
9	Ob	Orange/Black	Yellow or Spare
10	Gb	Green/Black	Green or Walk

Quick disconnect connectors shall be installed in the base of all poles supporting a luminaire. Every conductor above ground potential shall be served by a fused quick disconnect kit. Every conductor at ground potential shall be served by an unfused quick disconnect kit.

Pole and bracket cable meeting the requirements of Section 9-29.3(2)D shall be installed between the quick disconnects and the luminaire and between the sign light hand hole and the isolation switch. In addition, the conductors from the isolation switch and the sign light shall be minimum AWG 14, meeting the requirements of Section 9-29.3(2)A or 9-29.3(2)B. Pole and bracket cable jacket shall be removed from the quick disconnect to within 2 inches below the support bracket clamp.

Sufficient slack wire shall be installed at each junction box to allow conductors, cables, or splices within the junction box to be raised a minimum of 18 inches outside of the box. In pull boxes and cable vaults, slack wire and cable shall be coiled and racked on one side of the box or vault. For fiber-optic cables, each pull box shall have 50 feet of slack and each cable vault shall have 100 feet of slack. For all other wires and cables, with the exception of ground conductors, 10 feet of slack shall be provided. Where a pull box or vault contains both wire and fiber-optic cable, the fiber-optic cable shall be racked on one side and all other wires racked on the other side. Where a splice is present for any wire or cable, the slack shall be split as evenly as possible on each side of the splice.

Drip loops shall be provided on all aerial conductors where they enter poles, signal heads, or weather heads.

Service utility connections on the utility side of the meter socket shall only use aluminum wire. Service utility connections may use URD (Underground Residential Distribution) wire at the discretion of the Serving Utility.

8-20.3(8)A Splices

All splices in underground illumination circuits, induction loops circuits, and magnetometer circuits shall be installed in junction boxes. The only splice allowed in induction loop circuits and magnetometer circuits shall be the splice connecting the induction loop lead in conductors or magnetometer lead in conductors to the shielded lead in cable.

Splices for induction loop circuits and magnetometer circuits shall be one of the following:

1. Heat shrink type with moisture blocking, sized for conductors.
2. Epoxy filled clear rigid mold splice kits.
3. Rigid re-enterable type splice kits.

Only one conductor or one multiconductor cable per wire entrance will be allowed in rigid mold splices. Conductors for rigid mold kits shall be centered in the splice mold prior to installation of the encapsulation material.

Crimp connection splices shall be installed and enclosed as shown in the Standard Plans.

Magnetometer and induction loop splices shall be soldered. All connections with #10 and smaller wire shall use copper crimped connectors installed with a positive action (ratchet) tool, except where setscrew connections are allowed for quick disconnects as described in Section 9-29.7. The non-insulated die shall be an indent type and insulated die shall be of a smooth shape capable of crimping pre-insulated terminals and connectors. The tool shall be compound lever type with a ratchet mechanism to ensure positive closure for full crimping cycle. The tool shall be field adjustable to proper calibration with common tools and materials.

Splices and taps on underground circuits shall be made with solderless crimp connectors or submersible connectors meeting the requirements of Section 9-29.12. Tap splices for aluminum wire may only use submersible connectors.

All connectors installed in splices other than submersible connectors shall be wrapped with two layers of electrical tape. All epoxy splice kits shall be physically separated from other splices and wiring within the junction box to avoid damage from heat during the casting process.

Submersible connectors shall be installed with the set screws torqued in accordance with manufacturer's instructions using an appropriate torque screwdriver.

Aerial illumination splices shall employ vice or crimp type pressure connectors. Splice insulation may be epoxy, heat shrink, or tape. Tape splice insulation, where allowed, shall consist of thermoplastic electrical insulating tape equivalent to the original wire insulation rating. It shall be well lapped over the original insulation, and there shall be a coating of moisture resistant varnish applied and allowed to dry. Two layers of friction tape will then be applied, and the splice shall be finished with a second complete coating of moisture resistant varnish.

Splices for permanently installed aluminum wire shall use either irreversible mechanical crimp connectors or submersible connectors. Aluminum wire shall not be spliced to copper wire.

8-20.3(8)B Identification

Insulated neutral conductors shall be identified in accordance with the NEC requirements. Every conductor at every wire termination, connector, or device shall have an approved wire marking sleeve bearing as its legend, the circuit number indicated in the Contract. All terminal strips shall also bear the circuit number consistent with the Contract.

All wiring shall be labeled at all junction boxes, pull boxes, cable vaults, poles, and cabinets with an approved tag with legends as follows:

1. Individual conductors – the circuit number indicated in the Contract.
2. Multiconductor cable – the numbers of the signal heads and/or pedestrian pushbuttons served. One cable serving multiple displays or pushbuttons may be labeled with just the phase number (or numbers if more than one phase served).
3. Loop lead-in cable – the numbers of the loops served.
4. Magnetometer cable – the numbers of the magnetometers served.
5. Video detection camera lead-in cable – the numbers of the phases the camera served.
6. ITS cameras – the number of the camera indicated in the Contract and the number of the associated cabinet as indicated in the Plans.
7. Communication cable – Interconnect cable shall be labeled as the system type and IC, such as SGIC for signal or RRIC for railroad. All others shall be labeled as Comm.
8. Fiber-optic cables and patch cords - as shown in the Plans.

For all illumination circuit splices, each wire entering the splice shall have an approved wire marking sleeve bearing as its legend the circuit number indicated in the Contract. For induction loop splices, all wires entering each splice shall be labeled as shown in the [Standard Plans](#).

8-20.3(8)C Wire and Cable Pulling

When conductors, either cable or single, are being installed, the Contractor shall not exceed the tension limitations recommended by the manufacturer. Conductors may be pulled directly by hand or with mechanical assistance. If conductors are pulled by mechanical means, a dynamometer with drop-needle hand shall be used on every mechanically assisted pull.

On mechanically assisted pulls, insulation shall be stripped off the individual conductor and the conductor formed into a pulling eye and firmly attached to the pulling rope/tape, or a cable grip shall be used.

The Contractor shall determine the maximum allowable pulling tension, taking into account the direction of the pull, type of raceway, cable geometry, weight of the cable, the coefficient of friction, and side wall pressure, using the information from the cable manufacturer. If there are bends in the raceway or sheaves are used for the cable pull, the contractor shall use the cable manufacture's side wall pressure limits to determine the maximum pulling tension.

The maximum pulling force applied directly to the conductor when pulling eyes are used or when the conductor is formed into a loop, shall be limited to that shown in the following table for copper conductor. When a cable grip is applied over nonmetallic sheathed cables, the maximum pulling force shall be limited to 1,000 pounds provided this is not in excess of the force as determined above.

Conductor	Pounds
8	132
6	210
4	334
3	421
2	531
1	669
1/0	845
2/0	1,065
3/0	1,342
4/0	1,693
250 Kcmil	2,000
500 Kcmil	4,000

Adequate lubrication of the proper type to reduce friction in conduit and duct pulls shall be utilized. The grease and oil-type lubricants used on lead sheathed cables shall not be used on nonmetallic sheathed cables. Pulling tape shall meet the requirements of Section 9-29.1(10). Pull string may not be used.

8-20.3(9) Bonding, Grounding

All system bonding and grounding shall be complete and approved before energizing associated circuits or equipment, including before energizing a new or modified circuit in an existing system.

All metallic appurtenances containing electrical conductors (such as luminaires, light standards, cabinets, or metallic conduit) shall be made mechanically and electrically secure to form continuous systems that are effectively grounded.

Install an equipment grounding conductor in all new conduit, whether or not the equipment grounding conductor is called for in the wire schedule. For each new conduit with innerduct install an equipment grounding conductor in only one of the innerducts unless otherwise required by the NEC or the plans. Messenger cable shall be bonded to steel strain poles by means of a bond strap connected between an approved U-bolt connector and a bonding lug on the pole. The equipment ground conductor shall not be cut or spliced except at junction boxes.

At points where shields or shielded conductors are grounded, the shields shall be neatly wired and terminated on grounding terminal strip.

Bonding jumpers and equipment grounding conductors meeting the requirements of Section 9-29.3(2)A3 shall be minimum #8 AWG, installed in accordance with the NEC. Where existing conduits are used for the installation of new circuits, an equipment grounding conductor shall be installed unless an existing equipment ground conductor, which is appropriate for the largest circuit, is already present in the existing raceway. The

equipment ground conductor between the isolation switch and the sign lighter fixtures shall be minimum #14 AWG stranded copper conductor. Where parallel circuits are enclosed in a common conduit, the equipment-grounding conductor shall be sized by the largest overcurrent device serving any circuit contained within the conduit.

All connectors between bonding jumpers and equipment grounding conductors shall be installed in accordance with the NEC. Identification of the equipment grounding conductor shall conform to all code requirements.

Junction boxes with metallic lids shall have one 4-foot long tinned braided copper equipment bonding strap with full circle connector lugs installed from each metallic junction box lid(s) to the junction box frame. A non-insulated stranded copper conductor, minimum #8 AWG, with a full circle crimp on connector (crimped with a manufacturer recommended crimper) shall be connected to the junction box frame or frame bonding stud, the other end shall be crimped to the equipment bonding conductor, using a "C" type crimp connector.

8-20.3(9)A Supplemental Grounding

Supplemental grounding shall be provided at light standards, signal standards, cantilever and sign bridge structures. Steel signposts which support signs with sign lighting or flashing beacons shall also have supplemental grounding.

The supplemental ground conductor shall be connected to the foundation rebar (all rebar crossings shall be wire tied) by means of a grounding connector listed for use in concrete, and lead up directly adjacent to a conduit installed within the foundation. The free end of the conductor shall be terminated to the ground terminal, with an approved clamp, within the pole. If no ground terminal is provided, bond to standard or post. Three feet of slack shall be provided inside the standard.

Where a concrete and rebar foundation is not used the supplemental ground shall be a grounding electrode placed in the hole next to the post prior to back fill. For light standards, signal standards, cantilever and sign bridge Structures the supplemental grounding conductor shall be #4 AWG non-insulated stranded copper conductor. For steel sign posts which support signs with sign lighting or flashing beacons the supplemental grounding conductor shall be #6 AWG non-insulated stranded copper conductor.

8-20.3(9)B Service Grounding

Bonding of the equipment grounding system and neutral at the service point shall be accomplished as required under the NEC. Grounding of the neutral shall be accomplished only at the service or at a separately derived system.

Install a two grounding electrode system at each service entrance point, at each electrical service installation and at each separately derived power source. The service entrance grounding electrode system shall conform to the "Service Ground" detail in the [Standard Plans](#). If soil conditions make vertical grounding electrode installation impossible an alternate installation procedure as described in the NEC may be used. Maintain a minimum of 6 feet of separation between any two grounding electrodes within the grounding system. Grounding electrodes shall be bonded copper, ferrous core materials and shall be solid rods not less than 10 feet in length if they are ½ inch in diameter or not less than 8 feet in length if they are ¾ inch or larger in diameter.

The connection of the grounding electrode conductor to the grounding electrode shall be made with two approved ground clamps.

8-20.3(10) Service, Transformer and ITS Cabinets

Power sources shown in the Plans are approximate only; exact location will be determined in the field.

Aerial fed service and transformer cabinets shall include the following:

1. A timber pole, as specified in Section 9-29.6(3).
2. A meter base, installed in accordance with serving utility requirements.
3. A 2- or 3-wire service breaker of size noted in the Plans.
4. The necessary conduit risers and ground assembly as noted in the Standard Plans.

The timber pole shall be set at a depth of 10 percent of the total pole length plus 2 feet, with a minimum burial depth of 6 feet. Modified type B, type D and type E services shall be installed per Contract Plan, and service description in [Standard Plans](#). Pad mounted transformer cabinets shall be installed per Contract Plans.

The service breaker shall be a standard thermal circuit breaker encased in a raintight housing that can be padlocked.

Where remote metering is used, a service rated disconnect shall be installed on the customer side of the meter. This disconnect may be installed in the customer section of a meter pedestal or as a standalone enclosure for pole mounted meters.

Upon request of the Contractor, the Engineer will make the necessary arrangements with the serving utility to complete the service connections. Electrical energy used prior to Completion of the Contract will be charged to the Contractor, except that the cost of energy used for public benefit, when the Engineer orders such operation, will be borne by the Contracting Agency.

Service cabinets shall be marked with the service agreement letters (upper-case) and numbers as noted in the Plans. All other cabinets shall be marked with the designated 10-character identification designation (numbers and lower-case letters) shown in the Plans. The markings shall be installed on the outside cabinet door near the top of the cabinet. The markings shall be 4-inch block gothic letters (similar to series C highway lettering) using stencils and black enamel alkyd gloss paint conforming to Federal Specification TT-E-489F.

8-20.3(11) Testing

Traffic signal and ITS control cabinets shall be tested at the State Materials Laboratory unless otherwise designated in the Contract. Where initial testing is performed at the State Materials Laboratory, the Contractor shall arrange for transfer of the equipment to the designated maintenance facility for site-specific operational testing when notified that testing is complete at the State Materials Laboratory. Prior to shipping, the Contractor shall arrange an appointment for testing at the designated testing facility.

The Contractor will be notified of successful completion of all testing by the Contracting Agency. After notification, the Contractor shall pick up the cabinet within 7 calendar days of notification. If the Contractor has not removed the cabinet from the Contracting Agency facility within 14 calendar days, the Engineer may authorize the return of the cabinet to the Contractor with all freight charges deducted from money due or that may become due to the Contractor under the Contract.

Induction loop circuits shall be tested in accordance with Section 8-20.3(14)D. All other conductors shall be tested in accordance with this Section.

The Contractor shall conduct the following tests on all electrical circuits with nominal operating voltage between 115-volts and 600-volts, in the presence of the Engineer:

1. Test the continuity of each circuit.
2. Test for grounds in each circuit, which shall consist of the physical examination of the installation to ensure that all required ground jumpers, devices, and appurtenances do exist and are mechanically firm.
3. Test the insulation of each conductor. Using a megohm meter, a 500-volt test on each new circuit between the conductor and ground with all switch boards, panel boards, fuse holders, switches, receptacles, and overcurrent devices in place. All readings shall be recorded. The Contractor shall furnish the Engineer with electronic (PDF format) copies of the test results identifying observed readings with their respective circuits.

The insulation resistance shall not be less than 50 megohms between the conductor and ground on new circuits with a total single conductor length of 2,500 feet and over, nor less than 50 megohms on new circuits with single conductor length of less than 2,500 feet.

Changes in the above stated minimum readings must be approved in writing by the Engineer. Only those factors based on dielectric properties of conductor insulations, splicing insulations, or terminal strip castings, will be cause for consideration of a variance.

4. Functional testing in which it is demonstrated that each and every part of the system functions as specified.

For those new circuits below 115-volts nominal, the circuits shall be tested with a 500-volt megger for continuity, ground, and a test to demonstrate the circuit functions as specified. The megger test shall show an insulation resistance of not less than 2-megohms to ground for 24V DC circuits, and 8-megohms to ground for all other circuits.

A fault in materials or in any part of the installation revealed by these tests shall be replaced or repaired by the Contractor in a manner approved by the Engineer, and the same test shall be repeated until no fault appears.

8-20.3(11)A Traffic Signal System Testing

The Contractor shall provide the Engineer a minimum of 5 days advance written notice of the proposed traffic signal turn-on date and time for review and approval. System functional testing shall occur no later than the working day prior to the scheduled turn-on date. The Contractor shall provide traffic control to stop all traffic from entering the intersection during testing. During testing, the Contracting Agency personnel will need to enter the intersection to verify operations of all signal displays.

Detection systems shall be tested separately before the traffic signal system functional testing date. Induction loop detection shall be in accordance with Section 8-20.3(14)D.

The Contracting Agency electronics technician will deliver and install the programmed controller and verify proper operation. At the start of testing, the Contracting Agency electronics technician will 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, including running the traffic signal system for one full cycle with no traffic. These demonstrations shall be conducted in the presence of a Contracting Agency electronic technician, Inspector, the Contracting Agency electrical Inspector, and Regional Traffic Engineer or his/her designee. Covers for signal displays and pedestrian pushbuttons shall remain installed, with indications verified through the mesh portions of the covers.

If any part of the traffic signal system fails the functional testing, the Contractor shall make repairs or replace equipment as necessary, and then submit a new turn-on date request. Functional testing will be repeated in accordance with this Section prior to the new turn-on date.

8-20.3(11)B Traffic Signal System Turn-On

Traffic signal system turn-on shall occur no less than one working day after successful completion of functional testing in accordance with Section 8-20.3(11)A.

On the day of traffic signal system turn-on, the Contractor shall provide traffic control to stop all traffic from entering the intersection and remove the covers from all traffic signal displays and pedestrian pushbuttons. 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 Engineer will direct the Contracting Agency electronics technician to either turn the traffic signal on to normal stop and go operation or to turn the signal off and require the Contractor to cover all signal displays and correct all deficiencies.

If the Contractor is directed to turn off the traffic signal, the Contractor shall schedule a new turn-on date with the Engineer in accordance with the previously mentioned procedures.

Unless approved by the Engineer no change to signal stop and go operation will be allowed between 6:00 a.m. to 10:00 a.m. and 2:00 p.m. to 7:00 p.m. on Monday through Thursday, nor will signal operation changes be allowed on Fridays, weekends, holidays, or the day preceding a holiday.

8-20.3(11)C Uninterruptible Power Supply (UPS) Testing

Uninterruptible Power Supply (UPS) systems shall be tested before and after field installation. Each UPS system shall undergo quality control testing, Contracting Agency laboratory testing, and field testing.

8-20.3(11)C1 UPS Quality Control Testing

Prior to delivery of the UPS system to the State Materials Laboratory in Tumwater, all components and equipment, including the batteries shall be fully installed in the cabinet and the UPS system operations shall be successfully tested by the Contractor's representative. A testing certification (letter or similar) shall be provided with the cabinet.

After the UPS system has been successfully tested, the batteries shall be removed from the cabinet and the cabinet and batteries shall be delivered, independently, to the State

Materials Laboratory for pre-installation laboratory testing.

8-20.3(11)C2 UPS Laboratory Testing

The UPS system testing shall verify complete cabinet assembly and simulate UPS system operations as installed in the field. The tests shall check the operation of each individual component as well as the overall operation of the system.

Laboratory testing will consist of the following four separate stages:

1. Delivery and Assembly
2. Documentation
3. Demonstration
4. Performance Test

Testing will follow in the listed order with no time gaps between stages unless mutually agreed upon by the Contractor and the State Materials Laboratory.

The Contractor shall designate a qualified representative for these tests. All communications and actions regarding testing of all equipment submitted to the State Materials Laboratory shall be made through this representative. These communications and actions shall include, but not be limited to, all notifications of failure or rejection, demonstration of the equipment, and the return of rejected equipment.

Stage 1: Delivery and Assembly

The Contractor shall provide all Work necessary to assemble the UPS system and make ready for demonstration at the State Materials Laboratory. Upon delivery, the batteries shall be reinstalled in the cabinet and the UPS system shall be made fully operational. All components for the complete UPS system, including the necessary test equipment, shall be ready for testing within 14 calendar days of delivery to the State Materials Laboratory.

Stage 2: Documentation

All documentation shall be furnished with the UPS system equipment prior to the start of testing. The documents to be supplied shall consist of the following:

1. Serial numbers, as applicable
2. Wiring diagrams for all equipment in the required quantities and formats.
3. Complete operations and maintenance manuals in the required quantities and formats.
4. A description of the functions and the capabilities of individual components and of the overall UPS system.

Stage 3: Demonstration

The Contractor shall provide the following:

1. A presentation on how to operate the system.
2. A complete and thorough demonstration to show that all components of the UPS system are in good condition and operating properly.

The demonstration shall be performed by the Contractor's representative in the presence of State Materials Laboratory personnel.

Stage 4: Performance Test

The performance test will be conducted by the State Materials Laboratory to determine if the UPS system performs correctly. The performance test will include the testing of the following specifications:

1. Battery discharge rate.
2. Battery recharge rate.
3. Power transfer rate.
4. Operational duration.

Test results for items 1-3 shall be within the manufacturer's recommended values for the tests to be considered successful. Test 4 shall be considered successful if the system maintains the test load for the required minimum duration for the battery configuration.

Equipment failure or rejection

All component or system failures shall be documented. This documentation shall provide the following:

1. A detailed description of the failure.
2. The steps undertaken to correct the failure.
3. A list of parts that were replaced, if any.

All failed or rejected equipment shall be removed from the State Materials Laboratory within three working days following notification; otherwise, the failed or rejected equipment will be returned, freight collect, to the Contractor.

Following final approval by the State Materials Laboratory, all equipment shall be removed from the State Materials Laboratory by the Contractor and delivered to the appropriate site(s) as designated in the Contract.

8-20.3(11)C3 UPS System Field Testing

After installation, the Contractor shall field test the UPS system to ensure the system operates in accordance with Contract and manufacturer's instructions. The test shall ensure that all components are operational within manufacturer's tolerances. The Contractor shall provide a testing procedure to the Engineer for approval. The testing procedure shall provide for operational testing of the following:

1. UPS power module.
2. Surge suppressor.
3. Automatic transfer switch.
4. Generator power transfer switch.

The field test shall demonstrate the loss of utility power and the switch over to battery power without interference with the normal operation of the connected downstream cabinet. For traffic signal systems, this includes the traffic signal controller, conflict monitor, and any other peripheral devices within the traffic controller assembly.

8-20.3(12) Painting

Application of color to a pole shall be by powder-coating. Color applied to cabinets may be by powder-coating or the use of an approved wrapping material. Painting, repair, or touchup required shall be done in conformance with applicable portions of Section 6-07. Cabinets and poles shall not be painted unless specifically indicated in the Plans or Special Provisions. The bottom surface of all pole base plates (faying surface), all slip base plates and hardware, and all anchor bolt hardware shall not have any color applied.

Cabinet wraps shall be vinyl (such as Polyvinyl Fluoride/PVF) and shall include an anti-graffiti overlay. Wraps shall be intended for use on traffic signal and similar roadside equipment cabinets and shall not affect the thermal characteristics of the cabinet. Wraps shall be installed such that all doors, vents, and keyholes remain fully functional and unobstructed. Art for wraps shall comply with any public art requirements or restrictions of the agency that owns the cabinet upon which the wrap is being installed.

8-20.3(13) Illumination Systems**8-20.3(13)A Light Standards**

Light standards shall be handled when loading, unloading, and erecting in such a manner that they will not be damaged. Parts that are damaged due to the Contractor's operations shall be repaired or replaced at the Contractor's expense.

Light standards shall not be erected on concrete foundations until foundations have set at least 72 hours or attained a compressive strength of 2,400 psi, and shall be raked sufficiently to be plumb after all load has been placed.

Slip base installation shall conform to the following:

1. The slip plane shall be free of obstructions such as protruding conduit or anchor bolts. The anchor bolts, and other obstructions shall terminate at a height below the elevation of the top of the slip plate. Conduit shall extend a maximum of 1 inch above the top of the foundation, including grounding end bushing or end bell bushing.
2. Washers in the slip plane shall be placed between the slip plate and the keeper plate.

3. Anchor bolts shall extend through the top heavy-hex nut two full threads to the extent possible while conforming to the specified slip base clearance requirements. Anchor bolts shall be tightened by the Turn-of-Nut Tightening Method in accordance with Sections 6-03.3(33) and 8-20.3(4).
4. Clamping bolts shall be tightened in accordance with Sections 6-03.3(33) and 8-20.3(4). The clamping bolts shall be tightened to the specified torque, plus or minus 2 percent, in two stages using an accurately calibrated torque wrench before erecting the light standard. Except as otherwise specified, the Contractor shall install 1-inch diameter clamping bolts in all slip bases to a torque of 95 foot-pounds.
5. The galvanized surfaces of the slip plates, the keeper plate and the luminaire base plate shall be smooth, without irregularities, to reduce friction and to prevent slackening of bolt tension due to flattening of the irregularities.
6. Anchor bolts damaged after the foundation concrete is placed shall not be repaired by bending or welding. The Contractor's repair procedure is to be submitted to the Engineer for approval prior to making repairs. The procedure is to include removing the damaged portion of the anchor bolt, cutting threads on the undamaged portion to remain, the installation of an approved threaded sleeve nut and stud, and repairing the foundation with epoxy concrete. Epoxy concrete shall meet the requirements of Section 9-26.3(1)B.
7. The grout pad shall not extend above the elevation of the bottom of the anchor plate.
8. Wiring for slip base installation shall conform to details in the [Standard Plans](#).

Breakaway coupling installation shall conform to the following:

1. At existing foundations, the anchor nuts, pole, grout pad, and leveling nuts shall be removed. Conduits shall be cut to a maximum height of 2 inches above the foundation including grounding end bushing or end bell bushing. Paint, conforming to Section 9-08.1(2)B, shall be applied to the cut conduit that has been threaded. Anchor bolts that are damaged shall be repaired with approved sleeve nuts as noted under slip base installation procedures.
2. At new foundations, the anchor bolts shall be installed with top of bolt $2\frac{1}{2}$ to 3 inches above the foundation. New anchor bolts may not be cut and shall be verified plumb and at the correct height prior to pouring concrete. Where existing anchor bolts are designated to be re-used, the existing anchor bolts shall be cut off $2\frac{1}{2}$ to 3 inches above the foundation if they extend more than 4 inches above the foundation. The cut surface shall be painted with two coats of galvanizing repair paint in accordance with Section 9-08.
3. Couplings shall be installed to within $\frac{1}{8}$ to $\frac{3}{8}$ inch of the foundation. Couplings shall then be leveled.
4. The pole shall be set and plumbed; and washers, nuts, and skirt installed per manufacturer's recommendations.
5. The conduit installed in a luminaire foundation shall not exceed 1 inch, trade size.

Slip base insert installations shall conform to details in the [Standard Plans](#), and shall conform to items 1 through 8 above for slip base installation, except that the specified torque for the $\frac{3}{8}$ -inch diameter clamping bolts shall be 50 foot-pounds.

Prior to installation all relocated metal light standards shall have existing painted identification markings removed. Manufacturer's Identification tag shall not be removed. Damaged surfaces and coatings shall be repaired with material matching the existing coating.

All new light standards shall have an approved metal tag riveted to the pole above the handhole. The information provided on the tag shall be as noted on the preapproved drawings.

All new and relocated metal light standards shall be numbered for identification using painted 4 inch block gothic letters (similar to series C highway lettering) and numbers installed 3 feet above the base facing the Traveled Way. Paint shall be black enamel alkyd gloss conforming to Federal Specification TT-E-489. Labels shall be as shown in the *Standard Plans*.

In setting timber poles, the Contractor shall provide a minimum burial of 10 percent of the total pole length plus 2 feet, or 6 feet for poles that are 30 feet or shorter, and shall rake the poles as shown in the Plans.

8-20.3(13)B Vacant**8-20.3(13)C Luminaires**

The Contractor shall mark the installation date on the inside of the luminaire ballast or driver housing using a permanent marking pen.

All luminaires shall be mounted level, both transverse and longitudinally, as measured across points specified by the manufacturer. Leveling and orientation shall be accomplished after pole plumbing.

8-20.3(14) Signal Systems**8-20.3(14)A Signal Controllers**

All control cabinets and control equipment shall be factory wired ready for operation. Field work will be limited to placing cabinets and equipment and connecting the field wiring to field terminal strips. All controller cabinets shall be installed on a silicone seal pad.

Controllers for portable traffic signal systems shall conform to the requirements of Section 9-29.13(7).

8-20.3(14)B Signal Heads

Unless ordered otherwise by the Engineer, signal heads shall not be installed until all other signal equipment is installed and the controller is in place, inspected, and ready for operation at that intersection, except that the signal heads may be mounted if the faces are covered to clearly indicate the signal is not in operation.

Three section displays mounted on type M mounts shall have the plumbizer between the top and second display. Four and five section vertical displays mounted on type M mounts shall have the plumbizer between the second and third display.

8-20.3(14)C Induction Loop Vehicle Detectors

Induction loops shall be constructed as detailed in the Contract and the following:

1. Loop wire shall conform to Section 9-29.3.
2. Lead-in cable shall conform to Section 9-29.3.
3. All loops shall be installed after grinding or prior to paving the final lift of asphalt designated in the Contract. Loop conductors shall be held at the bottom of the saw cut by high temperature backer rod (sized to fit snugly in the saw cut). Two-inch-long pieces of the backer rod shall be installed on 24-inch centers along the entire loop and home run(s) and at the entrance and exit of all turns greater than 45 degrees. When a new loop is installed in the same location as an existing loop, the existing loop shall be removed by grinding deep enough to destroy the existing loop conductors. Where the bid item "Planing Bituminous Pavement" is not included in the Contract, removal of existing loops shall be included in the bid item for new loop installation unless otherwise specified in the Contract.

4. Each loop shall be the size and number of turns indicated in the Plans.
5. No loop installation will be done in rainy weather or when the pavement is wet.
6. All saw cuts shall be cleaned with a high-pressure washer and dried with 100 psi minimum air pressure, to the satisfaction of the Engineer. If traffic is allowed over the sawcut prior to wire installation, the saw cuts shall be cleaned again.
7. Wiring shall be installed with a blunt-nosed wooden wedge.
8. Prior to the installation of the high temperature backer rod all slack shall be removed from the wiring. Kinks in wiring or folding back of excess wiring will not be allowed.
9. High temperature backer rod, sized for snug fit shall be installed in the saw cut on 2-foot centers and at all sharp turns.
10. Install sealant as per Contract or as approved by the Engineer.
11. Sealant shall be applied such that air bubbles or foam will not be trapped in the saw cut.

8-20.3(14)D Test for Induction Loops and Lead-In Cable

All tests shall be performed by the Contractor in the presence of the Engineer for each loop. All costs associated with testing shall be included in the unit Contract prices of the respective Bid items. Tests are defined as follows:

Test A – DC resistance between the two lead-in cable wires, as measured by a volt ohmmeter. The resistance shall not exceed 10 ohms.

Test B – DC resistance test between the lead-in cable shield and ground, using a megohm meter at 500 volts DC. The resistance shall equal or exceed 100 megohms.

Test C – DC resistance test between the loop circuit and ground using a megohm meter at 500 volts DC. The resistance shall equal or exceed 100-megohms.

Test D – Inductance test of the loop circuit. Type 1 loops, Type 2, and Type 3 loops connected in series shall have a minimum inductance of 150 microhenries. Single and parallel spliced Type 2 and Type 3 loops shall have a minimum inductance of 75 microhenries.

The results of all tests shall be recorded and provided to the Engineer.

Testing shall be performed as follows:

1. **Loop Wire Testing.** Tests A, C, and D shall be performed on each loop wire before connecting it to any other wiring or terminal.
2. **Lead-In Cable Testing.** Tests A, B, and C shall be performed on the loop lead-in cable before connecting it to any other wiring or terminal. Test C shall be performed on each wire in the cable.
3. **Splice and Connection Testing.** Tests A, B, C, and D shall be performed on the entire loop wire and lead-in cable system, at the controller cabinet, after all splices and connections are made but with the lead-in cable disconnected from the controller cabinet terminals.

When a test fails, the Contractor shall repair or replace the faulty component(s) and perform all applicable tests again.

Where new loops are to be installed and connected to existing loop lead-in cable, the existing loop lead-in cable shall be tested in accordance with Item 2, Lead-In Cable Testing, above. Failure of any test requires replacement of the loop lead-in cable. Work to replace the existing lead-in cable shall be paid in accordance with Section 1-04.4.

8-20.3(14)E Signal Standards

Traffic signal standards shall be furnished and installed in accordance with the methods and materials noted in the Contract and the following requirements:

1. All dimensions and orientations will be field verified by the Engineer prior to fabrication.
2. The signal standard component identification shall conform to details in the Plans.
3. Disconnect connectors complete with pole and bracket cable shall be installed in any signal standard supporting a luminaire. Illumination wiring installation shall conform to details in the Plans for slip base wiring.
4. Mast arms may be field drilled to support the installation of any required pre-emption equipment, camera wiring, detector wiring, or type "N" signal mountings. The maximum diameter shall be 1 inch. No other field drilling of mast arms is allowed.
5. All pole entrances required for pole-mounted signal heads, cabinets, signs, or pedestrian pushbutton assemblies shall be field drilled.
6. Damage to the galvanized pole surface resulting from field drilling shall be repaired with approved zinc rich paint.
7. Field welding will not be allowed, except as shown in the Plans.
8. All tenons shall be factory installed.
9. All welding shall be completed prior to galvanizing.
10. Foundations shall be constructed to provide the pole orientation noted in the Plans. Anchor bolts shall be tightened in accordance with Sections 6-03.3(33) and 8-20.3(4).
11. Slip base installation for Type RM and FB signal standards shall conform to the slip base installation requirements specified in Section 8-20.3(13)A, except that the specified torque for the $\frac{3}{4}$ -inch diameter clamping bolts shall be 50 foot-pounds.
12. The pole shall be plumbed after signal heads are installed.
13. The space between the bottom base plate and the top of foundation shall be filled with grout with a $\frac{3}{8}$ -inch plastic drain tube.

Signal standards shall not be erected on concrete foundations until the foundations have attained 2,400 psi or 14 days after concrete placement. Signal standards without mast arms may be erected after 72 hours. Type IV and V strain pole standards may be erected but the messenger cable (span wire) shall not be placed until the foundation has attained 2400 psi or 14 days after concrete placement.

Signal supports used with portable traffic signal systems shall provide a minimum of two signal displays, spaced a minimum of 8 feet apart.

When portable traffic signals are used to provide alternating one-way control, a minimum of one of the signal displays shall be suspended over the Traveled Way. The minimum vertical clearance to the Traveled Way for this signal display is 16' 6".

Timber strain poles shall be set a burial depth of 10 percent of the total length plus 2 feet and shall be raked as noted in the Plans.

8-20.3(15) Grout

Grout shall conform to the requirements of Section 6-02.3(20) and 9-20.3(4).

8-20.3(16) Reinstalling Salvaged Material

When the Contract requires salvaged electrical equipment to be reinstalled, the Contractor shall furnish and install all necessary materials and equipment, including anchor bolts, nuts, washers, concrete, etc., required to install the salvaged equipment. Removed anchor bolts, connecting bolts, nuts, and washers shall not be re-used.

8-20.3(17) "As Built" Plans

Upon Physical Completion of the Work, the Contractor shall submit corrected shop drawings, schematic circuit diagrams, or other drawings necessary for the Engineer to prepare corrected Plans to show the Work as constructed.

These drawings shall be on sheets conforming in size to the provisions of Section 1-05.3.

8-20.4 Measurement

Conduit of the kind and diameter specified will be measured, through the junction boxes, by the linear foot of conduit placed, unless the conduit is included in an illumination system, signal system, intelligent transportation system, or other type of electrical system lump sum Bid item.

Casing will be measured by the linear foot for the actual length of casing placed, unless the casing is included in an illumination, signal, or other electrical system lump sum Bid item.

Directional boring will be measured by the linear foot for the length of the boring tunnel.

8-20.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

"Illumination System ____", lump sum.

"Traffic Signal System ____", lump sum.

"ITS ____", lump sum.

The lump sum Contract price for "Illumination System, ____", "Traffic Signal System ____", or "ITS ____" shall be full pay for the construction of the complete electrical system, modifying existing systems, or both, including sign lighting systems, as described above and as shown in the Plans, and herein specified, including excavation, backfilling, concrete foundations, conduit, wiring, restoring facilities destroyed or damaged during construction, salvaging existing materials, and for making all required tests. All additional materials and labor, not shown in the Plans or called for herein and which are required to complete the electrical system, shall be included in the lump sum Contract price.

"Conduit Pipe ____ In. Diam.", per linear foot.

The unit Contract price per linear foot for "Conduit Pipe ____ In. Diam." shall be full pay for furnishing all pipe, pipe connections, elbows, bends, caps, reducers, conduits, unions, junction boxes, and fittings; for placing the pipe in accordance with the above provisions, including all excavation, jacking, or drilling required, backfilling of any voids around casing, conduits, pits, or trenches; restoration of native vegetation disturbed by the operation, chipping of pavement, and bedding of the pipe; and all other Work necessary for the construction of the conduit, except that when conduit is included on any project as an integral part of an illumination, traffic signal, or ITS system, and the conduit is not shown as a pay item, it shall be included in the lump sum price for the system shown.

All costs for installing conduit containing both signal and illumination wiring shall be included in the Contract prices for the signal system.

All costs for installing junction boxes containing both illumination and signal wiring shall be included in the Contract prices for the signal system.

“Casing”, per linear foot.

The unit Contract price per linear feet for “casing” shall be full payment for boring, jacking or drilling for installing casing, and backfilling any voids around the casing and pits or back filling of the trenches required to install the casing. This cost will also include any restoration of native vegetation disturbed by the operation.

“Directional Boring”, per linear foot

The unit Contract price per linear foot for “Directional Boring”, shall be full pay for furnishing all labor, materials, equipment and electrical supervision associated with the directional boring, except that when directional boring is included on any project as an integral part of an illumination, traffic signal, or ITS system, and the directional boring is not shown as a pay item, it shall be included in the lump sum price for the system shown.

8-21 Permanent Signing**8-21.1 Description**

This Work consists of furnishing and installing permanent signing, sign removal, sign relocation, and refacing existing signs in accordance with the Plans, these Specifications, and at the locations shown in the Plans or where designated by the Engineer.

8-21.2 Materials

Materials shall meet the requirements of the following sections:

Roadside Sign Structures	9-06.16
Permanent Signs	9-28
Sign Support Structures	9-28.14
Temporary Casing	9-36.1(2)
Synthetic Slurry	9-36.2(2)
Water Slurry	9-36.2(3)

The Contractor shall submit a Manufacturer's Certificate of Compliance for all permanent signs in accordance with Section 1-06.3; a copy of the Manufacturer's Certificate of Compliance shall be available at the fabricator's plant. Permanent signs will be inspected at the fabricator's plant prior to shipment to the project unless otherwise accepted by the Engineer. Signs without an approved decal will not be installed on the project with the exception of double-faced signs which do not receive decals or fabricator's stickers.

8-21.3 Construction Requirements**8-21.3(1) Location of Signs**

Signs are located in the Plans by station numbers. These are tentative locations subject to change by the Engineer. The post lengths specified in the Plans are estimated for Bid purposes only. Final lengths shall be determined in the field by the Contractor prior to fabrication.

8-21.3(2) Placement of Signs

All reflectorized signs located less than 30 feet from the edge of the lane should be turned out approximately 3 degrees from the pavement edge of oncoming traffic lanes, and those located 30 feet or more from the edge of the lane should be turned in approximately 3 degrees from the pavement edge of oncoming traffic lanes. All sign posts shall be plumb and signs level. The signs shall be inspected at night by the Engineer and, if specular glare occurs from failure to install at 3 degrees as stipulated, the Contractor shall reinstall the signs at no expense to the Contracting Agency. The post holes shall be of sufficient dimensions to allow placement and thorough compaction of selected backfill material completely around the post. Selected backfill material shall consist of earth or fine sandy gravel free from organic matter with no individual particles exceeding 1½ inches in diameter.

8-21.3(3) Sign Covering

When notified by the Engineer, the Contractor shall cover or uncover certain signs to facilitate and control the operation of the project. The covering shall consist of 4 mils minimum thickness black polyethylene sheeting of sufficient size to entirely cover the sign, unless otherwise approved by the Engineer, and shall extend over the edges of the sign and fastened on the back. The Contractor shall not use adhesive tapes on the face of the signs. Other methods of covering may be considered if approved by the Engineer.

8-21.3(4) Sign Removal

Where shown in the Plans or ordered by the Engineer, the existing signs and, if so indicated, the sign Structures shall be removed by the Contractor.

Sign Structures shall include sign bridges, cantilever sign Structures, bridge-mounted sign brackets, and all other sign-mounting Structure shown in the Plans to be removed by the Contractor.

The embedded anchors attaching signs and sign Structures specified for removal to existing concrete Structures shall be removed a minimum of 1 inch beneath the existing concrete surface. The void left by removal of the embedded anchors shall be coated with epoxy bonding agent and filled with mortar conforming to Section 9-20.4(2). The epoxy bonding agent shall be Type II, conforming to Section 9-26.1, with the grade and class as recommended by the epoxy bonding agent manufacturer and as approved by the Engineer. The mortar shall consist of cement and fine aggregate mixed in the proportions to match the color of the existing concrete surface as near as practicable.

Where indicated, the Contractor shall remove concrete pedestals to a minimum of 2 feet below Subgrade or finished ground elevation and backfill the hole to the satisfaction of the Engineer. Where an existing sign post is located within a sidewalk area, the Contractor shall remove the post and finish the area so as to make the sidewalk continuous. Where signs are removed from existing overhead sign Structures, the existing vertical sign support braces shall also be removed. The removed aluminum signs, wood signs, wood sign posts, wood structures, metal sign posts, wind beams, and other metal structural members and all the existing fastening hardware connecting such members shall become the property of the Contractor and shall be removed from the project. Salvage value of the removed signs and sign Structure members shall be reflected in the Contractor's Bid price for other items of Work.

8-21.3(5) Sign Relocation

Where shown in the Plans, the existing signs and, if so indicated, the sign Structures shall be relocated by the Contractor to the location noted. Where the existing sign Structure is mounted on concrete pedestals, the Contractor shall remove the pedestal to a minimum of 2 feet below finished grade and backfill the remaining hole with material similar to that surrounding the hole. When the existing Structure is to be relocated, the Contractor shall provide all necessary materials, labor and hardware to erect and provide an operable unit. All materials damaged by the Contractor shall be replaced at no cost to the Contracting Agency. Unless otherwise allowed relocation of each existing sign and Structure shall be accomplished during the day in which it was removed. Relocation of overhead signs and Structures shall be accomplished during the hours between 12 midnight and 4:00 a.m. or as approved by the Engineer.

8-21.3(6) Sign Refacing

Where indicated in the Plans or in the Special Provisions, the Contractor shall reface existing signs with sheet aluminum overlay panels. Unless otherwise indicated in the Plans or allowed by the Engineer, all Work shall be accomplished while the existing sign is in place. Modifications to each sign shall be completed during the same day in which the Work is commenced.

Prior to the installation of overlay panels, the existing legend (message and border) shall be removed. The aluminum overlay panels shall be butt jointed. Aluminum or stainless steel screws, a minimum of ½ inch in length, shall be used to attach overlay panels to existing plywood signs. In addition to the screws, two ¼-inch diameter by 1-inch-long aluminum or stainless steel bolts shall be installed through the top of each panel and the plywood sign. Aluminum blind rivets shall be used to attach overlay panels to existing aluminum signs. Screws or rivets shall be installed at 24-inch centers. Unless otherwise noted, sign background material shall be in accordance with Section 9-28.

After installation of overlay panels, the existing legend shall be reinstalled or, where indicated in the Plans, new legend or portions thereof shall be furnished and installed by the Contractor. Direct applied legend shall be applied to the new face prior to resurfacing. Layout and letter spacing shall be in accordance with Contracting Agency standards unless otherwise approved by the Engineer. New legend components shall be of the same type and size as the existing materials, and it shall be the Contractor's responsibility to verify material type and size. Materials damaged by the Contractor shall be replaced at no expense to the Contracting Agency.

8-21.3(7) Sign Message Revision

Where indicated in the Plans or in the Special Provisions, the Contractor shall revise existing sign messages or layouts. The Contractor shall remove and reinstall portions of or all of the existing message or furnish and install new message components as necessary to provide the revised message as indicated. Prior to installing the revised message, the Contractor shall thoroughly clean the sign face and plug all existing rivet holes with aluminum blind rivets painted the same color as the area immediately surrounding the rivet head, with the exception that rivet heads in the white colored sign areas shall be coated to match the white color or be uncoated rivet heads. Plugging screw holes in plywood signs will not be required. Modifications to the sign shall be completed during the same day in which Work is commenced and while the sign is in place. All new materials necessary to accomplish this Work shall be the same type and size as the existing components, and it shall be the Contractor's responsibility to verify such component type and size. Materials damaged by the Contractor shall be replaced at no expense to the Contracting Agency. Existing materials not reinstalled shall become the property of the Contractor and shall be removed from the project.

8-21.3(8) Sign Cleaning

Signs shall be cleaned after relocation or installation to the satisfaction of the Engineer. The Contractor shall not use cleaning solvents that would be harmful to the sign finish.

8-21.3(9) Sign Structures

8-21.3(9)A Fabrication of Steel Structures

Fabrication shall conform to the applicable requirements of Sections 6-03 and 9-06. All welded connections of sign bridge and cantilever sign Structure posts, arms, and beams, including base and connection plates, shall be cleaned prior to welding to remove all mill scale from within 2 inches of the weld. As an alternative to the blast cleaning requirements of Section 6-03.3(13), the Contractor may perform the cleaning using power hand tools as approved by the Engineer. Unless otherwise specified in the Plans or Special Provisions, metal surfaces shall not be painted.

All fabrication, including repairs, adjustments or modifications of previously fabricated sign structure members and connection elements, shall be performed in the shop, under a Working Drawing prepared and submitted by the Contractor for the original fabrication or the specific repair, adjustment or modification. Sign structure fabrication repair, adjustment or modification of any kind in the field is not permitted. If fabrication repair, adjustment or modification occurs after a sign structure member or connection element has been galvanized, the entire member or element shall be re-galvanized in accordance with AASHTO M 111.

8-21.3(9)A1 Fabrication of Monotube Sign Bridges and Cantilever Sign Structures

The fabricator shop will provide a Certified Welding Inspector. The inspector shall be a AWS Certified Welding Inspector (CWI) qualified and certified in accordance with the provisions of AWS QCI Standard for Qualification and Certification.

Welds shall be inspected as follows:

1. Visual Inspection in accordance with Section 6-03.3(25)A1.
2. Magnetic Particle Inspection in accordance with Section 6-03.3(25)A4.
3. Ultrasonic Inspection in accordance with Section 6-03.3(25)A3.
4. Dye-Penetrant or Magnetic Particle Inspection

The post to beam connection weld shall have 100 percent of its length inspected using dye-penetrant or magnetic-particle testing techniques. The inspection shall be performed after the root pass and after completion of the weld.

All bolted connections shall be made using the direct tension indicator method in accordance with Section 6-03.3(33). Splice connections made using the direct tension indicator method are not required to be inspected in accordance with Section 6-03.3(33)B and will be accepted based on feeler gauge measurements conforming to Table 3 in Section 6-03.3(33).

All bolted connection faying surfaces shall be flat after fabrication as required to provide a solid fit upon assembly in accordance with Section 6-03.3(33). The flatness of the faying surfaces shall be flat to within a tolerance of $\frac{1}{32}$ inch in 12 inches and a tolerance of $\frac{1}{16}$ inch overall. Base plates with leveling nuts shall be flat to within a tolerance of $\frac{1}{8}$ inch in 12 inches and a tolerance of $\frac{3}{16}$ inch overall.

In order to achieve the flatness requirements, the Contractor may need to mill or machine the plates. The Contractor shall increase plate thicknesses as needed to ensure the remaining section meets the specified thickness after such machining or milling.

At bolted connections, both faying surfaces shall be at right angles to the bolt axis, parallel to each other, and shall be in full contact in the assembled condition. Full contact is defined as 90-percent of the outside and inside perimeters of the splice plates being visually in contact. The outside surface shall be inspected just inside the shell of the monotube and the inside shall be inspected at the handhole. Splices shall be fabricated such that the required camber remains continuous and smooth across the field splice.

Prior to galvanizing, the Contractor shall shop assemble the completed Structure lying on its side in an undeflected position to ensure correct alignment, accuracy of holes, fit of joints, smooth camber profile, and the specified amount of camber. The joints shall be bolted with a sufficient number of bolts tightened snug tight to close the joints in full contact as they would be in the final field assembled position as defined above. The Contractor shall not disassemble the sign structure for galvanizing as specified until receiving the Engineer's acceptance of the shop assembled structure.

All galvanized surfaces exposed to view after erection shall be shop painted or shop powder coated in accordance with Section 6-07.3(11), except when the Plans or Special Provisions require field painting only in accordance with Sections 6-07.3(9)I and 6-07.3(11)A. Contact surfaces of the field bolted connections shall be left as galvanized without an overcoat.

Unless otherwise specified in the Special Provisions the color of the finish coat shall match SAE AMS Standard 595 color number 35237 when dry.

All galvanized surfaces specified to be painted or powder coated shall be prepared for coating in accordance with Section 6-07.3(11).

After completing erection, the Contractor shall repair all metal surfaces with damaged paint or powder coatings and exposed metal with a field repair coating in accordance with Section 6-07.3(9)I and Section 6-07.3(11)A (for paint) or Section 6-07.3(11)B (for powder coating). The color of the finish coat of the field repair coating, when dry, shall match the color specified above.

8-21.3(9)B Erection of Steel Structures

Erection shall conform to the applicable requirements of Section 8-21.3(9)F. Before erecting steel Structures, the Contractor shall submit an erection plan as a Type 2 Working Drawing. The erection plan shall provide complete details of the erection process including at a minimum:

1. Procedure and sequence of operation;
2. Structure weights, lift points, and rigging devices;
3. Crane(s) make and model, weight, geometry, lift capacity, outrigger size and reactions;
4. Locations of cranes, trucks delivering structures, and the location of cranes and outriggers relative to other Structures, including retaining walls and wing walls.

Section 8-21.3(9)F notwithstanding, the Contractor may erect a sign bridge prior to completion of the shaft cap portion of one foundation for one post provided the following conditions are satisfied:

1. The Contractor shall submit a Type 2E Working Drawing consisting of design calculations and details of the temporary supports and falsework supporting the sign bridge near the location of the incomplete foundation. The submittal shall include the method of releasing and removing the temporary supports and falsework without inducing loads and stress into the sign bridge.
2. The Contractor shall submit a Type 2 Working Drawing consisting of the method used to secure the anchor bolt array in proper position with the sign bridge while casting the shaft cap concrete to complete the foundation.
3. The Contractor shall erect the sign bridge and temporary supports and falsework, complete the remaining portion of the incomplete foundation, and remove the temporary supports and falsework, in accordance with the accepted Working Drawings.

8-21.3(9)C Timber Posts

Timber sign posts shall conform to the requirements of Section 9-28.14(1).

8-21.3(9)D Aluminum Structures

Welding of aluminum shall be in accordance with Section 9-28.14(3).

8-21.3(9)E Bridge Mounted Sign Brackets

The Contractor shall fabricate and install sign supports for mounting signs on bridge Structures at the locations and as shown in the Plans, including inserts and anchor bolts. Fabrication and installation shall be in accordance with applicable requirements of Sections 6-03 and 9-06. Metal surfaces shall not be painted.

The quantity of structural carbon steel shown in the Contract is listed only for the convenience of the Contractor in determining the volume of Work involved and is not guaranteed to be accurate. The prospective Bidders shall verify this quantity before submitting a Bid. No adjustments other than for approved changes will be made in the lump sum Contract price for the bridge mounted sign brackets, even though the actual quantity of structural carbon steel required may deviate from that listed.

8-21.3(9)F Foundations

The excavation and backfill shall conform to the requirements of Section 3-07.3. Where obstructions prevent construction of planned foundations, the Contractor shall construct an effective foundation satisfactory to the Engineer.

The bottom of concrete foundations shall rest on firm ground. If the portion of the foundation beneath the existing ground line is formed or cased instead of being cast against the existing soil forming the sides of the excavation, then all gaps between

the existing soil and the completed foundation shall be backfilled and compacted in accordance with Section 3-07.3(1)E.

Concrete placed into an excavation where water is present shall be placed using an approved tremie. If water is not present, the concrete shall be placed such that the free-fall is vertical down the center of the shaft without hitting the sides, the steel reinforcing bars, or the steel reinforcing bar cage bracing. The Section 6-02.3(6) restriction for 5-foot maximum free-fall shall not apply to placement of Class 4000P concrete into a shaft.

Foundations shall be cast in one operation where practicable. The exposed portions shall be formed to present a neat appearance. Class 2 surface finish shall be applied to exposed surfaces of concrete in accordance with the requirements of Section 6-02.3(14)B.

Where soil conditions are poor, the Engineer may order the Contractor to extend the foundations shown in the Plans to provide additional depth. Such additional work shall be paid for according to Section 1-04.4.

Forms shall be true to line and grade. Tops of foundations for roadside sign structures shall be finished to ground line unless otherwise shown in the Plans or directed by the Engineer. Tops of foundations for sign bridges and cantilever sign structures shall be finished to the elevation shown in the Plans.

Both forms and ground that will be in contact with the concrete shall be thoroughly moistened before placing concrete; however, excess water in the foundation excavation will not be permitted. Forms shall not be removed until the concrete has set at least 3 days. All forms shall be removed, except when the Plans or Special Provisions specifically allow or require the forms or casing to remain.

Foundation concrete shall conform to the requirements for the specified class, be cast-in-place concrete, and be constructed in accordance with Sections 6-02.2 and 6-02.3.

After construction of concrete foundations for sign bridge and cantilever sign structures, the Contractor shall survey the foundation locations and elevations, the anchor bolt array locations and lengths of exposed threads. The Contractor shall confirm that the survey conforms to the sign structure post, beam, span and foundation design geometry shown in the Plans prior to completion of the sign structure foundation and shall identify all deviations from the design geometry shown in the Plans. When deviations are identified, the Contractor shall notify the Engineer and submit a Type 2 Working Drawing consisting of the Contractor's proposed method(s) of addressing the deviations.

Sign structures shall not be erected on concrete foundations until the Contractor confirms that the foundations and the fabricated sign structures are either compatible with each other and the design geometry shown in the Plans or have been modified in accordance with this section and as accepted by the Engineer to be compatible with each other, and the foundations have attained a compressive strength of 2,400-psi.

In addition to the basic requirements, sign bridges and cantilever sign structures shall be installed in accordance with the following:

1. Foundation excavations shall conform to the requirements of Section 3-07.3(3).
2. Tops of foundations for sign bridges and cantilever sign structures shall be finished to the elevation shown in the Plans.
3. Steel reinforcing bars shall conform to Section 9-07.
4. Concrete shall be Class 4000P, except as otherwise specified. The concrete for the shaft cap (the portion containing the anchor bolt array assemblies above the construction joint at the top of the shaft) shall be Class 4000.
5. All bolts and anchor bolts shall be installed so that two full threads extend beyond the top of the top heavy-hex nut. Anchor bolts shall be installed plumb, plus or minus 1 degree.

6. Plumbing of sign bridges and cantilever sign structures shall be accomplished by adjusting leveling nuts. Shims or other similar devices for plumbing or raking will not be permitted.
7. The top heavy-hex nuts of sign bridges and cantilever sign structures shall be tightened in accordance with Section 6-03.3(33), and by the Turn-of-Nut Method to a minimum rotation of $\frac{1}{4}$ turn and a maximum of $\frac{1}{2}$ turn past snug tight. Permanent marks shall be set on the base plate and nuts to indicate nut rotation past snug tight.

In addition to the basic requirements, roadside sign structures shall be installed in accordance with the following:

1. Tops of foundations shall be finished to final ground line unless otherwise shown in the Plans or staked by the Engineer.
2. Steel reinforcement, including spiral reinforcing, shall conform to Section 9-07.2.
3. Unless otherwise shown in the Plans, concrete shall be Class 4000P. Class 4000P concrete for roadside sign structures does not require air entrainment.
4. The assembly and installation of all Type TP-A or Type TP-B bases for roadside sign structures 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's certification shall be provided to the Engineer prior to installation.
5. For all Type TP-A or TP-B bases, the Contractor shall attach four female anchors to a flat rigid template following the manufacturer's recommendations. The Contractor shall lower the anchor assembly into fresh concrete foundation and vibrate into position such that the tops of the anchor washers are flush with the finished top surface of the foundation. The Contractor shall support the template such that all anchors are level and in their proper position.

Slip base and hinge connection nuts of roadside sign structures shall be tightened using a torque wrench to the torque, following the procedure specified in the Plans.

8-21.3(9)F1 Shafts for Monotube Sign Bridge and Cantilever Sign Structure Foundations

Shafts for monotube sign bridge and cantilever sign structure foundations shall be constructed in accordance with Section 6-19.3, except as follows:

The tolerance for placing the center at the top of the shaft under Section 6-19.3(1)A is revised for sign bridge and cantilever sign structure shafts to be within four-inches of the Plan location.

Non-destructive testing of shafts under Sections 6-19.3(1)B and 6-19.3(9) and associated Work under Section 6-19.3(6) does not apply.

Temporary casing shall be advanced during excavation operations within the limits of temporary casing shown in the Plans for all shaft locations specified in the Special Provisions as requiring temporary casing. Excavation in advance of the casing tip shall not exceed 3-feet, except in no case shall shaft excavation and casing placement extend below the bottom of shaft excavation as shown in the Plans. Unless partial depth temporary casing is shown in the Plans, temporary casing shall be full depth of the shaft.

When the rate of advance of the excavation to the design tip elevation is significantly reduced relative to previous rate of excavation advance in the same geological unit, then the Contractor shall remove, break-up, or push aside, the obstruction under the provisions of Section 8-21.5.

Slurry, if used, shall be synthetic slurry or water slurry as specified in Sections 9-36.2(2) and 9-36.2(3), respectively.

The concrete cover dimensions under Section 6-19.3(5)C are revised for sign bridge and cantilever sign structure shafts to be 3-inches minimum for shafts of diameters of 3-feet or less, and 4-inches minimum for shafts with diameters greater than 3-feet.

Sign bridge and cantilever sign structure shaft concrete shall be Class 4000P.

All temporary casing shall be completely removed.

8-21.3(9)G Sign Structure Identification Information

Whenever existing bridge-mounted sign brackets, cantilever sign structures, or sign bridge structures are removed from their anchorage, whether temporary or permanent, the Contractor shall provide the sign structure identification information, attached to the sign structures, to the Engineer. The identification information may be in the form of a riveted plate, sticker, or other means.

8-21.3(10) Sign Attachment

Sign panels consisting of sheet aluminum or fiberglass reinforced plastic shall be attached or mounted to signposts or sign structures as shown in the Plans.

Signs not conforming to the above, including all variable message sign (VMS) assemblies and other message boardtype assemblies, shall be attached or mounted to signposts or sign structures by means of positive connections—defined as through-bolted connections. The use of clips or clamps to accomplish the attachment or mounting of such signs and assemblies is prohibited.

8-21.3(11) Multiple Panel Signs

After installation of multiple panel signs, the Contractor shall furnish and install an approved reinforced aluminized tape on the reverse side of the sign to prevent visible light through the seam. The tape shall be pressure sensitive and a minimum of 2 inches wide and 2 mils thick. In lieu of tape, the Contractor may use 1-inch-wide aluminum sheeting riveted to the sign back. The aluminum shall be a minimum of 0.032 inch thick. Rivet heads shall match the sign color area immediately surrounding the rivet head, with the exception that rivet heads in white colored sign areas shall be coated to match the white color or be uncoated rivet heads.

8-21.3(12) Steel Sign Posts

For roadside sign structures on Type TP-A or Type TP-B bases, the Contractor shall use the following procedures and manufacturer's recommendations:

1. The couplings, special bolts, bracket bolts, and hinge connection nuts on all Type TP-A or Type TP-B bases shall be tightened using the Turn-of-Nut Tightening Method to a maximum rotation of $\frac{1}{2}$ turn past snug tight.
2. The Contractor shall shim as necessary to plumb the steel signposts.

For roadside sign structures on all Type PL and SB slip bases, the Contractor shall use the following procedures:

1. The Contractor shall assemble the steel signpost to stub post with bolts and flat washers as shown in the Plans.
2. Each bolt shall be tightened using a torque wrench to the torque, following the procedures specified in the Plans.

For roadside sign structures on SB-1, SB-2, or SB-3 slip bases, the Contractor shall use the following procedures and manufacturer's recommendations:

1. The Contractor shall attach the perforated square steel post or solid square steel post to the upper slip plate with bolts, nuts, and washers as shown in the Plans.
2. The three bolts connecting the upper and lower slip plates shall be tightened to torque, using a torque wrench, following the procedures in the Plans.

For roadside structures on ST-2 and ST-4 sign supports, the Contractor shall use the following procedures:

1. The Contractor shall attach the perforated square steel post to the lower sign post support with bolts, nuts, and washers as shown in the Plans.

8-21.4 Measurement

Sign covering will be measured in square feet of the area of the sign covered.

8-21.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

"Permanent Signing", lump sum.

"Sign Bridge No. ____", lump sum.

"Cantilever Sign Structure No. ____", lump sum.

All costs in connection with surveying completed concrete foundations for sign bridges and cantilever sign structures shall be included in the lump sum contract price for "Structure Surveying", except that when no Bid item is included in the Proposal for "Structure Surveying" then such costs shall be included in the lump sum contract price(s) for "Sign Bridge No. ____" and "Cantilever Sign Structure No. ____".

"Bridge Mounted Sign Bracket No. ____", lump sum.

"Sign Covering", per square foot.

"Removing Sign Structure Shaft Obstructions", estimated.

Payment for removing obstructions, as defined in Section 8-21.3(9)F1, will be made for the changes in shaft construction methods necessary to remove the obstruction. The Contractor and the Engineer shall evaluate the effort made and reach agreement on the equipment and employees utilized, and the number of hours involved for each. Once these cost items and their duration have been agreed upon, the payment amount will be determined using the rate and markup methods specified in Section 1-09.6. For the purpose of providing a common Proposal for all bidders, the Contracting Agency has entered an amount for the item "Removing Sign Structure Shaft Obstructions" in the bid Proposal to become a part of the total bid by the Contractor.

If the shaft construction equipment is idled as a result of the obstruction removal work and cannot be reasonably reassigned within the project, then standby payment for the idled equipment will be added to the payment calculations. If labor is idled as a result of the obstruction removal work and cannot be reasonably reassigned within the project, then all labor costs resulting from Contractor labor agreements and established Contractor policies will be added to the payment calculations.

The Contractor shall perform the amount of obstruction work estimated by the Contracting Agency within the original time of the contract. The Engineer will consider a time adjustment and additional compensation for costs related to the extended duration of the shaft construction operations, provided:

1. the dollar amount estimated by the Contracting Agency has been exceeded, and
2. the Contractor shows that the obstruction removal work represents a delay to the completion of the project based on the current progress schedule provided in accordance with Section 1-08.3.

8-22 **Pavement Marking**

8-22.1 **Description**

This Work consists of furnishing, installing, and removing pavement markings in accordance with the Plans, the FHWA publication Standard Alphabet for Highway Signs and Pavement Markings and these Specifications.

Pavement Markings may be either Longitudinal (long) Line Markings or Transverse Markings. Longitudinal line markings are generally placed parallel and adjacent to the flow of traffic. Transverse markings are generally placed perpendicular and across the flow of traffic. Word and symbol markings are classified as transverse markings.

8-22.2 **Materials**

Materials shall meet the requirements of the following sections:

Paint	9-34.2
Plastic	9-34.3
Glass Beads	9-34.4

Glass beads for plastic shall be as recommended by the material manufacturer.

8-22.3 **Construction Requirements**

8-22.3(1) **Preliminary Spotting**

The Engineer will provide necessary control points at intervals agreed upon with the Contractor to assist in preliminary spotting of the lines before marking begins. The Contractor shall be responsible for preliminary spotting of the lines to be marked. Approval by the Engineer is required before marking begins. Preliminary spotting to guide the striping machine is required for all longitudinal lines except where a clearly visible separation is present. Preliminary spotting shall be provided at a spacing of 100 feet maximum on tangents and 25-feet maximum on curves. The color of the material used for spotting shall match the color of the permanent marking.

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

All surfaces shall be dry, free of loose debris, and within the proper temperature range prior to striping. When required by the pavement marking manufacturer's installation instructions, any existing pavement markings that will adversely affect the bond of new pavement marking material to the roadway surface shall be removed from pavement surfaces in accordance with Section 8-22.3(6).

Remove all other contaminants from pavement surfaces that may adversely affect the installation of new pavement marking.

Apply pavement marking materials to new HMA that is sufficiently cured according to the manufacturer's recommendations. Typically, Type D material applied to new HMA pavement requires a pavement cure period of 21 days. This cure period may be reduced if the manufacturer performs a successful adhesion test and approves the reduction of the pavement cure period.

For new cement concrete surfaces, remove curing compounds and laitance by an approved mechanical means. Air blast the pavement with a high-pressure system to remove extraneous or loose material. Apply pavement marking materials to concrete that has reached a minimum compressive strength of 2,500 psi and that is sufficiently cured according to the manufacturer's recommendations. Typically, Type D material applied to cement concrete pavement (CCP) requires a pavement cure period of 28 days. This cure period may be reduced if the manufacturer performs a successful adhesion test and approves the reduction of the pavement cure period.

After the pavement surface is clean and dry, apply primer as recommended by the manufacturer to the area receiving the pavement markings. Apply the primer in a

continuous, solid film according to the recommendations of the primer manufacturer and the pavement markings manufacturer.

8-22.3(3) Marking Application

8-22.3(3)A Marking Colors

Lane line and right edge line shall be white in color. Centerline and left edge line shall be yellow in color. Transverse markings shall be white unless otherwise noted in the Plans.

8-22.3(3)B Line Patterns

The following line patterns shall be used to construct the marking patterns shown in the Plans:

Solid Line – A continuous line without gaps.

Broken Line – A line consisting of solid line segments separated by gaps.

Dotted Line – A broken line with noticeably shorter line segments separated by noticeably shorter gaps.

Marking patterns shown in the Plans may be made up of more than one of these line patterns. For example, a "No Pass Line" consists of one solid line and one broken line.

8-22.3(3)C Line Surfaces

Flat Lines – Pavement marking lines with a flat surface.

Profiled Plastic Lines – A profiled plastic line consists of a base line thickness and a profiled portion of greater thickness. Profiles shall be applied using the extruded method in the same application as the base line. The profiles may be slightly rounded provided the minimum profile thickness is the same throughout the length of the profile. See the Plans for the construction details.

Embossed Plastic Lines – Embossed plastic lines consist of a flat line with transverse grooves. An embossed plastic line may also have profiles. See the Plans for the construction details.

8-22.3(3)D Line Applications

Surface Line – A line constructed by installing pavement marking material directly to the pavement surface or existing pavement marking.

Grooved Line – A line constructed by grinding or saw cutting a groove into the pavement surface and installing pavement marking material into the groove. Groove depth is measured vertically from the bottom of a 2 foot or longer straightedge placed on the roadway surface to the ground surface. The groove depth is dependent upon the material used, the pavement surface, and the location. See these *Standard Specifications*, the project Plans, and Special Provisions. Grooved line pavement marking shall not be constructed on bridge decks or on bridge approach slabs.

8-22.3(3)E Installation

Apply pavement marking materials to clean, dry pavement surfaces and according to the following:

1. Place material according to the manufacture's recommendations,
2. Place parallel double lines 4 inches wide in one pass,
3. The top of pavement marking shall be smooth and uniform,
4. Line ends shall be square and clean,
5. Place pavement marking lines parallel and true to line, and
6. Place markings in proper alignment with existing markings.

When applying paint, Type A or Type C material, ensure that both the pavement surface and the air temperature at the time of application are not less than 50°F and rising. When applying Type B or Type D material, ensure that both the pavement surface and the air temperature at the time of application are not less than 40°F and rising.

Ensure that the Type A thermoplastic material meets the manufacturer's temperature specifications when it contacts the pavement surface.

Two applications of paint will be required to complete all paint markings. The second application of paint shall be squarely on top of the first pass. The time period between paint applications will vary depending on the type of pavement and paint (low VOC waterborne 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	Low VOC Solvent	40 min. min., 48 hrs. max.
Hot Mix Asphalt Pavement	Low VOC Solvent	40 min. min., 30 days max.
Cement Concrete Pavement	Low VOC Solvent	40 min. min., 30 days max.

Centerlines on two-lane Highways with broken line patterns, paint, or plastic shall be applied in cycle with existing broken lines. Broken line patterns applied to multilane or divided Roadways shall be applied in cycle in the direction of travel.

Where paint is applied on centerline on two-way roads with bituminous surface treatment or centerline rumble strips, the second paint application shall be applied in the opposite (decreasing milepost) direction as the first application (increasing milepost) direction. This will require minor broken line pattern corrections for curves on the second application.

8-22.3(3)F Application Thickness

Pavement markings shall be applied at the following base line thickness measured above the pavement surface or above the groove bottom for grooved markings in thousandths of an inch (mils):

Marking Material Application		HMA	CCP	BST	Groove Depth
Paint – first coat	spray	10	10	10	
Paint – second coat	spray	15	15	15	
Type A – flat/transverse & symbols	extruded	125	125	125	
Type A – flat/long line & symbols	spray	90	90	120	
Type A – with profiles	extruded	90	90	120	
Type A – embossed	extruded	160	160	160	
Type A – embossed with profiles	extruded	160	160	160	
Type A – grooved/flat/long line	extruded	230	230	230	250
Type B – flat/transverse & symbols	heat fused	125	125	125	
Type C-2 – flat/transverse & symbols	adhesive	90	90	NA	
Type C-1 & 2 – flat/long line	adhesive	60	60	NA	
Type C-1 – grooved/flat/long line	adhesive	60	60	NA	100
Type D – flat/transverse & symbols	spray	120	120	120	
Type D – flat/transverse & symbols	extruded	120	120	120	
Type D – flat/long line	spray	90	90	120	
Type D – flat/long line	extruded	90	90	120	
Type D – profiled/long line	extruded	90	90	120	
Type D – grooved/flat/long line	extruded	230	230	230	250

Liquid pavement marking material yield per gallon depending on thickness shall not exceed the following:

Mils thickness	Feet of 4" line/gallon	Square feet/gallon
10	483	161
15	322	108
18	268	89
20	242	80
22	220	73
24	202	67
30	161	54
40	122	41
45	107	36
60	81	27
90	54	18
90 with profiles	30	10
120	40	13
120 with profiles	26	9
230	21	7

Solid pavement marking material (Type A) yield per 50-pound bag shall not exceed the following:

Mils thickness	Feet of 4" line/50# bag	Square feet/50# bag
30 – flat	358	120
45 – flat	240	80
60 – flat	179	60
90 – flat	120	40
90 – flat with profiles	67	23
120 – flat	90	30
120 – flat with profiles	58	20
125 – embossed	86	29
125 – embossed with profiles	58	20
230 – flat grooved	47	15

All grooved lines shall be applied into a groove cut or ground into the pavement. For Type A or Type D material, the groove shall be cut or ground with equipment to produce a smooth square groove 4 inches wide. For Type C-1 material, the groove shall be cut with equipment to produce a smooth bottom square groove with a width in accordance with the material manufacturer's recommendation. After grinding, clean the groove. Immediately before placing the marking material, clean the groove with high-pressure air.

8-22.3(3)G Glass Beads

Top dress glass beads shall be applied to all spray and extruded pavement marking material. Glass beads shall be applied by a bead dispenser immediately following the pavement marking material application. Glass bead dispensers shall apply the glass beads in a manner such that the beads appear uniform on the entire pavement marking surface with 50 to 60 percent embedment. Hand casting of beads will not be allowed.

Glass beads shall be applied to 10 or 15 mil thick paint at a minimum application rate of 7 pounds per gallon of paint. For plastic pavement markings, glass bead type and application rate shall be as recommended by the marking material manufacturer.

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. The cure period between successive applications shall be in accordance with the manufacturer's recommendations. 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.

8-22.3(4) Tolerances for Lines and Grooves

Allowable tolerances for lines are as follows:

Length of Line – The longitudinal accumulative error within a 40 foot length of broken line shall not exceed plus or minus 1 inch. The broken line segment shall not be less than 10 feet.

Width of Line – The width of the line shall not be less than the specified line width or greater than the specified line width plus $\frac{1}{4}$ inch.

Lane Width – The lane width, which is defined as the lateral width from the edge of pavement to the center of the lane line or between the centers of successive lane lines, shall not vary from the widths shown in the Contract by more than plus or minus 4 inches.

Thickness – A thickness tolerance not exceeding plus 10 percent will be allowed for thickness or yield in paint and plastic material application.

Parallel Lines – The gap tolerance between parallel lines is plus or minus $\frac{1}{2}$ inch.

Grooves – All grooves for grooved pavement shall not exceed the length of the pavement marking by more than 1 inch, the width of the pavement marking by more than $\frac{1}{2}$ inch, or the depth of groove by more than $\frac{1}{4}$ inch.

8-22.3(5) Installation Instructions

Installation instructions for plastic markings shall be provided for the Engineer. The instructions shall include equipment requirements, approved work methods and procedures, material application temperature range, air and pavement surface temperature requirements, weather limitations, precautions, and all other requirements for successful application and material performance. Do not use materials with incomplete or missing instructions. All materials including glass beads shall be installed according to the manufacturer's recommendations. A manufacturer's technical representative shall be present at the initial installation of plastic material to approve the installation procedure, or the material manufacturer shall certify that the Contractor will install the plastic material in accordance with their recommended procedure.

8-22.3(6) Removal of Pavement Markings

Pavement markings to be removed shall be obliterated until all blemishes caused by the pavement marking removal conform to the coloration of the adjacent pavement.

Grinding to remove pavement markings in their entirety is allowed in areas designated for applications of either Hot Mix Asphalt (HMA) or Bituminous Surface Treatment (BST). Pavement marking removal shall be performed from April 1st through September 30th and only in those areas that shall be paved within the same time window as the grinding, unless otherwise allowed by the Engineer in writing.

For all cement concrete pavement and areas that will not be overlaid with hot mix asphalt or BST, grinding is allowed to a depth just above the pavement surface and then Water blasting or shot blasting shall be required to remove the remaining pavement markings.

If in the opinion of the Engineer, the pavement is materially damaged by pavement marking removal, such damage shall be repaired by the Contractor in accordance with Section 1-07.13(1). Sand or other material deposited on the pavement as a result of removing lines and markings shall be removed as the Work progresses to avoid hazardous conditions. Accumulation of sand or other material which might interfere with drainage will not be permitted.

8-22.4 Measurement

Plastic line including "Plastic Line", "Embossed Plastic Line", "Profiled Plastic Line", "Profiled Embossed Plastic Line" and "Grooved Plastic Line" will be measured by the linear foot of completed line. No deduction will be made for the unmarked area when the marking includes a broken line or a dotted line. Marking patterns made up of multiple plastic lines will be measured by the linear foot for each line that makes up the marking pattern.

Paint line will be measured by the linear foot for each marking pattern installed, regardless of the number of lines in the marking pattern. No deduction will be made for the unmarked area when the marking includes a broken line or dotted line.

Plastic wide line and painted wide line including "Painted Wide Line", "Plastic Wide Line", "Profiled Plastic Wide Line", "Profiled Embossed Wide Line", and "Grooved Plastic Wide Line" will be measured by the linear foot of completed line. No deduction will be made for the unmarked area when the marking includes a broken line or a dotted line. Marking patterns made up of multiple wide lines will be measured by the linear foot for each line that makes up the marking pattern.

Wide Dotted Entry Line will be measured by the completed linear foot as "Painted 12-inch Wide Line" or "Plastic 12-inch Wide Line". No deduction will be made for the unmarked area when the marking includes a broken or dotted line.

"Painted Barrier Center Line", "Plastic Barrier Center Line", "Painted Stop Line", and "Plastic Stop Line", will be based on the total length of each painted, plastic or profiled plastic line installed.

No additional measurement for payment will be made for the required second application of paint. No additional measurement for payment will be made for additional applications required to meet thickness requirements for plastic markings.

Diagonal lines used to delineate parking stalls that are constructed of painted or plastic 4-inch lines will be measured as "Paint Line" or "Plastic Line" by the linear foot of line installed. Crosswalk line will be measured by the square foot of marking installed.

Crosshatch markings used to delineate median and gore areas will be measured by the completed linear foot as "Painted Crosshatch Marking" or "Plastic Crosshatch Marking" and will be based on the total length of each 8-inch or 12-inch wide line installed.

Traffic arrows, traffic letters, access parking space symbols, HOV symbols, railroad crossing symbols, drainage markings, junction box markings, bicycle lane symbols, aerial surveillance full, and $\frac{1}{2}$ markers, yield line symbols, yield ahead symbols, and speed bump symbols will be measured per each. Type 1 through 6 traffic arrows will be measured as one unit each, regardless of the number of arrow heads.

Removal of lines, regardless of width, will be measured by the linear foot, with no deduction being made for the unmarked area when the marking includes a gap. Marking patterns made up of multiple lines, such as double center line and double lane line, will be measured by the linear foot for each line that makes up the pattern.

Removal of traffic arrows, traffic letters, access parking space symbol, HOV lane symbol, railroad crossing symbol, bicycle lane symbols, drainage markings, aerial surveillance full and $\frac{1}{2}$ markers, yield line symbol, yield ahead symbol, and speed bump symbol will be measured per each. Removal of crosswalk lines will be measured by the square foot of lines removed.

8-22.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

- "Paint Line", per linear foot.
- "Plastic Line", per linear foot.
- "Embossed Plastic Line", per linear foot.
- "Profiled Plastic Line", per linear foot.
- "Profiled Embossed Plastic Line", per linear foot.
- "Grooved Plastic Line", per linear foot.
- "Painted Wide Line", per linear foot.
- "Plastic Wide Line", per linear foot.
- "Embossed Plastic Wide Line" per linear foot.
- "Profiled Plastic Wide Line", per linear foot.
- "Profiled Embossed Plastic Wide Line", per linear foot.
- "Grooved Plastic Wide Line", per linear foot.
- "Painted 12-inch Wide Line", per linear foot.
- "Plastic 12-inch Wide Line", per linear foot.
- "Painted Barrier Center Line", per linear foot.
- "Plastic Barrier Center Line", per linear foot.
- "Painted Stop Line", per linear foot.
- "Plastic Stop Line", per linear foot.
- "Painted Crosswalk Line", per square foot.
- "Plastic Crosswalk Line", per square foot.
- "Painted Crosshatch Marking", per linear foot.
- "Plastic Crosshatch Marking", per linear foot.
- "Painted Traffic Arrow", per each.
- "Plastic Traffic Arrow", per each.
- "Painted Traffic Letter", per each.
- "Plastic Traffic Letter", per each.
- "Painted Access Parking Space Symbol", per each.
- "Plastic Access Parking Space Symbol", per each.
- "Painted Railroad Crossing Symbol", per each.
- "Plastic Railroad Crossing Symbol", per each.
- "Painted Bicycle Lane Symbol", per each.
- "Plastic Bicycle Lane Symbol", per each.
- "Painted Drainage Marking", per each.
- "Plastic Drainage Marking", per each.
- "Painted Junction Box Marking", per each.
- "Plastic Junction Box Marking", per each.
- "Painted Aerial Surveillance Full Marker", per each.
- "Plastic Aerial Surveillance Full Marker", per each.
- "Painted Aerial Surveillance ½ Marker", per each.
- "Plastic Aerial Surveillance ½ Marker", per each.

"Painted Access Parking Space Symbol with Background", per each.

"Plastic Access Parking Space Symbol with Background", per each.

"Painted HOV Lane Symbol", per each.

"Plastic HOV Lane Symbol", per each.

"Painted Yield Line Symbol", per each.

"Plastic Yield Line Symbol", per each.

"Painted Yield Ahead Symbol", per each.

"Plastic Yield Ahead Symbol", per each.

"Painted Speed Bump Symbol", per each.

"Plastic Speed Bump Symbol", per each.

"Removing Paint Line", per linear foot.

"Removing Plastic Line", per linear foot.

"Removing Painted Crosswalk Line", per square foot.

"Removing Plastic Crosswalk Line", per square foot.

"Removing Painted Traffic Marking", per each.

"Removing Plastic Traffic Marking", per each.

The unit Contract price for the aforementioned Bid items shall be full payment for all costs to perform the Work as described in Section 8-22.

8-23 Temporary Pavement Markings

8-23.1 Description

The Work consists of furnishing, installing, and removing temporary pavement markings.

8-23.2 Materials

Materials for pavement markings shall meet the following requirements:

Raised Pavement Marker	9-21
Paint	9-34.2
Plastic	9-34.3
Glass Beads for Pavement Marking Materials	9-34.4
Temporary Pavement Marking Tape	9-34.5
Temporary Flexible Raised Pavement Markers	9-34.6

8-23.3 Construction Requirements

8-23.3(1) General

Temporary pavement markings shall be provided where noted in the Plans and for all lane shifts and detours resulting from construction activities; or when permanent markings are removed because of construction operations.

Any conflicting preexisting pavement markings shall be removed in accordance with Section 8-22.3(6). Any conflicting temporary pavement markings shall be removed in accordance with Section 8-23.3(4)E.

8-23.3(2) Preliminary Spotting

All preliminary layout and marking in preparation for application and the application and removal of temporary pavement markings shall be the responsibility of the Contractor.

8-23.3(3) Preparation of Roadway Surface

Surface preparation for temporary pavement markings shall be in accordance with the manufacturer's recommendations.

8-23.3(4) Pavement Marking Application

8-23.3(4)A Temporary Pavement Markings – Short Duration

Lane line and right edge line shall be white in color. Center line and left edge line shall be yellow in color. Edge Lines shall be installed only if specifically required in the Plans. All temporary pavement markings shall be retroreflective.

Temporary pavement markings – short duration shall be in accordance with the [Standard Plans](#) and meet the following requirements:

Temporary Center Line – A BROKEN line used to delineate adjacent lanes of traffic moving in opposite directions. The broken pattern shall be based on a 40-foot unit, consisting of a 4-foot line with a 36-foot gap if paint or tape is used. If temporary raised pavement markers or temporary flexible raised pavement markers are used, the pattern shall be based on a 40-foot unit, consisting of a grouping of three temporary raised pavement markers, each spaced 3 feet apart, with a 34-foot gap.

Temporary Edge Line – A SOLID line used on the edges of Traveled Way. The line shall be continuous if paint or tape is used. If temporary raised pavement markers are used, the line shall consist of markers installed continuously at 5-foot spacings.

Temporary Lane Line – A BROKEN line used to delineate adjacent lanes with traffic traveling in the same direction. The broken pattern shall be based on a 40-foot unit, consisting of a 4-foot line with a 36-foot gap, if paint or tape is used. If temporary raised pavement markers or temporary flexible raised pavement markers are used, the pattern shall be based on a 40-foot unit, consisting of a grouping of three temporary raised pavement markers, each spaced 3 feet apart, with a 34-foot gap.

Temporary Miscellaneous Pavement Markings – A solid symbol or linear marking for traffic arrows, HOV lane symbols, and other markings made with white paint or tape. Symbols should mimic those shown in the [Standard Plans](#).

Temporary Stop Line – A solid transverse line made with white paint or tape in accordance with the [Standard Plans](#).

Temporary Crosswalk Line – Solid transverse lines made with white paint or tape in accordance with the [Standard Plans](#).

8-23.3(4)A1 Temporary Pavement Marking Paint

Paint used for short duration temporary pavement markings shall be applied in one application at a thickness of 15 mils or 108 square feet per gallon. Glass beads shall be in accordance with Section 8-22.3(3)G.

8-23.3(4)A2 Temporary Pavement Marking Tape

Application of temporary pavement marking tape shall be in conformance with the manufacturer's recommendations.

Black mask pavement marking tape shall mask the existing line in its entirety.

8-23.3(4)A3 Temporary Raised Pavement Markers

Temporary raised pavement markers are not allowed on bituminous surface treatments.

8-23.3(4)A4 Temporary Flexible Raised Pavement Markers

Flexible raised pavement markers are required for new applications of bituminous surface treatments. Flexible raised pavement markers are not allowed on other pavement types unless otherwise specified or approved by the Engineer. Flexible raised pavement markers shall be installed with the protective cover in place. The cover shall be removed immediately after spraying asphaltic material.

8-23.3(4)B Temporary Pavement Markings – Long Duration

Temporary pavement markings – long duration shall be in accordance with the [Standard Plans](#) and shall meet the following requirements:

Temporary Center Line – A BROKEN line used to delineate adjacent lanes of traffic moving in opposite directions. The broken pattern shall be based on a 40-foot unit, consisting of a 10-foot line with a 30-foot gap of paint or tape.

Temporary Edge Line – A SOLID line used on the edges of Traveled Way. The line shall be continuous paint or tape.

Temporary Lane Line – A BROKEN line used to delineate adjacent lanes with traffic traveling in the same direction. The broken pattern shall be based on a 40-foot unit, consisting of a 10-foot line with a 30-foot gap of paint or tape.

Temporary Miscellaneous Pavement Markings – A solid symbol or linear marking in accordance with the standard plans for traffic arrows, HOV lane symbols, and other markings made in accordance with the [Standard Plans](#) with white paint or tape.

Temporary Stop Line – A solid transverse line made with white paint or tape in accordance with the [Standard Plans](#).

Temporary Crosswalk Line – Solid transverse lines made with white paint or tape in accordance with the [Standard Plans](#).

Application of paint, pavement marking tape and plastic for long duration pavement markings shall meet the requirements of Section 8-22.3(3); application of raised pavement markers shall meet the requirements of Section 8-09.3; and application of flexible pavement markings shall be in conformance with the manufacturer's recommendations.

8-23.3(4)C Tolerance for Lines

Tolerance for lines shall conform to Section 8-22.3(4).

8-23.3(4)D Maintenance of Pavement Markings

Temporary pavement markings shall be maintained in serviceable condition throughout the project until permanent pavement markings are installed. As directed by the Engineer; temporary pavement markings that are damaged, including normal wear by traffic, shall be repaired or replaced immediately. Repaired and replaced pavement markings shall meet the requirements for the original pavement marking.

8-23.3(4)E Removal of Pavement Markings

Removal of temporary paint is not required prior to paving; all other temporary pavement markings shall be removed.

All temporary pavement markings that are required on the wearing course prior to construction of permanent pavement markings and are not a part of the permanent markings shall be completely removed concurrent with or immediately subsequent to the construction of the permanent pavement markings in accordance with the manufacturer's permanent marking application instructions. Temporary flexible raised pavement markers on bituminous surface treatment pavements shall be cut off flush with the surface if their location conflicts with the alignment of the permanent pavement markings. All other temporary pavement markings shall be removed in accordance with Section 8-22.3(6).

All damage to the permanent Work caused by removing temporary pavement markings shall be repaired by the Contractor at no additional cost to the Contracting Agency.

8-23.4 Measurement

Temporary center lines, edge lines, lane lines or other temporary longitudinal pavement markings will be measured by the linear foot of each installed line or grouping of markers, with no deduction for gaps in the line or markers and no additional measurement for the second application of paint required for long duration paint lines. Short duration and long duration temporary pavement markings will be measured for the initial installation only.

Temporary miscellaneous pavement marking will be measured per each for temporary traffic arrow, HOV lane symbol, and other markings placed.

Temporary Stop Line will be measured by the linear foot of installed line.

Temporary crosswalk lines will be measured by the square foot for each crosswalk line placed to complete a crosswalk.

Maintenance and removal of temporary pavement markings will be considered incidental to the installation of the temporary marking and will not be measured

8-23.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

"Temporary Pavement Marking – Short Duration", per linear foot.

"Temporary Pavement Marking – Long Duration", per linear foot.

The unit Contract price per linear foot for "Temporary Pavement Marking – Short Duration" and "Temporary Pavement Marking – Long Duration" shall be full pay for all Work as specified.

"Temporary Misc. Pavement Marking – Short Duration", per each.

"Temporary Misc. Pavement Marking – Long Duration", per each.

The unit Contract price per each for "Temporary Misc. Pavement Marking – Short Duration", and "Temporary Misc. Pavement Marking – Long Duration", shall be full pay for all Work as specified.

"Temporary Stop Line – Short Duration", – per linear foot.

"Temporary Stop Line – Long Duration", – per linear foot.

The unit Contract price per linear foot "Temporary Stop Line – Short Duration", and "Temporary Stop Line – Long Duration", shall be full pay for all Work as specified.

"Temporary Crosswalk Line – Short Duration", – per square foot.

"Temporary Crosswalk Line – Long Duration", – per square foot.

The unit Contract price per square foot for "Temporary Crosswalk Line – Short Duration", and "Temporary Crosswalk Line – Long Duration", shall be full pay for all Work as specified.

8-24 Rock and Gravity Block Wall and Gabion Cribbing**8-24.1 Description**

This Work consists of constructing rock and gravity block wall(s), and gabion cribbing in accordance with the Plans, Special Provisions, these Specifications, or as designated by the Engineer.

8-24.2 Materials

Materials shall meet the requirements of the following sections:

Rock for Rock Wall and Chinking Material	9-13.7(1)
Backfill for Rock Wall	9-13.7(2)
Gabion Cribbing	9-27.3
Wire Mesh Fabric	9-27.3(1)
PVC Coating for Welded Wire Mesh Fabric	9-27.3(2)
Gabion Basket Fasteners	9-27.3(4)
Stone	9-27.3(6)
Construction Geotextile	9-33

Materials for gravity block walls shall be as specified in the Special Provisions.

8-24.3 Construction Requirements**8-24.3(1) Rock Wall****8-24.3(1)A Geometric Tolerances**

The completed wall shall meet the following tolerances:

1. Wall batter shall be 6:1 or flatter as specified in the Plans.
2. The exterior slope plane and grade in the finished surface of the wall shall be plus or minus 6 inches.
3. The maximum void between adjacent rocks shall be 6 inches as measured at the smallest dimensions of the void within the thickness of the wall.

8-24.3(1)B Excavation

Excavation shall conform to Section 3-07.3(4), and to the limits and construction stages shown in the Plans.

The Contractor shall restrict the excavation limits to the length of rock wall that can be constructed in 1 day's Work, except as otherwise noted. The Engineer may permit excavation beyond the limits that can be completed in 1 day's Work provided the Contractor either demonstrates that the excavation will remain stable until the rock wall is completed, or shores the excavation in accordance with Section 3-07.3(4).

Slope above the rock wall shall be established prior to excavating for the wall.

8-24.3(1)C Foundation Preparation

The foundation for the wall shall be graded as shown in the Plans.

Prior to rock placement, the foundation, if not in rock, shall be compacted as approved by the Engineer. Any foundation soils found to be unsuitable shall be removed and replaced in accordance with Section 3-07.3(1)C.

Base course rocks shall have full contact with the foundation soils. If necessary, the excavation shall be shaped to fit the rocks. Rocks may be dropped to shape the ground provided the rocks do not crack. Cracked rocks shall be replaced and the foundation regraded to fit the replacement rock.

8-24.3(1)D Construction Geotextile

Construction geotextile shall be of the type, and shall be placed, as shown in the Plans.

8-24.3(1)E Rock Placement and Backfill

Rocks shall be placed so there are no continuous joint planes in either the vertical or lateral direction.

Where possible, rocks shall be placed so that the rock shall bear on at least two rocks below it. Rocks shall be oriented so that flat surface contact points between adjacent rocks are maximized. Point-to-point contact between adjacent rocks shall be minimized. Each rock in a course shall be arranged so that the natural irregularities in the rocks key the rocks together and so that the courses are keyed together.

Rocks shall increase in size from the top of the wall to the bottom at a uniform rate. The minimum rock sizes, as referenced from the top of the wall, shall be as follows:

Depth From Top of Wall (feet)	Minimum Rock Size at Depth From Top of Wall
6	Three Man
9	Four Man
12	Five Man

Rocks at the top of the wall shall be Two Man or larger.

Where voids larger than 6 inches are present, chinking rock shall be keyed between the rocks to fill the void.

Backfill for the rock wall shall be placed behind each course and tamped to provide a stable condition prior to placing rocks for the next successive course.

For rock walls constructed in fills, the fill shall be overbuilt and cut back to construct the wall.

8-24.3(2) Gravity Block Wall

Excavation shall conform to Section 3-07.3(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 3-07.3(1)C. Slope above the gravity block wall shall be established prior to beginning any excavation for the wall.

Gravity block walls are defined as a wall of modular blocks acting as a gravity wall to retain soil. The modular blocks may have features designed to interlock the blocks together. However there shall be no reinforcement of the retained soil nor any reinforcement connection between the modular blocks and the retained soil.

Gravity block walls shall be constructed as specified in the Special Provisions and as shown in the Plans.

8-24.3(3) Gabion Cribbing**8-24.3(3)A Foundations**

Before placing any gabion cribbing, the Contractor shall excavate the foundation or bed to the specified grade in accordance with Section 3-07.3(4). Foundation soils found to be unsuitable shall be removed and replaced in accordance with Section 3-07.3(1)C.

8-24.3(3)B Baskets

Baskets may be fabricated from either woven or welded steel wire; however, a gabion Structure shall not include both. Baskets may be assembled with either lacing wire or clip fasteners; however, a perimeter or diaphragm edge shall not include both.

8-24.3(3)C Dimensions

The Contractor shall supply gabion baskets in the lengths and heights the Plans require. Each length shall be a multiple (double, triple, or greater) of horizontal width. Horizontal width shall be 36 inches. All baskets from the same manufacturer shall be the same width and shall be within a tolerance of 5 percent of the manufacturer's stated sizes.

8-24.3(3)D Fabrication of Baskets

Gabions shall be made so that the sides, ends, lid, and diaphragms can be assembled into rectangular baskets of the required sizes at the construction site. Common-wall construction may be used in gabion Structures up to 12 feet high. Common-wall construction includes any basket where its top serves as the bottom of the one above it, or where one wall also serves an adjacent basket. When gabion Structures are more than 12 feet high, the baskets shall have independent sides, ends, top, and bottom.

Each gabion shall be divided by diaphragms into cells the same length as horizontal basket width. Diaphragms shall be made of the same mesh and gage as the basket body.

All perimeter and diaphragm edges shall be laced or clipped together so that joints are at least as strong as the body of the mesh itself. The ends of the lacing shall be anchored by three tight turns around the selvage wire.

8-24.3(3)E Filling Baskets

Baskets shall be filled with stone. The stone shall be placed and compacted to meet the unit weight requirements of Section 8-24.3(3)F.

The stone shall be placed in compacted layers not more than 14 inches deep. If cross-connecting wires are required, the Contractor shall adjust the number and depth of layers so that wires occur between the compacted layers of stone.

8-24.3(3)F Unit Weight Requirements and Test

The unit weight of the filled gabion basket shall be at least 100 pounds per cubic foot. Should the unit weight be less than 100 pounds per cubic foot, the gabion will be rejected and the Engineer will require the Contractor to conduct and pass additional unit weight tests before completing other gabions.

The Contractor shall conduct either of the following unit weight tests to prove the density of completed gabions:

1. A filled gabion basket shall be selected from the completed Structure and weighed.
2. A gabion basket shall be filled with stone from a loaded truck that has been weighed. After filling, the truck and unused stone shall be weighed again. The difference between the two weights shall be used to determine the weight per cubic foot of the stone in the gabion.

The Contractor shall conduct one unit weight test for each 500 cubic yards of gabions placed. The Engineer may reduce the specified frequency of these tests provided the specified minimum unit weight has been consistently achieved.

In conducting unit weight test 1 or 2, the Contractor shall provide and use scales conforming to Section 1-09.2.

8-24.3(3)G Gabion Cribbing Erection

Each row or tier of baskets shall be reasonably straight and shall conform to alignment and grade. Hexagonal mesh baskets shall be stretched endwise before filling. The stone shall be carefully placed in layers, then tamped or vibrated. The last layer of stones shall fill each basket completely so that the secured lid will rest upon the stones. Each basket shall be laced securely to all adjacent baskets and its lid then laced or clipped to the sides, ends, and diaphragms.

All selvage wires of ends of adjacent baskets shall be laced together. The bottom selvage of the basket being constructed on a previously constructed basket shall be laced to the top of that basket.

Backfilling behind or around gabions shall conform to Section 3-07.3(1)E.

8-24.4 Measurement

Rock for rock walls and backfill for rock walls will be measured by the ton of rock actually placed.

Gabion cribbing will be measured by the calculated neat line volume of gabion baskets in place, using the manufacturer's stated dimensions.

Gravity block wall will be measured by the square foot of completed wall in place. The vertical limits for measurement are from the bottom of the bottom layer of blocks to the top of the top layer of blocks. The horizontal limits for measurement are from the end of wall to the end of wall.

Construction geotextile will be measured by the square yard for the surface area actually covered.

Structure excavation Class B, Structure excavation Class B including haul, and shoring or extra excavation Class B, will be measured in accordance with Section 3-07.4.

8-24.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

"Rock for Rock Wall", per ton.

The unit Contract price per ton for "Rock for Rock Wall" shall also include furnishing and installing chinking materials.

"Backfill for Rock Wall", per ton.

"Gabion Cribbing", per cubic yard.

"Gravity Block Wall", per square foot.

"Construction Geotextile", per square yard.

"Structure Excavation Class B", per cubic yard.

"Structure Excavation Class B Incl. Haul", per cubic yard.

"Shoring or Extra Excavation Class B", per square foot.

8-25 Glare Screen

8-25.1 Description

This Work consists of furnishing and constructing glare screen of the types specified, in accordance with the Plans, these Specifications, the [Standard Plans](#), and as ordered by the Engineer in accordance with Section 1-04.4.

Glare screen consists of diamond woven wire mesh fence of aluminum, galvanized or aluminum coated steel wire, fabricated and placed to reduce glare from headlights of opposing traffic or other adjacent light sources.

8-25.2 Materials

Materials shall meet the requirements of Section 9-16.6.

8-25.3 Construction Requirements

8-25.3(1) Glare Screen Fabric

Glare screen fabric shall be placed on the face of the posts designated by the Engineer. On curves, the fabric shall be placed on the face of the post that is on the outside of the curve.

The fabric shall be stretched taut and securely fastened to the posts. Fastening to end, corner, and pull posts shall be with stretcher bars and fabric bands spaced at 1-foot intervals. The fabric shall be cut and each span attached independently at all pull and corner posts. Fabric shall be securely fastened to line and brace posts with tie wires, metal bands, or other approved methods, attached at 14-inch intervals. The top and bottom of the fabric shall be fastened to the tension wire with hog rings spaced at 24-inch intervals.

Rolls of wire fabric shall be joined by weaving a single strand into the end of the rolls to form a continuous mesh.

8-25.3(2) Slats

The slats shall be fastened into the weave by using staples, screws, or other methods as approved by the Engineer. Allowing the tension of the mesh to hold the slats in place will not be permitted.

Slats broken or split during construction shall be removed and replaced by the Contractor at no expense to the Contracting Agency.

8-25.3(3) Posts

Posts shall be constructed in accordance with the [Standard Plans](#) and applicable provisions of Section 8-12.3(1)A.

Posts for Type 1 Design A shall be bolted to the beam guardrail posts as detailed in the [Standard Plans](#). Drilling of the guardrail posts shall be done in such a manner to ensure that the glare screen posts are set plumb and centered over the guardrail posts unless otherwise directed.

All round posts for Type 1 Design B and Type 2 glare screen shall be fitted with a watertight top securely fastened to the post. Line posts shall have tops designed to carry the top tension wire.

8-25.3(4) Tension Wire

Tension wires shall be attached to the posts as detailed in the [Standard Plans](#) or as approved by the Engineer.

8-25.4 Measurement

Measurement of glare screen will be by the linear foot of completed glare screen for the particular type and design specified.

8-25.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

“Glare Screen Type 1 Design _____”, per linear foot.

“Glare Screen Type 2”, per linear foot.

8-26 Vacant

8-27 Vacant

8-28 Vacant

8-29 Wire Mesh Slope Protection**8-29.1 Description**

This Work consists of furnishing and installing the anchors and the wire mesh slope protection in accordance with these Specifications and the details shown in the Plans and in conformity with the lines and dimensions shown in the Plans or specified by the Engineer.

8-29.2 Materials

Materials shall meet the requirements of Section 9-16.4.

8-29.3 Construction Requirements**8-29.3(1) Submittals**

The Contractor shall submit a Type 2 Working Drawing consisting of a wire mesh slope protection plan. The wire mesh slope protection plan shall include the following:

1. Plan sheets for anchor layout and installation, and the equipment and process used to confirm the capacity of the constructed anchors including the calibration data for the stressing devices used to proof test the anchors, as completed by an independent testing laboratory within 60 calendar days of the wire mesh slope work.
2. Working drawings for the temporary yoke or load frame to be used for anchor proof testing in accordance with Section 6-01.9.
3. Plans and details for assembling wire mesh and erecting the assembled mesh on the slope.

All the costs for the Work required for Submittals shall be included in the unit Bid price detailed in Section 8-29.5.

8-29.3(2) Anchors

The Contractor shall install anchors of the type shown in the Plans and in conformance with the layout shown in the wire mesh protection plan. The spacing and number of the anchors and wire ropes as shown in the Plans are approximate only, and upon review of the wire mesh slope protection plan, the Engineer may arrange the spacing to better hold the wire mesh against the slope. Backfill material shall be thoroughly compacted with a mechanical compactor.

The Contractor shall proof test up to 25 percent of the anchors in vertical pullout to the minimum allowable anchor capacity specified in the Plans. Proof testing of anchors shall be performed against a temporary yoke or load frame. No part of the temporary yoke or load frame shall bear within three feet of the anchor being tested. For vertical pullout proof testing, an anchor is acceptable if it sustains the specified capacity for 10 minutes with no loss of load. Anchors that fail this criterion shall be replaced and retested. If more than three anchors fail, the Contractor shall proof test all anchors.

8-29.3(3) Wire Rope

All wire rope loops shall include a thimble. No wire rope splicing will be allowed.

8-29.3(4) Wire Mesh

The wire mesh shall be fastened to the completed wire rope assembly as shown in the Plans. High tensile steel fasteners on the vertical seams shall be staggered across width of the seam. Horizontal splices joining 2 rolls of mesh shall be made by overlapping the mesh approximately 3 feet and either weaving 3 rows of lacing wires through every mesh opening or using 4 rows of high tensile steel fasteners placed on approximately 3-inch spacing. All top and bottom laps shall be made by folding the mesh to the outside, away from the slope, to avoid the possibility of falling material hanging up in the folds. The bottom of the mesh shall be located as shown in the Plans. The ends of all lacing wires shall be secured to the mesh with a minimum of 1½-turns.

The wire mesh shall not be tensioned in any direction, but is to remain loose so as to increase its dampening effect on rolling rocks. The Contractor shall use care in the handling and installing of the wire mesh and wire rope. Any mesh or wire rope damaged due to the Contractor's operations shall be replaced by the Contractor at no expense to the Contracting Agency.

8-29.4 Measurement

Measurement of anchors will be per each for the completed anchor. Anchor types will not be differentiated.

Wire mesh slope protection will be measured by the square foot of wire mesh erected on the slope. There will be no deduction made for overlapping the wire mesh material as required for splices or for coverage due to variations in the slope or ground conditions.

8-29.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

"Wire Mesh Slope Protection Anchor", per each.

The unit Contract price per each for "Wire Mesh Slope Protection Anchor" shall be full payment for all costs for the Work described in Sections 8-29.3(1) and 8-29.3(2).

"Wire Mesh Slope Protection", per square foot.

The unit Contract price per square foot for "Wire Mesh Slope Protection" shall be full payment for all costs for the Work described in Sections 8-29.3(3) and 8-29.3(4).

8-30 Streams, Rivers, and Waterbodies**8-30.1 Description**

This Work consists of construction for streams, rivers and waterbodies of the type specified at the locations and in conformity with the lines and dimensions shown in the Plans or established by the Engineer.

8-30.1(1) Definitions

Blended Streambed Aggregates - the mix of the aggregates with the specified ratios in accordance with the Special Provisions or as shown in the Plans.

Erosion and Scour Protection - this includes the placement of a filter, rock for erosion and scour protection, or both in accordance with the Special Provisions or Plans.

8-30.2 Materials

Materials for Water Crossings shall meet the following requirements:

Filter Blanket (shall meet the gradation requirements for Permeable Ballast)	9-03.9(2)
Streambed Aggregates	9-03.11
Streambed Sediment	9-03.11(1)
Streambed Fine Sediment	9-03.11(2)
Streambed Sand	9-03.11(3)
Streambed Cobbles	9-03.11(4)
Streambed Boulders	9-03.11(5)
Quarry Spalls	9-13.1
Rock for Erosion and Scour Protection	9-13.4
Construction Geosynthetic	9-33

8-30.3 Construction Requirements**8-30.3(1) General Requirements****8-30.3(1)A Stream Preconstruction Meeting**

A stream preconstruction meeting shall be held at least 7 calendar days prior to the Contractor beginning streambed and erosion and scour protection construction. The Contractor shall notify the Engineer 14 calendar days prior to the meeting taking place and shall indicate within the notice if they intend to evaluate native streambed excavation materials for use on the project. The purpose of the meeting is to discuss the goals, objectives, intent, streambed construction procedures, erosion and scour protection construction procedures, construction sequence, woody material placement, critical functions during stream work, potential use of native streambed excavation materials, quality control steps to control mixing ratios, personnel, equipment to be used, onsite evaluation for erosion and scour protection, and other elements of construction.

Those attending shall include:

1. (Representing the Contractor) The superintendent or on-site supervisors, the Environmental Compliance Lead and other personnel or subcontractors that will have on-site responsibility for in-channel streambed Work.
2. (Representing the Contracting Agency) The Engineer, WSDOT Headquarters Hydraulics, key inspection personnel, and other key staff as appropriate will be invited by the Contracting Agency.
3. Representatives from interested permitting agencies and affected Tribes will be invited by the Contracting Agency.

8-30.3(1)B Onsite Evaluation Meetings**8-30.3(1)B1 Onsite Erosion and Scour Protection Evaluation Meeting**

The onsite erosion and scour protection evaluation meeting shall be held at least 7 calendar days prior to the Contractor placing material over the erosion and scour protection. The Contractor shall notify the Engineer 14 calendar days prior to the meeting taking place. The purpose of this meeting is to conduct an evaluation of the erosion and scour protection to ensure the work was completed in compliance with the Contract and permit requirements.

Those attending shall include:

1. (Representing the Contractor) The superintendent, on-site supervisors, the Environmental Compliance Lead, and other personnel that will have on-site responsibility for in-channel streambed Work.
2. (Representing the Contracting Agency) The Engineer, WSDOT Headquarters Hydraulics, and key inspection personnel.

WSDOT Bridge Preservation and other staff as appropriate will be notified and invited by the Contracting Agency.

8-30.3(1)B2 Onsite Streambed Evaluation Meeting

The onsite streambed evaluation meeting shall be held at least 7 calendar days prior to the Contractor reintroducing flows into the new channel or removal of the temporary stream diversion, whichever occurs first. The Contractor shall notify the Engineer 14 calendar days prior to the meeting taking place. The purpose of this prefinal inspection is to conduct an evaluation of the constructed streambed and Woody Material installation to ensure the work was completed in compliance with the Contract and permit requirements.

Those attending shall include:

1. (Representing the Contractor) The superintendent, on-site supervisors, the Environmental Compliance Lead and other personnel that will have on-site responsibility for in-channel streambed Work.
2. (Representing the Contracting Agency) The Engineer, WSDOT Headquarters Hydraulics, key inspection personnel, and other staff as appropriate will be invited by the Contracting Agency.
3. Representatives from interested permitting agencies and affected Tribes will be invited by Contracting Agency.

8-30.3(2) Erosion and Scour Protection

Erosion and scour protection when shown in the Plans, shall consist of a filter, rock for erosion and scour protection, or both.

8-30.3(2)A Stockpiling Material for Erosion and Scour Protection

Material for erosion and scour protection shall be delivered and separated into stockpiles so that each material is placed into its own stockpile.

8-30.3(2)B Excavation for Erosion and Scour Protection

Prior to placement of erosion and scour protection, the prepared surface slopes for erosion and scour protection shall be excavated to lines, grades, and elevations as shown in the Plans. No material shall be placed until the grade is approved by the Engineer.

8-30.3(2)C Placing Filter for Erosion and Scour Protection

When required in the Plans, the construction of erosion and scour protection involves placement of a filter. This filter shall be placed between the prepared surface and the material for erosion and scour protection. Whether the filter is composed of one or more layers of granular material or made of geotextile, its placement shall result in a continuous installation that maintains the contact with the prepared surface beneath. If multiple layers of different materials are required, they shall be placed using methods that will not cause mixing of the materials in the different layers. The prepared surface should be clean and free of projections, debris, construction materials, and other foreign objects that would prevent the filter from being properly placed. Voids, gaps, tears, or other holes in the filter layer shall be replaced or repaired.

The filter layer shall be placed as shown in the Plans, and according to the following sections:

Construction Geosynthetic	3-09
Quarry Spalls	8-15.3(6)
Filter Blanket	8-15.3(7)

8-30.3(2)D Placing Rock for Erosion and Scour Protection

Rock for erosion and scour protection shall be placed in such a manner to produce a well graded mix with smaller fragments filling the space between the larger rock. The layers shall be placed such that voids are minimized, and that the layers are the specified thickness. When placing rock, the method used shall not stretch, tear, puncture, or reposition the filter layer. Placement of rock shall be from the bottom working toward the top of the slope so that rolling and segregation does not occur.

8-30.3(3) Streambed Aggregates**8-30.3(3)A Blending of Streambed Aggregates**

Streambed sediment, streambed fine sediment, streambed cobbles, streambed sand, and aquitard bedding material will be separately tested and accepted by the Engineer prior to delivery, placement in a stockpile or blending activities.

After acceptance by the Engineer, streambed aggregates shall be thoroughly blended before placement. Acceptance of the final mixture of blended streambed aggregate will be based upon visual inspection by the Engineer.

Native streambed aggregates may be available from the existing streambed excavation limits as shown in the Contract Plans. Components of the excavated streambed which meet the criteria for the specific material may be used to supplement imported streambed aggregates as approved by the Engineer.

8-30.3(3)B Stockpiling Streambed Aggregates

Streambed aggregates, as described above, shall be blended into single well graded stockpiles separate from other aggregates.

8-30.3(3)C Placement of Streambed Aggregates**8-30.3(3)C1 Placing Blended Streambed Aggregates in Streambed**

Blended streambed aggregate shall be placed in the prepared channel excavation to the lines and grades shown on the Plans and in such a way as to prevent material segregation. Blended streambed aggregate shall be placed in lifts no thicker than 12 inches. Blended streambed aggregate in its final location shall be a well graded mix.

Placement of blended streambed aggregate shall be constructed to ensure that stream low flow rate of 30 gallons per minute is conveyed above each channel lift. The Contractor shall apply streambed sand and water at a rate of 30 gallons per minute to each lift to facilitate filling the interstitial voids of the blended streambed aggregate. Adjustment of the low flow rate may be required to ensure that the voids are satisfactorily filled. The voids are satisfactorily filled when the 30 gallons per minute flow rate does not go subsurface and there is no perceivable difference in the low flow rate from upstream of the project limits to the downstream of project limits. The Contractor shall apply water at the 30 gallons per minute flow rate to the stream channel for visual acceptance by the Engineer. Water shall be free from contaminants, chlorination and additives that have a risk on fish and other ecological life.

8-30.3(3)C2 Placing Blended Streambed Aggregates in Streambank

Blended streambed aggregate placed in the streambanks shall be placed in lifts no thicker than 12 inches. The Contractor shall compact each lift to be uniformly dense and unyielding as approved by the Engineer.

8-30.3(3)D Additional Streambed Grading

Changes to the streambed may be directed by the Engineer at the streambed evaluation meeting.

8-30.4 Measurement

Streambed Sediment, Streambed Fine Sediment, Streambed Sand, and Streambed Cobbles will be measured per ton prior to blending.

Streambed Boulders will be measured per each.

Rock for Erosion and Scour Protection will be measured by the ton or cubic yard of rock actually placed.

Filter blanket will be measured in accordance with Section 8-15.4.

Quarry spalls will be measured in accordance with Section 8-15.4.

Channel Excavation will be measured in accordance with Section 3-03.4.

Construction geotextile will be measured in accordance with Section 3-09.4.

8-30.5 Payment

Payment will be made for each of the following Bid items that are included in the Proposal:

“Streambed Sediment”, per ton.

“Streambed Fine Sediment”, per ton.

“Streambed Sand”, per ton.

“Streambed Cobbles __ In.”, per ton.

The unit Contract price per ton for “Streambed Sediment”, “Streambed Fine Sediment”, “Streambed Sand” and “Streambed Cobbles __ In.”, shall be full payment for all costs to perform the Work as specified including blending of streambed aggregates and watering in each lift, including supply and application of water to facilitate filling the interstitial voids.

“Streambed Boulders Type __”, per each.

The unit Contract price per each shall be full payment for all costs to perform the Work as specified including blending of streambed aggregates and watering in each lift, including supply and application of water to facilitate filling the interstitial voids.

"Additional Streambed Grading", by Force Account in accordance with 1-09.6.

For the purpose of providing a common Proposal for all Bidders, the Contract Agency has entered an amount for the item "Additional Streambed Grading" in the Bid Proposal to become a part of the total bid by the Contractor.

When native materials are approved for use, the Contracting Agency will compensate the Contractor by change order in accordance with Section 1-04.4.

"Rock for Erosion and Scour Protection Class ___", per ton, or cubic yard.

The unit Contract price per ton, or cubic yard for "Rock for Erosion and Scour Protection Class ___" shall be full payment for all costs to perform the Work.

Filter Blanket will be paid for in accordance with Section 8-15.5.

Quarry Spalls will be paid for in accordance with Section 8-15.3(6).

Channel Excavation will be paid for in accordance with Section 3-03.5.

Construction Geotextile for Separation will be paid for in accordance with Section 3-09.5.

8-31 Temporary Stream Diversion**8-31.1 Description**

This work shall include planning, designing, installing, operating, maintaining, removing, and disposing of the temporary stream diversion, environmental compliance and other Work as detailed in these Specifications.

8-31.2 Materials

All materials shall be as detailed in the Contractor's temporary stream diversion (TSD) Plan.

8-31.3 Construction Requirements**8-31.3(1) General****8-31.3(1)A General TSD Requirements**

The Work shall include compliance with Washington State Water Quality Standards in WAC 173-201A, project permits, environmental commitments, and these Provisions.

The temporary stream diversion may be either a gravity or a pumped system. Pump screens must comply with the requirements in Section 8-31.3(4). Once a pumped diversion begins, the pump must run continuously until it is no longer necessary to bypass flows. At all times of operation, the Contractor's temporary stream diversion(s) shall not restrict flows to less than the minimum flow rate(s) specified in the contract documents. The Contractor shall have back-up pumps on site and shall provide twenty-four-hour monitoring of the pumping operation. Monitoring can be achieved by providing monitoring personnel on site or by agreement with regulatory agencies through remote sensing and instrumentation to verify operation of the bypass. If the Contractor elects to monitor by remote sensing and instrumentation, a Type 2 Working Drawing shall be submitted outlining how system operation will be monitored, how alerts will be made and how personnel will respond to a diversion system failure.

The temporary stream diversion, including water that is retained by the temporary stream diversion and the dewatering system, shall be located within the permitted impact areas as shown in the Plans. The upstream diversion dam shall be constructed to a height sufficient to prevent stream flow from entering the work area. Scour protection shall be provided at the outfall of the temporary stream diversion systems and dewatering system to prevent flow re-entering the stream channel from mobilizing streambed and embankment sediments. When a temporary stream diversion is located in or near an intertidal zone the temporary stream diversion design shall take tidal influence into consideration.

When required by the Contract, the Contractor shall have a contingency plan for each temporary stream diversion to be used in the event of a storm producing streamflow in excess of the design flow requirement, equipment failure, vandalism, or other incident. A complete set of equipment and materials for the contingency system shall be available for each temporary stream diversion. The Contractor shall immediately implement the contingency system when required or specified by the Engineer. The contingency system shall be designed to be fully operational within 2 hours.

8-31.3(1)B TSD Plan Implementation Meeting

For each temporary stream diversion, the Contractor shall arrange a TSD Plan Implementation Meeting with the Engineer prior to implementation of the TSD Plan. At this meeting, the Contractor shall explain to the Engineer the Work to be completed for the temporary stream diversion. The meeting shall be held a minimum of 7 calendar days prior to start of the fish block net installation associated with the temporary stream diversion Work. The Contractor shall notify the Engineer 14 calendar days prior to the meeting taking place.

Those attending shall include:

1. Representing the Contractor: The superintendent, on site supervisor, foreman, the Environmental Compliance Lead and other personnel that will have on-site responsibility for implementing the Temporary Stream Diversion.
2. Representing the Contracting Agency: The Engineer, WSDOT Headquarters Hydraulics, key inspection personnel, and other appropriate WSDOT staff.
3. Representatives from interested permitting agencies and affected Tribes will be invited by the Contracting Agency. The Project Engineer will arrange for these interested parties to attend the TSD Plan Implementation Meeting.

The TSD shall be operational prior to performing Work below the ordinary high-water line as required to achieve permit compliance.

8-31.3(2) Temporary Stream Diversion Plan

8-31.3(2)A General Plan Requirements

The Contractor shall submit a temporary stream diversion plan in accordance with the requirements of a Type 2E Working Drawing and these Specifications. A separate TSD Plan shall be prepared and submitted for each temporary stream diversion.

The Contractor shall fully implement the TSD Plan throughout the duration of the associated Work. The Contractor shall update the TSD Plan throughout project construction to reflect actual site conditions and the Contractor's Work. Changes to plan shall comply with WAC 196-23-020. At the request of the Engineer, an updated TSD Plan shall be submitted as a Type 2E Working Drawing. A copy of the TSD Plan shall be on the project site at all times.

The TSD Plan shall describe measures that will be taken to comply with Washington State Water Quality Standards in WAC 173-201A, applicable permits, environmental commitments, and the Specifications and Contract Provisions.

The Contractor shall incorporate Section 8-31.3(2)B, item number 2 into their Progress Schedule.

8-31.3(2)B Plan Requirements

At a minimum, the TSD Plan shall provide the following information in the following order:

1. Description and Location of the temporary stream diversion
 - a. Identify the name of the water body where the temporary stream diversion will be placed. Provide a description of the temporary stream diversion.
 - b. Provide drawings showing each of the locations of the temporary stream diversion components, including proposed access routes and equipment to be used to construct the diversion.
2. Schedule and Sequence
 - a. Provide a schedule showing the following activities that illustrate how the Work will be completed within the in-water work window in the Special Provisions:
 - i. TSD Plan Implementation Meeting.
 - ii. Fish Block Net Installation and Fish exclusion (performed by the Contracting Agency).
 - iii. TSD installation.
 - iv. Dewatering of the isolated work area.
 - v. Restoration and stabilization of the temporary stream diversion work area to prevent erosion.

- vi. Relocations of the temporary stream diversion to accommodate the work sequence (if needed).
 - vii. Channel rewatering.
 - viii. Removal of the TSD.
 - ix. Fish block net removal (performed by Contracting Agency).
 - b. Include other Work that needs to be coordinated with the TSD (e.g., temporary erosion control).
3. Calculations and Materials
- a. Detail all elements of the temporary stream diversion; including but not limited to pipes, pumps, screen intake elements, and other equipment and materials.
 - b. Calculations shall demonstrate the diversion system conveys the minimum peak flow specified by the Contracting Agency and include tidal influence where applicable.
 - c. Temporary stream diversion shall include a water conveyance system to be used for dewatering and rewatering that is capable of conveying the flow required for the temporary stream diversion.
 - d. Methods for anchoring temporary stream diversion pipe and associated hardware; include calculations to demonstrate the device's ability to anchor the pipe and associated hardware.
 - e. Specifications for all materials and equipment to be used as part of the diversion including pump or diversion capacities and hose sizes. For example, provide the type, profile, and size of pipe.
 - f. Provide the size of fish screens (mesh size and surface area) to be used, in accordance with Section 8-31.3(4).
 - g. Detail where bags will be used for temporary stream diversion. Bags shall comply with the requirements of the HPA and be filled using clean pea gravel. Clean pea gravel is pea gravel that does not cause an exceedance of the allowable turbidity in the stream or waterbody.
4. Stream Flow Blocking and Dewatering
- a. Provide the method(s), including locations and details (narrative and drawings) for blocking both the upstream and downstream ends of the diversion. Describe how minor leakage from upstream and downstream will be addressed.
 - b. Include provisions for scour protection at the temporary stream diversion outfalls.
 - c. Identify the means and methods for dewatering and disposal of the water.
5. Contingency Plan (when required)
- a. The Contractor shall include the details of the system in the TSD Plan sections that are applicable.
 - b. Describe the Work that will be implemented to prevent the work area from becoming inundated.
 - c. Provide the type and size of materials that will be used in the event of the work area becoming inundated, including fish exclusion coordination with Contracting Agency if the block nets are compromised.
 - d. Describe how the contingency equipment and materials will be stored, inspected and maintained so they are ready for use if required.
 - e. Describe how the contingency system will be deployed and operational within 2 hours.

6. Inspection and Maintenance
 - a. Provide the schedule and frequency for inspection of the temporary stream diversion including the emergency contact information for the individuals inspecting and/or repairing, include weekends and holidays.
 - b. Describe how maintenance and Contracting Agency notification will be conducted when inspections identify deficiencies in the temporary stream diversion. These include but are not limited to removal and disposal of trapped sediment or debris and repairing leaks.
 - c. The Contractor shall keep a record of all inspections and maintenance of the temporary stream diversion and shall provide the records to the Engineer when requested.
 - d. The Contractor shall notify the Engineer within 12 hours of an emergency repair.
7. Rewatering the Stream Channel
 - a. Detail how the stream channel will be rewatered to comply with water quality requirements.
 - b. Identify measures that will prevent the stranding of fish during rewatering (i.e. describe methods, rates, and durations of the rewatering process knowing that flows downstream of the fish block must be maintained to protect fish).
8. Removal of the temporary stream diversion
 - a. Describe the sequence that will be used for removing the temporary stream diversion and methods to prevent exceeding allowable water quality standards.
 - b. Describe how disturbed soil will be permanently stabilized.
 - c. Describe temporary pipes, if, to remain (requires approval of the Engineer): their type, pipe class, size, location, and plugging procedure.
9. Other Work required for the Contractor's temporary stream diversion

8-31.3(3) Fish Block Net Installation and Fish and Aquatic Species Exclusion

The Contractor shall notify the Engineer in writing a minimum of 14 calendar days before fish block net installation and fish and aquatic species exclusion is scheduled and before performing in water work.

The Contractor shall allow the Contracting Agency 7 calendar days for the following:

1. To install fish block nets upstream and downstream of the in-water work area; and
2. Safely capture and relocate all fish and other aquatic organisms that become trapped between the block nets. No Work within the limits of the Ordinary High-Water Line will be allowed prior to installation of fish block nets and completion of fish exclusion activities.

8-31.3(3)A Fish Exclusion Assistance

As directed by the Engineer, the Contractor shall assist the Contracting Agency with fish and aquatic species exclusion.

8-31.3(3)B Contracting Agency Provided Materials

The Contracting Agency will provide and install the fish exclusion materials as listed in the Special Provisions or Plans.

8-31.3(4) Dewatering Work Areas

Dewatering the isolated in-water work area (between the upstream and downstream diversion dams) shall occur at a rate slow enough to allow the Contracting Agency to safely capture and relocate all fish species and other aquatic organisms to avoid stranding, as determined by the Engineer.

All pumps used for dewatering shall have an intake covered with a fish screen, operated, and maintained in accordance with RCW 77.57.010 and RCW 77.57.070. Appropriate fish screens are as follows:

1. Perforated plate: 0.094 inch (maximum opening diameter);
2. Profile bar: 0.069 inch (maximum width opening); or
3. Woven wire: 0.094 inch (maximum opening measured on the diagonal).

The minimum open area for all types of fish screens is 27 percent. The screened intake facility must have enough surface area to ensure that the velocity through the screen complies with the velocity provided within the Hydraulic Project Approval (HPA). If no velocity is provided within the HPA, the maximum approach velocity shall not exceed 0.33 feet per second. The fish screen must remain in place whenever water is withdrawn until the Contracting Agency Biologists confirm all fish have been removed. At that point, the Contractor may remove the fish screen to finish dewatering the work area.

8-31.3(5) Inspection and Maintenance

At a minimum, the Contractor shall perform the following activities once per day (including weekends and holidays):

1. Check for and correct leaks;
2. Ensure the fish block nets remain sealed to the channel substrate; and
3. Check inlet for proper function.

The fish block nets shall be kept clear of debris that could jeopardize the integrity of the nets. The Contractor shall perform the following activities a minimum of three times per day or when requested by the Engineer. On working days, these activities shall be performed at the start, middle, and at the end of the working day. On non-working days, these activities shall be performed between 6:00 am and 8:00 am, between 11:00 am and 1:00 pm, and between 4:00 pm and 6:00 pm:

1. Inspect the upstream and downstream fish block nets and remove debris;
2. Inspect the upstream fish block net and all screens and similar facilities for impinged fish; and
 - a. The Contractor shall immediately notify the Contracting Agency when impinged fish are discovered.
 - b. Removal of impinged fish will be performed by the Contracting Agency.

The Contractor shall maintain a written record of all inspection and maintenance activities; record to be available at the request of the Engineer. The Contractor shall assist the Contracting Agency with block net maintenance, as specified.

8-31.3(6) Channel Rewatering and Removal of TSD Components (Except Nets)

The Contractor shall notify the Engineer a minimum of 7 calendar days in advance of rewatering the stream channel. This notification shall include a schedule of activities from the start of rewatering the channel to the final removal of all stream diversion components.

The Contractor shall introduce water to the new stream channel section and trap sediments until the stream section meets the requirements of these Provisions. Rewatering shall occur at a rate to avoid loss of surface water downstream while the new channel section is rewatered.

Once the water in the new stream channel meets the applicable turbidity standards the Contractor may begin removal of the temporary stream diversion and the stream channel opened to flows.

The Contractor shall immediately take all corrective actions necessary to prevent the water from exceeding the turbidity standards should the stream turbidity increase. All Work within the channel, except for removal of the temporary erosion control items, shall be completed before the temporary stream diversion is removed. The Contractor must finish all construction activities within the limits of the Ordinary High-Water Line, including but not limited to culvert installation and creek bed channel restoration, before the Contracting Agency will remove the fish block nets.

8-31.3(7) Removal of Fish Block Nets

The Contractor shall allow 7 calendar days for Contracting Agency removal of the fish block nets.

8-31.3(7)A Contractor Provided Labor

The Contracting Agency will remove the fish block nets.

8-31.3(7)B Contracting Agency-Provided Materials

All materials used for the diversion shall become the property of the Contractor and removed from the project limits, except for the materials supplied by the Contracting Agency.

8-31.4 Vacant

8-31.5 Payment

Payment will be made for the following Bid item when it is included in the Proposal:

"Temporary Stream Diversion____", lump sum.

The lump sum Contract price for "Temporary Stream Diversion____" shall be full payment to perform the Work as specified. Progress payments for the lump sum item "Temporary Stream Diversion" will be made as follows:

1. Twenty-five percent of the bid amount will be paid following completion of the TSD Plan including resolution of all Contracting Agency review comments.
2. The remaining seventy-five percent of the bid amount shall be paid in accordance with Section 1-09.9.

"Fish Exclusion Assistance", by force account as provided in Section 1-09.6.

To provide a common Proposal for all Bidders, the Contracting Agency has entered an amount in the Proposal to become a part of the Contractor's total Bid.

"Fish Block Net Maintenance", by force account as provided in Section 1-09.6 shall be full payment for removal of debris from the fish block nets or other assistance required by the Engineer. When the block nets are staffed and the person staffing the nets are in standby mode, no payment will be made. Time spent actively removing debris or making adjustment to the blocks nets are eligible for payment under this item, all other costs associated with the maintenance of the temporary stream diversion system is included in the lump sum item "Temporary Stream Diversion." Fish block nets damaged due to the Contractor's operation shall be repaired or replaced by the Contractor at no expense to the Contracting Agency.

To provide a common Proposal for all Bidders, the Contracting Agency has entered an amount in the Proposal to become a part of the Contractor's total Bid.

8-32 Vacant