SECTION 600 – INCIDENTAL CONSTRUCTION

SECTION 601 – GUARDRAIL

601.01 Description. This work shall consist of the fabrication, assembly, and installation of guardrail, guardrail transitions, and guardrail end treatments, in accordance with these requirements, and as shown on the plans. This work may also consist of the extension of existing guardrail with new guardrail, the removal of existing guardrail, or adjusting the height of existing guardrail.

MATERIALS

601.02 Materials. Materials shall be in accordance with the following:

Rail Accessories, Fittings, and Hardware 910.11
Steel Guardrail Posts 910.10
Steel Thrie-Beam Rail 910.09
Steel W-Beam Rail 910.09
Timber Posts and Blocks.....911.02(f)

PCC in anchors and in pads or bases for impact attenuators shall be class A and in accordance with 702. Sheet signs and sign posts shall be in accordance with 802.

Barrels used in impact attenuators shall be yellow with black lids. The aggregate used in the barrels shall be uncrushed gravel, class F or higher, in accordance with 904 and the following gradation requirements.

Sieve Size	% Passing
12.5 mm (1/2 in.)	100
300 μm (No. 50)	0 - 5
150 μm (No. 100)	0 - 2

All other impact attenuators shall have end reflectorization as shown on the plans or attached to the nose of the attenuator in accordance with the attenuator manufacturer's recommendation.

Thrie beam guardrail elements shall be steel and shall be in accordance with the applicable requirements for steel beam guardrail shown in 910.09, 910.10, 910.11, and 910.12.

The components, assembly, post spacing, post lengths, and installation for each location shall be as shown on the plans. Double-facing of the guardrail will be required at the locations shown on the plans. In locations where conditions will not allow the use of 2130 mm (7 ft) posts, 1830 mm (6 ft) posts may be substituted when approved.

The base metal thickness of the steel W-beam rail element for a curved guardrail system shall be 3 mm (0.105 in.). The base metal thickness of the steel W-beam terminal connector shall be 3.5 mm (0.138 in.). The wood breakaway posts shall be S4S timber and shall otherwise be in accordance with 911. The curved rail timber posts

shall be in accordance with 911. All structural tubing shall be in accordance with ASTM A 500. The remaining steel components shall be in accordance with 910.

CONSTRUCTION REQUIREMENTS

601.03 General Requirements. Posts shall be installed plumb at the spacing and embedment depth shown on the plans. Posts shall be driven where subsurface conditions permit the use of normal driving equipment. Where subsurface conditions prohibit driving the posts, a 300 mm (12 in.) diameter hole shall be bored to the required embedment depth. The hole shall be backfilled with suitable material in 150 mm (6 in.) maximum lifts, compacted as directed, and then the post driven.

Posts damaged during installation shall be repaired or replaced as directed with no additional payment.

When new guardrail is being installed to replace existing guardrail and traffic is to be maintained during the work, the installation of the new guardrail shall follow the removal of the existing guardrail as closely as practical. Adequate safety protection shall be provided as directed between the time that the existing guardrail is removed and the time that the installation of the new guardrail is completed.

When new guardrail is being installed where there is no existing guardrail and traffic is to be maintained during the work, the mounting of the blocks and the rail elements to the posts shall be completed as soon as practical after the posts are installed. The time between the installation of the posts and the mounting of the blocks and rail elements shall not exceed 24 h. Drums shall be placed to mark all installed guardrail posts left bare overnight. The spacing of these devices shall be numerically equal to the worksite speed limit, but not less than 6 m (20 ft).

All damaged galvanized surfaces shall be coated in accordance with 910.11(a)4.

The nested W-beam guardrail element shall consist of two rail elements, one set inside the other. The length of nested guardrail placed over a culvert shall not be spliced.

601.04 Guardrail Erection. Blocks and rail elements shall be erected in a manner resulting in a smooth, continuous installation. All bolts shall be of sufficient length to extend beyond the nuts and shall be drawn tight. Rail installed along a radius of 46 m (150 ft) or less shall be shop curved. Rail elements shall be lapped as shown on the plans.

601.05 Curved W-Beam Guardrail Systems. This work shall consist of the fabrication, assembly, and installation of specified types of curved W-beam guardrail connector system or curved W-beam guardrail terminal system in accordance with the requirements herein and as shown on the plans.

The installation of the terminal end buffer may utilize an alternate single piece having similar dimensional shape to the terminal end buffer as shown on the plans, and which mates with the W-beam guardrail.

Where the W-beam terminal connector is lapped on the outside of the guardrail, a galvanized 25 mm (1 in.) inside diameter, 51 mm (2 in.) outside diameter, 3.4 mm (0.134 in.) thick, narrow plain washer shall be placed under the splice bolt heads.

Nuts for the anchor cable assembly shall be hand tightened, plus one complete turn at the anchor plate end. All other nuts shall be torqued to 67.8 Nm (50 ft lb).

The installation of the type 5 anchor shall include tightening the cable with the swaged end to eliminate all slack.

The W-beam rail in the type 5 anchor shall be attached to the steel pipe with M16 (5.8 in.) diameter x 32 mm (1 1/4 in.) button head bolt with no washer. Connection to the post will not be required.

601.06 Guardrail Transitions. Guardrail transitions shall be required to connect guardrail to bridge rail, guardrail to piers, and new W-Beam guardrail to existing rub rail type guardrail. The required type of guardrail transition shall be as shown on the plans. The fabrication, assembly, and installation of thrie-beam components and timber posts and blocks for guardrail transitions will be required for the locations shown on the plans.

601.07 Guardrail End Treatments. Guardrail end treatments shall be required to terminate guardrail installations at the locations shown on the plans. The type I guardrail end treatment shall be either as shown on the plans, or shall be selected from the Department's list of approved Guardrail End Treatments. The type II guardrail end treatment shall be as shown on the plans. The type OS or MS guardrail end treatment shall be selected from the Department's list of approved Guardrail End Treatments. The reflectorization of guardrail end treatments, and the grading requirements shall be as shown on the plans.

Double facing of guardrail end treatment type I will be required when it is used in conjunction with double faced guardrail.

Each unit shall be installed in accordance with the manufacturer's recommendations.

Assembly and installation shall be supervised or performed at all times by an installer trained and certified by the unit's manufacturer, and shall be in accordance with the manufacturer's recommendations at the locations shown on the plans. A copy of the installer's certificate shall be provided to the Engineer prior to the start of the work.

The Contractor shall provide the Department with original copies of all necessary current manufacturer's installation manuals and shop drawings prior to beginning installation work. Shop drawings shall be a minimum of 550 by 850 mm (22 by 34 in.) in size. No installation work shall begin prior to the Department's receipt of such manuals and drawings. Such manuals and drawings will remain the property of the

Department. If there is a discrepancy between shop drawings and the plans, the shop drawings shall govern.

When installing end treatments to existing rub rail type guardrail, the rub rail, if not spliced at the last existing post, shall be cut and the end repositioned behind the flange of the post. If the rub rail is spliced at the last existing post, the existing splice material shall be removed and the end of the rub rail repositioned behind the flange of the post. In both cases, the rub rail shall be connected to the post as shown on the plans.

Guardrail end treatments shall be installed within 24 h of the completion of the guardrail installation to which they are to be attached. Drums in accordance with 801.09 shall be placed for overnight marking of the bare end of the guardrail when the installation of the guardrail end treatment will not be completed until the day following the completion of the guardrail installation to which it is to be attached.

601.07.1 Impact Attenuators. Impact attenuators shall be placed or reset to obtain the proper height where shown on the plans. The unit for each new location shall be of the width recommended by the manufacturer and for the test level specified and shall be chosen from those shown on the Department's list of approved Impact Attenuators. Each unit shall be placed in accordance with the manufacturer's recommendations, on a PCC pad.

Assembly and installation or resetting shall be supervised or performed at all times by an installer trained and certified by the unit's manufacturer, and shall be in accordance with the manufacturer's recommendations at the locations shown on the plans. A copy of the installer's certificate shall be provided to the Engineer prior to the start of work.

The Contractor shall provide the Department with original copies of all necessary current manufacturer's installation manuals and shop drawings prior to beginning installation work. Shop drawings shall be a minimum of 550 by 850 mm (22 by 34 in.) in size. No installation work shall begin prior to the Department's receipt of such manuals and drawings. Such manuals and drawings will remain the property of the Department. If there is a discrepancy between shop drawings and the plans, the shop drawings shall govern.

Transition panels and all other necessary hardware shown in the manufacturer's recommendations to be required for bi-directional traffic protection shall be included in the installation or resetting, if the unit is installed at a location where traffic is passing the unit on both sides in opposite directions.

If a spare parts package is required for the unit being installed, such package shall consist of those parts which are shown on the list provided by the manufacturer. The spare parts shall correspond to those shown on the list for the unit to be placed. The package shall be delivered to the location directed and will become the property of the Department.

Impact attenuators may be placed on the Department's approved list based on the manufacturer's documentation subject to the Department's acceptance. The manufacturer shall provide a copy of the test report stating that its product fully complies with the requirements of NCHRP 350 crash test level 3, and that its product has been approved by the FHWA. Products will be maintained on the Department's approved list by a manufacturer's certification submitted annually in October and the Department's continued acceptance. This certification shall state that the product has not been changed since the NCHRP 350 crash testing, that the NCHRP 350 test results still apply to this product, and that the FHWA approval is still applicable.

601.08 Extension of Existing Guardrail. Extension of existing rub rail type guardrail with new W-beam guardrail shall require adjusting the post heights in the last 8 m (25 ft) of existing rub rail type guardrail adjacent to the extension as shown on the plans. Guardrail transition type VH shall be used to make this adjustment. The post spacing of the guardrail transition type VH shall equal that of the last 8 m (25 ft) of existing rub rail type guardrail adjacent to the extension. The rub rail shall be terminated at the last existing post in the transition in accordance with 601.06.

601.09 Removal of Existing Guardrail. Removal of existing guardrail shall be in accordance with the applicable requirements of 202 and these requirements. The locations shall be as shown on the plans. When it is specified that the removed guardrail is to become the property of the Department, the rail elements, posts, and blocks shall be removed without being damaged. The removed material shall be stored as directed.

601.10 Adjusting Existing Guardrail Height. The height of the existing guardrail shall be adjusted by the use of moveable blocks as shown on the plans. The height shall be measured to the top of the rail element along the face of the rail. Existing fixed blocks shall be replaced with moveable blocks installed at the proper height. Existing moveable blocks shall be disconnected from the posts and re-mounted at the proper height.

601.11 Resetting Guardrail. This work shall consist of the removal of existing guardrail and, if necessary, storing it, and then re-erecting it where shown on the plans or as directed.

601.12 Method of Measurement. Guardrail, guardrail with rub rail, shop curved guardrail, adjusting guardrail height, guardrail removal, and resetting guardrail will be measured by the meter (linear foot) along the top of the rail element, complete in place. Nested guardrail will be measured per each 30.48 m (100 lft) run placed. Modified posts for nested guardrail will be measured per each, complete in place. Guardrail transitions, W-beam guardrail cable terminal anchors, and guardrail end treatments will be measured per each, complete in place. Guardrail buried end treatments type II will be measured per each. Impact attenuators, reset impact attenuators, and impact attenuator spare parts packages will be measured per each for the type and width and test level, complete in place. The curved W-beam guardrail connector system and the curved W-beam guardrail terminal system will be measured per each for the type specified. Grading at guardrail end treatments, the reflectorization of guardrail end treatments,

and concrete used in anchoring guardrail end treatments will not be measured for payment.

601.13 Basis of Payment. W-beam guardrail will be paid for at the contract unit price per meter (linear foot) for the specified post spacing. Thrie-beam and thrie-beam double faced guardrail will be paid for at the contract unit price per meter (linear foot) for guardrail, thrie-beam and guardrail, thrie-beam, double faced, complete in place. Nested guardrail will be paid for at the contract price per each 30.48 m (100 lft) run, complete in place for guardrail, W-beam, nested. W-beam guardrail cable terminal anchor will be paid for at the contract price per each, complete in place. Modified posts for nested guardrail will be paid for at the contract unit price per each for modified posts, nested guardrail. W-beam guardrail with rub rail will be paid for at the contract unit price per meter (linear foot) for guardrail, WR-beam complete in place. Shop curved guardrail, adjusting guardrail height, guardrail removal, and resetting guardrail will be paid for at the contract unit price per meter (linear foot). Guardrail transitions and guardrail end treatments will be paid for at the contract unit price per each for the type specified. Guardrail buried end treatments type II will be paid for at the contract unit price per each, complete in place. Impact attenuators, reset impact attenuators, and impact attenuator spare parts packages will be paid for at the contract unit price per each for the type and width, and test level specified. The curved W-beam guardrail connector system and curved W-beam guardrail terminal system will be paid for at the contract unit price per each for the type specified, complete in place.

Where existing guardrail height is adjusted, such work will be paid for at the contract unit price per meter (linear foot). The costs of removal, all necessary storage, new adjustable post brackets, attachment of rail section, and miscellaneous nuts and bolts as required shall be included in the cost of adjust guardrail height.

Payment will be made under:

Metric Pay Item (English Pay Item Pay Item	**Metric Pay Unit Symbol English Pay Unit Symbol) Metric Pay Unit Symbol (English Pay Unit Symbol)**
Guardrail, Adjust Height	m (LFT)
Guardrail Connector System, W-Beam, Curved, _____ type	EACH
Guardrail End Treatment, _____ type	EACH
Guardrail, Remove	m (LFT)
Guardrail, Reset	m (LFT)
Guardrail, Terminal System, W-Beam Curved, _____ type	EACH
Guardrail Transition, _____ type	EACH
Guardrail Transition, VH, _____ m Spacing	EACH
(Guardrail Transition, VH, ___ ft.-___ in. Spacing	EACH)
Guardrail, Thrie-Beam	m (LFT)
Guardrail, Thrie-Beam, Double Faced	m (LFT)

Guardrail, Transition, _____ (type) ..... EACH

Guardrail, W-Beam, _____ m Spacing ..... m
(Guardrail, W-Beam, ___ ft.-___ in. Spacing ..... LFT)
Guardrail, W-Beam, Cable Terminal Anchor ..... EACH
Guardrail, W-Beam, Double Faced, _____ m Spacing ..... m
(Guardrail, W-Beam, Double Faced, ___ ft.-___ in. Spacing ..... LFT)
Guardrail, W-Beam, Nested ..... EACH
Guardrail, W-Beam, Shop Curved, _____ m Spacing ..... m
(Guardrail, W-Beam, Shop Curved, ____ ft.-____ in. spacing ..... LFT)
Guardrail, WR-Beam ..... m (LFT)
Impact Attenuator, _____ (type-width), _____ (test level) ..... EACH
Impact Attenuator, Reset, _____ (type-width), _____ (test level) ..... EACH
Impact Attenuator Spare Parts Package, _____ (type-width),
_____ (test level) ..... EACH
Modified Posts, Nested Guardrail ..... EACH

The substitution of 1830 mm (6 ft) posts for 2130 mm (7 ft) posts where conditions will not allow the use of the longer post will be at the same contract unit price of the longer post.

The costs of resetting guardrail shall include the removal, necessary storage, resetting and replacement of damaged or missing parts and new posts as required.

The cost of reflectorization of impact attenuators and guardrail end treatments shall be included in the respective pay items.

The cost of all grading required for the guardrail buried end treatment shall be included in the cost of guardrail end treatment, type II.

The costs of earthwork, grading, and transition panel if required, and PCC pad shall be included in the cost of impact attenuator.

The cost of excavation, concrete footings, reinforcement, and structural steel tubing required for modified posts, nested guardrail, shall be included in the cost of the pay item.

The cost of all materials, including replacing damaged or missing parts, labor, and necessary incidentals required to reset impact attenuators, will be included in the cost of impact attenuator, reset.

Where guardrail transition type TGB is used with bridge railing type TR, the costs of eliminating the thrie-beam terminal connector and driving the posts to the height above ground shown on the plans shall be included in the cost of the guardrail transition.

SECTION 602 – CONCRETE BARRIER

602.01 Description. This work shall consist of the construction of concrete barriers and concrete glare screens in accordance with these specifications and as shown on the plans. This work also includes furnishing, placing, maintaining and removing temporary concrete barrier.

MATERIALS

602.02 Materials. Materials shall be in accordance with the following:

Barrier Delineators	913.08(c)
Bridge Deck Overlay Materials	722.04, 723.04
Cast-in-Place Barriers	702
Cast-in-Place Concrete Glare Screen	702
Construction Warning Lights	913.12
Penetrating Sealer	709, 909.09
Precast Barriers	707
Precast Concrete Glare Screen	707
Reinforcing Steel	910.01

CONSTRUCTION REQUIREMENTS

602.03 Concrete Barrier and Concrete Glare Screen. Concrete barrier and concrete glare screen may be precast or cast-in-place. The option selected shall be used continuously throughout the project. Irregular sections shall be cast-in-place regardless of the option selected.

Concrete glare screen may only be precast when constructed in combination with new precast barrier. Concrete glare screen shall be cast-in-place when constructed in combination with cast-in-place barrier, and also when constructed on top of existing concrete barrier.

Excavation and compaction shall be in accordance with 605.03(a). Backfilling shall be in accordance with applicable requirements of 605.03(d).

(a) Precast Concrete Barrier and Concrete Glare Screen. Precast concrete barrier and concrete glare screen shall be constructed in accordance with applicable requirements of 707, except the minimum 28 day compressive strength shall be 20.7 MPa (3000 psi). The precast units shall not be shipped or used until this strength is attained. The surfaces of individual precast units shall vary no more than 6 mm (0.25 in.) in 3 m (10 ft) from the specified cross section, as measured from a longitudinal straightedge. The maximum variation in the vertical and horizontal alignment of adjacent units shall be 6 mm (0.25 in.) across the joint, as measured from a 3 m (10 ft) longitudinal straightedge. Approved bedding may be used to obtain proper alignment of the concrete barrier sections.

(b) Cast-in-Place Concrete Barrier and Concrete Glare Screen. Cast-in-place concrete barrier and concrete glare screen shall be constructed in accordance with applicable requirements of 706.03 or by the use of an approved slip-form machine. The surfaces of the concrete shall vary no more than 6 mm (0.25 in.) in 3 m (10 ft) from the specified cross section, as measured from a longitudinal straightedge. Where concrete pavement or concrete shoulder abuts the concrete barrier, a double application of curing compound shall be placed between the barrier and the pavement or shoulder.

Where the concrete barrier is to be placed on PCCP, dowel bars shall be placed as shown on the plans. The dowel bars shall be installed in the PCCP by drilling and grouting.

The barrier wall shall be constructed in single pours without subsequent vertical extensions.

(c) Finishing. Concrete barrier and concrete glare screen shall be finished in accordance with 702.21. If slip-form construction is used, an approved brush finish will be permitted. Curing material in accordance with 912.01(e) shall be applied as a bond breaker to all areas which result in concrete to concrete contact. It shall be applied at a minimum rate of 1 L/1.8 m^2 (1 gal./75 sq ft). If material is applied at a rate less than the minimum rate, a second application shall be applied.

(d) Sealing. Regardless of the method of construction, all exposed surfaces of the concrete barrier and concrete glare screen shall be sealed in accordance with the applicable requirements of 709.

(e) Joints. The type, size and location of joints and preformed joint filler shall be as shown on the plans.

(f) Reflectorization. All concrete barrier shall be reflectorized with barrier delineators spaced a minimum of 12 m (40 ft) apart and centered 600 mm (2 ft) above the surface of adjacent pavement or shoulder. The reflectorization shall be on both sides of the wall if traffic is on both sides. All delineators damaged during installation or placement of the concrete barrier shall be replaced with no additional payment. The color of the reflectors shall match the color of the adjacent pavement traffic markings.

602.04 Blank.

602.05 Method of Measurement. Concrete barrier will be measured by the meter (linear foot) along the centerline of the barrier, including irregular barrier sections around median obstructions such as bridge piers. Barrier delineators will be measured per each provided there is a pay item shown in the Schedule of Pay Items. Concrete glare screen will be measured by the meter (linear foot) along the centerline of the glare screen.

602.06 Basis of Payment. Concrete barrier will be paid for at the contract unit price per meter (linear foot), complete in place. Barrier delineators used on concrete barrier will be paid for at the contract unit price per each, complete in place.

Concrete glare screen will be paid for at the contract unit price per meter (linear foot), complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
Barrier Delineator	EACH
Concrete Barrier	m (LFT)
Concrete Barrier Glare Screen	m (LFT)

The costs of surface seal or curing-sealing material for concrete barrier and curing material shall be included in the cost of concrete barrier.

SECTION 603 – FENCES

603.01 Description. This work shall consist of the construction of fence and gates in accordance with 105.03.

MATERIALS

603.02 Materials. Materials shall be in accordance with the following:

Barbed Wire	910.18(b)4
Chain Link Fabric	910.18(b)
Concrete, Class B	702
Concrete, Packaged Dry	913.17
Farm Field/Woven Wire	910.18(a)
Fence Posts	910.13
Gates	910.18(d)
Tension Wire	910.18(b)1

CONSTRUCTION REQUIREMENTS

603.03 General Requirements. Clearing and grubbing shall be in accordance with 201.03.

At locations where breaks in a run of fencing are required, or at intersections with existing fences, appropriate adjustment in post spacing shall be made in accordance with the requirements for the type of closure indicated.

When the plans require that posts, braces, or anchors be imbedded in concrete, temporary guys or braces shall be installed, if required to hold the posts in proper position. Unless otherwise permitted, no materials shall be installed on posts or strain placed on guys and bracing set in concrete until 96 hours have elapsed from the time of placing of the concrete.

The tops of all posts shall be set to the required grade and alignment. Cutting of the posts will only be allowed with the approval of the Engineer. Post caps shall be installed at the time the fence fabric is placed on the posts.

Wire or fencing of the size and type required shall be firmly attached to the posts and braces in the manner indicated. All wires shall be stretched taut and installed to the required elevations.

At each location where an electric transmission, distribution, or secondary line crosses any of the types of fences covered by these specifications, a ground, conforming to applicable requirements of the National Electric Safety Code, shall be furnished and installed.

603.04 Setting Posts. Posts, including the concrete foundation for posts, braces and anchors shall be set so that the entire fence is inside the right-of-way and the fence can be placed on the side of the post facing the roadway. If an object, such as a tree, is located on the right-of-way and is to remain in place, the fence may be adjusted to miss the obstruction. There shall be a gradual offset for at least three posts in each direction of the obstruction.

Line posts for farm field type fence shall be set on 5 m (16 ft) centers, and for chain link fence on 3 m (10 ft) centers. In either case, a tolerance of $\pm$ 0.6 m (2 ft) in spacing will be allowed at special locations as approved. Spacing of these posts shall be as uniform as practicable under the existing conditions. However, additional posts shall be set to maintain the bottom clearance dimensions as required.

Pull posts shall be set at 150 m (500 ft) maximum intervals in straight runs and at each vertical angle point of 10 degrees or more.

Corner posts shall be set at each horizontal angle point of 10 degrees or more.

End, corner, and pull posts for both types of fence, line posts for chain link fence and diagonal braces for farm field fence shall be set in concrete as shown on the plans.

Except where rock is encountered, intermediate or line posts shall be driven and furnished with an approved anchor plate or other satisfactory device to hold the post in proper alignment and plumb. The plate or anchor shall be welded or riveted to the post with no less than two rivets.

Gate posts shall be set in concrete as shown on the plans.

Extra length posts shall be required at stream crossings as shown on the plans or as directed and also at ground depressions where it is not practicable for the fencing to follow closely the contour of the ground. These posts shall be set in concrete as shown on the plans.

At small stream crossings and ground depressions, the space below the fence fabric shall be closed with barbed or ground tension wire, either on horizontal lines or

fanned, as shown on the plans or as directed. The wires shall be stretched taut between and fastened to the posts to prevent vertical movement of the wires. Barbed or tension wire shall not be placed where its installation would cause collecting drifts in the channel.

603.05 Placing Barbed and Tension Wire and Fabric. The bottom of the fabric shall be placed above the ground line as shown on the plans. Over irregular ground, a minimum of 25 mm (1 in.) and a maximum of 100 mm (4 in.) clearance will be permitted. All necessary excavation and backfilling required shall be in accordance with 201.03.

The tension required to stretch the fabric and wire shall be applied by mechanical fence stretchers and with single wire stretchers designed and manufactured for the purpose, and in accordance with the fence manufacturer's recommendations.

All splices in the fabric and wire shall be securely made in accordance with the best practice and the manufacturer's recommendations, and by the use of tools designed for that purpose.

Farm field fence shall be placed by fastening one end and then applying sufficient tension to remove all slack before making permanent attachments elsewhere. The line wires shall be fastened to end, corner, and pull posts by wrapping the wires around the posts and tying the wire back on itself with no less than 1 1/2 tightly wrapped twists. Tying shall be with tools designed for the purpose in accordance with the fence manufacturer's recommendations. This same method shall be used in placing barbed or tension wire. Fence fabric shall be fastened to intermediate or line posts with at least five wire ties. Barbed or tension wire shall be fastened in the same manner with one fastening device for each post.

The top and bottom tension wires of chain link fence shall be placed, stretched taut, and secured at the ends and to all posts before the fabric is placed. The ends of the fabric shall be secured by the use of stretcher-bars threaded through the loops of the fabric and secured to the posts by means of clamps with bolts and nuts. The number of clamps shall be as indicated on the plans. The fabric shall be placed by securing one end and then applying tension to remove all slack before making attachments elsewhere. The fabric shall be fastened to the line posts and to the top and bottom tension wires with tie wires spaced as shown on the plans.

603.06 Resetting Fence. Resetting fence shall consist of the removal of existing fence within the specified limits and, if necessary, storing and then resetting it in accordance with the plans, or as directed. Resetting fence shall be in accordance with 603.03, 603.04, and 603.05. Damaged or missing parts, including posts shall be replaced.

603.07 Method of Measurement. Fence and resetting fence will be measured by the meter (linear foot) for the type specified. Measurement will be made along the top of the fence from outside to outside of end posts for each continuous run of fence.

Gates will be measured as complete units of the size and type specified.

603.08 Basis of Payment. The accepted quantities of fence and resetting fence will be paid for at the contract unit price per meter (linear foot) for the type specified, complete in place. Gates will be paid for at the contract unit price per each for fence gate, of the type and size specified, complete in place.

Payment will be made under:

Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
Fence, _____, _____ mm (in.) (type, height)	m (LFT)
Fence, _____, Reset (type)	m (LFT)
Fence, Farm Field, Barbed Wire, _____ mm (in.)	m (LFT)
Fence, Farm Field, Tension Wire, _____ mm (in.)	m (LFT)
Fence Gate, _____, _____ mm (in.) x _____ m (ft) (type, height, length)	EACH

The cost of adding grounding in accordance with the National Electric Safety Code including all materials, and labor shall be included in the cost of the fence.

The cost of fence, and corner, end, line, and pull posts shall be included in the cost of the fence.

The cost of fence, post and miscellaneous hardware shall be in the cost of the gate.

The cost of all miscellaneous hardware related to the type of fence including brace connections, caps, clips, clamps, hinges, rivets, ties, truss rods, diagonal braces and stretcher bars shall be included in the cost of the fence.

The cost of concrete for posts, braces or anchors shall be included in the cost of the fence and gates.

The cost of removal, storage, re-installation, and the replacement of damaged or missing parts shall be included in the cost of the resetting fence.

SECTION 604 – SIDEWALKS, CURB RAMPS, STEPS, AND HANDRAILS

604.01 Description. This work shall consist of constructing HMA or PCC sidewalks; curb ramps; concrete steps; or the reconstruction of PCC sidewalks in accordance with 105.03.

MATERIALS

604.02 Materials. Materials shall be in accordance with the following:

Coarse Aggregate, Class D or Higher, Size No. 53 904

Concrete, Class A.....702
Detectable Warning Elements.....905.05
Fine Aggregate, Size No. 23, No. 24, or No. 15 904
Joint Filler.....906.01
Paint 909.05
Reinforcing Bars 910.01
Silica Sand..... ASTM C 778

Hand railing shall be aluminum pipe in accordance with ASTM 221, alloy 6063, temper T52 or galvanized steel pipe in accordance with ASTM A 53, grade B, all as specified.

The detectable warning elements shall be set in a thin set latex modified mortar in accordance with ANSI A108.1 or as recommended by the element manufacturer for outdoor use for adhering brick to concrete.

A type A certification in accordance with 916 for detectable warning elements and thin set latex modified mortar shall be furnished prior to use of the materials.

A type C certification in accordance with 916 for the silica sand shall be furnished prior to use of the material.

CONSTRUCTION REQUIREMENTS

604.03 Portland Cement Concrete Sidewalks and Curb Ramps.

(a) General Requirements. The location of curb ramps shall take precedence over the location of drainage structures and signal, utility, or light poles. Drainage structures shall not be located within the limits of the curb ramp, exclusive of flared sides. Poles shall be located so as not to impede the usage or safety of the curb ramps. Crosswalk markings shall be located such that the curb ramps shall be contained within the markings unless otherwise specified. The flared sides need not fall within the crosswalk lines. The normal gutter flow line shall be maintained throughout the curb ramp area, and appropriate drainage structures shall be used, as needed, to intercept the flow prior to the curb ramp area. Positive drainage shall also be provided to carry water away from the intersection of the curb ramp and the gutter line.

The bottom edge of curb ramps and the top of curb shall be flush with the edge of the adjacent pavement or the gutter line.

The curb ramp running slope shall not exceed 12:1, except where conditions necessitate, a 10:1 slope may be utilized for a maximum rise of 150 mm (6 in.). Curb ramp cross slope shall not exceed 50:1 except where infeasible.

(b) 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 in accordance with the section shown on the plans. All soft and yielding material shall be removed and replaced with acceptable material.

(c) Forms. Forms shall be of wood, metal, or other approved material and shall extend for the full depth of the concrete. 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.

(d) Placing Concrete. The foundation shall be thoroughly moistened immediately prior to the placing of the concrete. The proportioning, mixing, and placing of the concrete shall be in accordance with 702. The thickness of the concrete in the curb ramp, including flared sides, shall be as shown on the plans for the type specified.

(e) Finishing. The surface shall be finished with a wooden float. No plastering of the surface will be permitted. Ramp surfaces shall be coarse broomed and corrugated transverse to the slope as shown on the plans. The surface texture of the flared sides shall be coarse broomed with the striations transverse to the slopes.

All exposed edges shall be finished with a 6 mm (1/4 in.) radius.

(f) Joints. The type and location of joints and the size of preformed joint filler shall be as shown on the plans.

All concrete joints shall be finished with a 6 mm (1/4 in.) radius.

Preformed 13 mm (1/2 in.) joint filler shall be placed around all appurtenances, such as manholes and utility poles which extend into and through the sidewalk, and between the sidewalk and any fixed structure, such as a building or bridge. The preformed joint filler shall extend for the full depth of the sidewalk or curb ramp, and shall be flush with the surface of the adjacent concrete.

(g) Detectable Warning Elements. Detectable warning elements shall be as shown on the plans. They shall be set in a thin set mortar on top of the concrete base. The concrete base shall be cleaned of all materials which might prevent the mortar from adhering to the base. The mortar shall be applied to the concrete in accordance with the manufacturer's recommendations. Where elements smaller than full sized are needed, whole elements shall be cut full depth with an appropriate power saw.

Brick joints shall be hand tight with a maximum of 1.5 mm (1/16 in.) width.

The joints between bricks shall be filled with a fine aggregate No. 15 or an equivalent sand. This filling shall be accomplished by repeated brooming of the aggregate across the face of the bricks. Excess aggregate shall then be removed from the surface.

(h) Curing. Concrete shall be cured for at least 72 h. Curing shall be in accordance with 504.04 except curing compound shall not be used in the area where detectable warning elements are to be installed. During the curing period all pedestrian traffic shall be excluded.

(i) Painting. The exposed surfaces of the curb throughout the width of curb ramps shall be painted yellow in accordance with 808.06. Silica sand shall be applied to the wet paint along the top of the curb at the rate of 0.7 kg/L (6.0 lb/gal.).

604.04 PCC Steps. PCC steps shall be in accordance with the applicable provisions of 604.03. In addition, all exposed edges shall be rounded to a 6 mm (1/4 in.) radius.

604.05 Reconstructed PCC Sidewalk. Where existing concrete sidewalk is to be reconstructed, all disintegrated concrete, brick, stone, or other material shall be completely removed and replaced with new concrete sidewalk in accordance with 604.03.

Such sidewalk shall be constructed to a minimum depth of 100 mm (4 in.) unless another depth is designated and to the width of the adjoining walk, or to a width of no less than 1200 mm (48 in.) from the face of curb, or to such other width as directed.

The removal of concrete sidewalk shall be to uniform lines as directed. The sidewalk to be removed shall be cut in a straight line with an approved power driven concrete saw. The sawing shall be such that the portion of sidewalk to remain in place shall not be damaged. All portions which are damaged or removed back of the established line shall be replaced.

Unless otherwise directed, sidewalk which must be removed shall be removed between tool marks or joints. At locations where the sidewalk and curb are adjacent and the curb is deteriorated, the curb shall also be replaced as directed.

The new sidewalk shall have a joint pattern similar to the surrounding sidewalk. Sidewalk placed at drives shall be 150 mm (6 in.) thick, or the same depth of the existing drive, whichever is greater.

604.06 Re-Laid Sidewalk. This work consists of the removal and re-laying of concrete, stone-slab, or brick sidewalk at the locations shown on the plans or as directed. In the operations of removing and re-laying, care shall be taken not to damage any of the sidewalk. Before re-laying, a cushion of fine aggregate shall be spread on the prepared subgrade to a depth of no less than 50 mm (2 in.). Cracked or damaged sections shall not be relaid but shall be disposed of as directed.

604.07 HMA Sidewalk.

(a) Excavation and Forms. Excavation and forms, when required, shall be in accordance with 604.03(b) and 604.03(c).

(b) Bed Course. Bed course material shall be coarse aggregate No. 53 and shall be placed in lifts not exceeding 100 mm (4 in.) in depth. Each lift shall be thoroughly compacted.

(c) Placing HMA Sidewalk. HMA sidewalk material shall be placed on a compacted bed course in one or more courses. The mixture shall consist of HMA base, intermediate, or surface, type A in accordance with 402. A MAF in accordance with 402.05 will not apply. Aggregate requirements of 904.03(d) do not apply. Compaction shall be accomplished by means of a hand operated or power roller of an acceptable type and mass (weight) in accordance with 402.15. In areas inaccessible to the roller, hand tamping will be permitted. In any case, the HMA sidewalk material shall be uniformly compacted.

If the finished compacted surface is too open or remains sticky, the surface shall be given a coating of fine aggregate, well broomed over the surface, leaving no excess.

604.08 Backfilling and Finishing Shoulders and Slopes. After forms have been removed, the space on each side of the sidewalks shall be filled to the required elevation with suitable material which shall be firmly compacted and neatly graded. Adjacent shoulders and slopes shall be finished to the required grade and cross section.

604.09 Hand Rails. This railing shall be erected in a workmanlike manner, straight and true to line and grade. Posts shall be vertical and railings shall be parallel to the walk surface or to the plane of the steps and spaced as shown on the plans. Fastenings shall be as indicated on the plans. Railing posts on masonry shall be held in place in a manner that develops the full strength of the railing post in bending.

Fabrication and placement of railings shall be completed in accordance with the applicable requirements of 711. Ends of tube sections shall be milled or sawed. Cut ends shall be true, smooth, and free from burrs and ragged edges. Welds shall be ground smooth. The rail system shall be continuous except as shown on the plans. Joints shall be spliced as detailed on the plans. Welding of steel shall be in accordance with 711.32 and welding of aluminum shall be in accordance with the applicable requirements of 803. Radiographic, magnetic particle, and dye penetrant inspection will not be required.

All aluminum surfaces in contact with concrete shall be coated with an aluminum impregnated caulking compound prior to installation. After installation and alignment, openings between metal surfaces and concrete shall be sealed in a watertight manner with the caulking compound.

Steel pipe railing not designated to be painted shall be galvanized after fabrication and prior to installation. Railing designated to be painted shall receive one shop coat of paint after fabrication and two field coats after installation. The type and color of paint shall be as specified on the plans. Cleaning and painting shall be in accordance with 619.

604.10 Method of Measurement. Concrete sidewalk, reconstructed concrete sidewalk and re-laid concrete sidewalk will be measured by the square meter (square yard) of finished surface. HMA for sidewalk will be measured by the megagram (ton) of mixture placed. Bed course material will be measured by the megagram (ton).

Concrete curb ramps will be measured by the square meter (square yard) in accordance with the pay limits shown on the plans.

Concrete steps will be measured by the cubic meter (cubic yard) based on the neat lines shown on the plans.

Hand rails will be measured by the meter (linear foot) in accordance with the dimensions shown on the plans or as directed. Measurements will be made from end to end of the railing along the centerline.

Curb and curb and gutter will be measured in accordance with 605.09. Reinforcing bars, if used, will be measured in accordance with 703.07.

604.11 Basis of Payment. The accepted quantities of concrete sidewalk will be paid for at the contract unit price per square meter (square yard) for sidewalk, concrete. HMA for sidewalk will be paid for at the contract unit price per megagram (ton), complete in place. Bed course material will be paid for at the contract unit price per megagram (ton). Concrete steps will be paid for at the contract unit price per cubic meter (cubic yard) for steps, concrete. Reconstructed sidewalk and relaid sidewalk will be paid for at the contract unit price per square meter (square yard) for sidewalk, reconstruct, or sidewalk, re-lay. Joint material will be paid for at the contract unit price per meter (linear foot), complete in place.

The accepted quantities of curb ramps will be paid for at the contract unit price per square meter (square yard) for curb ramp, concrete, per the type, complete in place.

Hand rails will be paid for at the contract unit price per meter (linear foot).

Curb and curb and gutter will be paid for in accordance with 605.10.

Reinforcing bars, if used, will be paid for in accordance with 703.08. Curb, if directed to be replaced, will be paid for in accordance with 605.10.

Payment will be made under:

Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
Bed Course Material	Mg (TON)
Curb Ramp, Concrete, _____ type	m2 (SYS)
Hand Rail, _____ type	m (LFT)
HMA for Sidewalk	Mg (TON)
Joint Material	m (LFT)
Sidewalk, Concrete	m2 (SYS)
Sidewalk, Concrete, Reconstruct	m2 (SYS)
Sidewalk, Concrete, Re-Lay	m2 (SYS)
Steps, Concrete	m3 (CYS)

The cost of excavation, backfill, and necessary incidentals shall be included in the cost of the pay items in this section.

The removal and disposal of concrete sidewalk which is unsuitable for re-laying and which has not been damaged due to negligence will be paid for in accordance with 202.13. Concrete sidewalk which is specified to be re-laid or to remain in place and which is damaged shall be removed and disposed of and replaced with no additional payment.

If directed, concrete sidewalk shall be constructed to a depth greater than that shown on the plans. Such additional thickness will be converted into the equivalent square meters (square yards) quantity of concrete sidewalk of the thickness shown on the plans and will be paid for as such.

The cost of furnishing and applying sand to finished compacted surfaces shall be included in the cost of HMA for sidewalk.

The cost of the concrete base, detectable warning element, thin set mortar, fine aggregate for filling joints, and the painting of the curb through the width of the curb ramp including the silica sand shall be included in the cost of the curb ramp.

The cost of aluminum impregnated caulking compound and the painting of steel hand railing shall be included in the cost of the handrail.

SECTION 605 – CURBING

605.01 Description. This work shall consist of the construction of curb or curb turnouts; combination curb and gutter, combined curb and gutter turnouts; or resetting curb in accordance with these specifications and in reasonably close conformance with the lines and grades shown on the plans or as directed.

MATERIALS

605.02 Materials. Materials shall be in accordance with the following:

Coarse Aggregate, Class D or Higher, Size No. 53 904
Concrete 502
Joint Materials 906
Joint Mortar 906.03
Precast Concrete Curbing.....913.05
Reinforcing Steel 910.01

605.03 Precast Cement Concrete Curbing.

(a) Excavation. Excavation shall be made to the required depth and the base upon which the curb is to be set shall be compacted to a firm even surface. All soft and unsuitable material shall be removed and replaced with suitable material which shall be thoroughly compacted.

(b) Installation. The curb shall be set in accordance with the line and grade required. The face and top of the curb shall be checked with a 3 m (10 ft) straightedge. Portions showing irregularities of 6 mm (0.25 in.) or more shall be removed and replaced with no additional payment. All spaces under the curbing shall be filled with bed course material. The bed course material shall be coarse aggregate, size No. 53 and shall be thoroughly tamped.

(c) Joints. Curbing shall be laid with joints as indicated on the plans. These joints shall be filled with mortar as specified. Where a portland cement concrete pavement is to be constructed contiguous to a curbing, joints shall be constructed in the curbing directly in line with pavement expansion joints. The joint in the curbing shall be the same width as the pavement joint and shall be filled with an expansion joint filler of the same nominal thickness as the pavement joint. Any voids between the joint filler and the curb shall be filled with mortar.

(d) Backfilling. After the curb has set, any remaining excavated areas shall be filled with approved material. This material shall be placed and thoroughly tamped in layers not exceeding 150 mm (6 in.) in depth.

605.04 Cast in Place Cement Concrete Curbing.

(a) Excavation. Excavation and bedding shall be in accordance with 605.03(a).

(b) Forms. Forms shall be of wood or metal, straight, free from warp, and of such construction that there will be no interference to the inspection of grade or alignment. All forms shall extend for the entire depth of the curb and shall be braced and secured sufficiently so that no deflection from alignment or grade shall occur during the placing of the concrete.

(c) Proportioning and Placing. Concrete shall be proportioned, mixed, and placed in accordance with 502. Where integral curb and gutter is specified, that portion of the curb below the upper surface elevation of the adjoining pavement shall be constructed by extending the pavement to the outer vertical plane of the curb at the time the pavement is placed. The concrete used in this extension shall be the same composition as that of the pavement.

After the concrete for the upper portion is placed in the forms, it shall be tamped and spaded or vibrated until mortar entirely covers the surface. The top shall be floated smooth and the outer upper corner rounded to a 6 mm (0.25 in.) radius.

The face and top of the curb, integral curb, and gutter shall be checked with a 3 m (10 ft) straightedge. Portions showing irregularities of 6 mm (0.25 in.) or more shall be removed and replaced.

Consolidation of concrete placed in the forms shall be by vibration or other acceptable methods. Forms shall be left in place for 24 h or until the concrete has set sufficiently so that they can be removed without injury to the curbing. Upon removal of

the forms, the exposed curbing face shall be rubbed immediately to a uniform surface. Rubbing shall be accomplished by the use of water and a carborundum brick. For the purpose of matching adjacent concrete finishes or for other reasons, other methods of finishing may be permitted. No plastering will be permitted.

(d) Curb Turnouts and Combined Concrete Curb and Gutter Turnouts. Turnouts will be required with specified inlets or with concrete gutter and paved side ditch in accordance with 607 and as shown on the plans. Concrete gutter and paved side ditch shall be constructed monolithically with the curb turnout.

(e) Joints. Joints in integral curbs shall be located at joints in adjoining PCCP. The joints shall be saw cut or formed with 6 mm (0.25 in.) thick preformed joint material. Joint sealant is not required for joints in integral curbs.

Curbing not constructed integral with adjacent pavement shall be constructed with intermediate joints located at 3 m (10 ft) intervals. These joints may be sawed or formed with metal separator plates, and the depth and width shall be in accordance with the plans.

Preformed expansion joints, 6 mm (0.25 in.) thick, shall be placed at the beginning and end of all curb returns and also at castings.

(f) Curing. Immediately upon completion of the rubbing, the curbing shall be moistened and kept moist for three days, or cured by the use of membrane forming material. The method and details of curing shall be subject to approval.

(g) Backfilling. After the concrete has set sufficiently, the spaces in front and back of the curb shall be refilled with suitable material to the required elevation in layers of not more than 150 mm (6 in.) and be tamped thoroughly.

(h) Curb Machine. Curb machines may be used to construct curb provided the curb can be constructed to the requirements of the specifications.

605.05 Reflecting Cement Concrete Curbing. Construction methods for this item shall be in accordance with 605.03 and the following requirements.

The reflecting surface of the curbing shall be a mortar mix consisting of one part white portland cement to 1 3/4 parts of light colored, washed, mortar sand. This mortar mix shall have a thickness of approximately 25 mm (1 in.). Alternately, the entire curbing may be constructed of concrete made with white portland cement.

Washed mortar sand shall meet all the requirements for mortar sand and shall be of a light satisfactory color. The reflecting surface mortar shall be placed immediately after the placing of the base concrete. No more than 20 min shall elapse between the placing of the base concrete and the placing of the reflecting surface.

Scoring or surface deformation and finish of the reflecting surface shall be in accordance with the details shown on the plans.

605.06 Concrete Center Curbing. The subgrade shall be prepared the same as for the adjoining pavement. If subbase is provided for the adjoining pavement, it shall be carried through for the full width of the curb and at the same thickness as that for the pavement.

The temperature limitations of 502.11 shall apply to placing the concrete. The surface shall be troweled smooth with a metal trowel. Curing shall be in accordance with 504.04.

Forms shall be removed within 24 h after the concrete has been placed. Plane surfaces and exposed sides of the curb shall be checked with a 3 m (10 ft) straightedge. Portions showing irregularities of 6 mm (0.25 in.) or more shall be removed and replaced in compliance with these specifications.

Joints in center curbs adjacent to PCCP shall be aligned with joints in adjoining PCCP. Joints in center curbs adjacent to asphalt shall be spaced at 15.5 m (18 ft) maximum. The joints shall be saw cut or formed with 6 mm (0.25 in.) thick preformed joint material. Joint sealant is not required for joints in center curbs.

Where an expansion joint is constructed in PCCP adjacent to concrete center curb, the expansion joint shall be carried through the center curb in accordance with applicable requirements of 503.03(f).

605.07 HMA Curbing.

(a) Excavation. Excavation shall be in accordance with 605.03(a).

(b) Preparation of Bed. When curbing is to be constructed on a fresh laid HMA surface, the curb may be laid only after the surface has been cleaned.

When curbing is to be constructed on a cured or aged portland cement concrete base, asphalt pavement, or asphalt treated base, the bed shall be thoroughly swept and cleaned with compressed air. The surface shall be thoroughly dried and, immediately prior to placing of the HMA mixture, shall receive a tack coat in accordance with 406. During application, the spread of this tack coat to areas outside of the area to be occupied by the curb shall be prevented.

(c) Mixture. The mixture shall be in accordance with 402.07(d).

Acceptance of HMA curbing mixtures will be a type D certification in accordance with 916. The test results shown on the certification shall be the quality control tests representing the material supplied and include gradation and binder content. The gradation tolerances shall be $\pm 2.5\%$ on the 75 μm (No. 200) sieve, $\pm 4.0\%$ on the 4.75 mm (No. 4) sieve, and binder content tolerance shall be $\pm 0.5\%$ from DMF.

(d) Placing. HMA curbing shall be constructed by use of a self-propelled automatic curber, curb machine or paver with curbing attachments. The curbing shall

be in accordance with the section shown on the plans. The automatic curber or machine shall meet the following requirements and shall be approved prior to its use.

1. The weight of the machine shall be such that required compaction is obtained without the machine riding above the bed on which curbing is being constructed.

2. The machine shall form curbing that is uniform in texture, shape, and density.

The construction of curbing by means other than the automatic curber or machine may be permitted when short sections or sections with short radii are required, or for such other reasons as may seem warranted. The resulting curbing shall conform in all respects to the curbing produced by the use of the machine. The face and top of the HMA curb shall be checked with a 3 m (10 ft) straightedge. Portions showing irregularities of 6 mm (0.25 in.) or more shall be removed and replaced.

Weather limitations shall be in accordance with 402.12

(e) Painting and Sealing. When sealing or painting is required, it shall be performed only on a curbing which is clean and dry and which has reached the ambient temperature.

605.08 Resetting Curbing.

(a) Salvage of Curbing. Curbing specified for resetting shall be cleaned, removed, and stored. Any existing curbing that is to be reset which is lost, damaged, or destroyed as a result of operations or because of failure to store and protect it in a manner that would eliminate its loss or damage, shall be replaced.

(b) Curb Removal. Curbing, which is unsuitable for resetting and which has not been damaged due to negligence, shall be removed and disposed of as directed.

(c) Excavation. Excavation and bedding shall be in accordance with 605.03(a).

(d) Resetting. The curb shall be set on a firm bed in accordance with the required line and grade. All sections of curbing shall be set so that the maximum opening between adjacent sections is 20 mm wide (0.75 in.) for the entire exposed top and face. Any dressing of the ends of the curbing necessary to meet this requirement shall be done as needed. Cutting or fitting may be necessary in order to install the curbing at the locations as directed.

After the curb has been set, the joints shall be completely filled with mortar as specified.

(e) Backfilling. The spaces in front and back of the curb shall be refilled to the required elevation with suitable material. This material shall be tamped thoroughly in layers of not over 150 mm (6 in.) in depth.

605.09 Method of Measurement. Curbing, both new and reset, and curb removal will be measured by the meter (linear foot) along the front face of the section at the finished grade elevation. Combined curb and gutter will be measured along the face of the curb. Curb turnout will be measured longitudinally by the meter (linear foot) as curb of the type specified, from the ends of the radii which touch the front face of the longitudinal curb portion. Combined curb and gutter turnout will be measured longitudinally by the meter (linear foot) as curb and gutter of the type specified, from the ends of the radii which touch the front face of the longitudinal curb portion. No deduction in length will be made for drainage structures installed in the curbing such as catch basins or drop inlets. Concrete center curb will be measured by the meter (linear foot), unless it is of variable width, in which case measurement will be by the square meter (square yard).

Bed course material will be measured by the megagram (ton).

605.10 Basis of Payment. The accepted quantities of curb work will be paid for at the contract unit price per meter (linear foot) for curb; curb and gutter; curb, reset; or center curb, of the type specified. Variable width center curb will be paid for at the contract unit price per square meter (square yard) for center curb, of the width specified. Bed course material will be paid for at the contract unit price per ton, complete in place.

Curb turnout will be paid for at the contract unit price per meter (linear foot) of the type of curb specified. Combined curb and gutter turnout will be paid for at the contract unit price per meter (linear foot) for curb and gutter of the type specified.

Payment will be made under:

Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
Bed Course Material	Mg (TON)
Center Curb, _____ type	m (LFT)
Center Curb, _____ m width	m2
(Center Curb, _____ ft width	SYS)
Curb, _____ type	m (LFT)
Curb and Gutter, _____ type	m (LFT)
Curb, Remove	m (LFT)
Curb, Reset, _____ type	m (LFT)

The cost of tack coat reinforcing steel or mesh reinforcement for curb, curb and gutter, or center curb shall be included in the costs of the pay items. The costs of

replacement curb portions for those which show irregularities of 6 mm (0.25 in.) or more shall be included in the cost of curb.

SECTION 606 – SHOULDER CORRUGATIONS

606.01 Description. This work shall consist of placing corrugations in paved shoulders in accordance with 105.03. Corrugations shall not be constructed within the limits of reinforced concrete bridge approaches or on bridge decks.

The operation shall be coordinated such that milled materials do not encroach on pavement lanes carrying traffic and all milled materials are disposed of in accordance with 104.07.

The corrugations shall be constructed by cutting smooth strips in existing or newly constructed shoulders. The operation shall be conducted by means of a cutting machine that provides a series of smooth cuts without tearing or snagging. The equipment shall include guides to maintain uniformity and consistency in the alignment of the strips.

606.02 Method of Measurement. HMA and PCCP shoulder corrugations will be measured by the meter (linear foot), measured parallel to the center line of the roadway. Gaps in PCCP shoulder corrugations at the D-1 joints will be included as milled PCCP corrugations.

606.03 Basis of Payment. HMA and PCCP shoulder corrugations will be paid for at the contract unit price per meter (linear foot), when specified.

Payment will be made under:

Pay Item	Pay Unit
Milled HMA Shoulder Corrugations	m (LFT)
Milled PCCP Shoulder Corrugations	m (LFT)

SECTION 607 – PAVED SIDE DITCH OR CONCRETE GUTTER

607.01 Description. This work shall consist of placing a portland cement concrete lining, gutter, or reinforced concrete gutter turnout for side ditches in accordance with these specifications and in reasonably close conformance with the lines, grades, and dimensions shown on the plans or as directed.

MATERIALS

607.02 Materials. Materials shall be in accordance with the following:

Concrete, Class A	702
Reinforcing Steel	910.01

CONSTRUCTION REQUIREMENTS

607.03 General Requirements. The excavation shall be to the required depth and shape of the bottom of the type and size of the side ditch being constructed, the details of which are shown on the plans. All soft, yielding, or unsuitable materials encountered at the required excavation elevation shall be removed and replaced with approved materials which shall be compacted and finished to a firm, smooth surface.

The applicable requirements of 605.04(b) shall apply to forms.

Placing, finishing, and curing shall be in accordance with 605.04 except the curing period shall be no less than 72 h. The finished surface need not be brushed.

Reinforcement will be required for all paved side ditch, cut-off-walls, and lugs as shown on the plans.

Paved side ditch transitions will be required at intersections with earth ditches and pipe culverts.

Transitions of 3 m (10 ft) or less will be required between two different types of paved side ditches.

Cut-off wall and lug details shall be as shown on the plans. A cut-off wall shall be constructed at the beginning and end of any paved side ditch. Lugs shall be poured monolithic with paved side ditch on steep grades. Their locations shall be as shown on the plans or as otherwise directed. Backfilling shall be in accordance with 605.04(g).

607.04 Cement Concrete Gutter and Turnout. Concrete gutter and concrete gutter turnout shall be constructed as shown on the plans or where directed. Construction shall be in accordance with all applicable requirements set out herein for paved side ditch.

607.05 Method of Measurement. Paved side ditch or cement concrete gutter will be measured by the meter (linear foot) along the centerline of the ditch per each type specified. Each cutoff wall or lug will be measured as 2.5 m (8 linear feet) of paved side ditch or cement concrete gutter. Paved side ditch transitions at earth ditches and pipe culverts will be measured as equivalent lengths in meters (linear feet) of the paved side ditch specified at each location. Transitions at the intersection of two different types of paved side ditch will be converted to equivalent lengths in meters (linear feet) of the larger type of paved side ditch specified at each site.

Reinforced concrete gutter turnout will be measured as 15 m (50 lft) of concrete gutter. Additional length, if required, will be measured by the meter (linear foot) of concrete gutter.

607.06 Basis of Payment. The accepted quantities of paved side ditch or cement concrete gutter of the type specified, including transitions, cutoff walls and lugs measured in accordance with 607.05, will be paid for at the contract price per meter

(linear foot) complete in place. Concrete gutter turnout will be paid for at the contract unit price per meter (linear foot) for gutter, concrete, of the type specified.

Payment will be made under:

Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
Gutter, Concrete, _____ type	.....m (LFT)
Paved Side Ditch, _____ type	.....m (LFT)

The costs of reinforcing steel or mesh, excavation, joints, and necessary incidentals shall be included in the costs of the pay items.

SECTION 608 – SHOULDER DRAINS

608.01 Description. This work shall consist of constructing shoulder drains in accordance with these specifications and in reasonably close conformance with the lines and grades shown on the plans or as directed.

MATERIALS

608.02 Materials. Materials shall be in accordance with the following:

Coarse Aggregates, Class D or Higher, Size No. 8 904

CONSTRUCTION REQUIREMENTS

608.03 General Requirements. Unless otherwise designated, shoulder drains shall be installed on both sides of the pavement by trenching from the edges of the pavement through the shoulders and backfilling with aggregate at low points in the grade and at other locations when so directed. This work shall precede the finishing of the shoulders.

The width of the trench shall be approximately 300 mm (12 in.) unless otherwise directed. Other dimensions shall be as shown on the plans.

After the trench has been prepared, it shall be backfilled to the required elevation with aggregate, and then be well compacted. After this, any remaining unfilled trench area shall be filled with material approved for shoulders and compacted by rolling or tamping or both. The finished shoulder elevation shall conform with that required at that point.

608.04 Method of Measurement. Shoulder drains will be measured by the megagram (ton) of aggregate placed.

608.05 Basis of Payment. The accepted quantities of aggregate for shoulder drains will be paid for at the contract unit price per megagram (ton) for aggregate for shoulder drains complete in place.

Payment will be made under:

Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
Aggregate for Shoulder Drains	Mg (TON)

Excavation, trenching, backfilling, and other related miscellaneous items will not be paid for separately, but the cost thereof shall be included in the cost of the pay item.

SECTION 609 – REINFORCED CONCRETE BRIDGE APPROACHES

609.01 Description. This work shall consist of constructing reinforced concrete bridge approaches, RCBA, on a prepared subgrade and subbase in accordance with 105.03.

MATERIALS

609.02 Materials. Materials shall be in accordance with the following:

Coarse Aggregate, Class D or Higher, Size No. 53	904
Concrete, Class C *	702
Curing Materials	912.01
Joint Materials	906.02(a)1
Reinforcing Bars, Epoxy Coated	910.01
Support Devices	910.01(b)9

* Coarse Aggregate shall be Class AP, Size No. 8

CONSTRUCTION REQUIREMENTS

609.03 General Requirements. Subgrade shall be prepared in accordance with 207. Subbase shall be prepared in accordance with 302.

609.04 Forms. Forms shall be either steel or wood and shall be in accordance with 508.04(c)1 or 508.04(c)2.

609.05 Joints. Longitudinal construction joints will only be permitted as shown on the plans. The type I-A joint shall be constructed as shown on the plans.

609.06 Reinforcing Bars. Furnishing and placement of reinforcing bars shall be in accordance with 703.

609.07 Thickness. The depth of the RCBA will be checked by the Engineer prior to pouring, by making stringline measurements every 1 m (3 ft) across the width of the approach. Any location deficient in depth by 13 mm (1/2 in.) or more shall be corrected prior to placing the concrete.

609.08 Concrete Placement. The subbase shall be uniformly moist at the time of concrete placement. Delivery and placement of concrete shall be in accordance with 702.

609.09 Finishing. The RCBA shall be finished with equipment in accordance with 508.04(c)3 and 508.04(c)4. The operations shall be controlled so that an excess of mortar and water is not worked to the top. Long handled floats may be used to smooth and fill in open textured areas. The edges of formed RCBA shall be tooled or chamfered.

The finished RCBA surface shall be textured with a double thickness burlap drag or a minimum 1.2 m (4 ft) wide turf drag. Immediately after the finishing operation is complete and before the surface film has formed, the surface of the RCBA shall be textured by transverse grooving in accordance with 504.03. The grooves may be formed by mechanized equipment using a vibrating beam roller, a series of discs or other approved device. Manual tools such as fluted floats, spring steel tined rakes, or finned floats with a single row of fins may be used. The grooves shall be relatively uniform and smooth and shall be formed without tearing the surface or bringing coarse aggregate to the top.

All areas of hardened RCBA which do not conform to the requirements due to either a deficiency in the grooving or a rough open textured surface shall be corrected. Corrections shall be made by cutting transverse grooves in the hardened surface with an approved cutting machine and retexturing to a satisfactory finish as directed.

609.10 Curing. RCBA shall be wet cured in accordance with 702 or shall have liquid membrane forming curing compound applied to exposed surfaces within 30 min after the finishing operations have been completed. The edges of the RCBA shall be cured immediately upon removal of the forms. The edge shall be covered with curing materials equal to the material used on the surface or banked with soil 300 mm (12 in.) wide or greater.

When conditions arise which prevent timely application of curing materials the surfaces shall be kept wet with a fine spray of water. The fine spray of water shall continue until application of curing materials is resumed.

Liquid membrane forming curing compound shall be applied in a continuous uniform film at a rate not less than 1 L/3.7 m^2 (1 gal./150 ft^2). Additional applications, if needed, shall follow the previous application within 30 min. The curing compound may be warmed in a water bath during cold weather at a temperature not exceeding 38°C (100°F). Thinning with solvents will not be permitted. Non-uniform film rates will result in the discontinuance of that application method.

A new coat of curing compound shall be applied to areas damaged by rain or other means during the curing period. The recoating shall be applied as soon as possible and at a rate equal to that specified for the original coat.

609.11 Smoothness. The smoothness of the surface of the RCBA will be measured by means of a 3 m (10 ft) long straightedge as soon as practical following curing or completion of adjoining roadway or structure sections. All surface variations shall be corrected to 3 mm (1/8 in.) or less.

Smoothness variations outside specified tolerances shall be corrected in accordance with 502.20.

609.12 Opening to Traffic. RCBA may be opened to traffic after 14 days. The RCBA may be opened earlier if test beams indicate a modulus of rupture of 3800 kPa (550 psi) or greater.

The Contractor and Engineer will conduct an inspection of the new RCBA for any damage. The inspection and all necessary repairs shall be completed prior to opening to traffic.

609.13 Method of Measurement. Reinforced concrete bridge approaches will be measured by the square meter (square yard). Dense graded subbase will be measured in accordance with 302.08. Reinforcing bars will be measured in accordance with 703.07.

Subgrade preparation will not be measured for payment. Finishing and curing of the RCBA will not be measured for payment. Construction joints will not be measured.

609.14 Basis of Payment. Reinforced concrete bridge approaches will be paid for at the contract unit price per square meter (square yard). Dense graded subbase will be paid for in accordance with 302.09. Reinforcing bars will be paid for in accordance with 703.08.

Payment will be made under:

Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
Reinforced Concrete Bridge Approach, _____ mm (in.) thickness	..... m2 (SYS)

The cost of all materials, water, equipment, and all labor for the compaction of the subgrade, shall be included in the cost of the RCBA.

The cost of finishing, furnishing and placing curing materials shall be included in the cost of the RCBA.

The cost of corrections for smoothness or re-texturing shall be included in the cost of the RCBA.

The cost of all labor and materials for the placement of construction joints shall be included in the cost of the RCBA.

SECTION 610 – APPROACHES AND CROSSOVERS

610.01 Description. This work shall consist of constructing or resurfacing from the edge of the mainline pavement to the right-of-way line at public road intersections; turn lanes, passing lanes, acceleration lanes, deceleration lanes, or recovery lanes where the total longitudinal dimension is less than 30 m (100 lft), excluding tapers; mail box approaches; from the edge of the mainline surface to a width of 1 m (3 ft) on private and commercial driveways; and crossovers; all in accordance with 105.03.

MATERIALS

610.02 Materials. Materials shall be in accordance with the following:

Aggregate Base 301.02
Subbase 302.02
HMA 402.02
PCCP.....502.02

CONSTRUCTION REQUIREMENTS

610.03 General Requirements. Subgrade for approaches shall be prepared in accordance with 207. Aggregate base shall be constructed in accordance with 301. HMA for approaches shall be constructed in accordance with 402. HMA mixture for approaches shall be HMA surface or intermediate, type A, B, C, or D in accordance with 402.04. A MAF in accordance with 402.04 will not apply.

Dense graded subbase shall be constructed in accordance with 302. PCCP for approaches shall be constructed in accordance with 502.

610.04 Existing Approaches and Crossovers. If an existing surface is to be left in place as an approach pavement or crossover the surface shall be patched in accordance with 304.04 or 305.04, or as directed.

610.05 Method of Measurement. Compacted aggregate base will be measured by the megagram (ton) in accordance with 109.01(b). HMA mixture for approaches will be measured by the megagram (ton) of the type specified, in accordance with 109.01(b). Dense graded subbase will be measured in accordance with 302.08. PCCP for approaches will be measured in accordance with 502.22.

HMA patching in accordance with 610.04, will be measured by the megagram (ton) in accordance with 304.06. PCCP patching in accordance with 610.04, will be measured by the square meter (square yard) in accordance with 305.06.

Prime coat will be measured in accordance with 405.09. Tack coat will be measured in accordance with 406.06. Seal coat will be measured in accordance with 404.09.

610.06 Basis of Payment. The accepted quantities of HMA mixture for approaches will be paid for at the contract unit price per megagram (ton) of the type specified, complete in place. Compacted aggregate base will be paid for in accordance with 301.10. PCCP for approaches will be paid for at the contract unit price per square meter (square yard), complete in place.

HMA patching will be paid for in accordance with 304.07. PCCP patching will be paid for in accordance with 305.07.

Prime coat will be paid for in accordance with 405.10. Tack coat will be paid for in accordance with 406.07. Seal coat will be paid for in accordance with 404.10.

The accepted quantities of HMA material for mailbox approaches will be included with quantities required to construct the shoulder section when the shoulder is to be paved. If the shoulder is not to be paved, the HMA material for mailbox approaches will be paid for as HMA mixture for approaches.

Payment will be made under:

Pay Item Metric Pay Item (English Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol) Metric Pay Unit Symbol English Pay Unit Symbol)
HMA for Approaches, Type *	Mg (TON)
PCCP for Approaches	m2 (SYS)

* Mixture Type in accordance with 402.04

The cost of excavation, shaping, leveling, forming, compaction, placing, and all necessary incidentals shall be included in the cost of the pay items in this section.

The cost of the 1 m (3 ft) wedge placed on approaches at the same time and in conjunction with the mainline HMA intermediate or surface, or if turn lanes, passing lanes, acceleration lanes, deceleration lanes, or recovery lanes are greater than 30 m (100 ft) longitudinally, payment will be made at the same unit price as for the material placed on the mainline.

The cost for curbing placed monolithically with the PCCP for approaches shall be included in the cost of PCCP for approaches.

SECTION 611 – MAILBOX INSTALLATIONS

611.01 Description. This work shall consist of the construction of mailbox installations in accordance with 105.03.

MATERIALS

611.02 Materials. Materials shall be in accordance with the following:

Mailbox Support Galvanized Hardware	ASTM A 153
Nominal Standard Galvanized Pipe	ASTM A 120

CONSTRUCTION REQUIREMENTS

611.03 Mailbox Assembly. Existing mailboxes and assemblies shall be removed without damage from the highway right-of-way. Mailboxes, which must remain in service between removal and erection of the new assembly, shall be securely mounted to an empty 220 L (55 gal.) metal drum. The temporary assembly shall be located where it is accessible for mail delivery but placed as far as possible from the traveled roadway. The apparent owner of the existing mailbox shall be contacted and allowed to take possession of the existing mailbox and assembly. If the owner refuses to take possession, the existing mailbox and assemblies shall be removed.

Mailbox assemblies shall be furnished and installed as shown on the plans. Alternate mailbox assemblies which have been crash tested and approved in accordance with NCHRP 350 requirements may be considered upon receipt of a written request. Alternate mailbox assemblies approved for use shall be furnished and installed in conformance with the manufacturer's recommendations.

Mailboxes complying with the requirements of the United States Postal Service, including markings and sizes, shall be furnished and installed with the mailbox assembly. The mailbox shall be of comparable size to the existing mailbox previously removed from the highway right-of-way. The markings shall include "approved by U.S. Postmaster" stamped on the mailbox by the manufacturer and the address number, box number, or house number, in 50 mm (2 in.) or larger reflective material placed on the side of the mailbox in view of motorists in the nearest travel lane.

611.04 Method of Measurement. Mailbox assemblies will be measured by the number of units installed.

611.05 Basis of Payment. Mailbox assemblies will be paid for at the contract unit price for each, complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
Mailbox Assembly, Double	EACH
Mailbox Assembly, Single	EACH

The cost of wood or pipe posts, support hardware, mailbox, and removal of existing mailbox and its assembly shall be included in the cost of the mailbox assembly.

SECTION 612 – UNDERSEALING

612.01 Description. This work shall consist of furnishing and pumping an asphalt material under cement concrete pavement in accordance with 105.03.

MATERIALS

612.02 Materials. Utility asphalt, UA-II or UA-III shall be in accordance with 902.02(d).

CONSTRUCTION REQUIREMENTS

612.03 Shoulders. All holes, low areas, or displaced areas in the shoulders immediately adjacent to the pavement edge shall be filled with loam, clay, or other approved material and compacted to the elevation of the pavement. Such areas, including all other shoulder areas immediately adjacent to the pavement edge, shall be compacted with a roller or another approved method.

612.04 Drilled Holes. Where the existing pavement has transverse joints, holes not to exceed 38 mm (1.5 in.) in diameter shall be drilled on the centerlines of the pavement lane to be treated. Such holes, unless otherwise directed, shall be located longitudinally between transverse joints or cracks at approximately 750 to 900 mm (30 to 36 in.) from the joints or cracks. Intermediate holes, if necessary, shall be spaced as directed.

If the existing pavement does not have transverse joints, holes not to exceed 38 mm (1.5 in.) in diameter shall, unless otherwise permitted or directed, be located on the centerline of the pavement lane to be treated and be spaced as directed.

An approved method shall be used to prevent the drill from entering the subgrade after penetrating the pavement. Automatic stops on mechanical equipment and marked drill bits on hand-operated jackhammers may be approved subject to satisfactory operation.

Just prior to pumping operations, the surface of the pavement around each hole for an area of at least 1/2 the width of the lane being treated shall be thoroughly sprinkled with water to prevent the undersealing material from adhering to the pavement surface.

612.05 Pumping Asphalt. After the above procedure is complete, the asphalt shall then be pumped through the holes and under the pavement with an approved type of self-propelled pressure distributor, the pressure to be as directed. A metallic hose shall connect the asphalt tank through an asphalt pump to a 25 mm (1 in.) nozzle and a return metallic hose shall connect the nozzle to the asphalt distributor tank.

The nozzle shall be equipped with a three way valve so designed that the asphalt may circulate back to the distributor tank when pumping operations are not in progress. The nozzle shall be inserted in the hole, driven to a snug fit, and pumping of the asphalt continued until the undersealing is complete, or to such other amount as directed. In case of an existing asphalt resurface on concrete, holes shall be drilled through the resurface and the underlying concrete and the nozzle shall be of sufficient length that it can be driven to a snug fit into the concrete without the upper part of the nozzle being below the elevation of the existing asphalt resurface. Upon completion of the pumping operation, the nozzle shall be removed and a wood plug driven into the hole without an

excessive back flow of asphalt material. After the material has hardened, the plug shall be removed and a hardwood plug at least 75 mm (3 in.) long and a minimum of 2 mm (1/16 in.) larger than the diameter of the drilled hole shall be driven flush with the surface of the concrete pavement. All material extruded during the pumping operations shall be immediately cleaned from the pavement surface and removed from the limits of the contract within a period of 24 h.

Where undersealing operations are being performed under traffic, necessary signs, barricades, watchers, and flaggers shall be used to maintain one lane traffic in the immediate vicinity of pumping operations. Traffic may be permitted to use the pumped areas upon removal of the original plugs and after the hardwood plugs are driven.

All storage tanks, pipes, retorts, booster tanks, and distributors used for storing or handling the asphalt materials shall be kept clean and in good operating condition at all times so there is no contamination of the materials.

The asphalt shall not be heated above 260°C (500°F) at any time and, when pumped under the pavement, the temperature shall be no less than 177°C (350°F). All material heated beyond 260°C (500°F) shall be rejected.

No material shall be applied on a frozen subgrade nor when the atmospheric temperature is 4°C (40°F) or lower and falling. The asphalt shall be placed only when general weather conditions are suitable.

When directed, certain portions may be required to be undersealed a second time. The number of holes involved in this second undersealing shall not exceed 5% of the number of holes indicated in the Schedule of Pay Items.

612.06 Method of Measurement. Asphalt material will be measured by the megagram (ton). Drilled holes will be measured per each hole drilled.

612.07 Basis of Payment. This work will be paid for at the contract unit price per megagram (ton) for asphalt material for underseal. Drilled holes for underseal will be paid for at the contract unit price per each, complete in place.

Additional holes and materials required for a second undersealing operation will be paid for at the contract unit prices for the quantities involved.

Payment will be made under:

Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
Asphalt Material for Underseal	Mg (TON)
Drilled Hole for Underseal	EACH

The costs of shoulder material, wood and hardwood plugs, and necessary incidentals shall be included in the costs of the pay items.

SECTION 613 – SALVAGED ROAD MATERIALS

613.01 Description. This work shall consist of removing approved material from an existing road within the limits of the contract, including intersecting approaches, and using it in reconstruction of the road in accordance with these specifications or as directed.

613.02 Materials. Approved materials may be asphalt treated or untreated gravel, stone, slag, or all combination of these or other materials which are suitable for salvaging.

613.03 Construction Requirements. Before any filling or further work is done at locations where material is to be salvaged, such material shall be removed and stored in stockpiles outside the construction limits and adjacent thereto, or it may be incorporated directly into the work without stockpiling if conditions permit.

The quantities removed, if available, shall be sufficient to complete the item of work or certain portions thereof for which it is intended. The depth of excavation shall be as directed.

The incorporation of the salvaged material into the work shall be in accordance with applicable provisions of the specifications for which the material is to be used or in accordance with the special provisions, depending on the nature of the material and the use to which it is put.

613.04 Method of Measurement. Salvaged road material will be measured by the cubic meter (cubic yard) in stockpiles after removal from its original position or, if the Contractor prefers, it will be measured by the cubic meter (cubic yard) in its original position. All measurements will be made by means of cross sections. The volumes will be computed by the average end area method.

If salvaged road material is used as subbase, the combined pay quantities of subbase and salvaged road material for subbase shall equal but shall not exceed the total theoretical volume as calculated to the neat lines shown on the plans for subbase. If the volume of salvaged road material used as subbase determined by the cross section method does exceed the total theoretical volume of subbase, the final pay quantity for salvaged road material for subbase shall be the total theoretical volume.

The final pay quantity of subbase will be determined by deducting the final pay quantity of salvaged road material for subbase from the total theoretical volume of subbase.

If salvaged road material is obtained from within the pay limits of the new construction, such cubic meterage (cubic yardage) of salvaged material will be deducted from the excavation quantities to be measured for payment.

613.05 Basis of Payment. The accepted quantities of salvaged road material for the use shown in the Schedule of Pay Items will be paid for at the contract unit price per cubic meter (cubic yard), complete in place.

Payment will be made under:

Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
Salvaged Road Material for _____	m3 (CYS)

The costs of removal of the material, storage, incorporating it into the work, and necessary incidentals shall be included in the cost of the pay item.

SECTION 614 – CONCRETE HEADER

614.01 Description. This work shall consist of the construction or reconstruction of PCC headers adjacent to railroad tracks, bridges, and similar locations in accordance with 105.03.

MATERIALS

614.02 Materials. Materials shall be in accordance with the following:

Concrete	702
Reinforcing Steel	910.01

If the header is adjacent to cement concrete base or pavement, the header concrete shall be the same composition as that of the base or pavement header constructed monolithic with the base or pavement. If the adjacent base or pavement is thickened, that portion forming the thickening shall be considered as part of the header.

If the header is adjacent to asphalt pavement, the concrete shall be class A in accordance with 702 using class AP coarse aggregate.

CONSTRUCTION REQUIREMENTS

614.03 PCC Header. Construction shall be in accordance with the applicable provisions of 702 and with these requirements.

Welding shall be in accordance with 711.32.

Headers at railroad crossings shall be as shown on the plans.

614.04 Reconstructed Cement Concrete Header. This work shall be in accordance with the plans. Round plug welds or rectangular shaped plug welds may be used to weld the steel angle to the existing steel edge protection. Round plug welds shall be a minimum of 25 mm (1 in.) diameter.

Welding shall be in accordance with 711.32.

614.05 Method of Measurement. Cement concrete header and reconstructed cement concrete header will be measured by the meter (linear foot).

614.06 Basis of Payment. The accepted quantities of this work will be paid for at the contract unit price per meter (linear foot) for header, cement concrete, of the type specified, or header, cement concrete, reconstruct, complete in place.

Payment will be made under:

Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
Header, Cement Concrete, _____ type	m (LFT)
Header, Cement Concrete, Reconstruct	m (LFT)

The costs of edge protection, metal chairs, excavation, and necessary incidentals shall be included in the costs of the pay items.

SECTION 615 – MONUMENTS, MARKERS AND PARKING BARRIERS

615.01 Description. This work shall consist of furnishing and setting, setting only, or resetting right-of-way markers, monuments for marking section or other lines, bench-mark posts and tablets, and parking barriers in accordance with 105.03.

MATERIALS

615.02 Materials. Materials shall be in accordance with the following:

Coarse Aggregate, Class A or Higher, Size No. 8 or 91	904
Fine Aggregate, Size No. 23	904
Portland Cement	901.01(b)
Reinforcing Steel	910.01

615.03 Reinforced Cement Concrete Right-of-Way Markers. These markers shall conform with the dimensions and lettering shown on the plans. The reinforcement shall be securely held in place by at least four spacers of an approved design. The concrete ingredients shall be graded and proportioned to produce a strong dense concrete.

When tested as hereinafter described, a specimen shall support a total load of at least 10700 N (2,400 lb) before the first crack appears. The specimen will be tested as a simple beam. The distance between supports shall be exactly 600 mm (24 in.) with the load applied at the rate of approximately 5400 N (1200 lb) per min in the center of the span. Loading will continue until the first crack appears.

The cement concrete shall absorb no more than 8% water. Specimens for absorption may be taken from the markers tested for strength. The absorption test shall be as described in AASHTO T 280 except the specimen tested shall be the full cross section marker.

The markers shall have a smooth workmanlike finish free from cracks, patches, honeycomb, exposed reinforcement, and excessive bubble holes. Each marker shall be plainly marked near the bottom with the trademark or initials of the manufacturer and the date of manufacture. These letters and figures shall be no less than 25 mm (1 in.) in height and shall be indented 3 mm (1/8 in.).

Right-of-way markers furnished under this specification shall be covered by a type C certification in accordance with 916.

615.04 Monuments. Monuments shall be of the type specified in the Proposal book, the details of which are shown on the plans. Any portion extending above the ground shall be finished in accordance with 702.20.

Where concrete is required, it shall be class A in accordance with 702. When placed in the forms it shall be tamped in layers until mortar covers the outer surface. The tops of the monuments shall be floated smooth. Monuments may be cast in place or cast outside and then set.

The pin shall be set perpendicular to and flush with the top of the monument while the concrete is plastic and left undisturbed until the concrete has set. The pin shall be copper and shall be 25 mm (1 in.) in diameter and 125 mm (5 in.) long. If for type D monuments, the hole shall be drilled in the center with a 3 mm (1/8 in.) drill for a depth of 38 mm (1.5 in.). The hole shall be filled with lead flush with the end of the pin. Castings for protected monuments shall be in accordance with 910.05(a).

615.05 Bench Mark Posts. Bench mark posts shall be of the dimensions shown on the plans and cast in accordance with applicable provisions of 615.03, except the strength shall be determined by concrete cores taken from the finished product. At least two concrete cores will be taken from each unit and the average strength of the unit shall be at least 28 MPa (4000 psi) with no individual core strength less than 25 MPa (3600 psi). Tablets will be furnished by the Department and shall be set in the posts as indicated on the plans.

615.06 Parking Barriers. Parking barriers shall be of the dimensions shown on the plans. The barriers shall be cast and tested in accordance with the applicable requirements of 615.03, except the strength shall be determined by concrete cores taken from the finished product. At least two concrete cores will be taken from each unit and the average strength of the unit shall be at least 28 MPa (4000 psi) with no individual core strength less than 25 MPa (3600 psi).

CONSTRUCTION REQUIREMENTS

615.07 Setting Right-of-Way Markers. The back face of these markers shall be set on right-of-way lines approximately 300 m (1,000 ft) apart as hereinafter provided. They shall be set at all corners of irregular right-of-way lines, opposite each P.C. and P.T. of curves, and not to exceed 150 m (500 ft) apart on the inside and outside of curves. Care shall be used in locating markers on tangents so that a marker is plainly visible from each of those adjacent.

Markers shall be set plumb, to the depth required on the plans, and with the letters facing the pavement. Portions of the holes not occupied by markers shall be backfilled and compacted in layers with suitable material up to the level of the original ground. The markers shall not be displaced during backfilling.

615.08 Resetting Right-of-Way Markers. When the proposal provides that existing right-of-way markers be reset, the existing markers shall be removed and reset at designated locations in accordance with 615.07.

615.09 Setting Monuments. If the location of a monument falls within the limits of a cement concrete pavement, a copper pin, the details of which are shown on the plans, shall be set perpendicular to and flush with the top of the finished pavement. It shall be placed just before the concrete takes initial set and then left undisturbed until the concrete has set. Other monuments shall be of the type shown on the plans, depending on the type or surface of the pavement in which they are to be placed or if they are to be placed outside the pavement. Necessary excavation shall be to the required depth. The bottom of the excavation shall be firm and true to line and grades given. After a monument is in place, the remaining excavated areas shall be backfilled with suitable material firmly tamped in layers. The monument shall not be disturbed.

Existing monuments which are not required to be disturbed or re-established, but which are disturbed during construction operations, shall be re-established.

615.10 Re-Established Monuments. It may be necessary to re-establish existing monuments in pavements or bases which are disturbed unavoidably or covered by operations embraced in the contract.

If the existing monument is, or contains a brass or copper pin, the pin shall be extended to the surface of the new pavement by attaching a brass or copper pin with at least a 25 mm (1 in.) diameter and of the length required. Such extensions shall be attached by tapping the original pin and providing a necessary screw attachment such that the extension can be fastened securely to the original pin. The tapped hole shall be at least 6 mm (0.25 in.) in diameter and no less than 25 mm (1 in.) deep. The screw attachment shall have the same diameter as that for the hole in the original pin and shall be no less than 25 mm (1 in.) in length.

Where an existing monument of the type specified above has not been re-established on a previous contract, the monument shall be re-established in the same manner as set out above.

Where existing monuments are protected and encased in cast iron, such castings shall be adjusted to meet the elevation of the proposed surface by means of an asphalt coated, cast iron, adjustment casting. The size shall be the same as the original casting and of the depth necessary to meet the elevation of the proposed new surface.

615.11 Setting Bench Mark Posts and Tablets. Bench mark posts shall be set at locations indicated on the plans or as directed. Excavation shall be to the depth indicated and to dimensions sufficient to provide for the concrete backfilling. This concrete shall be class A and shall extend for 150 mm (6 in.) around and below the

post. The bottom shall be monolithic with the sides. The remainder of the excavation up to the original ground line shall be backfilled with suitable material well tamped in layers. Care shall be taken not to disturb the post. When specified on the plans, or directed, bench mark tablets furnished by the Department shall be placed in newly constructed or existing drainage structures located within the limits of the contracts.

615.12 Reset Bench Mark Posts. When the Proposal book provides that existing bench mark posts be reset, the existing bench mark posts shall be removed and reset at designated locations in accordance with 615.11.

615.13 Method of Measurement. Right-of-way markers, reset right-of-way markers, monuments, re-established monuments, castings adjusted to grade monuments, bench mark posts, and reset bench mark posts will be measured by the number of units installed. Parking barriers will be measured by the number of units installed.

615.14 Basis of Payment. The accepted quantities of right-of-way markers, reset right-of-way markers, monuments, re-established monuments, castings adjusted to grade monuments, bench mark posts, reset bench mark posts, and parking barriers will be paid for at the contract unit price per each complete in place.

Payment will be made under:

Pay Item	Pay Unit
Bench Mark Post	EACH
Bench Mark Post, Reset	EACH
Casting Adjusted to Grade, Monument	EACH
Monument, _____ type	EACH
Monument, Re-establish	EACH
Parking Barrier	EACH
Right-of-Way Marker	EACH
Right-of-Way Marker, Reset	EACH

The costs of setting tablets in structures or bench mark posts, extensions for monuments, adjustment castings, re-establishing disturbed existing monuments, and other necessary incidentals shall be included in the costs of the pay items.

SECTION 616 – RIPRAP AND SLOPEWALL

616.01 Description. This work shall consist of placing broken stone or concrete which may or may not be grouted, precast slabs, or slopewall in accordance with these specifications and in accordance with 105.03.

MATERIALS

616.02 Materials. Materials shall be in accordance with the following:

Asphalt Joint Filler	906.01
Clay	903.01
Concrete, Class A	702
Fine Aggregate, Size No. 23	904
Geotextile	913.18
Portland Cement	901.01(b)
Precast Concrete Riprap	905.04
Riprap	904.04
Water	913.01
Welded Steel Wire Fabric	910.01(b)5

Welded wire fabric shall be 150 mm by 150 mm (6 in. by 6 in.) mesh, W-3 x W-3 wires, with a mass (weight) per square area of 205 kg/100 m^2 (42 lb/100 ft^2).

CONSTRUCTION REQUIREMENTS

616.03 Placing Dumped Riprap. Dumped riprap shall be placed to produce a surface of approximate regularity but need not necessarily be hand placed. The finished surface shall vary no more than 225 mm (9 in.) from a true plane. The thickness perpendicular to its surface shall be no more than 0.6 m (2 ft) nor less than 0.3 m (1 ft) unless otherwise directed.

616.04 Placing Grouted Riprap. The aggregate, preparation of the slope, and the depth of riprap aggregate for grouted riprap shall be in accordance with 616.05. After the aggregate has been placed and accepted, all openings shall be filled with cement grout. The finished surface shall be approximately smooth, solid, and true to line, grade, and section.

Grout shall be composed of one part portland cement and four parts fine aggregate. The portland cement and fine aggregate shall be dry-mixed to a uniform mixture. Water shall be added as the mixing continues until the grout attains a consistency that will allow it to flow into the openings.

616.05 Placing Revetment, Class 1, and Class 2 Riprap. Revetment, class 1 and class 2 riprap may be placed by dumping and shall be placed to the required thickness. The finished surface shall be free from clusters of small stones or of large ones. The finished surface shall vary from a true plane no more than 225 mm (9 in.) for revetment riprap or 450 mm (18 in.) for class 1 or class 2 riprap but shall not be less than the minimum depth specified.

616.06 Placing Uniform Riprap. Uniform riprap shall be placed to produce a surface of approximate regularity with edges having projections no more than 75 mm (3 in.) above the required cross section. The material shall be hand laid or placed by other approved means.

616.07 Blank.

616.08 Placing Precast Cement Concrete Riprap. The slope on which the riprap is to be placed shall be in accordance with that shown on the plans unless otherwise designated. Laying shall begin in a trench below the toe of the slope and progress upward. Each piece shall be laid by hand perpendicular to the slope. It shall be firmly embedded against the slope in such a manner that the vertical joint space between individual units does not exceed 10 mm (3/8 in.), unless otherwise permitted. Half blocks, odd shaped blocks, or class A concrete shall be used to fill the voids at the ends of sections to be placed or on curved shaped sections. The top course shall conform, as nearly as practicable, with the prescribed berm or shoulder elevation. Any adjustment necessary to achieve this shall be obtained by constructing a wedge course near the top of the slope as directed. This wedge course, when required, shall consist of class A concrete. If the thickness of the course does not permit class A concrete, it shall be constructed of a 1:2 mortar proportioned by volume. Toewalls, when required, shall consist of class A concrete.

616.09 Slopewall. The slope on which slopewall is to be placed shall be in accordance with that shown on the plans unless a different slope is designated.

The concrete mixture shall be class A. Where paved slopewall abuts or surrounds columns, piers, or other structures, 15 mm (5/8 in.) of asphalt joint filler shall be used between the slopewall and such structure. Welded steel wire fabric shall be placed within the middle third of the slopewall thickness unless otherwise directed. The fabric shall extend through all construction joints. The surface of the slopewall shall be cured for 48 h in accordance with 501.17. Construction joints may be either butt or keyway type.

Inspection holes shall be provided at the locations shown on the plans or as directed. The holes shall be approximately 1 m x 1 m (3 ft x 3 ft) in size.

Precast concrete riprap, type B, as shown on the plans, may be used in lieu of slopewall of 100 mm (4 in.) thickness.

616.09.1 Undermined Paved Side Ditch. Treatment of undermined existing paved side ditch and placement of revetment riprap shall be as shown on the plans or as otherwise directed.

Undermined paved side ditch shall be broken up and left in place. If it is determined that erosion is excessive, the eroded area shall be backfilled with a cohesive material, compacted, regraded, and lined with revetment or uniform riprap.

616.10 Installation of Geotextile Under Riprap. Storage and handling of geotextiles shall be in accordance with the manufacturer's recommendations, except that the geotextile shall not be exposed to direct sunlight, ultraviolet rays, water, temperature greater than 60°C (140°F), mud, dirt, dust, and debris, to the extent that its strength, toughness or permeability requirements are diminished. Each geotextile roll shall be labeled or tagged to provide product identification sufficient for inventory and quality control purposes. Exposure of geotextiles to the elements between lay down

and cover shall be a maximum of 14 days. At the time of installation, the geotextile shall be rejected and replaced with no additional payment if defects, rips, flaws, deterioration or damage incurred during manufacture, transportation, storage or construction is evident.

The surface to receive the geotextile shall be prepared to a relatively smooth condition free of obstructions, depressions and debris within the limits indicated on the plans.

Geotextiles used along channels shall be placed with the machine direction of the geotextile parallel to the channel. Successive geotextile sheets shall be overlapped in such a manner that the upstream sheet is placed over the downstream sheet and the upslope sheet over downslope sheet.

Geotextiles used for 2:1 slopes or greater shall be placed with the machine direction of the geotextile sheets perpendicular to the toe of slope. The geotextile sheets shall be overlapped in the direction of the anticipated movement of the water.

Adjacent pieces of geotextile may be joined by sewing if approved, or by overlapping and pinning. The minimum overlap shall be 460 mm (18 in.) except when placed under water. When placed under water the overlap shall be a minimum of one meter (3 ft). Securing pins shall be steel, 5 mm (3/16 in.) in diameter, 460 mm (18 in.) long, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of no less than 38 mm (1.5 in.). Securing pins with washers shall be inserted through both strips of overlapped geotextile at spacing intervals in Table 1 along a line through the midpoint of the overlap. The geotextile strip shall be placed so that the lower strip will be overlapped by the next higher strip. Pins shall be driven until the washer bears against the geotextile and secures it firmly to the ground.

Whether the fabric is joined by sewing or pinning, additional pins shall be installed as necessary to prevent any slippage of the fabric regardless of location.

TABLE 1

Slope	Pin Spacing
steeper than 3:1	0.5 m (2 ft)
3:1 to 4:1	1.0 m (3 ft)
4:1 or flatter	1.5 m (5 ft)

The geotextile shall be placed in such a manner that placement of the overlying materials will not excessively stretch or tear the geotextile and will not pull the required overlap or seam apart. Construction equipment will not be allowed on the exposed geotextile. Placement of riprap or stone shall start from the base of the slope, moving upslope and from the center outward. Riprap shall not be allowed to roll downslope and the height drop for riprap shall be kept to less than 0.6 m (2 ft).

616.11 Method of Measurement. Dumped, revetment, class 1, and class 2 riprap obtained from outside the right-of-way will be measured by the megagram (ton). If obtained from inside the right-of-way, no measurement will be made if placed as

shown on the plans unless direct payment is specified. If placed at locations not shown on the plans, measurement will be made by the square meter (square yard).

Grouted riprap, and precast concrete riprap, including the area occupied by the wedge course, will be measured by the square meter (square yard), parallel to the slope. Slopewall will be measured by the square meter (square yard). Holes for inspecting slopewalls will be measured per each. Geotextiles used under riprap will be measured by the square meter (square yard), complete in place. Uniform riprap will be measured by the megagram (ton).

Treatment of undermined paved side ditch will be measured by the meter (linear foot) of paved side ditch, broken and left in place.

616.12 Basis of Payment. The accepted quantities of dumped, revetment, class 1, and class 2 riprap obtained from outside the right-of-way will be paid for at the contract unit price per megagram (ton). Dumped, revetment, class 1, and class 2 riprap obtained from within the project limits will be paid for at the contract unit price per square meter (square yard). Uniform riprap will be paid for at the contract unit price per megagram (ton). Grouted riprap will be paid for at the contract unit price per square meter (square yard) of the specified depth. Precast concrete riprap, and concrete slopewall will be paid for at the contract unit price per square meter (square yard), all complete in place. If slag is used as dumped riprap and payment will be made per megagram (ton), the pay quantity will be adjusted in accordance with 904.01.

The accepted quantities of geotextiles used under riprap will be paid for at the contact unit price per square meter (square yard), complete in place.

Inspection holes will be paid for at the contract unit price per each.

The treatment of undermined paved side ditch will be paid for at the contract unit price per meter (linear foot) for paved side ditch, break. Backfill required for treatment of paved side ditch will be paid for at the contract unit price per cubic meter (cubic yard) for borrow, cohesive.

Payment will be made under:

Pay Item	**Metric Pay Unit Symbol (English Pay Unit Symbol)**
Pay Item	**Metric Pay Unit Symbol**
(Pay Item	**English Pay Unit Symbol)**
Borrow, Cohesive	m3 (CYS)
Geotextiles	m2 (SYS)
Inspection Hole	EACH
Paved Side Ditch, Break	m (LFT)
Riprap, Class _____	Mg (TON)
	m2 (SYS)
Riprap, Dumped	Mg (TON)
	m2 (SYS)

Riprap, Grouted, _____ mm (depth) m2
(Riprap, Grouted, _____ in. (depth) ..... SYS)
Riprap, Precast Concrete ..... m2 (SYS)
Riprap, Revetment ..... Mg (TON)
m2 (SYS)
Riprap, Uniform ..... Mg (TON)
Slopewall ..... m2 (SYS)
Slopewall, Concrete, _____ mm (depth) m2
(Slopewall, Concrete, _____ in. (depth) ..... SYS)

If the contract includes a pay item for removing materials from within the project limits which are used as grouted riprap, the cost of such removal shall be included in the cost of the pay item for the removal work. The cost of placing such material shall be included in the cost of the riprap pay item.

The cost of paved ditch required at the top of riprap and along the edge of riprap will be paid for in accordance with 607.06. The cost of welded steel wire fabric shall be included in the cost of the slopewall.

The cost of excavation below the finished riprap or slopewall surface shall be included in the cost of the riprap and slopewall pay items. The costs of excavation, grading, sewing, pinning, and necessary incidentals shall be included in the cost of geotextiles.

SECTION 617 – GEOGRID FOR SUBGRADE STABILIZATION OR MODIFICATION

617.01 Description. This work shall consist of furnishing and installing geogrid for subgrade stabilization or modification as shown on the plans and in accordance with 105.03.

MATERIALS

617.02 Materials. Materials shall be in accordance with 913.21.

CONSTRUCTION REQUIREMENTS

617.03 Foundation Preparation. The foundation shall be cleared and grubbed in accordance with 201 and excavated using lightweight equipment to minimize disturbance of the foundation soils. Construction activities using heavy weight equipment which cause pumping and rutting of the foundation soils shall be prevented where possible or otherwise minimized. Fine grading may be waived where impractical. However, when very soft soil is encountered, the foundation shall be cleared of all trash and rubbish materials, leaving the roots in place and not disturbing

the vegetation cover. The foundation surface shall be subject to inspection and approval prior to geogrid and fill placement. Proofrolling inspection will not be required.

617.04 Geogrid Placement. The geogrid shall be installed in accordance with the manufacturer's recommendations. Excess geogrid shall be removed. As an alternative, the Contractor will be permitted to turn the excess portion of the geogrid into the fill layer as an envelope, provided an acceptable installation is obtained. The geogrid shall be placed taut prior to backfill placement. Installation may require the use of stakes to hold the geogrid in place.

The geogrid material supplier shall provide a qualified and experienced manufacturer's representative on the project site at the start of the work to assist the Contractor and the Engineer at the start of construction. The representative shall also be available during construction when required by the Engineer.

Geogrid rolls shall be overlapped a minimum of 0.6 m (2.0 ft) side to side and end to end. The geogrids shall be overlapped 1 m (3.0 ft) in areas where foundation conditions cannot support workers' foot traffic or where 0.6 m (2.0 ft) is found to be inadequate during fill placement. Overlaps shall be oriented, or shingled, to prevent advancing fill from lifting the geogrid. Overlaps shall be further secured with metal or plastic ties, hog rings, or small mounds of fill, if necessary, to prevent separation during fill placement. If damage is caused by construction traffic after laying the geogrid, such geogrid shall be patched. Patching shall include placement of a minimum of 1 m (3.0 ft) of overlapped geogrid beyond the damaged area. If the damaged portion extends for more than 50 percent of the roll in the width direction, the entire width shall be replaced.

Geogrid shall be covered with fill as soon as reasonably possible after placement. Exposure of geogrid between laydown and cover shall not be longer than three calendar days. Only that amount of geogrid required for immediately pending work shall be placed to prevent damage to the geogrid.

Each geogrid roll shall be labeled or tagged to provide product identification sufficient for inventory and quality control purposes. No changes to the geogrid layer, including, but not limited to, length, geogrid type, or elevation shall be made without written consent of the Engineer.

617.05 Fill Placement. Vehicles shall not be permitted on the geogrid until 200 mm (8 in.) of fill has been placed on the geogrid. The fill placement shall proceed forward along the roadway centerline and outward to the roadway shoulders of the embankment edges, to minimize wrinkles in the geogrids.

The first lift of fill shall be 200 mm (8 in.) loose in thickness to stabilize and eliminate observable displacement of the subgrade under construction vehicular traffic loads. If it is not possible to compact the first lift of fill to 95 percent of maximum dry density in accordance with AASHTO T 99, the stabilized fill shall be lightly compacted, so as to prevent excessive loading and destabilization of the subgrade. Subsequent lifts shall be placed and compacted in accordance with 203.23. Heavy compaction equipment and vibratory compactors shall be avoided on the stabilized fill.

Fill placed over very soft foundation soil conditions shall require lightweight earth moving equipment.

617.06 Method of Measurement. Geogrid for subgrade will be measured by the square meter (square yard). The quantity will be computed based on the total area of geogrid shown on the plans, exclusive of the area of geogrids used in overlaps. The portion of geogrid cut off or turned up into the backfill layer will not be measured for payment.

617.07 Basis of Payment. The accepted quantities of geogrid for subgrade will be paid for at the contract unit price per square meter (square yard) for geogrid.

Payment will be made under:

Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
Geogrid, Subgrade	m2 (SYS)

The costs of furnishing the materials, manufacturer's representative, all labor, equipment required for furnishing and placing the geogrid, all work necessary to establish grades, geogrid splices, overlaps, stakes or pins, supplemental product test data, and patching or replacement of damaged geogrid shall be included in the cost of this work.

SECTION 618 – Blank

SECTION 619 – PAINTING BRIDGE STEEL

619.01 Description. This work shall consist of preparing surfaces and applying paint to steel bridges in accordance with these specifications or as directed.

MATERIALS

619.02 Materials. Materials shall be in accordance with the following:

Epoxy Intermediate Paint	909.02(b)
Finish Coat for Weathering Steel	909.02(e)
Inorganic Zinc Primer	909.02(a)1
Organic Zinc Primer	909.02(a)3
Polyurethane Finish Coat	909.02(c)
Single Component Inorganic Zinc Primer	909.02(a)2
Structural Steel Coating Systems	909.03
Waterborne Finish Paint	909.02(d)

Material safety data sheets shall be provided in the QCP for all materials to be delivered to the project site.

619.03 Quality Control and Quality Assurance. The Contractor shall be responsible for the quality of work on the contract and shall ensure that all work has been performed by accepted quality control methods. A QCP shall be prepared and submitted by the Contractor in accordance with ITM 803. The QCP shall contain information specific to each bridge in the contract and shall be well organized in content. The QCP shall be submitted at least 15 work days prior to commencing this work. No work may begin until written notice has been received that the QCP was accepted by the Engineer. The QCP Manager shall furnish the current SSPC Structural Steel Painting Manual, Volumes 1 and 2, at the project site.

The painting Contractor shall be certified SSPC-QP 1 for cleaning and painting bridge steel which does not have lead coatings and certified SSPC-QP 2 for cleaning and painting bridge steel which does have lead based coatings. Evidence of the certifications shall be provided in the QCP. A QCP manager and QC technicians shall also be identified in the QCP.

The Department will accept work performed on the project through quality assurance inspections and testing. Acceptance testing will be performed and will be the basis for which acceptance will be made.

(a) Acceptance Testing Definitions. The following definitions of terms shall apply to acceptance testing of painting steel bridges work.

1. Lot. A lot shall be a series of tests performed on each phase for each 100 m^2 (1076 sq ft) or portions thereof.

2. Series. A series shall be 10 random tests performed by the Engineer on a lot.

3. Phase. A phase shall be painting operations consisting of either the cleaning of steel or the application of each coat of paint.

(b) Testing Procedure. During acceptance testing, the results of the random testing within a series will be compared to the specified requirements for that phase of work. A series of spot measurements spaced evenly over each lot will be made. The average of 10 spot measurements for each lot shall not be less than the specified thickness. A single spot measurement in any lot shall not be less than 80% of the specified thickness. A reading below the minimum of the average of 10 spot measurements less than the specified thickness shall be considered a defect. If there is only one defect for the series of tests, the lot will be accepted provided there are no visual defects. If two defects are found in the first series of tests, then a second series of tests for each lot shall be measured. If three defects are found in the first series of tests, then the lot fails. If the first and second series of tests have four or less defects, both series pass. If there are more than four defects, then the lot fails.

If a lot fails, corrective action shall be taken to make the lot acceptable. Corrective action shall be submitted in writing and performed as approved. A failed lot shall not be covered until the whole lot has been accepted.

(c) Test Methods and Procedures. The current version of the following test methods and procedures shall be performed as a minimum for quality control by the Contractor. These and other tests may be performed for acceptance testing by the Engineer.

TEST/PROCEDURE	METHOD AND PROCEDURE
Surface Profile	ASTM D 4417
Clean Compressed Air	ASTM D 4285
Cleaning of Steel	SSPC Vis 1, Vis 3, and ISO 8501-1
Dry Film Thickness	SSPC PA 2
State of Cure of Inorganic Zinc Primers	ASTM D 4752
Relative Humidity	ASTM E 337

619.04 Prosecution of Work. Prosecution of work shall be in accordance with the applicable requirements of 108.03. Once the operations of cleaning and painting have begun, it shall be performed on all work days without stoppage until all work has been completed. If the contract contains more than one bridge, a schedule shall be included in the QCP which provides the sequence of work on the bridges. When work has begun on a bridge, it shall be performed until complete, including all cleanup.

Permission shall be obtained in writing to start or continue work at the hold points as follows:

(a) prior to the acceptance of the QCP and start of work;
(b) immediately following a surface preparation phase;
(c) immediately before the application of the first coat;
(d) prior to the application of each succeeding coat; and
(e) after the final coat has cured.

A minimum of one day's notice shall be given in advance of each of the hold points.

619.05 Inspection Access to Bridges. Safe and reasonable access to all points of the bridge shall be provided for the Engineer's inspections immediately upon request. The inspection access equipment shall be obtained, maintained, and kept in safe working order.

619.06 Maintaining Traffic. The traffic lanes may be restricted when surface preparation or painting phases are being performed on a portion of the bridge over the travelled roadway, or as directed, when the need exists. A traffic maintenance plan shall be provided in the QCP and shall be in accordance with the plans.

Construction signs in accordance with 801.04 shall be furnished and placement at each project site shall be shown in the QCP. However, a "Bridge Painting Ahead" sign may be used in place of the "Road Construction Ahead" sign.

The traffic maintenance plan shall include a type of barrier system which shall protect against direct blasting of vehicles or pedestrians, eliminate abrasive materials and debris from falling onto the travelled portion of the pavement, and prevent the spreading of abrasive materials and debris in the area which may create a traffic hazard. If the intended purposed of the protective devices has not been accomplished, work shall stop until adequate corrections have been made. All abrasive material or debris shall be removed by the end of each day's work in accordance with 619.07.

619.07 Environmental and Safety Requirements. Pollution control and waste disposal of existing paint and debris shall be in accordance with the following requirements.

The QCP shall contain a written description of the Contractor's hazardous waste training program in accordance with 40 CFR 265.16 and ITM 803. Likewise, the waste contingency plan shall be contained in the QCP and in accordance with ITM 803.

A health and safety plan shall be provided in the QCP and in accordance with ITM 803. Workers shall be protected in accordance with IOSHA requirements. All personnel on the project site shall wear personal protective equipment. The protective equipment shall be furnished by the Contractor, including to Department personnel. Training shall be given to all personnel provided with the protective equipment. Protective equipment shall include, but not be limited to, clean air supplied respirators, air purifying respirators, conventional hood as applicable, eye protection, and protective clothing. Two rooms for changing and washing shall be provided on lead primed bridges.

(a) Pollution Control. The containment procedure plan shall be provided in the QCP. The telephone numbers for the IDEM Emergency Response Branch, local health department, and all water intake users within 150 m (500 ft) shall be provided in the QCP.

Blasting materials, scrapings, wire brushings, and paint particles shall be contained in accordance with SSPC-Guide 6 (CON), Class 3, specifically for zinc primed bridges, and SSPC-Guide 6 (CON), Class 2, for lead primed bridges.

If a spill, as defined in IDEM Regulation 327 IAC 2-6 does occur, all work shall stop and immediate action shall be taken to clean up the site. Spills of material, which enter or threaten to enter the water, shall be handled in accordance with IDEM Regulation 327 IAC 2-6. The IDEM Emergency Response Branch, the local health department, and all water intake users within 150 m (500 ft) of the bridge shall be immediately contacted and advised of the spill. Written documentation of all such contacts and actions shall be kept. All applicable Federal, State, and local rules and regulations described in 619.07(b)1 shall be observed.

On bridges with lead paint, steel grit blasting abrasives shall be used and recycled. The recycling equipment shall be capable of separating the blasting abrasive from the paint debris. The residue from the bridge shall be sampled within the first five days of removal and shipped to be tested. Residue shall be placed in an approved container. Such containers shall be properly labeled and maintained to comply with 40 CFR 264.

No waste shall remain on the booms or on the water surface overnight. All blasting debris shall be cleaned up after each day's work. All waste material shall be properly stored at the project site to prevent loss or pollution.

(b) Waste Disposal. Disposal of existing paint and debris shall be in accordance with SSPC-Guide 7 (DIS) and the following requirements.

1. Laws to be Observed. Federal and State laws and regulations regulate the disposal of bridge painting debris. Bridge paint debris shall be manifested or certified and shall be disposed of at an appropriate disposal facility.

The Contractor shall have direct knowledge regarding compliance with laws pertaining to pollution control and waste management such as follows.

a. subtitle C of the Resource Conservation and Recovery Act, 40 CFR 261, 262, 263, 265, and 268;

b. the Solid Waste Rule, 329 IAC 2;

c. the Hazardous Waste Rule, 329 IAC 3;

d. the Air Pollution Rule 326 IAC 4;

e. the Water Pollution Rule, 327 IAC 2-6;

f. the United States Department of Transportation regulations 49-CFR 172.300; and

g. OSHA worker safety regulations 29 CFR 1926.

2. Time Limitations. The maximum time limit from the date the generated waste is placed in a container and the date the material is transported to a permitted treatment, storage, and disposal facility shall be 90 calendar days.

3. Marking of Spent Material Containers. Spent material containers shall be marked with the date that waste is first placed in the container. Until laboratory results are received concerning the category of the waste, the containers shall be labeled "LEAD PAINT WASTE DEBRIS" or "ZINC PAINT WASTE DEBRIS", as appropriate. Labeling of containers as hazardous waste will not be required until the appropriate laboratory analysis determines the waste to be hazardous in accordance with the current RCRA hazardous waste definitions. Immediately upon notice that the waste

is hazardous, the containers shall be marked in accordance with 49 CFR 172, Subpart D.

4. Instruction for Disposal of Paint Waste. Sampling and analysis of the paint waste debris shall be performed to determine if the wastes are hazardous. If the waste is not found to be hazardous in accordance with current RCRA hazardous waste definitions, the waste material shall be disposed of at an appropriate facility. If the waste is found to be hazardous, IDEM shall be notified and an EPA identification number will be obtained by the Department. This will be provided to the Contractor within 30 days of the start of waste generation for bridges having hazardous waste paint debris. The waste from different bridges shall not be mixed. The Contractor shall have the responsibilities as follows:

a. determining the location for disposal, treatment or recycling of the waste, obtaining the Engineer's approval of the site, and arranging with the approved site for the acceptance of the materials;

b. preparing a hazardous waste manifest, as required by Federal and State requirements, for signature;

c. scheduling the shipment of waste to the permitted disposal site;

d. ensuring that the hazardous waste manifest is carried in the transportation vehicle;

e. ensuring that all required hazardous materials placards are properly displayed on the vehicle;

f. ensuring prompt movement of the vehicle to the disposal site; and

g. returning one copy of signed manifest documents to the Engineer. A copy of the chemical and physical analysis of the waste, all deposit receipts, manifests, and required paperwork for disposal shall be given to the Engineer and all waste disposed of before the contract will be accepted.

The waste disposal site shall be identified in the QCP.

5. Instructions for Disposal of Other Project Generated Waste. The other wastes that may be generated on the project include, but are not limited to, spent solvents from cleaning of equipment and empty or partially empty containers of paint, paint thinners, spent abrasives and solvents. The Contractor shall recycle or dispose of all project generated waste materials.

If the waste is defined as a hazardous waste in accordance with the current RCRA definitions, the waste shall be recycled or disposed of in accordance with 619.07(b)4. All project generated wastes and the method of recycling or disposal shall be identified in the QCP.

619.08 Surface Preparation. Cleaning of steel surfaces shall be performed by a SSPC certified contractor. This requirement will not apply to the following:

(a) shop cleaning,

(b) bearings at end bents,

(c) small sections of beams at end bents or at piers with open joints, or

(d) small sections of beams or other structural members where heat-straightening or similar repairs have taken place.

Surfaces to be painted shall be cleaned in accordance with SSPC classification, unless otherwise specified. The latest cleaning comparison chart available shall be provided in the QCP. Compressed air shall pass through an oil and water extractor before entering another apparatus.

Field cleaned steel surfaces shall be primed the same day as cleaned. If rust forms after cleaning, the surface shall be cleaned again before painting. Work shall be stopped when there is disagreement about whether a surface has been adequately cleaned. Written notification shall be provided specifically identifying the problem.

Cleaning shall be scheduled so that dust or other contaminants do not fall on wet, newly-painted surfaces.

The surface profile of cleaned new steel surfaces shall not be less than 25 μm (1 mil) and not greater than 50 μm (2 mil). The surface profile of cleaned existing steel shall not be less than 25 μm (1 mil) and not greater than 75 μm (3 mil).

Pressure washing in accordance with 619.08(a) and solvent cleaning in accordance with 619.08(b) shall be performed before all other cleaning methods.

(a) Pressure Washing. All surfaces to be painted and the tops of pier and abutment caps shall be washed. The washing shall be accomplished by means of a low pressure power water washer with potable water. The pressure shall be between 5 and 10 MPa (800 and 1500 psi). If detergents or other additives are added to the water, the surface shall be rinsed with potable water before the detergents dries. All washed surfaces shall be completely free of all foreign matter and shall be approved prior to other surface preparation activities.

(b) Solvent Cleaning. After pressure washing has been approved, solvent cleaning shall be in accordance with SSPC-SP1.

(c) Near-White Blast Cleaning. Near-white blast cleaning shall be in accordance with SSPC-SP10/NACE No. 2.

(d) Commercial Blast Cleaning. Commercial blast cleaning shall be in accordance with SSPC-SP6/NACE No. 3.

(e) Hand Tool Cleaning. Hand tool cleaning shall be in accordance with SSPC-SP2.

(f) Brush-Off Blast Cleaning. Brush-off blast cleaning shall be in accordance with SSPC-SP7/NACE No. 4.

(g) Power Tool Cleaning. Power tool cleaning shall be in accordance with SSPC-SP3.

(h) Power Tool Cleaning to Bare Metal. Power tool cleaning to bare metal shall be in accordance with SSPC-SP11.

619.09 Paint Systems. Paint systems shall be applied in accordance with the manufacturer's recommendations. The dry film thickness of a paint coating will be measured with a calibrated film thickness gauge.

(a) Structural Steel Paint System. The coating system shall consist of an inorganic zinc primer with a dry film thickness of 75 μm (3 mil), an epoxy intermediate coat with a dry film thickness of 100 μm (4 mil), and a polyurethane finish coat with a dry film thickness of 75 μm (3 mil) for the painting of steel bridges and other structural steel.

(b) Partial Paint System. The coating system shall consist of an organic zinc primer with a dry film thickness of 75 μm (3 mil) and a waterborne finish coat with a dry film thickness of 75 μm (3 mil) for partial painting of steel bridges and other structural steel.

619.10 Painting. Painting shall be performed by a SSPC certified contractor, except as noted in 619.08. All technical data sheets containing the manufacturer's recommendations and instructions shall be provided in the QCP and in accordance with ITM 803.

Concrete at all junction points of concrete and steel shall be adequately shielded or otherwise protected so that the application of paint on steel is full and complete, and that spraying onto the concrete is minimized.

If a blasted or painted surface is unsatisfactory, removal of the paint, thorough cleaning of the surface, and repainting or other correction will be required as directed. Where defects or damages occur in a film of any coating, all defective areas shall be removed to soundly bonded paint or bare steel and painted to the specified thickness.

No lettering shall be painted on bare or painted steel surfaces, except marks required for erection and project information stenciled in accordance with 619.10(g).

(a) Weather Limitations. Field painting will not be permitted between November 15 and the following April 1. Painting shall begin only when the 24 h ambient temperature is to remain above 10°C (50°F) after paint application, and the steel surface temperature is between 10°C and 40°C (50°F and 100°F). Coating and curing shall be done only when the relative humidity is to remain between 30 and 80

percent. All variations of these weather limitations to allow the use of any coating below the minimum or above the maximum temperature or humidity as may be recommended by the manufacturer shall be provided in the QCP. The pot life and induction time shall be in accordance with the manufacturer's recommendations for the existing temperature and humidity.

Paint shall not be applied when the air is misty, or when conditions are otherwise unsuitable. The surface temperature of the steel to be painted shall not be within 3°C (5°F) of the dew point. When painting in a protected area to eliminate the above conditions, the steel shall remain under cover until the paint is dry. All wet paint which has been exposed to excessive humidity, rain, snow, or condensation shall be permitted to dry. Damaged paint shall then be removed. The surface shall be recleaned and repainted as directed. The Engineer will be the sole authority to decide when work may begin or shall stop due to weather conditions.

(b) Storage. Paint shall be stored in accordance with the manufacturer's recommendations. If paint is permitted to remain in storage, the containers shall be turned end for end at least once per week. The paint shall be used within the manufacturer's recommended shelf life.

(c) Mixing. Paint shall be thoroughly mixed so that the pigment is completely in suspension and the consistency is uniform. Mechanical mixers shall be used in accordance with the manufacturer's instructions. The paint shall remain in this condition during application to the steel surface. After initial mixing and before application, zinc primer shall be strained through a metal screen not coarser than the 600 μm (No. 30) sieve.

Partially empty containers of paint shall not be used. Partial mixing of containers will not be permitted. All paint containers shall remain closed until needed for mixing.

(d) Thinning. When required for proper application, the thinning of field paint will be permitted. Only thinners recommended by the manufacturer and as approved shall be used. Thinners shall be added to paint in accordance with the manufacturer's recommendations. The maximum quantity added shall not exceed the manufacturer's recommendations. The thinned paint shall not exceed IDEM regulations for volatile organic compounds.

The Contractor shall contact IDEM and the local air pollution control board for information about any volatile organic compound regulations or restrictions. Proof of contact to these agencies shall be provided in the QCP.

(e) Application of Paint. All paint coatings shall be of colors to produce a distinct contrast with adjacent coatings, including the color of a clean steel surface.

Paint shall be applied by either an airless or conventional spray method which has been recommended by the paint manufacturer. The compressed air used for painting shall pass through an oil and water extractor before entering the paint pot. However, areas to be painted which are inaccessible to spray application or areas

requiring touchup may be painted with brushed or daubers. Epoxy intermediate and polyurethane finish paints may be applied by brushes or rollers provided the coating cures to a smooth and uniform finish.

Spray shall be adjusted to produce a uniform coating. All 90 degree edges shall be striped, and then repainted with the remaining steel surfaces. Painting techniques shall minimize dry overspray. Dry overspray shall be removed prior to application of other coatings and after application of the finish coat.

All paint coatings shall have a dry film thickness not less than 80 percent of the required dry film thickness.

(f) Curing Time. The minimum curing time between coatings shall be 24 h for inorganic zinc primers and 8 h for the epoxy intermediate coat. The curing time will vary depending on the temperature and humidity. The inorganic zinc primer shall be cured to a minimum solvent resistance rating of 4 in accordance with ASTM D 4752 prior to the application of the epoxy intermediate coat. It shall be demonstrated that the inorganic zinc primer is in accordance with this requirement. The epoxy intermediate coat shall be cured in accordance with the manufacturer's recommendations prior to the application of the polyurethane finish coat. The polyurethane finish coat shall be applied within 12 calendar days of application of the epoxy intermediate coat.

The curing time of all other paint systems or coatings shall be in accordance with the manufacturer's recommendations.

(g) Stencil Identification. After the finish coat has been approved, project identification information shall be painted with a stencil in 50 mm (2 in.) black capital letters onto the outside of both facia beams, at the right end of the beam and near the end bent, which reads as follows:

_____
bridge number

_____
contract number

PAINTED_____
date

619.11 Shop Painting. All structural steel shall be cleaned in accordance with 619.08(c). All technical data sheets containing manufacturer's recommendations and instructions shall be provided in the QCP and in accordance with ITM 803.

All structural steel, except for ASTM A 709M, grade 345W (ASTM A 709, grade 50W) steel, shall receive an inorganic zinc primer, including faying surfaces of high strength bolted connections and areas in contact with concrete. When shear connectors have been specified, the top of the flange shall not be painted.

Surfaces, other than the contact surfaces described above, which are inaccessible after erection shall be painted in the shop with the full paint system required on the completed bridge.

Machine finished surfaces for sliding contact shall be coated with heavy grease as soon as practicable after being accepted, but before removal from the shop.

Erection marks may be painted on zinc painted surfaces. Shop painted beams shall not be loaded for shipment until the paint is dry.

ASTM A 709M, grade 345W (ASTM A 709, grade 50W) steel shall be left unpainted, except as shown on the plans. Surfaces, when specified, shall be painted in accordance with 619.09(a), except the finish coat shall be in accordance with 909.02(e).

619.12 Field Painting New Steel Bridge. All structural steel which has been painted with inorganic zinc primer in the shop, except for steel contact surfaces and surfaces to be in contact with concrete, shall be painted with the other coatings specified for structural steel paint system in accordance with 619.09(a). All steel surfaces which become inaccessible to field painting after final erection shall be painted with all coats of structural steel paint system before structural steel is erected.

If application of the inorganic zinc primer on a steel surface is not permitted in the shop before erection of the bridge, the surfaces which are exposed shall be cleaned in accordance with 619.08(a), 619.08(b), and 619.08(c). These surfaces shall then be painted with the structural steel paint system after erection.

Surface areas where the inorganic zinc primer was damaged during shipping, handling, and erection shall be cleaned in accordance with 619.08(a), 619.08(b), and either 619.08(d) or 619.08(h). Likewise, all bolt and field connections shall be cleaned in the same manner. All the damaged areas, and bolt and field connections shall then be painted with the inorganic zinc primer applied in the shop. This requirement will not apply to temporary steel bridges.

Where steel surfaces have been painted with the full paint system and the paint coatings have been damaged, the affected steel surface areas shall be cleaned in accordance with 619.08(h). Structural steel paint system shall then be reapplied.

619.13 Painting Existing Steel Bridges. The surfaces to be cleaned and painted shall include the surfaces of all steel members of the superstructure, substructure, floor beams, stringers, plates, castings, bearing assemblies, ornamental handrails, lattice work, and other steel appurtenances.

If the contract specifies clean steel bridge, the bridge steel shall be cleaned in accordance with 619.08(a), 619.08(b), and either 619.08(d) or 619.08(h). The structural steel paint system in accordance with 619.09(a) shall be used for painting.

If the contract specifies clean steel bridge, partial, the bridge steel shall be cleaned in accordance with 619.08(a), 619.08(b), and either 619.08(d), 619.08(g), or

619.08(h). The partial paint system in accordance with 619.09(b) shall then be used for painting.

619.14 Drain Castings Treatment. Drain castings shall be satisfactorily cleaned. The castings shall not be shot-blasted. If castings are sandblasted, a brush blast technique shall be used in accordance with 619.08(f).

The drain castings shall be painted with a black finish coat in accordance with 909.02(c).

619.15 Claims. No claim shall be made for damage, including but not limited to, damage for delay, increased expense, maintenance, start up costs, additional costs due to passage of time arising out of a dispute, or work stoppage relating to whether a surface was adequately cleaned or painted.

No claim shall be made due to a greater amount of paint used in excess of the minimums required by the contract or for the stoppage of work. Each bridge shall be inspected before bidding for the exact type of primer that exists on each bridge.

619.16 Responsibility for Damage. All persons and property shall be protected from damage or injury from the surface preparation operations, paint, and painting operations. Persons and property shall include, but not be limited to, pedestrians, vehicles, and other traffic upon or underneath a bridge, all portions of the bridge superstructure and substructure, and all adjacent property. The Contractor shall be responsible for damages in accordance with 107.16.

619.17 Method of Measurement. Cleaning and painting will not be measured.

Floor drain extensions will be measured per each drain extended.

The estimated mass (weight), length, and number of steel spans and type of primer shown on the plans or in the Proposal book is incidental information. Such information is approximate only. The Department will not guarantee its accuracy.

619.18 Basis of Payment. Removal of paint on an existing bridge will be paid for at the contract lump sum price for clean steel bridge or clean steel bridge, partial, at the bridge number specified. The accepted quantities of existing steel bridges to be painted, or partial painted, whichever is specified, will be paid for at the contract lump sum price for paint steel bridge or paint steel bridge, partial, at the bridge number specified.

Drain extensions will be paid for at the contract unit price per each.

If the contract includes a pay item for maintaining traffic, such work will be paid for at the contract lump sum price for maintaining traffic, at the bridge number specified.

Environmental control devices required when cleaning and painting existing steel bridges will be paid for at the contract lump sum price for environmental control at the bridge number specified.

Payment will be made under:

Pay Item	Pay Unit Symbol
Clean Steel Bridge, Br. No. ____	LS
Clean Steel Bridge, Partial, Br. No. ____	LS
Drain Extension	EACH
Environmental Control, Br. No. ____	LS
Maintaining Traffic, Br. No. ____	LS
Paint Steel Bridge, Br. No. ____	LS
Paint Steel Bridge, Partial, Br. No. ____	LS

The cost to prepare a QCP shall be included in the costs of other pay items. The costs of providing the Department with access to the bridge, the use of special cleaning methods, handling debris containers, seasonal or weather limitations, and labor, materials, and equipment required for maintaining traffic shall be included in the costs of other pay items.

The costs of furnishing all materials, equipment, and labor required for washing, solvent cleaning, scraping, steel brushing, or other acceptable methods for removing paint in the locations directed shall be included in the cost of clean steel bridge or clean steel bridge, partial.

The costs of furnishing all materials, equipment, and labor to perform painting with structural steel paint system shall be included in the cost of paint steel bridge and to perform painting with partial paint system shall be included in the cost of paint steel bridge, partial. Painting will not be paid for separately, unless so specified. The cost thereof shall be included in the costs of other pay items.

The costs of all equipment, material, labor, testing, and disposal of spent materials and debris shall be included in the cost of environmental control. No additional payment will be made for delays from all operations undertaken for this work. The absence of an environmental control pay item shall not negate the Contractor's responsibility for complying with the environmental control requirements in all phases of this work.

SECTION 620 – Blank

SECTION 621 – SEEDING AND SODDING

621.01 Description. This work shall consist of either or both plain and mulched seeding or placing approved sod. It includes furnishing and placing seed, fertilizer, inoculants, top soil, and mulch, if required, in a prepared seed bed or furnishing and placing sod at locations in accordance with 105.03.

MATERIALS

621.02 Materials. Materials shall be in accordance with the following:

Fertilizer	914.03
Grass Seed	914.04
Grass Seed, Temporary	914.02
Leguminous Inoculants	914.06
Mulch	914.05(a)
Plastic Net	914.09(g)
Sod, including Nursery Sod	914.07
Top Soil	914.01
Water	914.09(a)
Wire Staples	914.09(f)

CONSTRUCTION REQUIREMENTS

621.03 Preparation of Ground Before Seeding. The area to be seeded shall be made smooth and uniform and shall be in accordance with the finished grade and cross section shown on the plans or as otherwise designated and shall be trimmed in accordance with 210.

The seed bed, if not loose, shall be loosened to a minimum depth of 75 mm (3 in.) before fertilizer or seed is applied. In areas of excessive vehicular traffic, such as parking of construction equipment near a bridge repair, the soil shall be loosened to a minimum depth of 150 mm (6 in.). Areas to be covered with topsoil shall be milled or disked slightly before the topsoil is placed. A disk, spike-toothed harrow, or other similar device may be used for this purpose. Such loosening will be required to ensure bond of the topsoil with the surface on which it is put and to form a uniform surface. The topsoil shall then be spread to a sufficient depth to produce the thickness specified after it has been compacted lightly with an approved roller, tamping device, or other method.

For temporary seeding, the seed bed, if not loose, shall be scarified. The area to be temporary seeded need not be made smooth and uniform.

621.04 Preparation of Ground Before Applying Erosion Control Blankets. Prior to placing the blankets, the area to be covered shall be relatively free of all rocks or clods over 38 mm (1.5 in.) in diameter, and all sticks or other foreign material, which prevent the close contact of the blanket with the seed bed. If as a result of a rain, prepared seed bed becomes crusted or eroded, or if eroded places, ruts, or depressions exist, the soil shall be reworked until it is smooth. Such areas which are reworked shall be reseeded.

621.05 Applying Fertilizer, Seed, and Mulch.

(a) Fertilizer. Fertilizer as specified shall be spread uniformly over the area to be seeded. Fertilizer shall be spread at the rate of 900 kg/ha (800 lb/acre) unless otherwise specified.

(b) Seed. Seed may be drilled in or mixed with water. The mixture shall be sprayed over the area to be seeded. An approved mechanical method which shall place the seed in direct contact with the soil may be used. In places inaccessible to mechanical equipment, or where the area to be seeded is small, a hand operated cyclone seeder or other approved equipment may be used. Seed of warm season grasses, forbs, or aquatic species shall not be covered more than 3 mm (0.125 in.). All other seed shall not be covered more than 13 mm (0.5 in.).

Leguminous seeds, unless otherwise specified, shall be inoculated with a culture in accordance with 914.06. The culture shall be mixed with sufficient water to distribute it thoroughly. The seed shall be wetted thoroughly with the solution and allowed to dry sufficiently to be in condition for sowing. Inoculated seed shall be sown within 30 h after the treatment. Where seeding is to be done by hydraulic methods, the inoculate may be added to the water in the spray tank.

(c) Mulch. Mulching material, when specified, shall be applied uniformly in a continuous blanket at the rate of 4.5 Mg/ha (2 tons per acre). Mulch shall be placed within 24 h after seeding. The percent of moisture in the mulch shall be determined in accordance with 621.13(c).

Mulching material shall be punched into the soil so that it is partially covered. The punching operation shall be performed longitudinally with the mulch tiller. The tools used for punching purposes shall be disks that are notched and have a minimum diameter of 400 mm (16 in.). The disks shall be flat or uncupped such as notched coulters commonly used on moldboard plows. Disks shall be placed a maximum of 200 mm (8 in.) apart along the axle or shaft. Shaft or axle sections of disks shall not exceed 2.5 m (8 ft) in length.

The mulch tiller for punching shall be constructed so that weight may be added or hydraulic force from the tractor may push the puncher into the ground. If heavy weights are not used, several trips over the area may be necessary to work part of the mulch into the soil. Care shall be exercised to obtain a reasonably even distribution of mulch incorporated into the soil.

After procedures for holding the mulch in place have been completed, mulch, other than when applied by hydroseeder, shall be watered thoroughly. The seed or soil beneath it shall not be displaced. The mulching material shall be maintained in place satisfactorily until final completion and acceptance of the contract except as provided in 107.17. When seeding is performed between June 1 and August 15, a second thorough watering shall be applied approximately 21 days after seeding.

On slopes steeper than 3:1, or when specified, the following methods will be permitted.

1. Method A. The mulch may be held in place by means of a commercially produced mulch binder which is in accordance with all applicable State and Federal regulations. Such product shall be applied in accordance with the manufacturer's written instructions. A copy of the written instructions shall be supplied

to the Engineer prior to the seeding work. The product shall contain a coverage indicator to facilitate visual inspection for evenness of application. If the mulch fails to stay in place, the Contractor shall repair all damaged areas. A change in the mulch binder may be requested by the Engineer.

2. Method B. The mulch may be held in place by spraying it with a satisfactory liquid asphalt or asphalt emulsion. The bituminous material may be applied immediately after the mulch is in place or it may be injected into the mulch as it leaves a power driven mulch spreader. If applied to the surface, the amount shall be approximately 0.25 L/m^2 (0.06 gal./sq yd). If applied as the mulch comes from the spreader, the amount shall be approximately 0.25 L/kg (60 gal./ton) of mulch material. The exact amount shall be as directed.

3. Method C. The mulch may be held in place with binder twine fastened down with wooden pegs not less than 150 mm (6 in.) long spaced 1.2 m (4 ft) apart. The twine shall be placed parallel to and also at 60 degrees with the pavement edge in both directions. The distance between the intersections of the diagonal strands measured along the strands shall be 3.7 m (12 ft). The strand parallel to the pavement shall cross the diagonal strands at their intersections to form equilateral triangles 3.7 m (12 ft) on a side.

4. Method D. The mulch may be held in place with a polymeric plastic net. The plastic net shall be unrolled such that it lays out flat, evenly and smoothly, without stretching the material. The plastic net shall be held in place by means of wire staples. The wire staples shall be driven at a 90 degrees angle to the plane of the soil slope. Staples shall be spaced not more than 1.2 m (4 ft) apart with rows alternately spaced. The plastic net shall be secured along the top and bottom of the soil slope with staples placed not more than 0.3 m (1 ft) on center. The ends and edges of the plastic net shall be overlapped approximately 100 mm (4 in.) and stapled. Overlaps running parallel to the slope shall be stapled 0.3 m (1 ft) on center and overlaps running perpendicular to the slope shall be stapled at least 0.9 m (3 ft) on center. The plastic net shall be placed with the length running from top of slope to toe of slope, or the plastic net shall be placed with the length running horizontally or parallel to the contour.

5. Method E. The area may be covered with erosion control blankets. The Contractor will be permitted to use excelsior blanket, paper mat, or straw mat.

(d) Excelsior Blankets. Excelsior blankets may be used where mulched seeding is specified or where erosion control blanket is specified. Excelsior blankets shall be placed within 24 h after seeding operations have been completed. The ground shall be prepared in accordance with 621.04. After the area has been properly shaped, fertilized, and seeded, the blanket shall be laid out flat, evenly and smoothly, without stretching the material. Excelsior blankets shall be held in place by means of wire staples. The staples shall be driven at a 90 degree angle to the plane of the soil slope. Staples shall be spaced not more than 1.5 m (5 ft) apart in three rows for each strip, with a row along each edge and one row alternately spaced in the middle. The upslope edge shall be fastened by staples spaced 300 mm (12 in.) apart. The ends and edges of the blankets shall be tightly butted together, but not lapped. When excelsior blanket is used, the blanket shall be placed with the length running from top of slope to toe of

slope, or the blanket shall be placed with the length running horizontally or parallel to the contour. The staples used for stapling shall be in accordance with 914.09(f).

(e) Paper Mat. Paper mat may be used for mulch for seeding where mulched seeding is specified or where erosion control blanket is specified. Paper mat shall be placed within 24 h after seeding operations have been completed. The ground shall be prepared in accordance with 621.04.

After the area has been properly shaped, fertilized, and seeded, two anchor trenches shall be dug, one along the foot of the slope and the other 0.3 m (1 ft) back from the crown of the slope. These anchor trenches shall be 100 mm (4 in.) deep and at least 150 mm (6 in.) wide. One edge of the paper mat shall be placed into the top trench and stapled 230 mm (9 in.) on center. The trench shall then be filled in with soil. The paper mat shall then be unrolled such that it lays out flat, evenly and smoothly, without stretching the material. Paper mat shall be held in place by means of wire staples. The staples shall be driven at a 90 degree angle to the plane of the soil slope. Staples shall be spaced not more than 1.0 m (3 ft) apart with rows alternately spaced. The paper mat shall be secured in the bottom anchor trench in the same manner as it was secured in the upper anchor trench. The ends and edges of the mat shall be overlapped at least 100 mm (4 in.) and stapled.

Overlaps running parallel to the slope shall be stapled 460 mm (18 in.) on center and overlaps running perpendicular to the slope shall be stapled at least 230 mm (9 in.) on center. When paper mat is used, the mat shall be placed with the length running from top of slope to toe of slope, or the mat shall be placed with the length running horizontally or parallel to the contour.

(f) Straw Mat. Straw mat may be used for mulch for seeding on projects where mulched seeding is specified or where erosion control blanket is specified. Straw mat shall be placed within 24 h after seeding. The ground shall be prepared in accordance with 621.04. After the area has been properly shaped, fertilized, and seeded, the straw mat shall be unrolled over the designated area so that the plastic mesh is on top and the straw fibers are snugly and uniformly in contact with the soil surface without stretching the material. The rolls shall be butted snugly together and stapled in place. The staples shall be driven through the blanket at a 90 degree angle to the plane of the ground surface. Each staple shall anchor the plastic mesh. The staples shall be spaced at approximately 1.0 m (3 ft) increments, both longitudinally and transversely.

For placement on slopes, the straw mat shall be placed with the length running from the top of slope to the toe of slope and shall extend a minimum of 0.9 m (3 ft) over the crown of the slope. On slope applications, six staples shall be installed across the uphill end of each roll. The downhill ends of the lowermost rolls across the slope shall also be anchored with six staples, placed on uniform spacing.

For placement in ditchlines, the straw mat shall be unrolled parallel to the center line of the ditch. The mat shall be placed so that there are no longitudinal seams within 600 mm (24 in.) of the bottom center line of the ditch. In ditchlines, six staples shall be placed at uniform spacing across the upstream end of each roll.

(g) Wood Cellulose Fiber Mulch. Wood cellulose fiber may be used where mulched seeding is specified. Wood cellulose fiber mulch shall be placed at the rate of 2200 kg/ha (1 ton/acre) within 24 h after seeding operations have been completed. Application shall be by hydraulic mulching and consist of mixing wood cellulose fiber mulch and grass seed with water. It shall be mixed in standard hydraulic mulching equipment to form a homogeneous slurry. The slurry shall be sprayed, under pressure, uniformly over the soil surface. The hydraulic mulching equipment shall contain a continuous agitation system that keeps all materials in uniform suspension throughout the mixing and distribution cycles. Fertilizer shall be applied in accordance with 621.05(a).

621.06 Seed Mixtures. Seed mixtures shall be classified as follows. Mixes including warm season grasses, forbs, or aquatic species will be specified in the plans.

(a) Seed Mixture R. This seed mixture shall be applied at the rate of 190 kg/ha (170 lb/acre). The mixture shall consist of 43 kg (95 lb) of low endophyte Kentucky 31 Fescue or approved equal, 30 kg (65 lb) perennial rye grass, and 4.5 kg (10 lb) Jasper Red Fescue or approved equal. Fertilizer and mulching material, where specified or directed, shall be applied in accordance with 621.05.

(b) Seed Mixture U. This seed mixture shall be applied at the rate of 165 kg/ha (150 lb/acre). The mixture shall consist of 43 kg (95 lb) of a 4-way blend of turf type tall fescues such as Tribute, Rebel II, Trailblazer, or approved equal; 9 kg (20 lb) Jasper Red Fescue or approved equal; and 16 kg (35 lb) certified fine bladed perennial ryegrass such as Regal, Fiesta, Blazer, or approved equal. Fertilizer and mulching material, where specified or directed, shall be applied in accordance with 621.05.

(c) Seed Mixture P. This seed mixture shall be applied at the rate of 90 kg/ha (80 lb/acre). The mixture shall consist of 14 kg (30 lb) of "Fults" Puccinella Distans, 14 kg (30 lb) of Jasper Red Fescue, or approved equal, and 9 kg (20 lb) of perennial ryegrass. Fertilizer shall be applied at the rate of 450 kg/ha (400 lb/acre). Fertilizer and mulching material, where specified or directed, shall be applied in accordance with 621.05.

(d) Blank.

(e) Seed Mixture D. This seed mixture is intended for ditch situations which experience seasonal to chronic saturated soils. This seed mixture shall be used on maintenance contracts or where otherwise specified. This mixture shall be applied at the rate of 16.5 kg/ha (14 lb 12 oz per acre). The mix shall be composed of 28 g (1 oz) Fowl Mana Grass, 85 g (3 oz) wetland Carex species, 56 g (2 oz) Rice Cut Grass, 56 g (2 oz) Bullrush, 56 g (2 oz) Leptochloa fasicularis, 56 g (2 oz) Barnyard Grass, 56 g (2 oz) Prairie Wild Rye, 4.5 kg (10 lb) perennial ryegrass, 1 kg (2 lb) Jasper Red Fescue, 56 g (2 oz) "Fults" Puccinella Distans, and 0.5 kg (1 lb) Redtop. If certain species in this mix are unavailable, substitutions may be submitted for approval. The mix shall be applied as specified per hectare (acre). The method of planting shall be by means of hydroseeding or by means of a hand method with a minimal amount of mulch applied in a separate operation. Fertilizer shall not be added to this seed mixture.

(f) Seed Mixture T. This seed mixture shall be used to establish a temporary cover for disturbed soil during the construction operations. Seed mixture T shall be used for soil stabilization and temporary ground cover. Temporary cover mixes shall be placed as directed and be subject to seasonal limitations as defined herein. This mixture is not intended to be used as a permanent seed mixture. The mix shall be mulched in accordance with 621.05(c) when slopes exceed 3:1. From December 1 to March 14 and from June 16 to August 31, mulching alone shall be used to stabilize the soil. This mixture shall not be used to satisfy the requirements of the warranty bond.

1. Spring Mix. Spring mix shall be used from March 15 through June 15. This mixture shall be applied at the rate of 165 kg/ha (150 lb/acre). The mix shall consist of oats.

2. Fall Mix. Fall mix shall be used from September 1 through November 30. This mixture shall be applied at the rate of 165 kg/ha (150 lb/acre). This mix shall consist of winter wheat.

(g) Seed Mixture Grass. This seed mixture shall be placed when specified as shown below.

1. Type 1. This seed mixture shall be placed at the rate of 220 kg/ha (195 lb/acre). The mixture shall consist of 7 kg (15 lb) of Smooth Bromegrass, 4.5 kg (10 lb) of Orchardgrass, and the mixture specified in 621.06(a).

2. Type 2. This seed mixture shall be placed at the rate of 124 kg/ha (110 lb/acre). The mixture shall consist of 7 kg (15 lb) of Smooth Bromegrass, 4.5 kg (10 lb) of Orchardgrass, 18 kg (40 lb) of Certified Common Kentucky Bluegrass, 14 kg (30 lb) of Creeping Red Fescue, and 7 kg (15 lb) of Perennial Rye Grass.

(h) Seed Mixture Legume. This seed mixture shall be placed when specified as shown below. Mulched seeding, when specified, shall be in accordance with 621.07.

1. Type 1. This seed mixture shall be placed at the rate of 214 kg/ha (190 lb/acre). The mixture shall consist of 4.5 kg (10 lb) of Sericea Lespedeza or Korean Lespedeza, 4.5 kg (10 lb) of medium Red Clover or Alsike Clover, and the mixture specified in 621.06(a).

2. Type 2. This seed mixture shall be placed at the rate of 112 kg/ha (100 lb/acre). The mixture shall consist of 4.5 kg (10 lb) of Sericea Lespedeza or Korean Lespedeza, 4.5 kg (10 lb) of medium Red Clover or Alsike Clover, 4.5 kg (10 lb) of Birdsfoot Trefoil, 18 kg (40 lb) of Certified Common Kentucky Bluegrass, 14 kg (30 lb) of Creeping Red Fescue, and 4.5 kg (10 lb) of Annual Rye Grass.

"Do Not Spray" signs shall be placed near the beginning and end of this work, at 60 m (200 ft) intervals, or as otherwise directed. The sign shall be 1.6 mm (16 gage) aluminum. The size and message arrangement shall be as shown on the plans. The sign background shall be white. The sign lettering shall be black. The sign shall not be reflectorized. Paint and primer shall be in accordance with 909.04. The sign post shall

be placed as shown on the plans. The post shall otherwise be in accordance with 910.15.

621.07 Mulched Seeding. Mulched seeding, when specified, shall consist of applying the seed mixtures in accordance with 621.06(a), 621.06(b), and 621.06(c) as specified. This mixture shall include fertilizer and mulching material in the amounts set out herein. If erosion control blanket is specified, the Contractor will be permitted to use excelsior blanket, paper mat, or straw mat in accordance with 621.05(d), 621.05(e), or 621.05(f), respectively.

621.08 Preparation of Ground Before Sodding. The area to be sodded shall be smooth, uniform, and shall be in accordance with the required cross section. Surfaces prepared for sod shall be of sufficient depth below unseated areas that newly laid sod shall be in accordance with the surrounding surface.

For those areas which shall be covered with topsoil, the procedure for the application of topsoil shall be in accordance with 621.04.

After the area has been prepared for sod, fertilizer shall be applied at the rate of 450 kg/ha (400 lb/acre). The surface shall be loosened to a depth of 25 to 50 mm (1 to 2 in.) and then raked before the sod is placed. All clods, lumps, boulders, or waste material shall be removed satisfactorily.

In areas where the above method of preparation is impracticable, a different method may be approved.

621.09 Laying Sod. Sod strips shall be laid carefully by hand in the designated direction. The sod shall be fitted to the surrounding grade and fixed objects. The sod strips shall be butted together closely to avoid open joints. Overlapping of sod will not be permitted. After laying and initial watering, the sod shall be tamped or rolled as directed to ensure contact with the soil underneath and shall be in accordance with the surrounding surface. After compaction, the sod shall present a smooth even surface free from lumps and depressions. On slopes of 3:1, or flatter, the use of broken sod strips will be permitted. Where broken pieces are laid, no overlaps will be allowed.

Sod placed in ditches with grades steeper than 1% and on slopes 3:1 and steeper shall be pegged. The pegs shall be spaced not over 610 mm (2 ft) apart in each strip measured lengthwise of the strip. Pegs shall be driven down until no more than 25 mm (1 in.) protrudes above the surface of the sod. Grades and slopes flatter than specified herein shall be pegged as directed.

Pegs shall be wood at least 13 mm by 19 mm by 300 mm (0.5 in. by 0.075 in. by 12 in.). In lieu of pegs, T-shaped wire pins may be used. The pins shall be machine bent from 4 mm (8 gage) low carbon steel with a minimum of a 200 mm (8 in.) leg, a 100 mm (4 in.) head, and a 25 mm (1 in.) secondary drive. Pins shall be driven flush with the top of the sod.

621.10 Watering Sod. Sod shall be watered immediately after laying. The amount of watering shall be sufficient to saturate the sod and the upper few millimeters

(inches) of the underlying soil. The sod shall be watered once everyday of the first week, once every second day of the second week, once every third day of the third week, and once a week thereafter. Sod shall be maintained for a minimum of four weeks from the time it is laid before being accepted. During periods of ample rainfall, watering may be modified to simulate the above schedule. The requirements of 107.17 shall apply.

621.10.1 Seeding or Sodding Disturbed Areas Outside Construction Limits. Areas outside shown construction limits which are disturbed by the Contractor shall be repaired to their original condition or better. The areas shall be seeded with a seed mixture grass type 2 in accordance with 621.06(g)2 or seed mixture legume type 2 in accordance with 621.06(h)2 as directed. If the contract contains seed mixtures other than the two listed here, the Contractor may seed the disturbed area with the mixture contained in the contract provided the area is less than 0.5 ha (1 ac) in size. If the area disturbed is well-maintained and part of a residential or commercial lot, it shall be sodded unless the Engineer determines otherwise.

621.11 Seasonal Limitations. The Contractor shall post a warranty bond for all permanent seeding done from October 16 through January 31. Only completed seeding with seed mixtures R, U, or P shall satisfy the requirements of the warranty bond. Seeding without mulch shall not be done between May 1 and August 15.

Sod placed during the months of June, July, and August shall be subject to the following conditions:

(a) sod shall be in good, live, growing condition; and

(b) sod shall be placed within 36 h after cutting and protected from damage during that period.

Winter sodding will be permitted when the temperature is above 2°C (35°F). No frozen sod shall be laid and no sod shall be laid on frozen soil. Sod shall be properly protected from drying out and shall be laid within 48 h after cutting.

621.12 Method of Measurement. Fertilizer and mulching material will be measured by the megagram (ton). Seed mixtures will be measured by the kilogram (pound). Topsoil will be measured by the cubic meter (cubic yard) in accordance with 211.09. Mulched seeding and sodding will be measured by the square meter (square yard). Water will be measured by the kiloliter (1,000 gallons). Mobilization and demobilization for seeding will be measured per each trip, when directed, to the project site. "Do Not Spray" signs will be measured by the number of signs installed.

621.13 Basis of Payment. The accepted quantities of fertilizer and mulching material, furnished and delivered complete in place, will be paid for at the contract price per megagram (ton), except as set out below for sodding. Seed mixtures will be paid for at the contract unit price per kilogram (pound) for the class and type specified. Mulched seeding will be paid for at the contract unit price per square meter (square yard) for the class and type specified, complete in place. Topsoil will be paid for at the contract price per cubic meter (cubic yard). Sodding and nursery sodding will be paid

for at the contract unit price per square meter (square yard), complete in place. "Do Not Spray" signs will be paid for at the contract unit price per each.

Payment for mobilization and demobilization for seeding will be made for the initial movement to the project site so that permanent or temporary seeding or mulching work, as specified, is performed. When one or more operations are completed within the same mobilization, payment will be made for one mobilization. Payment will be for all work necessary to move personnel and equipment to and from the project site. Payment will also be made for additional mobilization, when directed.

Payment will be made under:

Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
Erosion Control Blanket	m2 (SYS)
Fertilizer	Mg (TON)
Mobilization and Demobilization for Seeding	EACH
Mulched Seeding _____ (class), _____ (type)	m2 (SYS)
Mulching Material	Mg (TON)
Seed Mixture _____ (class), _____ (type)	kg (LBS)
Sign, "Do Not Spray"	EACH
Sodding	m2 (SYS)
Sodding, Nursery	m2 (SYS)
Topsoil	m3 (CYS)
Water	kL (kGAL.)

The costs of leguminous inoculants, preparing seed beds, sowing, raking, and all other necessary incidentals shall be included in the costs of seed mixtures. The costs of furnishing and placing fertilizer, seed mixtures, and mulching material, in addition to the incidentals listed above for seed mixtures shall be included in the cost of mulched seeding.

The costs of furnishing, hauling, and placing the material, including material used as tie-down, repair of areas for which mulch fails to stay in place, all labor, equipment, and necessary incidentals shall be included in the cost of mulching material.

Repair of areas outside the construction limits which must be disturbed to construct the work required by the contract will be paid for in accordance with 201.07(e).

Water will be paid for only when ordered after the 30 day period, in accordance with 621.10.

Payment will not be made for topsoil which is obtained from within the right-of-way.

The costs of fertilizer, water, excavation of earth bed, disposal of surplus material, and all necessary incidentals shall be included in the costs of sodding or nursery sodding.

(a) Warranty Bond. Permanent seeding that requires a warranty bond to meet the requirements of 621.11 shall be warranted against failure resulting from lack of germination or method of application. The seeding shall be warranted to germinate and shall be free of obvious erosion occurrences. The intent of the warranty bond shall be to permit the final acceptance of the contract and payment of the retainage. All seeding which has significantly failed to attain approximately 60% germination shall be replaced with no additional payment. A properly executed maintenance bond with a surety shall be provided prior to the completion of work. A warranty shall be made, with no additional payment, to replace all seeding in areas which has not effectively performed useful service as specified, as well as for the repair of designated erosion areas caused by seeding failure. Such warranty shall be in writing with proper execution of the maintenance bond with a proper surety. The warranty shall be equivalent to 1 1/2 times the cost of the seeding work completed after October 15 with a minimum bond amount of $25,000. All requirements for seeding work will still apply during the warranty period unless otherwise directed.

For the terms of the warranty, a reseeding unit shall be defined as an area equal to or larger than 185 m^2 (2,000 sq ft) in size. An erosion unit may be of an area of significance as determined.

The warranty shall cover work completed from October 16 through January 31. The Department will determine if the Contractor shall be released from the warranty. This determination will be made within 10 calendar days after documented request for inspection is made by the Contractor. Such determination will not be made prior to April 1. All replacement work shall be finished prior to June 15 with no additional payment. The requirements of 107.16 will apply to the warranty area only. The Engineer will certify in writing as to the completion of the work and will make proper notification for the releasing of the bond.

If the Contractor does not complete the necessary repairs before June 15, and there are no justifiable reasons for the Department to grant an extension, the Contractor shall forfeit the bond for the seeding work only. If a bond is forfeited, the Contractor will be required to explain to the Department why the Contractor's experience reduction factors do not warrant an increase.

(b) Changed Fertilizer. A fertilizer may be required with a higher nitrogen content than that specified, or the fertilizer specified may be required to be enriched by adding chemicals in order to be in accordance with such requirements. All additional costs incurred due to such procedure will be paid at the prices shown by certified vouchers. Such payment will include and will be full compensation for furnishing the required chemicals, or furnishing and processing the additional materials required.

(c) Mulching. The percent of moisture shall be determined at the time the mulching material is weighed. Facilities shall be provided for weighing in accordance with 109.01(b). Arrangements shall be made in advance so that the percent of moisture

will be determined at the time of weighing and that the mass (weight) of the material will be checked. Moisture content of the mulch will be determined on the basis of air dry weight as follows:

$$\text{Moisture Content \%} = \frac{\text{Wet Mass (Weight) of Sample} - \text{Air Dry Mass (Weight) of Sample}}{\text{Air Dry Mass (Weight) of Sample}} \times 100$$

The gross, or wet, mass (weight) of mulching material furnished and placed will be paid for if the moisture content does not exceed 10%. If the moisture content exceeds 10%, the mass (weight) to be paid for will be the gross, or wet, mass (weight) minus the mass (weight) of excess moisture computed as follows:

$$\text{Mass (Weight) to be paid for} = G \times \frac{110}{(100 + M)}$$

G = Gross, or wet, mass (weight) of mulching material
M = Moisture content, percent, in the mulching material to the nearest 0.5%

Mulching material which contains more than 50% moisture will be rejected. Wood cellulose fiber mulch containing more than 15% moisture will be rejected.

SECTION 622 – PLANTING TREES, SHRUBS, AND VINES

622.01 Description. This work shall consist of furnishing, delivering, and planting trees, shrubs, and vines, and also seedlings for wildlife habitat. This work shall also consist of the performance of incidental planting procedures and plant establishment work to provide a complete operation in accordance with these specifications and in reasonably close conformance with the plans or as directed.

MATERIALS

622.02 Materials. Materials shall be in accordance with the following:

Backfill Material 914.01
Fertilizer 914.03
Mulch .....914.05(b)
Pipe .....914.09(e)
Plants 914.08
Porous Material .....914.09(d)
Tree Wound Dressing .....914.09(c)
Water .....914.09(a)

Soil conditioners such as peat moss or calcine clay may be added with written permission.

Guy wire shall be minimum 2.0 mm (No. 14 gage) galvanized steel wire.

CONSTRUCTION REQUIREMENTS

622.03 Care and Handling of Plants.

(a) Bare Rooted Plants. If the outside air temperature exceeds 2°C (35°F) when the plants are delivered, the plants shall be planted immediately or placed in inside or outside storage. If they are stored outside, the roots shall first be puddled in a paste solution of backfill and water. The plants shall then be separated and their root systems heeled-in by completely covering with moist soil. If they are stored inside, the roots shall be puddled in a paste solution of backfill and water. Straw, peat moss, or corncobs shall be worked in and around the root system and kept moist. Plants which are delivered in boxes, wrapped bundles, or other forms of closed containers, including trucks, and which are stored inside may remain in the container for 48 h from time of delivery, provided the containers are opened immediately and the plants are watered if necessary.

If the outside temperature is 2°C (35°F) or less when plants are delivered, the plants shall be placed in inside storage immediately. Inside storage procedures shall be in accordance with the above requirements. Plants may be transferred to outside storage when the outside air temperature exceeds 2°C (35°F) provided they are puddled again and then heeled-in.

Temperature inside the storage building shall be maintained between 2°C (35°F) and 13°C (55°F). Plants shall not remain in storage, either inside or outside, for more than seven days, unless otherwise permitted because of unfavorable planting conditions.

Plants may be rejected on failure to comply with these specifications.

(b) Balled and Burlapped Plants and Container Grown Plants. Plants shall be planted or placed in storage before being exposed for 10 consecutive hours at temperatures less than 2°C (35°F). Storage of plants shall be in a moist storage building or they shall be placed outside in a compact group with balls or containers completely covered with corncobs and kept moist. Plants shall not remain in storage for more than 10 days, unless otherwise permitted because of unfavorable planting conditions.

Plants may be rejected on failure to comply with these specifications.

622.04 Collected Plants. At least 24 h before starting to dig collected plants, notification shall be given of the time and place of digging so inspection of the work and of the plants can be made, if so desired.

Collected plants shall be dug carefully in a satisfactory manner. All operations of digging, transporting, and replanting collected plants shall be in accordance with all applicable laws and regulations of the state.

622.05 Excavation for Plant Holes. Stakes will be set to locate plant holes for each tree, shrub, or vine. The outline of each seeding bed will be staked and the

planting on the required centers shall be as directed. Stakes for the staking operation shall be furnished. The location stakes shall be removed as directed. Excavation shall be such that the plant holes are cylindrical in shape with the sides approximately vertical. Material excavated from the holes may be used for backfill providing it is in accordance with 914.01. Otherwise, it shall be distributed uniformly within the construction area as directed. The excavated material shall not be stockpiled on turf or in ditches. Material unsuitable for the growth of vegetation, including rocks and boulders, shall be disposed of outside the right-of-way as directed and in accordance with 203.01 and 203.10. Plant holes shall be in accordance with the details and tables shown on the plans. If plants have not been planted within 10 days after excavation of the hole, the hole shall be refilled and re-excavated at the time of planting. No additional payment will be made for this operation.

If, after staking or excavation of the plant holes at the locations shown on the plans, it becomes apparent that the location is unsuitable for planting due to accumulation of ground water, possible flooding because of terrain conditions, or unsuitable soil conditions, plant holes shall be relocated as directed. Such relocation shall be done with no additional payment.

622.06 Planting Season. The planting season shall be from September 1 through the following May 25, with the exception that trees shall be planted from October 1 through the following April 15, provided that trees are dormant. Crown vetch plants and seedlings shall be planted only from April 15 through May 30, unless approved in writing. Bare rooted plants shall be planted only when the outside air temperature exceeds 2°C (35°F). Unless otherwise approved, deciduous plants, except those container grown, shall be dormant at the time they arrive at the work or storage site. Evergreens shall not have active terminal growth. At least 40% of the total number of balled and burlapped, and container grown plants, not including crown vetch plants, shall be planted from the beginning of the planting season through December 31. Bare root seedlings for wildlife habitat shall be planted from October 1 through the following April 30. Container grown seedlings for wildlife habitat shall be planted at any time.

The initial planting and spring replacements, in accordance with 622.18, shall be completed satisfactorily within the planting season which expires prior to the completion date of the contract. These plants shall have an establishment period which shall be from the end of the specified planting period to the fall inspection. If the initial planting and spring replacements are not completed within the specified time, the completion date may be extended one year to provide an establishment period. If the completion date is extended, all requirements of 622.18 shall apply until final inspection and acceptance.

622.07 Pruning. Before the plant is placed in the plant hole, any bruised or broken parts of roots shall be cut off smoothly as approved unless otherwise specified or directed. All plants shall be pruned either before or after planting. Such pruning generally shall consist of thinning out or cutting back secondary branching to reduce the foliage by 1/3 to 1/2 in accordance with accepted horticultural practices. Pruning operations shall maintain the general crown outline and characteristic branching pattern for each species. Pruning or cutting back of terminal leaders which are over 10 mm (3/8 in.) in diameter at the point of cut will not be permitted. Broken or dead branches,

or any other objectionable parts of the plant, shall be removed throughout the life of the contract. Pruning tools shall be kept sharp and shall be sterilized in denatured alcohol after each hour of use. All cut surfaces 10 mm (3/8 in.) or more in diameter shall be painted with a tree wound dressing.

Bare rooted shrubs shall be cut back to 1/2 their minimum specified height as shown on the plans. Pruning shall be performed after the shrubs have been sealed with Department seals and prior to the leaf buds breaking dormancy. At the time of the spring and fall inspections, bare rooted shrubs will be accepted at their original specified height provided they are healthy, in good growing condition, and are no less than 1/2 the minimum specified height.

622.08 Planting, Backfilling, and Watering. The plant shall be placed in the plant hole at the proper position for depth, alignment, final grade of the surrounding ground level, and vertical position of the trunk. The planting procedure shall be performed in such a manner that the top of the ball of the plant is as shown on the plans at the time of planting. The planting procedure shall be in accordance with the details as shown on the plans. Backfill material in accordance with 914.01 shall be placed around all plants except seedlings. The quantities of backfill material required per plant shall be as shown on the plans.

In areas which are designated on the plans as beds for group planting, the soil shall be tilled to a minimum depth of 150 mm (6 in.) in such a manner that all sod and vegetation is destroyed. These areas shall be tilled at least two times with an interval of 14 days between tilling operations. Planting may be done immediately after the second tilling. Additional tilling shall be performed if vegetation appears before mulch is applied. Sod and vegetation shall be removed in lieu of the tilling operation when the soil temperature or moisture conditions are such that the sod and vegetation would not be destroyed by tilling. At other times, sod and vegetation may be removed in lieu of tilling. If the excavation resulting from sod removal is greater than 25 mm (1 in.) deep, it shall be backfilled with topsoil to 25 mm (1 in.) above the original ground. After sod and vegetation removal and backfilling, the bed area shall be cultivated to a depth of 150 mm (6 in.). Large clods, rocks, and other debris encountered in the cultivation work and any excess soil shall be removed. The outline of beds for group plantings shall be no closer than 1.0 m (3 ft) to the center of any of the outer plants in the area.

In addition to the water applied at the time of planting, unless excessive moisture prevails, the minimum supplemental waterings required shall be two between May 1 and June 15, and one every 14 days between June 15 and September 15. Sufficient water shall be applied to individual plants to saturate the backfill and the mulch area. Plants in beds shall receive water equivalent to the quantity used for individual plants. Liquid fertilizer, in accordance with 622.09, may be applied with the supplemental watering and the method of application shall be as approved. Lance watering will not be permitted.

Container grown seedlings for wildlife habitat which have been planted from June 1 through August 31 shall be maintained after installation for 30 days. Maintenance shall include watering the seedlings at the time of planting and once every seven days.

(a) Plants with Bare Roots. With the plant in its proper position, the plant hole shall be backfilled with material in accordance with 914.01. The backfill material shall be worked firmly around the roots as the hole is gradually filled. The plant shall be raised gently and lowered slightly as the soil is added to help eliminate air pockets around the roots. Soil shall be added in layers of about 150 mm (6 in.) and each layer tamped to make it firm and to hold the plant perpendicular. Water shall be used to settle the soil and to eliminate air pockets around the roots, unless otherwise directed. The top 100 mm (4 in.) of soil necessary to fill the plant hole completely shall be of a very fine texture and shall be placed on top of the firmed backfill and allowed to remain loose and untamped.

(b) Balled and Burlapped Plants. Balled and burlapped plants shall be handled by the ball and placed in the holes in such a manner that the soil of the ball does not become loosened from the roots. The soil directly beneath the ball shall be firmed to minimize settling. Guy stakes shall be driven before backfilling operations begin. After the hole has been partially backfilled and the material firmed under and around the ball, the burlap shall be cut away and removed from the stem of the plant. Backfilling and firming shall then be completed in a manner to avoid loosening the soil from the root ball. Watering shall be done in accordance with 622.08(a). Backfill material shall be in accordance with 914.01.

(c) Seedlings for Wildlife Habitat. Seedlings shall be from 150 to 450 mm (6 to 18 in.) in height. Seedlings shall be planted as directed in the locations shown on the plans. Species shall be selected from the list as shown on the plans. Alternate species selection shall be subject to approval. Seedlings shall be planted no closer to each other than the distance shown on the plans. Seedlings shall not be planted in rows, but instead shall be planted in a natural appearing pattern. Failure to comply with this procedure will require the replanting of the seedlings as directed with no additional payment. All damaged seedlings shall be replaced with no additional payment if replanting is required.

622.09 Liquid Fertilizer Application. All plants shall be fertilized with a water soluble 5-10-10 fertilizer, or an equivalent amount of plant nutrients, at the rate of 0.36 kg/400 L (0.75 lb/100 gal.) of water. Fertilizer shall be applied to each installed plant until the mulched area over the plant hole is saturated. Three applications shall be made: one on or about July 1; one about August 1; and one about September 1.

622.10 Mulching. Mulch, in accordance with 914.05(b), shall be placed as a top layer around each plant as soon as it has been installed. The mulch shall cover the entire area as described in 622.08 and shall be placed around individual plants in accordance with the plans.

622.11 Guying and Staking. Guying and staking shall be in accordance with the details shown on the plans. Guy wire shall be placed through rubber hose material around each tree then twisted to secure the tree in a relatively stable position. Three wood stakes shall be spaced equally about each tree. The guy wire shall be secured to each stake at an approximately right angle. Support of multi-stem trees of 1.2 to 1.8 m (4 to 6 ft) in height shall consist of inner limb guying and bracing stakes. The

securement point and placement of guy wire shall be so as to avoid abrasion of tree limbs. The guys and stakes shall be maintained for the duration of the contract. Prior to final inspection, all materials used to support trees shall be removed and disposed of, except as otherwise directed for trees requiring additional bracing time. However, supports for fall replacement shall remain in place. If approved, stakes may be left flush with the ground.

622.12 Plant Protection.

(a) Borer Control Coatings. Within five days after planting and prior to wrapping, all trees, except evergreens, shall be protected against borer attack with an insecticide mixture applied to the tree trunk with a paint brush or a suitable hand sprayer. The application shall cover the trunk from the root crown to the first major branches. The mixture shall consist of enough powdered skim milk to form a smooth slurry when added to either dieldrin 18 at the rate of 1 L to 100 L (2 qt to 50 gal.) of water or thiodan 50 at the rate of 1 kg to 420 L (1 lb to 50 gal.) of water.

(b) Wrapping for Rodent Protection. Within seven days after planting, all crabapple and shade trees with a 13 mm (0.5 in.) diameter or larger, except for multi-stem forms, shall be wrapped with a double layer of 71 by 55 wires per 10,000 mm^2 (18 by 14 wires per square in.) aluminum mill finish screen wire mesh around the trunk of each tree as shown on the plans. The height of screen wire shall be from the existing grade to below the lowest branch. The screen wire shall be overlapped at the ends. The screen wire shall be secured to itself with hog rings or other approved methods, and to the rods by approved means.

Plastic coil type protective wrapping will be acceptable as an alternative to the screen wire and reinforcement rod method of tree protection for staked trees of less than 50 mm (2 in.) caliper. The wrapping shall be loosened twice each calendar year. The first adjustment shall be made between May 15 and June 15. The second adjustment shall be made between September 1 and September 30. The plastic tree protective wrapping shall extend to the height of the bottom limb.

The Contractor may submit other proposed methods of rodent protection to the Department's landscape architect for approval prior to installation. The design of the protection shall ensure an average air space diameter of 50 mm (2 in.) greater than the tree's calipered size at installation. The protection shall permit air movement through its surface to dry the tree trunk following periods of precipitation. The protection shall not damage the tree nor hinder its growth.

Multi-stem trees shall be wrapped with commercially available wrapping paper wrapped tightly around the trunks from the ground to the lowest branch with a minimum of 13 mm (0.5 in.) overlap. The wrapping paper shall be tied securely with stout cord at top and bottom and at two intermediate intervals.

622.13 Retaining Walls and Tree Wells. Retaining walls around the roots of trees or shrubs, and tree wells around the trunks of trees or shrubs shall be constructed at the locations and to the shape and dimensions shown on the plans or as otherwise designated. They shall be of mortar and masonry, or other type as specified. Mortar

shall not be used in any portion of the tree well extending below the top of contiguous porous material used for tree root protection. The inside face of a tree well shall be no less than 0.6 m (2 ft) from the outside edge of the trunk of the tree or shrub. No material shall be placed between the tree trunk and the wall of the tree well.

622.14 Tree Root Protection. Where tree root protection is specified, the entire area of the root spread shall be protected. The limits of this area shall be as designated, but in general this area corresponds to the area of the ground surface lying beneath the limb spread of the tree. The area shall be cleaned of all vegetation and debris. Porous material, in accordance with 914.09(d), shall be placed uniformly over the area to a depth in proportion to the height of fill, varying proportionally from 75 mm (3 in.) for fills of 300 mm (1 ft) or less to 300 mm (12 in.) for fills of 1.2 m (4 ft) or more, or to such other depths as may be designated. A layer of No. 23 sand or other approved material shall then be placed in sufficient quantity to choke the top layer of porous material and will be measured and paid for as porous material.

Where the earth fill is less than 300 mm (12 in.) and tree root protection is specified without the construction of a tree well, the thickness of the porous material at the tree trunk shall be increased to the height of the fill and extend outward from the tree trunk in collar form for a distance of 300 mm (12 in.), unless otherwise shown on the plans.

No fill shall be placed over the root spread of any tree or shrub that is to be protected in the above manner until the required depth of porous material has been placed.

622.15 Pipe Underdrains. Pipe underdrains, when shown on the plans or directed, shall be placed to drain tree wells or porous material for tree root protection. These shall be placed in accordance with applicable provisions of 718.

622.16 Damage to Plants. During all operations of tree protection, care shall be used to prevent unnecessary cutting of roots and to prevent scarring or damage to selected trees or shrubs. Motorized equipment shall not be operated within the drip line of trees unless permitted. Where trimming of branches or cutting of roots is necessary, all cuts shall be made cleanly with proper sharp tools in accordance with generally accepted horticultural practices. Scarred areas and cut surfaces 10 mm (3/8 in.) or more in diameter shall be covered completely with a tree wound dressing.

622.17 Grass and Weed Control. Weeding and mowing of grass in and around all group plantings, beds, and individual trees and shrubs shall be performed until final acceptance. The grass and weed control areas shall be the areas within 0.6 m (2 ft) of the outer limits of all group plantings and shrub beds and within 0.6 m (2 ft) of the outer limits of the mulch area of individual shrubs. For the care of individual trees, the area shall extend to a perimeter centered from the plant itself to 0.6 m (2 ft) beyond the stub stakes of the guy wires or 0.6 m (2 ft) beyond the mulched area. In general, these areas shall be in accordance with the plans.

622.18 Care, Inspection, and Replacement.

(a) Care. Watering, fertilizing, weeding, cultivating, spraying to control insect infestation and disease, and all other good horticultural practices necessary to maintain the plants in a living healthy condition shall be performed up to the time for termination of responsibility for care as set out herein. The plants shall be cared for throughout the life of the contract. All plants stolen, damaged, or destroyed by fire, automobiles, vandalism, or any other cause, with the exception of plants damaged or destroyed by Department maintenance operations, shall be replaced with no additional payment as soon as practicable. Plants damaged or destroyed by the Department will be replaced by the Department prior to the date of final acceptance.

(b) Inspection and Replacement. On or about May 1, a spring inspection of initial plantings will be made during and before the end of the planting season and prior to the beginning of the establishment period. Plants not living, unhealthy, in a poor growing condition, or otherwise not meeting the specifications shall be replaced with no additional payment, prior to May 15 for trees and prior to May 25 for other plants. These replacements shall be in accordance with all other requirements of the initial planting. All plants found to be not living or in an unhealthy condition between this replacement and final inspection shall be removed from the project immediately, as directed, and shall be replaced after September 15 as detailed below.

A fall inspection will be made on or about September 15, at which time the condition of the materials planted within the specified planting season will be determined. At the time of this inspection, all plants which are found to be dead, unhealthy, in a poor growing condition, or otherwise not meeting the specifications will be rejected. Rejected plants shall be removed and disposed of as soon as practicable and replaced prior to November 15 with no additional payment. Replacement materials and operations shall be in accordance with the requirements of the initial planting.

A final inspection of the contract will be made as soon as possible after replacement. All plants shall be cared for and maintained until final inspection and acceptance.

All seedlings for wildlife habitat shall be in accordance with ASNS Seedling Trees and Shrubs and will be inspected by a landscape architect within one week of planting. Spring and fall inspections as described above will not be required. The inspection, planting, and maintenance of seedlings as required will constitute final acceptance.

622.19 Crown Vetch Plants and Seedlings. The requirements of 622.09 and 622.18 will not apply to these items. Seedlings shall be fertilized as specified on the plans. Crown Vetch plants and seedlings, including replacements, shall be watered as necessary to keep them in a living, healthy, and good growing condition.

On or about June 5, these items will be inspected. If it is estimated that 90% or more of the plan quantity of any individual item in a specific area is living, healthy, and in a good growing condition, replacements will not be required. If less than 90% are alive, healthy, and in a good growing condition, all items not meeting these requirements shall be replaced. Replacements shall be marked in the same manner as the original planting, except the markers shall be yellow.

Replacement planting shall be accomplished prior to June 15.

A final inspection will be made on or about the following September 15. If it is estimated that 90% of the contract quantity of any individual item is living, healthy, and in a good growing condition, payment will be made for the contract quantity. If less than 90% meet these requirements, the pay quantity for the item will be established.

622.20 "Do Not Mow or Spray" Signs and "Do Not Disturb" Signs. These signs shall be placed at the boundaries of areas where seedlings for wildlife habitat have been placed. The locations and spacing of the signs shall be shown on the plans or as directed. The sign shall otherwise be in accordance with 621.06(h).

622.21 Method of Measurement. Furnishing and planting trees, shrubs, and vines will be measured by the number of units of each type and size specified, installed, and accepted. Seedlings for wildlife habitat, "Do Not Mow or Spray" signs, and "Do Not Disturb" signs will be measured by the number installed and accepted. Retaining wall masonry, either mortared or not mortared as specified, will be measured by the cubic meter (cubic yard). Porous material for root protection will be measured by the megagram (ton). Drain tile will be measured by the meter (linear foot).

622.22 Basis of Payment. The number of trees, shrubs, and vines of each variety planted, determined as provided above, will be paid for at the contract unit price per each for plant, of the type, form, and size shown in the Schedule of Pay Items. Seedlings for wildlife habitat, "Do Not Mow or Spray" signs, and "Do Not Disturb" signs will be paid for at the contract unit price per each.

Masonry wall and masonry tree well will be paid for at the contract unit price per cubic meter (cubic yard). Porous material for root protection will be paid for at the contract unit price per megagram (ton). Drain tile will be paid for at the contract unit price per meter (linear foot) of the diameter specified.

Payment will be made under:

Pay Item **Metric Pay Item** **(English Pay Item**	**Metric Pay Unit Symbol (English Pay Unit Symbol)** **Metric Pay Unit** **English Pay Unit Symbol)**
Drain Tile, _____ mm diameter	m
(Drain Tile, _____ in. diameter	LFT)
Masonry Wall	m3 (CYS)
Masonry Tree Well	m3 (CYS)
Plant, Annual	EACH
Plant, Aquatic	EACH
Plant, Biannual	EACH
Plant, Broadleaf Evergreen, Cone, Broad Upright, ____ size	EACH

Plant, Broadleaf Evergreen, Globe, Dwarf, ____ size ..... EACH
Plant, Broadleaf Evergreen, Spreading, Semispreading, ____ size ..... EACH
Plant, Coniferous Evergreen, Cone, Broad Upright, ____ size ..... EACH
Plant, Coniferous Evergreen, Globe, Dwarf, ____ size ..... EACH
Plant, Coniferous Evergreen, Prostrate Broad Spreading, Semispreading, ____ size ..... EACH
Plant, Deciduous Shrub, ____ size ..... EACH
Plant, Deciduous Tree, Multi-Stem, ____ size ..... EACH
Plant, Deciduous Tree, Single Stem, ____ size ..... EACH
Plant, Ground Cover ..... EACH
Plant, Perennial ..... EACH
Plant, Root, Tuber, Corm, Bulb ..... EACH
Plant, Rose Grade ..... EACH
Porous Material for Root Protection ..... Mg (TON)
Seedling ..... EACH
Sign, "Do Not Disturb" ..... EACH
Sign, "Do Not Mow or Spray" ..... EACH

The costs of furnishing all materials, labor, and necessary incidentals shall be included in the costs of the pay items.

Progress payment for planting trees, shrubs, or vines will be based on the premise that 75% of the work has been completed when such trees, shrubs, or vines have been completely planted. The remaining portion of the payment will be for maintenance and plant replacement.