DIVISION 600
INCIDENTAL CONSTRUCTION

SECTION 601
MOBILIZATION

601.01 Description. This item shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of the Contractor's offices, buildings, and other facilities necessary to undertake the work on the project.

This item shall also include other work and operations that must be performed, or for expenses incurred, before beginning work on the various Contract items on the project site. It shall also include pre-construction costs which are necessary direct costs to the project and are of a general nature rather than directly attributable to other pay items under the Contract.

601.02 Measurement and Payment. Mobilization will be measured as a complete unit and will be paid for at the contract lump sum price bid. In computing the allowable partial payments from the schedule below, the percentage of the original Contract earned will be based on all items exclusive of the item Mobilization and any materials estimates paid. Payment for Mobilization at any of the listed stages of completion will be made on the basis of the percentage of the item allowed less all payments made.

PARTIAL PAYMENT SCHEDULE

Percentage of Original Contract Amount Earned	Percentage of Bid Price for Mobilization Allowed
First Progress Estimate	25
10	50
25	100

This item will be paid for on regular estimates. Payments on percentages of the original Contract amount other than those set out above will not be considered. No adjustment in the amount bid for this item will be made for additional quantities or items of work required to satisfactorily complete the Contract.

IN NO CASE SHALL THE AMOUNT BID FOR THE ITEM OF "MOBILIZATION" EXCEED 5% OF THE TOTAL CONTRACT AMOUNT FOR ALL OTHER ITEMS LISTED IN THE PROPOSAL. Should the amount entered in the Proposal for this item exceed 5%, the Engineer will reduce it to the maximum allowed amount to determine the correct total bid.

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

Payment will be made under:

Pay Item	**Pay Unit**
Mobilization	Lump Sum

SECTION 602
FURNISHING FIELD OFFICES AND LABORATORIES

602.01 Description. This item shall consist of providing and maintaining temporary field office and field laboratory facilities, with the services listed below, at convenient locations on or near the work for the exclusive use of the Engineer. These facilities shall remain the property of and will be released to the Contractor when the Engineer determines that they are no longer needed or when all construction work is completed.

602.02 Facilities to be Furnished. (a) General. Field offices and laboratories shall comply with the requirements listed below. The dimensions and other requirements specified herein are minimums and the facilities may be built by the Contractor for the specific purposes noted herein. It is not intended, however, to prohibit the use of commercially built trailers or prefabricated buildings that may deviate in minor dimension or detail from the requirements listed herein but may in some features exceed the listed requirements and in all major respects be entirely suitable for the purpose intended. The Contractor may furnish, in lieu of a separate building, a facility having sufficient space in a building, parts of which are used for other purposes, provided that the facility furnished complies with all other requirements of this Section; is physically separated from the remainder of the building; and has an

outside entrance with unrestricted access allowed and reserved for the exclusive use of the Engineer. Adequate space shall be provided for the parking of at least three Department vehicles in the vicinity of each facility furnished. The Engineer will determine the suitability of any building or facility furnished.

Minimum requirements for offices and laboratories:

(1) Buildings may be portable or other suitable types with 7' (2 m) minimum ceiling height; must be floored, weatherproof, and reasonably dustproof; must have at least two clear glazed windows capable of being opened and locked only from the inside. The facility must have at least one door provided with a substantial lock and all keys placed in the possession of the Engineer. Doors and windows shall be screened. The facilities need not be new for each contract but facilities furnished under this item shall be neat, clean, sound, and usable for the purpose intended.

(2) Each facility shall be provided with adequate electric lights and power outlets usable for the purpose intended. In cold weather each facility shall be provided with adequate vented space heating facilities and fuel for heating. In hot weather each facility shall be equipped with adequate air conditioning units. Heating and cooling utility service will be furnished at no cost to the Department.

(3) Suitable toilet facilities shall be available in reasonably close proximity to each office and laboratory furnished.

(b) Field Offices. Facilities for field offices shall provide not less than 120 square feet (11 sq m) of floor space. At least two tables suitable for desk or drafting work shall be provided with approximate dimensions of 30" x 48" (750 mm x 1200 mm). These tables may be movable, attached to a wall, or built in. Each table shall be provided with at least two drawers (minimum dimensions: 8" [200 mm] deep by 12″ [300 mm] wide by 24″ [600 mm] long) or an equivalent cabinet or shelf space for storing field records and plans. At least three chairs shall be provided. A local access touchtone telephone line with access to toll free telephone numbers but otherwise blocked for out-going long distance calls, a landline modular jack, and a touchtone telephone shall be provided in the

field office for use by Department personnel. The local landline telephone service will be furnished at no cost to the Department.

(c) Field Laboratories. Facilities for field laboratories shall provide not less than 120 square feet (11 sq m) of floor space with a work bench approximately 30″ (750 mm) wide built along one side wall and one end wall. A single sink, approximately 20" x 24" (500 mm x 600 mm) with outside drain, suitable for washing samples, shall be provided. A water supply shall be provided with not less than 50 gallons (200 L) storage discharging through a faucet mounted above the sink. An adequate supply of clean water shall be maintained at all times when work is in progress. Adequate shelves and/or cabinets shall be provided for storing testing equipment. A 24" x 36" (600 mm x 900 mm) desk shall be provided, or may be built in, with at least two drawers, each being a minimum of 13" x 13" x 18" (330 mm x 330 mm x 450 mm) long, for storing records. At least three chairs shall be provided. An exhaust fan adequate for removing fumes from the laboratory stove used for heating samples shall be installed and maintained operational.

602.03 Number of Facilities to be Furnished. The number of facilities to be furnished will be listed on the plans or in the Proposal. The Engineer may reduce or expand the number of facilities required according to the location of the work and according to the sequence of the Contractor's operations in order to facilitate the administration of the work and to furnish adequate testing facilities. Facilities shall be provided at the project site on or before the date their use is requested by the Engineer. The Contractor may be required to move a facility from one location to another according to the requirements of the work. The Contractor shall not remove any Field Office or Field Laboratory from the project site until the Engineer has determined that it is no longer needed or until all construction work has been completed. The Contractor shall notify the Engineer at least five business days prior to removing a facility from the project. This notification requirement may be waived by the Engineer.

602.04 Method of Measurement. Field offices and/or field laboratories furnished as provided above will be measured by the unit.

602.05 Basis of Payment. Facilities furnished and accepted and measured as provided above will be paid for at the contract unit price bid per each for Furnishing Field Office or Furnishing Field Laboratory, which price shall be full compensation for furnishing and maintaining the facilities and services.

Payment will be made under this item at the rate of 75% of the contract unit price bid at the time the facility is complete in place and accepted by the Engineer. The remaining 25% of the contract unit price bid will be paid upon completion of all work under the Contract.

Payment will be made under:

Pay Item	**Pay Unit**
Furnishing Field Office	Each
Furnishing Field Laboratory	Each

SECTION 603
MAINTENANCE OF TRAFFIC AND TEMPORARY STRUCTURES

603.01 Description. This item shall be accomplished according to the plans, this specification, Subsections 104.05 and 107.07, and the MUTCD. It is also applicable to the furnishing, installing, maintaining, and removal of Temporary Culverts and Temporary Bridge Structures and to those traffic control devices and operations required to delineate temporary hazards that are a result of the Contractor's operations and which are not otherwise specified on the plans.

The Contractor shall maintain the existing roads, including shoulders, bridges, and culverts, within the limits of the project from the date work is begun until the project has been completed and accepted. This maintenance of existing roads, including shoulders, bridges, and culverts, is the ordinary day to day maintenance, including minor repairs. Major repairs or reconstruction of existing roads, including shoulders, bridges, and culverts, will be the

responsibility of the State, County, or City, unless such are made necessary by the Contractor's operations.

The Contractor shall provide, under the item of Maintenance of Traffic, those traffic control devices and operations required to delineate temporary hazards that are a result of Contractor operations. When the pay item of Maintenance of Traffic is not included in the Contract, the Contractor shall perform operations according to Subsection 104.05 and this Section. Full compensation for this work will be considered included in the contract unit prices bid for the various items of the Contract.

The Contractor shall provide a competent traffic control supervisor for the project. When the pay item Traffic Control Supervisor is not included in the Contract, the work required will not be paid for separately, but full compensation therefor will be considered included in the contract lump sum price bid for Maintenance of Traffic, or, if Maintenance of Traffic is not included in the Contract as a pay item, included in the contract unit prices bid for the various items of the Contract.

Speed limits through construction zones will be determined by the Department.

603.02 Construction Requirements. (a) Maintenance of Traffic. Maintenance of Traffic shall be accomplished by the Contractor in an expeditious manner to preserve the integrity of the traveled way and shoulders and to protect traffic from temporary hazards created by Contractor operations.

The delineation of temporary hazards shall include the placement of any traffic control devices that are necessary for the protection from, and/or delineation of, such objects as open trenches or holes, stationary objects, drop-offs, parked equipment, stockpiled materials, fresh oil, etc. These traffic control devices shall be placed at locations where they will provide adequate warning to the traffic, including side roads that enter the work limits. All traffic control devices used shall comply with the applicable requirements of Section 604.

Traffic control plans for detours, lane closures, lane width reductions, shoulder closures, and other alterations to the original traffic pattern shall not be placed in operation more than 72 hours before the work begins which requires the traffic control changes.

After a traffic control plan is placed in operation, if progress on the work that required such plan is interrupted by more than 72 continuous hours, the original traffic operations must be restored as conditions allow, unless otherwise directed by the Engineer. Removal and restoration of traffic control devices to restore original traffic operations, and the subsequent reinstallation of the traffic control modifications will be at no additional cost to the Department.

Passageways for traffic shall be maintained dust free by the application of water or other approved material.

The Contractor shall make judicious use of pilot vehicles or properly attired and trained flaggers or sentinels, as necessary, to safely and conveniently guide traffic through the work limits.

On unpaved traveled ways or shoulders, the Contractor shall keep the surface smooth and stable by blading, ditching, etc.

Shoulder material shall be maintained to closely match the grade of the existing pavement.

(b) Traffic Control Supervisor. When the pay item Traffic Control Supervisor is included in the Contract, the traffic control supervisor shall be certified as a worksite traffic supervisor by either the American Traffic Safety Services Association (ATSSA) or the Arkansas Associated General Contractors, and shall be someone other than the Contractor's superintendent. The name, address, and telephone number of the traffic control supervisor shall be furnished to the Engineer at the pre-construction conference. The Contractor shall advise the Engineer of any changes to the contact information for the traffic control supervisor or changes in person designated as the traffic control supervisor.

The traffic control supervisor shall:

- Perform or supervise the performance of the inspections required in Section 604;
- Prepare, sign, and submit to the Engineer the certification of inspection required in Section 604;
- Train and supervise flaggers and pilot car operators, as needed;

- Review the project for additional traffic control measures needed to delineate hazards due to the Contractor's operations;
- Correct all traffic control deficiencies;
- Provide emergency maintenance of traffic control devices as needed.

Emergency maintenance shall consist of maintenance, repair, or replacement of traffic control devices that have been damaged, vandalized, or otherwise rendered ineffective to the extent that a serious hazard exists. The traffic control supervisor, or a designated alternate, shall begin such emergency work within two (2) hours after being notified. When emergency maintenance is required during non-working hours, devices that are classified as "unacceptable" according to ATSSA *Quality Standards for Work Zone Traffic Control Devices* may be used in emergency maintenance provided the devices are effective in reducing the existing hazard and further provided that they are replaced not later than the next business day. The traffic control supervisor shall keep the Resident Engineer informed of the name, address, and telephone number of the individual responsible for performing emergency maintenance.

(c) Detour or Stage Construction. Where shown on the plans for the maintenance of traffic, the Contractor shall construct and maintain detours or stage roadway sections to provide for the construction of the roadway, culverts, bridges, or miscellaneous items.

Any temporary culvert shall be of sufficient length to provide the specified roadway width, but in no case be less than that required to provide a minimum 20' (6 m) traveled way, and shall have a minimum design capacity of H15 (M13.5) loading.

Any temporary bridge structure, regardless of type or centerline roadway lengths, shall have a minimum 20' (6 m) bridge roadway width and a minimum design capacity of H15 (M13.5) loading, unless otherwise specified.

Except as provided herein, a layout and working drawings shall be submitted to the Engineer for informational and record purposes for all temporary bridges and drainage structures, except standard pipe culverts. The layout submitted shall show the length and type

of spans, and the type of substructure. Working drawings shall show all dimensions and details necessary to construct the structure, and the type and condition of all materials that will be used. The Contractor shall construct the temporary structures according to these drawings, or shall submit revised drawings if changes become necessary.

The Department's plans will, as appropriate, include temporary bridge details. The Contractor may elect to use these temporary bridge details, or use an optional design. If an optional design is used, the Contractor shall submit a layout and working drawings signed by a Registered Professional Engineer and a certification by a Registered Professional Engineer that the design and working drawings meet all the requirements of the plans, specifications, and the design requirements of the current edition of the AASHTO Standard Specifications for Highway Bridges with interim Specifications, except as modified herein. The rail and curb system for an optional design shall be at least equal in strength to that shown on the Department's temporary bridge details. If the Department's temporary bridge details are used, only a layout and a listing of the type and condition of materials to be used will be required for submittal. When an optional design is used, file copies of the design calculations shall be maintained by the Contractor until final acceptance of the project.

No work other than the driving of test piles shall be performed on a temporary bridge until the Contractor has submitted the layout, working drawings, and any required certifications to the Engineer.

Materials used in temporary bridges and temporary drainage structures, whether Department design or Contractor design, may be new or used and in good condition. Materials and workmanship shall comply with the requirements of the applicable sections of the specifications covering the items. Timber used in the substructure or superstructure may be untreated unless treatment is specified on the plans. Lumber and timber materials and construction shall comply with Section 817 except that 1) the preservative requirements for used material shall be a minimum of 50% of that required for new material, and 2) the differential of two adjacent planks in the finished deck surface shall not exceed 1/4" (6 mm).

Timber flooring shall be installed in a transverse direction. Longitudinal runners will not be permitted.

Unless otherwise specified, the Contractor has the option of using timber, steel, or concrete piling. If timber piling is used, the piling shall be peeled as specified in Subsection 818.02. Untreated piling may be used unless treatment is specified on the plans. If treated timber piling is specified, the preservative requirements for used timber piling shall be 50% of that required for new material.

Pile driving shall be according to the provisions of Subsections 805.06 through 805.09 except that painting of steel piles is not required. Safe bearing values shall be determined by Method A, Empirical Pile formula.

Before the temporary structure is open to traffic, the Contractor shall submit a certification that the structure was built according to the submitted layout, working drawings, and materials. The certification will be required whether the Department's temporary bridge details are used or the Contractor's optional design is used.

The materials and completed drainage structure shall be maintained in good serviceable condition that will safely accommodate traffic using the facility for the duration of the work.

Temporary pipes in detour or stage construction shall be as shown on the plans or shall be approved before installation. No additional payment will be allowed if a bridge type structure is furnished in lieu of a temporary culvert at the Contractor's request.

Construction of approaches to temporary culverts or bridge structures, or other roadway construction shown on the plans as part of detour or stage construction, shall conform to the lines, grades, cross sections, and typical sections shown on the plans or established by the Engineer. Materials used in detour or temporary roadway construction, and the maintenance thereof, shall comply with the requirements of the applicable sections of the specifications covering the items.

The detour or temporary roadway shall be maintained in a condition to allow the safe and convenient passage of vehicles. When the plans do not provide for a dust free surfacing, the passageway shall be maintained dust free by the application of water

or other approved material to the roadway itself or to adjacent areas of construction activity that are the source of dust.

Temporary culverts or bridge structures shall be removed when the new facility has been completed and opened to traffic.

Materials from temporary culverts or temporary bridge structures shall remain the property of the Contractor. Materials used on detours and in stage construction and not incorporated into the permanent work, shall be salvaged to the extent practicable and used for base on other detours, drives, approaches, islands or shoulders, or stockpiled as directed. Non-salvageable materials shall be disposed of by the Contractor according to Section 201.

(d) Projects on Existing Roadways. Shoulder material shall not be cut away from the edge of the pavement on both sides of any section open to traffic. Unless otherwise specified, the total length of work areas on the entire project having vertical differences greater than 4" (100 mm) adjacent to the edge of traveled lanes shall be limited to 5,280 linear feet (2 km) in advance of backfill.

Where detour or stage construction is specified, traffic control shall be accomplished as shown on the plans or as modified by the Engineer.

The Contractor shall provide the Engineer with a minimum of three full business days advance, written notification of any non-emergency lane closure or lane width restriction. The first full business day shall commence at midnight on the first business day following written notification to the Engineer. This advanced notification is required to allow adequate notice for the issuance of over width load permits by the Department.

Where any operations result in a vertical differential at the centerline, lane lines, or edge of pavement, the Contractor shall immediately place traffic control devices or install a positive barrier according to the plans. Traffic control devices shall be maintained until the planned typical section is completed or until temporary shoulders are constructed.

In addition to the above requirements, when pavement construction in lanes open to traffic results in a vertical differential at the centerline, lane lines, or edge of pavement, then backfill or

adjacent pavement construction shall be accomplished as soon as practicable but in all cases no later than the following:

Vertical Differential		Location	Time Limitation
(1" or less)	25 mm or less	centerline, lane lines, and/or edge of pavement	None
(1" to 3")	25 to 75 mm*	centerline and/or lane lines	Next working day
(1" to 4")	25 to 100 mm	edge of pavement	30 calendar days
(greater than 4")	greater than 100 mm	edge of pavement	**

*No vertical differential greater than 3" (75 mm) will be permitted at centerline or lane lines.

**Traffic control devices shall be installed according to the plans. However, shoulder work in conjunction with overlay projects shall be accomplished within 7 business days.

Where temporary shoulder construction is utilized, the shoulder material shall closely match the grade at the edge of the pavement, but not necessarily conform to the planned typical section. The temporary material shall be stable, but specification density will not be required. Caution shall be exercised in temporary shoulder construction to prevent damage to the pavement. The Contractor will be required to maintain the temporary shoulder in a safe condition until the planned typical shoulder section is constructed.

The Contractor may utilize the planned shoulder material for the temporary shoulder or, at Contractor option, may use other materials approved by the Engineer. Any temporary material that does not comply with the requirements of the planned shoulder material shall be removed by the Contractor before constructing the planned shoulder. There will be no additional payment for constructing, maintaining, or removing temporary shoulders.

Where Contracts do not include shoulder work, the Contractor shall coordinate work with the State, County, or City forces that will be performing the shoulder work. In this case, the State, County, or

City will be responsible for placing and maintaining the required "Low Shoulder" signs. The Contractor will be responsible for all other construction signs until completion of the Contract.

Temporary culverts or bridge structures required in detour or stage construction shall be according to Subsection 603.02(c).

The Contractor shall schedule all work in a manner that will allow the routing of traffic over the permanent pavement as quickly as practicable.

When the plans do not show a detailed sequence of construction or planned detour, the Contractor shall provide a safe and convenient two-way passage throughout the entire length of the work. The Contractor shall perform the work and operate equipment in a manner that will permit the safe, continuous flow of two-way traffic through the work at all times, except when blasting or other potentially hazardous construction operations are actually in progress and where the unregulated movement of traffic would be unsafe. In such sections, the Contractor shall provide a safe and convenient passageway for traffic either by means of one-way passage on the roadway, with traffic controlled by flaggers or signal lights, or by means of short, two-way temporary detours within the right-of-way. Such sections shall be limited to approximately 1500' (500 m) in length. If traffic conditions warrant, the length of such sections may be increased or decreased as directed or approved by the Engineer.

The Contractor shall utilize, and store when directed, material available within the project, including existing surfacing, which is suitable for surfacing temporary portions of the grading for use as passageways for traffic. Gravel or crushed stone may be used for temporary surfacing if other suitable materials are not available within the project limits.

If it is determined that the Contractor's performance of the work was not completed in an efficient, workmanlike manner, making it necessary to use temporary surfacing materials for maintaining traffic, the Contractor shall provide the necessary temporary surfacing material at no cost to the Department.

The Contractor shall maintain access for the safe and convenient use of the adjacent property owners/occupants. The Contractor shall maintain all existing highway, street, and county road regulatory,

warning, guide, and informational signs in an effective location at all times for the duration of the work and shall install them at the correct location upon completion of the work. Any signs damaged by the Contractor shall be replaced at no cost to the Department.

(e) Projects Constructed on New Location. When projects on new location sever existing public or private roads or the access to premises, the Contractor shall schedule and perform the various items of construction to provide a safe and convenient passageway for traffic at all times according to Subsections 603.02(a), (b), (c) and (d).

603.03 Method of Measurement. (a) Maintenance of Traffic will be measured by the lump sum.

(b) Traffic Control Supervisor will be measured by the lump sum.

(c) The construction and subsequent removal of Temporary Culverts will be measured by the linear foot (meter) measured parallel to the flow line of the culvert. For multiple pipes, the measured length will be the sum of the lengths of the individual barrels. No measurement or payment will be made for lengths in excess of that required to provide the roadway width specified on the plans or as directed by the Engineer for the particular location.

The construction and subsequent removal of Temporary Bridge Structures, of the specified width, will be measured by the linear foot (meter) of bridge structure actually constructed, not to exceed the length specified on the plans for the particular location. No additional measurement or payment will be made for widths or lengths in excess of those shown on the plans or as directed by the Engineer for the particular location.

(d) Materials designated on the plans or authorized by the Engineer to be used for the maintenance of traffic, for repairs to the existing roadway within the limits of the work, for temporary bases and surfaces directed to be used during stage construction and reconstruction, and for the construction and maintenance of detours will be measured according to the specifications for the particular item used. Materials required for maintenance of traffic due to negligence of the Contractor or failure of the Contractor to construct and maintain the work in proper sequence will not be measured or paid for.

Materials removed from detours or temporary passageways and placed as directed will be measured under the item of Common Excavation, Unclassified Excavation, or Removing and Replacing Base Course and Asphalt Surfacing, as appropriate.

603.04 Basis of Payment. **(a)** Work completed and accepted under the item of Maintenance of Traffic and measured as provided above will be paid for at the contract lump sum price bid for Maintenance of Traffic, which price shall be full compensation for furnishing, placing, maintaining, and removing traffic control devices; for ordinary maintenance of the existing roads, bridges, and culverts; for the application of water or other approved materials to alleviate dust conditions on passageways; for furnishing flaggers, pilot vehicles, and sentinels, as necessary; for maintaining a smooth and stable passageway; for maintaining and re-erecting all existing highway, street, and county road signs; and for all materials, labor, equipment, tools, and incidentals necessary to safely maintain traffic during the construction period.

(b) Work completed and accepted under the item Traffic Control Supervisor and measured as provided above will be paid for at the contract lump sum price bid for Traffic Control Supervisor, which price shall be full compensation for providing the traffic control supervisor and for all materials, additional labor, equipment, tools, and incidentals necessary to accomplish the specified work.

(c) Work completed and accepted under the item Temporary Culverts and/or Temporary Bridge Structures and measured as provided above will be paid for at the price bid per linear foot (meter) for __" (__mm) Temporary Culvert and/or at the price bid per linear foot (meter) for Temporary Bridge Structure (___′ [__m] Roadway Width), which price shall be full compensation for the preparation of necessary design details and/or Registered Professional Engineer certifications; the construction, maintenance, and subsequent removal of the structures; and for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the work. The Contractor may substitute temporary culverts of different sizes and shapes from those specified on the plans, provided that the minimum specified waterway opening is obtained for the particular location. Payment will be based on the culvert size specified for the particular location.

(d) Materials furnished and used for the maintenance of traffic and measured as provided above will be paid for at the contract unit price bid for the particular items used, which price shall be full compensation for furnishing all materials; for removal, if applicable; and for all labor, equipment, tools, and incidentals necessary to complete the work. Advanced payment for stockpiled materials will not be allowed for any of the pay items in this Section.

(e) Traffic control devices required for temporary hazard delineation as a result of the Contractor's operations; for those operations required to provide smooth and dust free traffic passageways; for flaggers, pilot vehicles, and/or sentinels required to safely and conveniently guide traffic through the work limits; and for maintaining and re-erecting all existing highway, street, and county road signs will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Maintenance of Traffic.

(f) Periodic payments will be made for Temporary Culverts, Temporary Bridge Structures, Maintenance of Traffic, and Traffic Control Supervisor.

The periodic payments for Temporary Culverts and Temporary Bridge Structures will be limited to the following percentages of the total price bid for each culvert or structure:

Temporary Culverts	**Temporary Bridge Structures**
Installation - 80%	Substructure - 30%
Removal and Disposal - 20%	Superstructure - 50%
	Removal and Disposal - 20%

The periodic payments for the items Traffic Control Supervisor and Maintenance of Traffic will be in proportion to the percent of the total work performed on the Contract.

Payment will be made under:

Pay Item	**Pay Unit**
Maintenance of Traffic	Lump Sum
Traffic Control Supervisor	Lump Sum
__" (___mm) Temporary Culvert	Linear Foot (Meter)
Temporary Bridge Structure (___′ [__m] Roadway Width)	Linear Foot (Meter)

SECTION 604
TRAFFIC CONTROL DEVICES IN CONSTRUCTION ZONES

604.01 Description. This item consists of furnishing, installing, maintaining, moving from one location to another, and removing traffic control devices as specified on the plans according to this Section, Subsections 104.05 and 107.07, and the MUTCD. Traffic control devices shall include, but not be limited to: traffic cones, signs, vertical panels, barricades, barrier units, traffic drums, advance warning arrow panels, portable changeable message signs, pavement markings, and removal of pavement markings.

604.02 Materials. (a) General. All work zone traffic control devices used on the project, including sign supports, barricades, traffic drums equipped with flashing lights, crash cushions, and impact attenuators shall comply with the requirements of National Cooperative Highway Research Program (NCHRP) Report 350 or the Manual for Assessing Safety Hardware (MASH). The Contractor shall furnish a certification of such compliance from the manufacturer or supplier of all work zone traffic control devices prior to using the devices on the project. The certification shall state the device meets the requirements of NCHRP 350 or MASH and include a copy of the Federal Highway Administration's (FHWA) approval letter with all attachments for each device. Devices shall be fabricated and installed in accordance with the plans and with the crash testing documentation provided in the FHWA approval letter, which is available at:
http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/.

The 2lb. (0.9 kg) minimum channel post or 4" x 4" (100 mm x 100 mm) wood post sign support systems, installed in accordance with the plans (direct buried), have been previously tested and accepted, and, therefore, do not require certification. No direct payment will be made for fulfilling the requirements of this Specification, but full compensation will be considered included in the contract unit prices bid for the various traffic control devices.

Traffic control devices will be accepted based on a visual inspection according to ATSSA *Quality Standards for Work Zone Traffic Control Devices* as to their effectiveness and condition. At the time of initial setup, 100% of all traffic control devices shall be

classified as "acceptable". Maintenance, repair, and replacement operations shall be conducted so that at least 75% of each type device in use are maintained in the "acceptable" classification, with the remaining devices classified as "marginal". Traffic control devices that are classified as "unacceptable" shall be removed from the project and replaced within 12 hours after notification.

Used signs, vertical panels, barricades, drums, traffic cones, precast concrete barrier, advanced warning arrow panels and portable changeable message signs will be allowed provided such devices comply with the requirements set out herein and on the plans.

(b) Signs, Vertical Panels, Barricades, Drums, and Traffic Cones. Materials for signs, vertical panels, and barricades required under this subsection shall comply with materials requirement of the plans, specifications and the MUTCD for the construction of signs using ASTM D 4956 for Type VIII or IX sheeting furnished according to the QPL. All orange signs must meet requirements for Fluorescent Orange.

Sign messages, symbols, borders, and backgrounds shall be of the size, type, and/or color shown on the plans. All colors for signs shall match the colors specified by the MUTCD. All sign messages designating project lengths in miles shall be carried only to the nearest mile.

All letters and numerals shall be standard Series C, D, E, E modified, and F as specified in the current edition of *Standard Highway Signs*.

All letters, numerals, symbols, and borders shall have a regular outline, be clean-cut and sharp, and have a continuous stroke and border.

The letters, numerals, arrows, symbols, borders, and other features shall be produced on the retroreflective sheeting of the sign field by a silk screen process approved by the Engineer. Sign messages and borders of a color darker than the sign field shall be applied to the retroreflective sheeting by direct process. Sign messages and borders of a color lighter than the sign field shall be produced by the reverse process in which the message and border are outlined by applying darker transparent color to the retroreflective sheeting of the sign field. Transparent colors, inks, and paints used

in the silk screen process shall be of the type or quality recommended by the manufacturer of the retroreflective sheeting and shall conform to the colors shown in the current editions of the MUTCD and *Standard Highway Signs*. Precut letters, symbols, and numerals, when applied according to the manufacturer's recommendation, will be permitted.

The Contractor shall submit a certification to the Engineer stating that the retroreflective sheeting complies with the requirements of the specifications.

Traffic cones used for night work or which will be used for delineation during nighttime hours shall be reflectorized with retroreflective sheeting meeting the requirements of ASTM D 4956 for Type III or IV with the additional requirements for Reboundable Sheeting. All traffic cones shall meet the requirements of the MUTCD.

(c) Precast Concrete Barrier. Materials for precast concrete barrier shall comply with the applicable requirements of the plans.

The Contractor shall certify to the Engineer, in writing, that the materials and the design used in the construction of the barrier comply with the requirements of the plans and specifications and that the barrier was constructed according to the details of the plans.

(d) Construction Pavement Markings. (1) Asphalt Surfaces. Construction pavement marking material shall consist of an adhesive backed retroreflective tape that can be applied to the pavement. As an alternate, painted markings complying with Section 718 may be used. Markings shall be yellow for centerlines and inside edge lines, white for lane lines and outside edge lines, and have straight, unbroken edges.

For all markings that are to be removed, paint will not be allowed on the final roadway surface or on any pavement surface that will not be resurfaced or obliterated unless otherwise authorized in writing by the Engineer. The Contractor may, at Contractor expense, use painted markings on the final surface as a primer for permanent thermoplastic markings.

(2) Portland Cement Concrete Surfaces. Construction pavement markings for Portland cement concrete surfaces shall comply with the requirements for removable pavement markings as

specified in Subsection 604.02(f). As an alternate, painted markings complying with Section 718 may be used. Markings shall be yellow for centerlines and inside edge lines and white for lane lines and outside edge lines, and shall have straight, unbroken edges.

For all markings that are to be removed, paint will not be allowed on the final roadway surface or on any pavement surface that will not be resurfaced or obliterated unless otherwise authorized in writing by the Engineer. Paint may be used as a primer for thermoplastic markings.

(e) Interim Pavement Markings. For interim pavement markings, the Contractor may use paint or tape as specified above for Construction Pavement Markings. Retroreflectorized raised pavement markers complying with Section 721 may be used in lieu of paint or tape specified above. Three raised pavement markers shall be installed, equally spaced, in the place of the 4' (1.2 m) stripe. The markers shall be retroreflectorized in the direction(s) facing traffic and shall be the color required for tape or paint.

In lieu of raised pavement markers complying with Section 721, the Contractor may use Construction Raised Pavement Markers (CRPM) listed on the QPL.

(f) Removable Construction Pavement Markings. Removable markings shall meet the requirements of Section 720 for Type 4.

(g) Certification for Construction and Interim Pavement Markings. The Contractor shall submit a certification to the Engineer stating that the construction and/or interim pavement markings used comply with the requirements of the specifications.

(h) Advance Warning Arrow Panel. Advance warning arrow panels shall meet the requirements of the MUTCD.

(i) Portable Changeable Message Signs. Portable changeable message signs shall meet the requirements of the MUTCD.

604.03 Construction Requirements. (a) General. Traffic control devices shall be installed and maintained in good condition and in compliance with the plans, this specification, and the MUTCD. The Contractor shall certify weekly to the Engineer that all traffic control devices in use have been inspected on at least a daily basis and that any devices failing to comply with the requirements set out herein or on the plans were corrected. The

certification for inspection of traffic control devices shall be documented on the attached "Traffic Control Device Inspection Checklist", which is to be completed in its entirety, as applicable, on a daily basis. The Traffic Control Device Inspection Checklist form is available on the Department's website at:

http://www.arkansashighways.com/construction_division/TrafficControlDeviceInspectionForm.

At least one inspection weekly shall be performed at night. The work involved in performing the required inspections and furnishing the certification will not be paid for separately, but full compensation therefor will be considered included in the contract unit prices bid for other items of the Contract.

Traffic control devices shall be constructed according to the plans. The Contractor shall be responsible for properly locating the traffic control devices according to the plans, or as directed.

The Contractor shall accomplish the items of work required for traffic control through construction zones in a logical sequence throughout the duration of the project. Any item constructed prematurely will not be accepted until the item is required for its intended use.

All traffic control devices shall be constructed and maintained in such manner that the devices will be fully visible, intact, and erect for the entire duration of their intended use and shall be removed from the project when their use is no longer required. All devices shall remain the property of the Contractor unless otherwise specified.

(b) Signs. Regulatory, warning, and guide signs, and vertical panels of a permanent nature, shall be placed and maintained in a vertical position as shown on the plans or as directed. Each device will be considered as a unit, including the sign and support assembly as shown on the plans.

After the project has been declared substantially complete by the Engineer, the Contractor shall either cover or remove the advance warning signs. In the event that work is required after the project is declared substantially complete, the Contractor will uncover the advanced warning signs or provide appropriate signs and traffic control devices needed to perform the work. Additional signs or

traffic control devices required for such work will not be measured or paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Maintenance of Traffic.

(c) Barricades. Type III barricades and assemblies used on detour signing and signing required to close off all or part of a roadway shall be placed as shown on the plans or as directed.

(d) Traffic Drums. Traffic drums shall be placed as shown on the plans or as directed.

(e) Precast Concrete Barrier. Precast concrete barrier shall be placed as shown on the plans or as directed.

(f) Pavement Markings. At the end of each day's operations, pavement markings, either permanent, construction, or interim, shall be in place on all roadways open to traffic. Work shall not continue or commence until the required pavement markings are in place. Before opening a detour or stage roadway to traffic, pavement markings, either permanent or construction, shall be in place.

Conflicting pavement markings shall be removed to prevent confusion to drivers. Removal of pavement markings shall leave a minimum of pavement gouging. Unless otherwise specified, painting over conflicting markings as a means of line removal will not be allowed.

(1) Classification of Markings. Pavement markings are classified as follows:

a. Permanent Pavement Markings. Permanent pavement markings are those markings that will be left in place upon completion of the project. Permanent pavement markings shall comply with the requirements of Sections 3A and 3B of the MUTCD and Section 718, 719, or 720, as specified on the plans or in the Contract. Skip lines shall be placed on a 40' (12 m) cycle (10' [3 m] stripe, 30' [9 m] skip) for white lane lines and for yellow centerlines where passing is permitted. No-passing zones shall be marked with solid yellow lines. Edge lines shall be white solid lines for both edges of the pavement on two-way traffic roadways. On divided multi-lane roadways, edge lines shall be white solid lines on the

outside edge and solid yellow on the inside edge. Unless otherwise specified, all lines shall be broken only for street and/or ramp intersections.

b. Construction Pavement Markings. Construction pavement markings are those markings that will be removed, replaced with permanent markings, or covered with a pavement course before the completion of the project. Construction pavement markings shall comply with the requirements of Sections 3A and 3B of the MUTCD and shall be the same pattern as Permanent Pavement Markings. Unless otherwise specified, edge lines will not be required. The Contractor shall replace all markings that become ineffective, as determined by the Engineer, at no cost to the Department.

c. Interim Pavement Markings. Interim pavement markings are those that may be used for a short period of time until it is practical and possible to place either permanent or construction pavement markings. Interim pavement markings shall be replaced with permanent or construction markings or covered with a succeeding course of paving within three (3) calendar days on high-volume roads or fourteen (14) calendar days on low-volume roads. (Day 1 of the 3- or 14-day period is the first calendar day that it becomes practical and possible to place permanent or construction pavement markings.) If interim markings are not covered or replaced with permanent or construction markings within the specified time period, no work on the project shall continue or commence until either permanent or construction pavement markings are in place. High-volume and low-volume roads will be designated on the plans.

Except as noted below for divided multi-lane roadways, interim pavement markings shall consist of white lane lines and yellow centerlines placed on a 40' (12 m) cycle (4' [1.2 m] stripe, 36' [10.8 m] skip). When interim markings are used and unless otherwise specified, all two- and three-lane, two-way traffic roadways shall be marked with a single 4" (100 mm) wide yellow skip line on the centerline so as to operate as two-lane roadways.

Four lane two-way traffic roadways shall be marked with double 4" (100 mm) wide yellow skip lines on the centerline and a single 4" (100 mm) wide white skip line on lane lines in each direction so as to operate as four-lane roadways. On all roadways with existing turn lanes (either continuous or dedicated), the existing striping pattern shall be maintained with the interim markings. The center turn lane shall be marked with double 4" (100 mm) wide yellow skip lines on each side of the turn lane and a single 4" (100 mm) wide white skip line shall be used on lane lines in each direction. On multi-lane divided roadways, a 4" (100 mm) wide white skip line 10' (3 m) long on a 40' (12 m) cycle shall be installed on the lane line(s) in each direction.

In conjunction with interim pavement markings on roadways marked for two-way traffic, no-passing zones shall be marked with signs. DO NOT PASS signs (R4-1) shall be placed at the beginning of no-passing zones and the PASS WITH CARE sign (R4-2) shall be placed at the end of no-passing zones. When the length of the no-passing zone exceeds 1/2 mile (800 m) in length, or when the alignment of the roadway warrants, supplemental DO NOT PASS signs shall be placed at 1/2 mile (800 m) intervals, or more frequently if necessary, to provide adequate warning to the public. The signs shall be mounted as shown on the plans.

Construction Raised Pavement Markers, when used, shall be securely attached to the surface in such manner that the surface will not be damaged and the device will remain in place for the time required for its use. Markers that become detached from the surface, are damaged, are coated with asphalt, or otherwise lose their effectiveness shall be replaced or repaired by the Contractor at no cost to the Department.

(2) Application of Markings. Pavement markings shall be applied as follows:

a. Final Surfaces. Permanent or construction markings, as specified in the Contract, shall be in place on the final surface at the end of each day's operations on all lanes

open to traffic. Unless otherwise specified, edge lines will not be required. The Contractor may, at Contractor option and expense, use interim pavement markings as follows:

High volume roads. On roadways designated on the plans as high volume, interim pavement markings may be used for not longer than 3 calendar days. All centerline and lane line permanent markings shall be placed within the three-day period.

Low volume roads. On roadways designated on the plans as low volume, interim pavement markings may be used for not longer than 14 calendar days. All centerline and lane line permanent markings shall be placed within the 14 day period.

The Contractor shall carefully place all interim markings to avoid any overlapping by the permanent pavement markings. Interim pavement markings shall be removed from the final surface as soon as possible after the placement of permanent markings. Any voids caused by the removal of interim markings shall be repaired immediately at the Contractor's expense. For all markings that are to be removed, paint will not be allowed on the final surface unless otherwise authorized in writing by the Engineer.

On roadways open to traffic, if interim pavement markings are used, they shall be removed only after permanent pavement markings are in place.

b. Intermediate Surfaces. On all except the final surfaces, construction pavement markings shall be in place at the end of each day's operations on roadways open to traffic. Unless otherwise specified, edge lines will not be required. The Contractor may, at Contractor option and expense, use interim pavement markings under the same conditions and time limits as specified for final surfaces.

When CRPM are used on an intermediate surface before a final surface of ACHM and when the final ACHM surface course will not completely cover the CRPM, the CRPM shall be removed immediately in advance of the paver placing the final surface course. Removal of the CRPM shall be at the Contractor's expense.

c. Detours and Stage Construction. On detours and stage construction, construction pavement markings, including edge lines when required as shown on the plans, shall be in place before opening the roadway to traffic.

d. Asphalt Surface Treatment. When the final surface is asphalt surface treatment, pavement markings shall not be placed until the asphalt has set, the aggregate firmly embedded, and loose aggregate removed from the surface. No-passing zones shall be marked with signs as specified under interim pavement markings above. Permanent or construction pavement markings shall be placed within 14 calendar days after placement of the final surface.

(g) Removable Construction Pavement Markings. The tape, pavement, and ambient air temperature shall be 50° F (10° C) and rising and the pavement surface shall be free of moisture at the time of placement. If weather conditions prohibit placement of removable construction pavement markings and the Engineer determines that pavement markings must be placed due to the sequencing of the work, the Contractor shall place and remove painted markings. The placement and removal of painted markings in this case will be measured and paid for at the contract unit price bid for removable construction pavement markings. No payment will be made for removable construction pavement markings that do not properly adhere to the pavement.

On jointed concrete pavement, the tape shall be cut at all joints. On all other pavements, the tape shall be cut at approximately 40' (12 m) intervals.

(h) Referencing No-Passing Zones. On two-way traffic roadways, the Contractor shall reference the locations of all no-passing zones with standard DO NOT PASS and PASS WITH CARE signs before obliteration of the existing pavement markings.

On detours, new construction, and when construction significantly changes the horizontal or vertical alignment of an existing roadway, the Department will establish the locations of no-passing zones for referencing by the Contractor. Signs used to mark no passing zones shall remain in place until installation of permanent markings or final acceptance of the project, whichever is earlier.

On unpaved or unmarked roadways, the Contractor shall mark the locations of no-passing zones with signs immediately after the Department establishes the locations of the zones. If permanent or construction pavement markings are placed immediately after zoning is completed, the marking of no-passing zones with signs will not be required.

(i) Advance Warning Arrow Panel. Advance warning arrow panels shall be placed as shown on the plans or as directed, and shall remain in place for the time specified by the Engineer. The Engineer will specify the mode of operation to be used.

(j) Portable Changeable Message Signs. Portable changeable message signs shall be installed at the locations shown on the plans or as directed by the Engineer. The Engineer will specify the message(s) to be displayed and the mode of display. The sign shall be maintained operational in the specified location until the Engineer directs that it be removed.

(k) Traffic Cones. Traffic cones shall be placed as shown on the plans or as directed.

604.04 Method of Measurement. Traffic control devices designated on the plans or authorized by the Engineer will be measured by the square foot (square meter), linear foot (meter), each, or day. The maximum quantities of traffic control devices, other than pavement markings, authorized for payment will be the maximum amounts of each, shown on the plans or authorized by the Engineer, that may be required to be in place at any one time during the construction period.

The various traffic control devices will be measured according to the following:

(a) Signs, Vertical Panels, Traffic Drums, Barricades, and Traffic Cones. The actual amount of signs, vertical panels, traffic drums, barricades, and traffic cones, furnished and in place, up to the

maximum amount that is authorized to be in place at any one time, will be measured by the square foot (square meter), each, each, linear foot (meter), and each, respectively. No additional payment will be made for moving these devices from one location to another or for maintenance or repair.

(b) Precast Concrete Barrier. (1) Furnishing and Installing Precast Concrete Barrier. The actual amount of precast concrete barrier, furnished and installed, up to the maximum amount that is authorized to be in place at any one time, will be measured by the linear foot (meter).

(2) Relocating Precast Concrete Barrier. The actual amount of precast concrete barrier, previously furnished and installed, which is relocated within the project limits will be measured by the linear foot (meter) for each authorized relocation.

(c) Pavement Markings. Permanent pavement markings will be measured and paid for under Sections 718, 719, or 720, as applicable.

Construction Pavement Markings will be measured by the meter (linear foot). Construction Pavement Markings (Words), (Arrows), and (Railroad Emblems) will be measured by the unit. One railroad emblem unit will consist of both R's, the X, the transverse lines, and the stop line near the tracks.

Interim pavement markings will not be paid for separately, but full compensation therefor will be considered included in the contract unit prices bid for other items of the work.

Markings that become ineffective for any reason other than normal wear shall be replaced by the Contractor at no cost to the Department. Replacement of markings that become ineffective due to normal wear will be measured by the meter (linear foot) or unit.

Removal of Permanent Pavement Markings and Removal of Construction Pavement Markings will be measured by the linear foot (meter) of marking removed. Removal of Permanent and Construction Pavement Markings (Words), (Arrows), and (Railroad Emblems) will be measured by the unit. One railroad emblem unit consists of both R's, the X, the transverse lines, and the stop line near the tracks.

Removal of interim pavement markings, including RPM and/or CRPM, will not be paid for separately, but full compensation therefor will be considered included in the contract unit prices bid for other items of the work.

When any pavement marking is removed in conjunction with the removal, scarification, milling, or grinding of the pavement, or is covered by a succeeding pavement course, the removal of the marking will not be measured for payment.

There will be no payment for removal of Removable Construction Pavement Markings.

Signs used to mark no-passing zones will be measured by the square (square meter) according to Subsection 604.04(a). Each sign will be considered as a unit, including the sign and the support assembly as shown on the plans.

(d) Advance Warning Arrow Panels and Portable Changeable Message Signs. Advance Warning Arrow Panels and Portable Changeable Message Signs furnished will be measured for payment by the number of days each panel or sign is required and authorized by the Engineer. Payment for a full day will be made for any portion of a day that the panel or sign is used, but the measurement shall not exceed one per panel or sign in any calendar day. When Advance Arrow Warning Panels or Portable Changeable Message Signs are required after the contract time has expired and liquidated damages are being assessed, the Contractor shall furnish such panels and/or signs at no cost to the Department.

604.05 Basis of Payment. Traffic control devices completed and accepted and measured as provided above will be paid for at the contract unit price bid per square foot (square meter), each, linear foot (meter), or day, as applicable for the particular item, according to the following:

(a) Signs, Vertical Panels, Traffic Drums, Barricades, and Traffic Cones. The unit prices bid for these items shall be full compensation for all materials, labor, equipment, tools, and incidentals necessary for installation, moving from one location to another, and for maintenance, repair, and removal.

(b) Precast Concrete Barrier. (1) Furnishing and Installing Precast Concrete Barrier. The unit price bid for this item shall be

full compensation for all materials, labor, equipment, tools, and incidentals necessary for the initial furnishing and installation of the barrier on the project; for maintenance and repair; and for final removal of the barrier upon completion of the work.

(2) Relocating Precast Concrete Barrier. The unit price bid for this item shall be full compensation for all materials, labor, equipment, tools, and incidentals necessary for each relocation of the barrier that was initially furnished and installed on the project and that is authorized to be used at other locations within the project limits.

The maximum unit bid price for Relocating Precast Concrete Barrier shall not exceed 25% of the unit price bid for Furnishing and Installing Precast Concrete Barrier. Any unit bid price submitted in an amount more than the specified maximum will be automatically adjusted by the Engineer downward to the specified maximum to determine the correct total bid. This adjustment to the specified maximum will be automatically made, without any counter-adjustments in prices for other items.

(c) Pavement Markings. The contract unit prices bid for these items shall be full compensation for installing and maintaining markings; for removing pavement markings; and for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Replacement of construction pavement markings, when required due to normal wear, completed and accepted and measured as provided above, will be paid for at the contract unit price bid for construction pavement markings.

Signs used to mark no-passing zones will be paid for under Subsection 604.05(a).

(d) Advance Warning Arrow Panel. The contract unit price bid for this item shall be full compensation for furnishing, installing, moving, and maintaining the panel; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(e) Portable Changeable Message Sign. The contract unit price bid for this item shall be full compensation for furnishing, installing, moving, and maintaining the sign; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(f) Payment for replacing traffic control devices that are damaged beyond use by traffic or vandalism will be made at 75% of the actual measurement of the items being replaced if their continued use on the project is required. The damaged devices will be inspected by the Engineer and marked for disposal before payment for replacement. The replacement device shall be classified as "acceptable" according to ATSSA *Quality Standards for Work Zone Traffic Control Devices*. The Department reserves the right to seek any and all recovery of the amount of any such payment from the parties responsible for the damage.

No payment will be made for repair or replacement of Advanced Warning Arrow Panels or Portable Changeable Message Signs. No payment will be made for replacing any traffic control device that has been stolen or has been damaged due to the negligence of the Contractor.

Payment will be made under:

Pay Item	**Pay Unit**
Signs	Square Foot (Square Meter)
Vertical Panels	Each
Traffic Drums	Each
Barricades	Linear Foot (Meter)
Furnishing and Installing Precast Concrete Barrier	Linear Foot (Meter)
Relocating Precast Concrete Barrier	Linear Foot (Meter)
Construction Pavement Markings	Linear Foot (Meter)
Construction Pavement Markings (Words, Arrows, Railroad Emblems)	Each
Removal of Permanent Pavement Markings	Linear Foot (Meter)
Removal of Permanent Pavement Markings (Words, Arrows, Railroad Emblems)	Each
Removal of Construction Pavement Markings	Linear Foot (Meter)
Removal of Construction Pavement Markings (Words, Arrows, Railroad Emblems)	Each

Removable Construction Pavement Markings	Linear Foot (Meter)
Advance Warning Arrow Panel	Day
Portable Changeable Message Sign	Day
Traffic Cone	Each

SECTION 605
CONCRETE DITCH PAVING

605.01 Description. This item shall consist of the construction of concrete ditch paving, according to these specifications and in conformity with the locations, lines, and grades shown on the plans, or as directed.

605.02 Materials. The concrete shall comply with Section 802 for Class M Concrete. The Department will perform all acceptance sampling and testing at the frequencies shown for Contractor acceptance testing in Subsection 802.06.

When required, reinforcing steel shall comply with Section 804.

Curing materials shall comply with Subsection 501.02(i).

605.03 Construction Requirements. (a) Subgrade. The subgrade shall be excavated or filled to the required grade. Soft and yielding material shall be removed and replaced with suitable material and the entire subgrade shall be thoroughly compacted.

(b) Forms. Forms shall be constructed of metal or wood, free from warp, and of sufficient strength to resist springing during the process of depositing concrete. They shall be securely staked, braced, set, and held firmly to the required line and grade. Forms shall be cleaned and oiled before concrete is placed against them. As an alternate to stationary forms, the Contractor may use a slip form paver method with a template matching the plan configuration of the ditch paving.

(c) Placing and Finishing. The concrete shall be deposited in the forms upon a wetted subgrade to such depth that when it is compacted and finished, the flow line shall be at the required elevation and the sides at required widths, slopes, and thicknesses. The concrete shall be thoroughly compacted and the edges along the

forms spaded to prevent honeycomb. The flow lines and sides shall be struck off with a straightedge and tamped sufficiently to flush mortar to the surface, after which it shall be finished with a wood float to a smooth and even surface. Edges shall be rounded with a 1/4" (6 mm) edger.

Transverse joints shall be cut with a 1/4" (6 mm) jointer at intervals not greater than 5' (1.5 m) measured longitudinally along the flow line.

When completed, the concrete shall be cured as specified in Section 501.

(d) Backfilling. Immediately after the forms have been removed, the spaces on each side of the paving shall be backfilled with suitable material, compacted with mechanical equipment, and solid sod placed to the top of the ditch paving. The Contractor shall be responsible for any damage to the ditch paving and the area adjacent to the ditch paving that occurs before the solid sod is placed. All such damage shall be repaired by the Contractor at no cost to the Department.

(e) Expansion Joints. When a section of ditch paving terminates at a drop inlet or other structure, a space not less than 1/2" (12 mm) wide shall be left between the end of the paving and the structure. This space shall be filled with joint filler complying with AASHTO M 213.

(f) Placement on Slopes. Slope paving shall begin at the toe of the slope and be constructed to the lines and dimensions as shown on the plans or as directed.

605.04 Method of Measurement. Concrete Ditch Paving constructed within the limits shown on the plans or as directed will be measured by the square yard (square meter) of exposed surface.

605.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per square yard (square meter) for Concrete Ditch Paving of the type specified, which price shall be full compensation for furnishing materials, including joint filler; for constructing the concrete ditch paving; for excavation and backfilling; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Concrete Ditch Paving (Type___)	Square Yard (Square Meter)

SECTION 606
PIPE CULVERTS

606.01 Description. This item shall consist of the construction of pipe culverts, flared end sections for pipe culverts, and safety end sections for pipe culverts according to these specifications; of the type, size, and dimensions shown on the plans; and in conformity with the locations, lines, and grades shown on the plans; or as directed.

For side drains, when the type is not specified on the plans, the Contractor may furnish any of the types listed in Subsection 606.02 provided that only one type and material shall be used for all side drains on the project. In addition, when circular pipe is specified for a side drain the Contractor may, at no additional cost to the Department, substitute an arch pipe providing the equivalent waterway.

606.02 Materials. Materials and design requirements for the several types of pipe culverts and flared end sections shall comply with the following:

(a) All Pipe and Flared End Sections. All pipe, flared end sections, precast curtain walls, preformed gaskets, and other accessories shall be furnished from those sources listed on the QPL.

The Contractor shall furnish the Engineer an itemized statement of the sizes and lengths of culvert pipe in each shipment. A field inspection will be made by the Engineer. This inspection will include an examination of the culvert pipe for nominal specified diameter, net length of finished culvert pipe, condition of pipe, and any evidence of poor workmanship. The inspection may include an examination for deficiencies in lengths of sheets used and a check of the brand name and heat numbers.

(b) Reinforced Concrete Pipe. The pipe may be of either bell and spigot or tongue and groove unless one type is specified on the plans or is required to extend an existing culvert. Tests shall be conducted according to AASHTO T 280.

(1) The manufacture and furnishing of circular pipe shall be according to the provisions of AASHTO M 170 with a minimum B wall thickness.

(2) The manufacture and furnishing of arch shaped pipe shall be according to the provisions of AASHTO M 206.

(3) The manufacture and furnishing of horizontal elliptical pipe shall be according to the provisions of AASHTO M 207.

(4) Joints shall be sealed with either preformed rubber gaskets or bitumen/butyl rubber plastic gaskets complying with AASHTO M 198 or with tubular cross-section closed cellular rubber gaskets complying with the physical requirements of ASTM D 1056 (Type 2, Class C, Grade 1) and meeting the chemical requirements of AASHTO M 198.

When a primer is recommended by the manufacturer to be used with the gasket, the material in the primer shall comply with the requirements as specified by the manufacturer.

When Reinforced Concrete Arch Pipe is specified, Reinforced Concrete Horizontal Elliptical Pipe of equivalent size may be substituted unless Arch Pipe is required to extend an existing culvert.

(c) Corrugated Metal Pipe and Arch Pipe. Each end of individual metal pipe sections, 12" (300 mm) or equivalent diameter and larger, shall be reformed so as to have not less than two annular

corrugations. Metal pipe shall comply with the following requirements:

(1) Zinc Coated (Galvanized) Corrugated Steel Pipe. The manufacture and furnishing of zinc coated (galvanized)corrugated steel pipe shall be according to AASHTO M 36 and M 218.

(2) Aluminum Coated Corrugated Steel Pipe. The manufacture and furnishing of aluminum coated corrugated steel pipe shall be according to AASHTO M 36 and M 274.

(3) Aluminum-Zinc Alloy Coated Corrugated Steel Pipe. The manufacture and furnishing of aluminum-zinc alloy coated corrugated steel pipe shall be according to AASHTO M 36 and AASHTO M 289.

(4) Corrugated Aluminum Pipe. The manufacture and furnishing of corrugated aluminum pipe shall be according to AASHTO M 196 or M 197.

(5) Asphalt Coated Corrugated Metal Pipe. The manufacture and furnishing of asphalt coated corrugated metal pipe shall be according to AASHTO M 190, Type A.

(6) Polymer Precoated Metallic Coated Corrugated Steel Pipe Culverts. The manufacture and furnishing of polymer precoated metallic coated corrugated steel pipe culverts shall comply with AASHTO M 245. The metallic coating shall comply with the applicable requirements of AASHTO M 218 or M 289 for zinc or aluminum-zinc alloy coating.

The sheets shall have a polymeric coating of 0.010" (250 μm) minimum thickness on each side after corrugation.

(7) Smooth Lined Polymer Precoated Metallic Coated Corrugated Steel Pipe shall comply with AASHTO M 245, AASHTO M 246, and AASHTO *Specifications for Highway Bridges,* except as follows:

a. The minimum acceptable steel sheet thickness for the outer corrugated shell shall be 0.046″ (1.17 mm).

b. Both the outer corrugated shell and smooth inner liner shall have a standard 2 oz./sq. foot (610 g/sq m) coating of zinc

(1 oz./sq foot [305 g/sq m] per side) and be precoated 10 mils (250 μm) on each side with a polymer precoated laminate.

c. The pipe ends shall be reformed in such manner as to seal the outer shell and liner together to protect the ends from damage. The band coupler for connecting pipe ends shall have a minimum of 2 corrugations and be a minimum of 12″ (300 mm) wide.

(d) Plastic Pipe.

(1) Polyethylene Pipe. The manufacture and furnishing of polyethylene pipe shall be according to AASHTO M 294, Type S. Polyethylene pipe shall have a corrugated outer shell with an essentially smooth wall waterway. Couplings and fittings supplied or recommended by the pipe manufacturer shall be used.

(2) PVC Pipe. The manufacture and furnishing of PVC pipe shall be according to AASHTO M 304. PVC pipe shall have annular or helical projections or ribs on the outer surface and an essentially smooth wall waterway. Couplings and fittings supplied or recommended by the pipe manufacturer shall be used.

(e) Flared End Sections for Pipe Culverts. The manufacture and furnishing of flared end sections for pipe culverts shall comply with Subsection 606.02(b) for concrete pipe and Subsection 606.02(c) for metal pipe. The flared end sections shall be of the same material as the culvert pipe for a given installation except that Zinc Coated, Aluminum Coated, or Aluminum-Zinc Alloy Coated Corrugated Steel Flared End sections may be used with any Corrugated Steel Pipe.

Reinforced concrete flared end sections for circular, arch, or elliptical pipe shall comply with the applicable requirements for Class II or higher classes of pipe. The area of reinforcing for circular pipe flared end sections shall be according to the requirements for elliptical reinforcing for Class II pipe for the appropriate wall thickness.

Concrete for curtain walls shall comply with Section 802 for Class M concrete.

Reinforcing steel for curtain walls shall comply with Section 804.

In lieu of constructing concrete curtain walls in place, the Contractor may elect to precast the units. Precast units shall comply with all applicable requirements of Subsection 606.02(b) for concrete pipe.

Flared end sections for corrugated steel circular or arch pipe shall be fabricated from steel sheets having a thickness of 0.064" (1.63 mm) or more.

Flared end sections for corrugated aluminum circular or arch pipe shall be fabricated from aluminum sheets having a thickness of 0.060" (1.5 mm) or more.

(f) Coupling Bands. Except as otherwise required herein, coupling bands and other hardware for corrugated metal pipe shall comply with the requirements of AASHTO M 36 for steel pipe and M 196 for aluminum pipe. Coupling bands shall be made of the same base metal and coating (metallic or otherwise) as the pipe.

Band widths shall be as specified in AASHTO M 36 and M 196.

Pipes shall be field jointed with corrugated locking bands. This includes pipe with helical corrugations that has reformed annular corrugations on the ends.

Helical pipe without annular end corrugations will be permitted only when it is necessary to join a new pipe to an existing pipe that was installed with no annular end corrugations. In this event pipe furnished with helical corrugations at the ends shall be field jointed with either helically corrugated bands or with bands with projections (dimples).

Bands with projections shall have circumferential rows of projections with one projection for each corrugation.

Unless otherwise shown on the plans, all bolts for coupling bands shall be 1/2" (12 mm) diameter. Bands 15" (380 mm) wide or less shall have a minimum of 2 bolts and bands greater than 15" (380 mm) wide shall have a minimum of 3 bolts.

(g) Selected pipe bedding shall consist of silty loam, loam, sand, or other similar material free from lumps, clods, and rocks.

(h) Selected pipe backfill shall comply with the requirements established by the Engineer.

(i) Structural Bedding for Reinforced Concrete Pipe Culverts shall be as shown in the plans for the specified installation type.

(j) Structural Bedding and Structural Backfill for Corrugated Metal Pipe Culverts shall meet the requirements for SM-3 material as shown in Subsection 302.02 of these specifications or for Aggregate Base Course Classes 4, 5, 6, or 7, as shown in Subsection 303.02.

(k) Structural Bedding and Structural Backfill for Plastic Pipe Culverts shall meet the requirements for SM-3 material as shown in Subsection 302.02 of these specifications except that the maximum particle size shall be 1¼″ (31.5 mm) for Structural Bedding and 1½″ (37.5 mm) for Structural Backfill.

(l) Safety End Sections for Pipe Culverts. The manufacture and furnishing of safety end sections for pipe culverts shall comply with Subsection 606.02(c) (1) and the details shown in the plans.

606.03 Construction Requirements. (a) Depth of Excavation. Excavation shall be carried to a depth where foundation materials are satisfactory to the Engineer regardless of the elevations shown on the plans, and foundations shall be inspected and approved before placing any part of the structure. Unless otherwise provided, soft or yielding material below the bottom of the specified pipe bedding shall be removed and replaced with a suitable material.

Pipe culverts under the roadbed shall be so placed that the minimum depth of cover at the subgrade shoulder for pipe of any diameter or type shall be not less than one foot (0.3 m).

(b) Forming Bed for Pipe. Where the pipe is to be laid below the ground line, a trench shall be excavated to the required depth and to the minimum width practicable for working conditions. Structural bedding shall be placed and compacted as shown in the plans. For Reinforced Concrete Pipe Culverts using bell and spigot pipe, recesses shall be excavated to receive the bells. Where unsuitable material exists at the bottom of the excavated trench, the unsuitable material will be excavated and replaced with selected pipe bedding, which shall be compacted thoroughly into place with mechanical equipment. Where rock is encountered, the trench shall be excavated to a minimum depth as shown on the plans and

backfilled with suitable material, which shall be tamped thoroughly with mechanical equipment.

Where pipe is not laid in a trench, structural pipe bedding shall be placed as shown in the plans.

(c) Laying Pipe. The pipe laying shall begin at the downstream end and bell or groove ends of concrete pipe and outside circumferential laps of corrugated metal pipe shall be placed facing upstream. Corrugated metal pipe shall be placed with longitudinal laps or seams at the sides. Pipe that is not in true alignment or which shows settlement after laying shall be corrected by the Contractor at no additional cost to the Department.

(d) Joining Pipe. The method of joining pipe sections shall be such that the ends are fully entered and the inner surfaces are reasonably flush and even.

Pipe protruding through structure walls shall be cut off flush with the inside face of wall.

All surfaces of the joint upon or against which joint seal gaskets may bear shall be smooth, free of spalls, cracks, fractures, and imperfections that would adversely affect the performance of the joint. A primer shall be applied if recommended by the manufacturer.

(1) When preformed rubber gasket is selected by the Contractor, the gasket shall be the sole element depended upon to make the joint flexible and watertight. The gasket shall be a continuous ring that fits snugly into the annular space between the overlapping surfaces of the assembled pipe joint to form a flexible watertight seal. The circumference of the seated gasket shall not be more than 130% of its original circumference.

(2) When bitumen/butyl plastic gasket is selected by the Contractor, the following procedure shall be used. The protective wrapping shall be removed from one side of the gasket. The gasket shall be placed and pressed firmly to the surface of the pipe joint around the entire circumference of the joint. The remaining protective wrapping shall be removed and the pipe forced into connection until material fills the joint space.

(3) When tubular cross-section closed cellular rubber gaskets are selected by the Contractor, the gaskets shall be a single,

continuous part conforming to the joint shape. The outer surface of the gasket shall be completely covered with a natural skin. The cross-sectional diameters and installation practices shall be in accordance with the manufactures' recommendations for the size of pipe or culvert being placed.

To ensure an even and well-filled joint, the final joining of the pipe shall be accomplished by either pushing or pulling, by approved mechanical means, each joint of the pipe as it is laid. In cold weather, when directed, the joint material shall be warmed in a hot water bath, or by other approved methods, to the extent required to keep the material pliable for placement without breaking or cracking.**(e)** Field cutting of polymer precoated pipe shall be by mechanical means as approved by the Engineer. Torch cutting or other applied heat methods shall not be used. Ends of pipe that have been field cut shall be treated and/or repaired according to the manufacturer's recommendations.

Coatings damaged during manufacturing, shipping, or installation shall be repaired according to the applicable AASHTO specifications. Treatment and/or repair of damaged or cut ends shall be at no cost to the Department.

(f) Backfilling. (1) General. Special care shall be taken to compact the fill under the haunches of the pipe. In trench excavation, the backfill above the area specified as structural backfill (or structural bedding for reinforced concrete pipe culverts) shall be placed in 6″ (150 mm) lifts and compacted with mechanical equipment to 95% of the maximum density, as determined by AASHTO T 99. In a fill section, the backfill shall be brought up evenly on each side for the full length of the pipe to avoid displacement. The berm of thoroughly compacted material on each side of the pipe shall be at least as wide as the outside diameter of the pipe. The Department will perform acceptance sampling and testing of the compacted backfill material in accordance with Subsection 210.10 at the frequencies established in the Department's *Manual of Field Sampling and Testing Procedures*. Pipe damaged during construction operations shall be replaced at no cost to the Department.

When the existing material excavated for the pipe trench is determined by the Engineer to be unsuitable for pipe backfill, this

material shall be placed at other locations on the project such as backfill behind curbs, placed on the fill slopes, etc. If the Engineer determines that no suitable location exists on the project to utilize this material, the Engineer may approve the material to be wasted at an appropriate location outside the project limits according to Subsection 210.08. Material declared unsuitable for backfill shall be replaced with suitable material from roadway excavation and/or borrow. If suitable material from roadway excavation and/or borrow is not available, the Engineer may authorize the use of the Selected Pipe Backfill.

(2) Reinforced Concrete Pipe Culverts. Backfilling around the pipe shall be with material as shown on the plans. The material shall be placed along side the pipe in layers not to exceed 6″ (150 mm) at near optimum moisture content and compacted with mechanical equipment to 95% of the maximum density, as determined by AASHTO T 99.

(3) Corrugated Metal Pipe Culverts and Plastic Pipe Culverts. Structural backfill material shall be placed along side the pipe in layers not to exceed 6″ (150 mm) at near optimum moisture content and compacted with mechanical equipment to 95% of the maximum density, as determined by AASHTO T 99, up to an elevation of not less than 12″ (300 mm) above the top of the pipe. Backfilling of the pipe trench above the structural backfill will be accomplished as described in (1) above.

(g) Curtain Walls for Flared End Sections. The foundation for curtain walls shall be prepared to the required depth. For cast in place curtain walls, the forming, placement of reinforcing steel, and placement, finishing, and curing of concrete shall be according to the applicable requirements of Sections 802 and 804. Precast curtain walls shall be installed according to the applicable requirements for laying concrete pipe. The Department will perform all acceptance sampling and testing at the frequencies shown for Contractor acceptance testing in Subsection 802.06.

606.04 Method of Measurement. (a) Pipe Culverts and Side Drains will be measured by the linear foot (meter) measured parallel to the flow line of the pipe. Where inlets, catch basins, junction boxes, or other structures are included in lines of pipe, that length of pipe extending to and flush with the inside of the structure wall will

be included for measurement but no other portion of the structure length or width will be so included. No allowance will be made for any pipe cut-off. Whenever possible, the lengths shown on the plans may be adjusted by the Engineer to accommodate the pipe lengths available from the supplier that most nearly match the plan lengths.

For multiple pipes, the measured length will be the sum of the lengths of the individual barrels measured as prescribed above.

(b) Flared End Sections for pipe culverts will be measured by the unit and will include the curtain wall, complete in place.

(c) Selected Pipe Bedding material will be measured either by the cubic yard (cubic meter) or ton (metric ton). When measured by the cubic yard (cubic meter), no adjustment will be made for swell.

(d) Selected Pipe Backfill material will be measured either by the cubic yard (cubic meter) or ton (metric ton). When measured by the cubic yard (cubic meter), no adjustment will be made for swell.

(e) When pipe culvert is used for extensions of existing culverts, the removal of any headwall, end section, or pipe joints shall be accomplished according to Section 202.

(f) Structural Bedding for Reinforced Concrete Pipe Culverts, Structural Bedding and Structural Backfill for Corrugated Metal Pipe Culverts, and Structural Bedding and Structural Backfill for Plastic Pipe Culverts will not be measured or paid for separately but full compensation therefor will be considered included in the contract unit prices bid per linear foot (meter) for the respective type of pipe culvert.

(g) Safety End Sections for Pipe Culverts will be measured by the unit.

606.05 Basis of Payment. (a) Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for the respective type of Pipe Culverts of the several sizes, which price shall be full compensation for furnishing, hauling, and installing the pipe; for materials including joint filler for concrete pipe and connecting bands for metal pipe; for excavation and backfilling, including compacting backfill; for furnishing, placing, and compacting structural bedding and structural backfill; for removing and disposing of the existing headwall and attached end joint of concrete pipe or the flared end

section on all types of pipe, in order to accomplish culvert extensions; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(b) Work completed and accepted and measured as provided above will be paid for at the contract unit price bid each for the respective type of Flared End Sections of the several sizes, which price shall be full compensation for furnishing, hauling, and installing the end sections; for materials, including joint filler for concrete end sections and connecting bands for metal end sections; for excavation and backfilling, including compacting backfill; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(c) Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per cubic yard (cubic meter) or ton (metric ton) for Selected Pipe Bedding, which price shall be full compensation for excavating and disposing of soft and yielding material; for furnishing, placing, and compacting bedding material; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(d) Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per cubic yard (cubic meter) or ton (metric ton) for Selected Pipe Backfill, which price shall be full compensation for furnishing backfill material; and for all labor, equipment, tools, and incidentals necessary to complete the work. Placing and compacting backfill will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Pipe Culverts and Flared End Sections.

(e) Side Drains completed and accepted and measured as provided above will be paid for at the unit price bid per linear foot (meter) for Side Drains of the size specified, which price shall be full compensation for furnishing, hauling, and installing the pipe; for materials including joint filler for concrete pipe and connecting bands for metal pipe; for excavating and backfilling; and for all labor, equipment, tools, and incidentals necessary to complete the work. Backfill for PVC pipe will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Side Drains.

(f) Work completed and accepted and measured as provided above will be paid at the contract unit price bid each for Safety End Sections of the several sizes, which shall be full compensation for furnishing, hauling and installing the end section; for all materials; for excavating and backfilling; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
__" (__mm) Reinforced Concrete Pipe Culverts (Class__)	Linear Foot (Meter)
__" (__mm) Zinc Coated (Galvanized) Corrugated Steel Pipe Culverts (___Gauge)	Linear Foot (Meter)
__" (__mm) Aluminum Coated Corrugated Steel Pipe Culverts (___Gauge)	Linear Foot (Meter)
__" (__mm) Aluminum-Zinc Alloy Coated Corrugated Steel Pipe Culverts (___Gauge)	Linear Foot (Meter)
__" (__mm) Corrugated Aluminum Pipe Culverts (___Gauge)	Linear Foot (Meter)
__" (__mm) Asphalt Coated Corrugated Steel Pipe Culverts (___Gauge)	Linear Foot (Meter)
__" (__mm) Polymer Precoated Metallic Coated Corrugated Steel Pipe Culverts (___Gauge)	Linear Foot (Meter)
__" (__mm) Asphalt Coated Corrugated Aluminum Pipe Culverts (___Gauge)	Linear Foot (Meter)
__"x__" (__x__mm) Reinforced Concrete Arch Pipe Culverts (Class___)	Linear Foot (Meter)
__"x__" (__x__mm) Reinforced Concrete Horizontal Elliptical Pipe Culverts (Class___)	Linear Foot (Meter)
__"x__" (__x__mm) Zinc Coated (Galvanized) Corrugated Steel Arch Pipe Culverts (___Gauge)	Linear Foot (Meter)
__"x__" (__x__mm) Aluminum Coated Corrugated Steel Arch Pipe Culverts (___Gauge)	Linear Foot (Meter)

Pay Item	Pay Unit
__"x__" (__x__mm) Aluminum-Zinc Alloy Coated Corrugated Steel Arch Pipe Culverts (___Gauge)	Linear Foot (Meter)
__"x__" (__x__mm) Corrugated Aluminum Arch Pipe Culverts (___Gauge)	Linear Foot (Meter)
__"x__" (__x__mm) Asphalt Coated Corrugated Steel Arch Pipe Culverts (___Gauge)	Linear Foot (Meter)
__"x__" (__x__mm) Polymer Precoated Metallic Coated Corrugated Steel Arch Pipe Culverts (___Gauge)	Linear Foot (Meter)
__"x__" (__x__mm) Asphalt Coated Corrugated Aluminum Arch Pipe Culverts (___Gauge)	Linear Foot (Meter)
__" (__ mm) Flared End Sections for ____ Pipe Culverts	Each
__"x__" (__x__mm) Flared End Sections for ____ Arch Pipe Culverts	Each
__" (__ mm) Smooth Lined Polymer Precoated Metallic Coated Corrugated Steel Pipe	Linear Foot (Meter)
__"x__" (__x__mm) Smooth Lined Polymer Precoated Metallic Coated Corrugated Steel Arch Pipe	Linear Foot (Meter)
__" (__ mm) Side Drain	Linear Foot (Meter)
__"x__" (__x__mm) Side Drain	Linear Foot (Meter)
Selected Pipe Bedding	Cubic Yard (Cubic Meter),or Ton (Metric Ton)
Selected Pipe Backfill	Cubic Yard (Cubic Meter), or Ton (Metric Ton)
__" (__ mm) Safety End Sections for Cross Drain Pipe Culverts (Class ___)	Each

Pay Item	Pay Unit
__"x__" (__x__mm) Safety End Sections for Cross Drain Arch Pipe Culverts (Class ___)	Each
__" (__ mm) Safety End Sections for Side Drain Pipe Culverts (Class ___)	Each
__"x__" (__x__mm) Safety End Sections for Side Drain Arch Pipe Culverts (Class ___)	Each

SECTION 607
PRECAST REINFORCED CONCRETE BOX CULVERTS

607.01 Description. This item shall provide for the substitution of precast reinforced concrete box culverts as an equal alternate to cast in place box culverts, as further detailed below.

607.02 Materials. The manufacturer shall furnish design drawings for each project sufficiently in advance of casting operations to allow for review by the Engineer. Precast units shall bear evidence that the component materials have been tested and approved and the construction methods have been inspected by an inspector approved by the Engineer.

607.03 Design. (a) Load and Resistance Factor Design. When a cast in place box culvert has been designed meeting the AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications, current edition, with current interims, the precast box culvert proposed for substitution shall be designed to meet the LRFD Bridge Design Specifications noted above. The design shall be certified by a Professional Engineer, who is registered in any of the United States.

The manufacture and furnishing of precast reinforced concrete box culverts meeting these design specifications shall be according to ASTM C 1577. The manufacturer shall furnish a certification to the Engineer that the units comply with ASTM C 1577 and that all steel materials incorporated in the units comply with Subsection 106.01.

(b) Alternate Design. When a cast in place box culvert has not been designed meeting AASHTO LRFD Bridge Design Specifications, , the precast box culvert proposed for substitution may be designed to meet the AASHTO Standard Specifications for Highway Bridges, 16th Edition, with interims or the AASHTO LRFD Bridge Design Specifications noted

above. The design shall be certified by a Professional Engineer, who is registered in any of the United States.

The manufacture and furnishing of precast reinforced concrete box culverts shall be according to AASHTO M 259 or M 273, or ASTM C 1577, as applicable. The manufacturer shall furnish a certification to the Engineer that the units comply with AASHTO M 259 or M 273, or ASTM C 1577, as appropriate, and that all steel materials incorporated in the units comply with Subsection 106.01.

607.04 Construction Requirements. Excavation and backfill shall be according to the requirements of Section 801. The Department will perform acceptance sampling and testing of the compacted backfill material in accordance with Subsection 210.10 at the frequencies established in the Department's *Manual of Field Sampling and Testing Procedures*.

Precast reinforced concrete box culvert units shall be bedded on a foundation of firm and stable material, accurately shaped to conform to their base. When required by the plans, special bedding material shall be provided.

Joints and joint materials shall comply with the requirements of Section 606.

Lifting holes shall be filled with mortar or concrete and cured as directed.

When precast boxes are used to form multiple barrel structures, they shall be placed in conformance with the details shown on the plans. Material required between barrels shall be as shown on the plans.

Connections of precast boxes to cast-in-place boxes or to any required headwalls, wingwalls, riprap, or other structure shall comply with the details shown on the plans.

Headwalls, wingwalls, and footings shall be according to the details of the plans, except that the overall widths of the headwalls and footings shall be modified to fit the finished width of the various structures.

607.05 Method of Measurement and Basis of Payment. Precast Reinforced Concrete Box Culverts will not be measured and paid for directly.

Measurement and payment for precast culvert will be made on the same basis as for a cast in place culvert under Sections 802 and 804 for the length and size of culvert specified.

SECTION 608
STRUCTURAL PLATE PIPE AND ARCHES

608.01 Description. This item shall consist of the construction of corrugated metal structural plate pipe, pipe-arches, and arches according to these specifications, of the type, size, and dimensions shown on the plans, and in conformity with the locations, lines, and grades shown on the plans, or as directed.

608.02 Materials. The material furnished shall be either steel or aluminum, at the Contractor's option, and shall comply with the following requirements:

The manufacture and furnishing of structural plate shall be according to AASHTO M 167 or M 219 as amended below:

1) No metal will be accepted until after the sheet manufacturer's certified analysis and fabricator's certification have been received and approved by the Engineer of Materials.

If the Engineer so elects, the material may be inspected and sampled in the rolling mill or in the shop where fabricated and a detailed chemical analysis of any heat may be required from the mill. The inspection, either in the mill or in the shop, shall be made under the direction of the Engineer. The Engineer shall have free access to the mill or shop for inspection and every reasonable facility shall be provided for this purpose. The inclusion of any material or pipe that has been previously rejected at the mill or shop will be considered sufficient cause for the rejection of the entire lot.

2) A field inspection shall be made by the Engineer. The Contractor shall furnish an itemized statement of the number and length of the plates in each shipment. Each plate included in a shipment shall comply with the requirements of these specifications. If 25% of the plates in any shipment fail to comply with the requirements, the entire shipment may be rejected.

3) The gauge of structural plate and radius of curvature shall be as specified on the plans.

4) When specified on the plans, an asphalt coating complying with Subsection 606.02 shall be applied to the structure.

608.03 Construction Requirements. (a) Excavation. When a structure is to be erected in a trench or channel, the width of the excavation shall be sufficient to permit thorough tamping of the backfill material, but shall not exceed the span width by more than 3' (1 m) on each side at the bottom of the trench. Side slopes of the excavation shall not be flatter than 2:1 except where unsuitable material is encountered.

(b) Bedding. The pipe shall be bedded in an earth foundation of uniform density, carefully shaped by means of a template supported at the desired grade, to fit the lower plate of the pipe. A minimum camber of 1% of the length of pipe shall be made to allow for settlement. The amount of camber shall be varied to suit the height of fill and supporting soil as directed.

Where rock in either ledge or boulder formation is encountered, it shall be removed to a depth of at least 12" (300 mm) below the grade established for the bottom of the structure, and to a minimum width equal to the span. This additional excavation shall be backfilled with material complying with Subsection 608.03(d).

If the existing material exposed at the grade established for the bottom of the structure appears unstable and is of such character as to invite unequal settlement along the length of the structure, such unstable material shall be removed as directed and the excavation shall be backfilled with gravel or other suitable material as hereinafter specified and thoroughly tamped or otherwise compacted in place to ensure a firm foundation. Any necessary excavation below the invert of the structure shall be made according to Section 801.

(c) Assembly. All plates shall be unloaded and handled with reasonable care. Plates shall not be rolled or dragged over gravel or rock and shall be prevented from striking rock or other hard objects during placement in trench or on bedding.

Structural plate pipe shall be assembled progressively according to the manufacturer's instructions starting at the downstream end with the inside circumferential laps pointing downstream.

On all plates above the invert plate or plates, only sufficient bolts shall be used to hold the plates loosely in position until assembly has been completed for four or more rings. When all plates are in position, all bolts not already in place shall be inserted and the nuts

tightened progressively through the structure. All nuts shall be tightened a second time to a torque of not less than 100 foot-pounds (135 newton meters [N·m]) nor more than 250 foot-pounds (340 N·m). Each 20th bolt will be checked with a torque wrench that shall be furnished by the Contractor. Where tests indicate loose bolts, the bolts in that area shall be properly tightened and additional tests made. Standard bolts are furnished in two lengths: the short bolts shall be placed where two plates lap and the long bolts shall be placed where three plates lap. All service bolts used in drawing the plates together shall be replaced with standard bolts.

(d) Backfill. Unless otherwise specified on the plans, backfill material shall be of a granular nature with a maximum size of 3" (75 mm), free of frozen lumps, chunks of highly plastic clay, or other objectionable matter. Materials from roadway excavation or borrow meeting these requirements may be used if approved by the Engineer.

After the structure has been erected according to these specifications, backfill material shall be placed in layers not to exceed 6" (150 mm) thickness at near optimum moisture content and compacted. The side fill shall be placed and compacted with care under the haunches of the structure and shall be brought up evenly and simultaneously on both sides of the structure to not less than 1' (0.3 m) above the top for the full length of the structure. Compaction equipment shall be mechanical hand tamps and rolling equipment in such combination as to provide 95% of maximum density as determined by AASHTO T 99. The Department will perform acceptance sampling and testing of the compacted backfill material in accordance with Subsection 210.10 at the frequencies established in the Department's *Manual of Field Sampling and Testing Procedures*. Pipe damaged during construction operations shall be replaced or repaired at no cost to the Department.

608.04 Method of Measurement. Structural Plate Pipe, Pipe-Arch, or Arch will be measured by the linear foot (meter) along the bottom centerline of the structure.

608.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Structural Plate Pipe, Structural Plate Pipe-Arch, or Structural Plate Arch, of the sizes specified,

which price shall be full compensation for furnishing, handling, erecting, strutting, and installing; and for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Channel excavation, backfilling, and concrete and reinforcing steel for headwalls and foundations will be paid for as separate items as specified on the plans. Structural excavation will be paid for under Section 801 for the appropriate classification of Excavation for Structures - Roadway.

Payment will be made under:

Pay Item	**Pay Unit**
__" (__mm) Structural Plate Pipe (___Gauge)	Linear Foot (Meter)
__"x__" (__x__mm) Structural Plate Pipe-Arch (___Gauge)	Linear Foot (Meter)
__"x__" (__x__mm) Structural Plate Arch (___Gauge)	Linear Foot (Meter)

SECTION 609
DROP INLETS AND JUNCTION BOXES

609.01 Description. This item shall consist of the construction of drop inlets, yard drains, junction boxes, and drop inlet extensions with rings and covers or grates and frames, according to these specifications, of the type, size, and dimensions shown on the plans, and in conformity with the locations, lines, and grades shown on the plans, or as directed.

609.02 Materials. (a) The concrete shall comply with Section 802 for Class A Concrete. The Department will perform all acceptance sampling and testing at the frequencies shown for Contractor acceptance testing in Subsection 802.06.

(b) Reinforcing steel shall comply with Section 804.

(c) Steel for welded steel grates and frames shall comply with AASHTO M 270, Grade 36 (250).

(d) Iron castings for rings and covers, grates and frames, and other appurtenances, shall comply with AASHTO M 105, Class 35B. Bearing surfaces between rings and covers or grates and

frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact.

(e) Paint shall comply with Section 638.

(f) Precast concrete units of the type, size, and designation shown on the plans may be used in lieu of cast-in-place concrete units and shall be subject to the requirements of AASHTO M 199 or ASTM C 913 as applicable, and shall be furnished from sources listed on the Department's QPL. Units so manufactured must bear evidence that the component materials have been tested and approved and that the construction methods have been inspected by an Inspector approved by the Engineer. Joint materials shall comply with Subsection 606.02(b)(4).

(g) Curing Materials. Curing materials shall comply with Subsection 501.02(i).

(h) Pipe culverts for yard drains shall comply with Subsection 606.02.

609.03 Construction Requirements. Drop inlets, junction boxes, and drop inlet extensions shall be constructed with either reinforced or non-reinforced concrete, as shown on the plans. The Engineer may adjust the plan locations of drop inlets and junction boxes to avoid the necessity of cutting pipe or to avoid utility lines provided such adjustment does not move the drop inlet out of a low point in the gutter line or into a curb radius.

Concrete shall not be placed until the Engineer has inspected the forms and the placement of reinforcing steel and rings or frames.

Round monolithic drop inlets may have the floors cast monolithically with the walls. All other concrete floors shall be placed at least 24 hours before beginning construction of the walls. A longer period of time may be required if weather conditions make it necessary.

When completed, the concrete shall be cured as specified in Subsection 501.05(l).

Walls shall be constructed to form a tight joint with the floor and around the inlet and outlet pipes. Pipes shall be cut flush with the inside surfaces of the wall.

Utility lines that are carried through the walls shall be protected to avoid damage.

When tops of drop inlets are cast in place, the faces of drop inlets and drop inlet extensions shall be placed as a part of the curb in order to preserve the proper alignment.

Precast reinforced concrete drop inlet or junction box sections shall be set with joints complying with Subsection 606.02(b)(4).

Yard drains shall be constructed of a 12" (300 mm) corrugated metal pipe with the use of a pipe elbow or tee, as the case requires, at the bottom of the drain. The ring and grate shall be set on the top of the pipe culvert as shown on the plans. The concrete square frame shall be formed and placed to match the grade of the ring and grate.

Metal rings or frames shall be set accurately to the finished elevations so that no subsequent adjustments will be necessary. They shall be set in a full mortar bed with firm bearing on the walls or securely fastened to the forms so that no movement will occur when concrete is placed around them.

Welded steel grates and frames shall be welded with 1/4" (6 mm) fillet welds according to Section 807. The grates and frames shall be painted according to Section 638 or hot dip galvanized according to AASHTO M 111, Thickness Grade 100.

Iron castings for rings and covers or grates and frames shall not be painted.

Backfilling around structures shall be with approved material, free from large lumps or clods. The material shall be placed alongside the structure in layers not to exceed 6" (150 mm) in depth at near optimum moisture content and compacted with mechanical equipment to 95% of maximum density as determined by AASHTO T 99 for the full depth of structure. The Department will perform acceptance sampling and testing of the compacted backfill material in accordance with Subsection 210.10 at the frequencies established in the Department's *Manual of Field Sampling and Testing Procedures*.

Structures shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be reasonably free of such accumulations at the time of final inspection.

609.04 Method of Measurement. Drop Inlets, Junction Boxes, and Drop Inlet Extensions of the length specified will be measured by the unit. Yard Drains will be measured by the unit. Each unit shall consist of the concrete frame, the ring and grate, and all pipe required to form the vertical portion of the drain including a standard elbow or tee.

609.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid each for Drop Inlets, Drop Inlet Extensions, Yard Drains, or Junction Boxes, of the type specified, which price shall be full compensation for constructing drop inlets, drop inlet extensions, yard drains, or junction boxes; for furnishing, installing, and painting, if required, of rings and covers or grates and frames; for excavation and backfill; and for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Drop Inlets (Type___)	Each
Junction Boxes (Type___)	Each
Drop Inlet Extensions (__′)(__m)	Each
Yard Drains	Each

SECTION 610
MANHOLES, DROP INLETS AND JUNCTION BOXES ADJUSTED TO GRADE

610.01 Description. This item shall consist of adjusting the top elevation of existing manholes, drop inlets, or junction boxes according to these specifications and to the grades shown on the plans, or as directed.

610.02 Materials. New materials used in the grade adjustment shall comply with Subsection 609.02.

610.03 Construction Requirements. Construction methods, as modified below, shall comply with Subsection 609.03, except that painting of existing rings and covers or grates and frames will not be required.

The existing rings and covers or grates and frames shall be removed in a manner to avoid breaking or cracking and cleaned of old mortar before resetting at the specified elevation. Structures damaged because of the Contractor's negligence shall be repaired or replaced at no cost to the Department.

If the top of the structure is to be lowered, masonry courses shall be removed and old mortar cleaned from the remaining top course, or concrete shall be cut on a horizontal line as directed, to an elevation that will allow the rings or frames to be set in concrete to the specified grade.

If the top of the structure is to be raised, the top of walls shall be cleaned of old mortar, or the top of concrete walls shall be cleaned of old mortar and roughened, and the walls built up with concrete to an elevation that will allow the rings and frames to be set to the specified grade.

610.04 Method of Measurement. Manholes, Drop Inlets, or Junction Boxes Adjusted to Grade will be measured by the unit.

610.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid each for Manholes Adjusted to Grade, Drop Inlets Adjusted to Grade, or Junction Boxes Adjusted to Grade, which price shall be full compensation for adjusting manholes, drop inlets, or junction boxes; for excavation and backfill; and for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Manholes Adjusted to Grade	Each
Drop Inlets Adjusted to Grade	Each
Junction Boxes Adjusted to Grade	Each

SECTION 611
PIPE UNDERDRAINS, OUTLET PROTECTORS, AND COVERS

611.01 Description. This item shall consist of constructing underdrains using pipe, filter fabric, and granular filter material according to these specifications and in reasonably close conformity with the lines and grades shown on the plans, or as directed; and the inspection for acceptance of the underdrain system installed on the project, if included as a pay item.

611.02 Materials (a) Pipe. All corrugated metal pipe, polyethylene tubing, and acrylonitrile butadiene styrene (ABS) pipe shall be furnished from those sources listed on the Department's Qualified Products List (QPL). The types of pipe for underdrains shall comply with the following requirements:

(1) Corrugated Metal Pipe for Underdrains. Corrugated Metal Pipe shall comply with Subsection 606.02(c). Pipe furnished with a nominal diameter of 6" to 8" (150 to 200 mm) shall be fabricated from metal with a thickness not less than 0.052 inch (1.32 mm).

(2) Corrugated Polyethylene Tubing. The tubing shall be the heavy duty type and shall comply with AASHTO M 252. The tubing shall have a minimum pipe stiffness of 46 psi (3.23 kg/cm^2) at 5% deflection and shall be capable of 60 percent vertical deflection in parallel plate loading without splitting or cracking when tested in accordance with ASTM 2412.

(3) Acrylonitrile Butadiene Styrene (ABS) Pipe. The pipe shall be extruded from virgin ABS complying with ASTM D2680.

Fittings shall be of the same composition and have the same physical properties as the pipe and shall not restrict flow.

Corrugated polyethylene tubing shall have AASHTO M 252, Class 2 perforations. Perforations for other types of pipes shall be approximately circular and cleanly cut; shall have nominal diameters not less than 3/16" (5 mm) nor more than 3/8" (10 mm); and shall be arranged in at least two rows parallel to the axis of the pipe.

(b) Underdrain Outlet Protectors. Concrete shall comply with Section 802 for Class M Concrete. Reinforcing steel shall comply with Section 804. In lieu of constructing underdrain outlet protectors in place, the Contractor may use precast units that comply with the applicable requirements of Subsection 606.02(b) for concrete pipe and are furnished from sources listed on the QPL.

(c) Granular Filter Material. Granular filter material shall comply with Subsection 403.01 and 403.02 for Class 5 Mineral Aggregate, or Section 802 for coarse aggregate for concrete. Granular filter material shall be crushed stone or crushed gravel. Uncrushed gravel shall not be used. All acceptance sampling and testing will be performed by the Department.

(d) Filter Fabric. Filter fabric shall be a nonwoven geotextile complying with Section 625, Type 1.

(e) Underdrain Cover. The material used for underdrain cover shall be as specified on the plans.

611.03 Construction Requirements. (a) Pipe Installation. Trenches shall be excavated to the width shown on the plans. The trench depth shall be as shown on the plans or as established by the Engineer.

Pipe of the type selected by the Contractor and of the size specified shall be laid with perforations down and the pipe sections joined securely with the appropriate coupling fittings or bands, or joint filler. The upgrade end of pipe installations shall be closed with suitable plugs to prevent entry of soil materials. The pipe shall be installed in such a manner that continuous outflow is provided during construction.

(b) Underdrain Outlet Protectors. The foundation shall be prepared to the required depth, forms set rigidly to the line and grade designated, and the concrete placed, spaded, vibrated, and finished with a wood float to a true and even surface. When completed, the concrete shall be cured as specified in Section 802.

Precast units shall be placed on a foundation prepared to the proper depth and the pipe underdrain shall be firmly secured to the outlet protector.

The outlet protector shall be placed in such a manner that the underdrain lateral has a uniform slope to ensure proper drainage.

Abrupt changes in slope along any portion of the lateral will not be permitted.

(c) Granular Filter Material. After the pipe installation has been inspected and approved, granular filter material shall be placed and uniformly compacted with mechanical equipment to a stable condition as directed by the Engineer.

(d) Filter Fabric. When required, the filter fabric shall be installed as shown on the plans. Care shall be taken during the placement of the Granular Filter Material, as well as pipe installation, to prevent damage to the fabric. The Granular Filter Material shall be compacted using a vibratory compactor to the satisfaction of the Engineer before making the filter fabric closure at the top of the trench.

(e) Underdrain Cover. When required, underdrain cover shall be placed immediately following the granular filter material. The width and depth of the cover shall be as specified on the plans.

(f) Inspection. When included as a pay item in the Contract, the underdrain system that is installed shall be inspected by the Contractor. If the planned final surface is asphalt concrete hot mix (ACHM), the inspection shall be performed prior to placement of the final surface course and after placement of the ACHM preceding this course. If the planned final surface is Portland cement concrete pavement (PCCP), the inspection shall be performed after the base course has been placed and before the PCCP is placed. A video record and written report for each line inspected shall be furnished to the Engineer. The line identification, distance traversed by the camera and pipe deficiency shall be recorded on the videotape and in the written report.

Equipment used for inspecting the underdrain system shall satisfy the following minimum requirements:

(1) The system shall be capable of providing color video inspection of pipelines from 3.5″ to 8.0″ (88 mm to 200 mm) inside diameter in a wet, corrosive environment and shall be capable of negotiating a 90° bend in a 4″ (100 mm) or larger diameter, smooth bore or corrugated drainpipe.

(2) The system shall be capable of video inspecting up to 300 linear feet (91 m) of laterals and 4″ (100mm) pipe

underdrains, by push rodding, pull cabling, jetting or tractoring the camera through the line and recording the condition.

(3) The system shall be equipped with a video monitor capable of allowing live viewing of the video inspection

(4) The system shall be capable of displaying and recording the date, line identification, footage and type of pipe deficiency.

(5) The system shall be capable of recording the distance traversed by the camera to within 0.5 feet (0.15 m), allowing for overlapping of distances if a reversal is required to permit full-length inspection.

Any foreign materials that impede the placement or movement of the inspection equipment within the underdrain system shall be flushed from the system. Flushing of the underdrain system shall be required when efforts are needed beyond the normal, as determined by the Engineer, to allow forward progress or to prevent obscured vision of the video inspection equipment.

Any underdrain pipe that is damaged or does not conform to the lines and grades shown on the plans shall be replaced at no cost to the Department.

The Contractor shall install the required rodent screens promptly after satisfactory video inspection is completed on a section of underdrain.

611.04 Method of Measurement. Pipe Underdrains will be measured by the linear foot (meter) measured parallel to the flow line of the pipe on a variable depth basis. The measurement of variable depth required for pipe installation will be made from the finished roadway or ditch elevation as shown on the plans, or from natural ground elevation, whichever is lower, to the established flowline elevation of the pipe.

Underdrain Cover will be measured by the linear foot (meter).

Underdrain Outlet Protectors will be measured by the unit.

Underdrain Video Inspection will be measured by the linear foot (meter) of pipe underdrains and laterals inspected as directed by the Engineer.

611.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) of variable depth for Pipe Underdrains of the size specified; per each for Underdrain Outlet Protectors; or per linear foot (meter) for Underdrain Cover, which price shall be full compensation for excavation and backfill; for furnishing materials, including necessary fittings, bands, or joint filler; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Granular Filter Material and Filter Fabric will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Pipe Underdrains.

Underdrain inspection completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Underdrain Video Inspection, which price shall be full compensation for furnishing all video records and written reports; for flushing the completed underdrain whenever foreign material impedes the movement of the inspection equipment or quality of the video; and for all labor, equipment tools and incidentals necessary to complete the work.

Variable depth installation of pipe underdrains, measured as provided above, will be paid for at the contract unit price bid plus a percentage as provided in the following schedule:

DEPTH OF EXCAVATION		**RATE**
From more than	**To and including**	
0′ (0 m)	3′ (1 m)	Contract Price
3′ (1 m)	6′ (2 m)	Contract price plus 25%
Depth greater than 6′ (2 m)		To be established by Supplemental Agreement

Payment will be made under:

Pay Item	Pay Unit
__" (__mm) Pipe Underdrains	Linear Foot (Meter)
Underdrain Cover	Linear Foot (Meter)
Underdrain Outlet Protectors	Each
Underdrain Video Inspection	Linear Foot (Meter)

SECTION 612
PIPE SIPHONS

612.01 Description. This item shall consist of constructing pipe siphons according to these specifications and in conformity with the locations, lines, and grades shown on the plans, or as directed.

612.02 Materials. The manufacture and furnishing of steel pipe for siphons shall comply with ASTM A 139, Grade A or B; or ASTM A 53, Type E or S, Grade A or B, with the further provision that all pipe sizes shall have a minimum wall thickness of 0.250" (6.35 mm) and shall have a beveled end finish for field welding.

612.03 Construction Requirements. Construction requirements shall be according to Subsection 606.03, as applicable.

Field welding of pipe shall comply with the applicable requirements of Section 807 and proper alignment shall be maintained to provide a straight axis before backfilling.

612.04 Method of Measurement. Pipe Siphons will be measured by the linear foot (meter). The measurement upon which payment will be made will be the horizontal length measured between the ends of the pipe without allowance for bends or connections.

612.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Pipe Siphons of the size specified, which price shall be full compensation for furnishing, hauling, and installing the pipe; for excavation and backfilling; and for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Concrete and reinforcing steel for headwalls will be paid for as separate items as specified on the plans.

Payment will be made under:

Pay Item	Pay Unit
__" (___mm) Pipe Siphons	Linear Foot (Meter)

SECTION 613
STEEL GRATE ASSEMBLY

613.01 Description. This item shall consist of the construction of reinforced concrete wingwalls and aprons and the attachment of a shop fabricated steel grate according to these specifications and in conformity with the type, locations, design, dimensions, lines, and grades shown on the plans, or as directed.

613.02 Materials. **(a)** The concrete shall comply with Section 802 for Class S concrete or Section 501 for paving concrete. The maximum allowable slump shall be 4" (100 mm). The maximum water/cement ratio shall not be exceeded. The Department will perform all acceptance sampling and testing at the frequencies shown for Contractor acceptance sampling and testing in Subsection 802.06.

(b) Reinforcing steel shall comply with Section 804.

(c) Structural steel shall comply with Section 807.

(d) Steel pipe for grates and bolts shall comply with Section 807.

Steel pipe for grates shall be "Standard Weight" pipe complying with ASTM A 53 National Standard Pipe.

Bolts, nuts, and washers shall comply with ASTM A 307, Grade A or AASHTO M 314, Grade 36, and shall be galvanized according to AASHTO M 232 or ASTM B695, Class 40 or 50. After galvanizing, the nuts shall be free running on the bolts.

613.03 Construction Requirements. Except as otherwise provided, the methods employed in performing the work shall comply with the applicable requirements of the following:

(a) Concrete shall be placed, finished, and cured according to Section 802. Concrete shall not be placed until the Engineer has inspected the forms and the placement of reinforcing steel or frames.

(b) Reinforcing steel shall be placed according to Section 804.

(c) Structural steel shall be placed according to Section 807.

(d) Bolts shall be installed according to Section 807.

Welded steel grates shall be welded with 1/4" (6 mm) fillet welds according to Subsection 807.26.

Steel grates and angles shall be hot-dip galvanized according to AASHTO M 111 after fabrication and punching. Field galvanizing shall be allowed as directed by the Engineer only to repair small areas damaged during installation.

613.04 Method of Measurement. Steel Grate Assemblies will be measured by the unit of the size and type designated on the plans. Each unit will be a complete grate assembly for one end of a pipe culvert.

613.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per each for Steel Grate Assembly of the Type designated, which price shall be full compensation for furnishing materials; for excavation, forming, mixing, placing, curing, and finishing; for backfill; for furnishing and placing steel grate panels; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
__" (__mm) Steel Grate Assembly (Type___)	Each

SECTION 614
CONCRETE SPILLWAY

614.01 Description. This item shall consist of the construction of concrete spillways according to these specifications and in conformity with the design and detailed dimensions and at the locations shown on the plans, or as directed.

614.02 Materials. Concrete shall comply with Section 802 for Class A Concrete. The Department will perform all acceptance sampling and testing at the frequencies shown for Contractor acceptance sampling and testing in Subsection 802.06.

Reinforcing steel shall comply with Section 804.

Precast concrete spillways of the type and size shown on the plans may be used in lieu of cast-in-place concrete units and shall be furnished from sources listed on the Department's QPL.

614.03 Construction Requirements. The foundation shall be prepared to the proper depth, forms set rigidly to the line and grade designated, and the concrete placed, spaded, vibrated, and finished with a wood float to a true and even surface. When completed, the concrete shall be cured as specified in Section 501.

614.04 Method of Measurement. Concrete Spillways will be measured by the unit.

614.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per each for Concrete Spillway of the Type designated, which price shall be full compensation for furnishing, preparing, hauling, and placing materials, including reinforcing steel; for excavation and backfill; for preparation of subgrade; for mixing, shaping, finishing, and curing; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Concrete Spillway (Type___)	Each

SECTION 615
PAVEMENT REPAIR OVER CULVERTS

615.01 Description. This item shall consist of replacing the existing pavement that has been removed for the purposes of constructing new culverts or replacing existing structures. The material replaced shall conform to the lines, grades, and cross section of the existing pavement.

615.02 Materials. Concrete for Pavement Repair Over Culverts (Concrete) shall comply with Section 802 for Class A Concrete. High Early Strength Concrete complying with Subsection 501.08 shall be used when specified by the Engineer. The Department will perform all acceptance sampling and testing at the frequencies shown for Contractor acceptance sampling and testing in Subsection 802.06.

Reinforcing steel shall comply with Section 804.

The patching materials for Pavement Repair Over Culverts (Asphalt) shall comply with Section 406 or 407 for ACHM Binder Course or ACHM Surface Course.

615.03 Construction Methods. The pavement repair shall be placed on a prepared surface. The depth of the pavement repair shall be the depth of the existing pavement with a minimum depth of 9" (225 mm). For concrete patch, the concrete shall be cured according to the requirements of Section 802.

615.04 Method of Measurement. Pavement Repair Over Culverts (Concrete) will be measured by the cubic yard (cubic meter).

Pavement Repair Over Culverts (Asphalt) will be measured by the ton (metric ton).

615.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for as follows:

Pavement Repair Over Culverts (Concrete) will be paid for at the unit price bid per cubic yard (cubic meter) for Pavement Repair Over Culverts (Concrete), which price shall be full compensation for preparing the subgrade, any forming, for furnishing, transporting, and placing all materials, including steel; for the preparation and processing of materials; for the mixing, spreading, vibrating, finishing, and curing; and for all labor, equipment, tools, and incidentals necessary to complete the work. Reinforcing Steel will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Pavement Repair Over Culverts (Concrete).

Pavement Repair Over Culverts (Asphalt) will be paid for at the unit price bid per ton (metric ton) for Pavement Repair Over Culverts (Asphalt), which price shall be full compensation for

preparing the subgrade; for furnishing, placing, and compacting materials; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Pavement Repair Over Culverts (Concrete)	Cubic Yard (Cubic Meter)
Pavement Repair Over Culverts (Asphalt)	Ton (Metric Ton)

SECTION 616
AUTOMATIC FLOODGATES

616.01 Description. This item shall consist of furnishing and installing automatic floodgates for closing corrugated metal pipes, according to these specifications, and at the locations shown on the plans or as directed.

616.02 Materials. Automatic floodgates shall be of standard design and shall be made of cast iron complying with AASHTO M 105 for Gray Iron Castings. The gates shall be carefully machined, water-tight, entirely automatic in their operation, and shall meet the approval of the Engineer. They shall be sensitive to a difference in water level and must be hinged so as to seat accurately.

616.03 Construction Requirements. The floodgate shall be attached to the section of corrugated metal pipe before the pipe is placed and the pipe must be so laid that the flap valve, without pressure from either side, will seat against the flange.

616.04 Method of Measurement. Automatic Floodgates will be measured by the unit.

616.05 Basis of Payment. Work performed and accepted and measured as provided above will be paid for at the contract unit price bid per each for Automatic Floodgates of the size specified, which price shall be full compensation for furnishing and installing

the gate and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit
__" (___mm) Automatic Floodgates	Each

SECTION 617
GUARDRAIL

617.01 Description. This item shall consist of furnishing and installing complete sections of steel plate guardrail, including line posts, blockouts, terminal anchor posts, and guardrail anchor posts of the type shown on the plans. The guardrail shall be constructed at the locations shown on the plans or designated by the Engineer, in conformity with the detailed requirements of the plans, and according to these specifications.

The item "Thrie Beam Guardrail Terminal" shall consist of furnishing and installing complete sections of steel plate thrie beam guardrail connecting to the concrete parapet wall, and thrie beam guardrail transition sections connecting W-beam guardrail sections to thrie beam guardrail sections. This item shall also include line posts, blockouts, connector plates, special end shoes, and all hardware and materials necessary to construct the thrie beam guardrail complete from the W-beam guardrail connection to the connection with the concrete parapet wall. The thrie beam guardrail terminal shall be constructed at the locations shown on the plans or designated by the Engineer, in conformity with the detailed requirements of the plans, and according to these specifications.

The item "Guardrail Terminal (Type 2)" shall consist of furnishing and installing an acceptable crashworthy end terminal for W-beam guardrail at the locations shown in the plans or as directed by the Engineer. The guardrail terminal shall be specifically designed as a W-beam guardrail terminal, and shall provide an anchor against which the full tensile strength of the rail can be developed for downstream hits while remaining crashworthy for end-on impacts. The guardrail terminal shall satisfy the National Cooperative Highway Research Program (NCHRP) Report 350 or the Manual for Assessing Safety Hardware (MASH) for a test level 3

(TL-3) terminal. The guardrail terminal shall be of a configuration that will be compatible with the site geometry shown on the plans. Guardrail terminals that require additional grading or require anchoring outside the limits of the site shown on the plans will be acceptable; however, the cost of any additional site work shall be included in the price bid for the particular type of guard rail terminal used. Guard rail terminals shown on the plans shall be 50 feet (15 meters) in length. Any additional length of guardrail needed to fulfill the 50 feet (15 meters) requirement shall be included in the price bid for the particular type of guardrail terminal used.

617.02 Materials. All materials used in this construction shall comply with the following requirements:

(a) Line Posts. Guardrail line posts and blockouts shall be of either wood or steel, unless a specific type is indicated on the plans. As an alternate, plastic blockouts may be used where permitted on the plans. Plastic blockouts shall be listed on the Department's Qualified Products List.

(1) Wood Posts. Wood posts and blockouts shall be treated timber. All posts shall be of seasoned straight Southern Pine or Douglas Fir of the West Coast Region complying with Section 817. The posts shall conform to the dimensions shown on the plans. Posts shall be pressure treated by a standard empty cell or full cell process according to AWPA (U1) practice with creosote to retain a minimum of 12 pounds per cubic foot (190 kg/cu m) of wood, or with pentachlorophenol or chromated copper arsenate to retain a minimum of 0.6 pounds of active chemical per cubic foot of wood (9.6 kg per cu m).

(2) Steel Posts. Steel line posts and blockouts shall consist of structural shapes of the section shown on the plans or as otherwise specified and may be fabricated by the electrical resistance process complying with ASTM A 769. The steel shall comply with AASHTO M 270, Grade 36 (250). Posts and blockouts shall be galvanized according to AASHTO M 111.

(3) Line Posts for Thrie Beam Guardrail Terminal. Thrie beam guardrail and transition guardrail line posts and blockouts shall be of either wood or steel as shown on the plans. Concrete line posts or blockouts are not permitted. Thrie beam guardrail and transition guardrail blockouts shall be either steel tubing used

with steel posts or wood blockouts used with wood posts as indicated on the plans.

Steel posts shall conform to Subsection 617.02(a)(3). Structural steel tubing for blockouts in thrie beam guardrail section with steel posts shall be fabricated from ASTM A500 Grade B Steel.

(b) Terminal Anchor Posts.

(1) Terminal anchor posts shall be of the type and dimensions shown on the plans.

(2) Concrete for the anchor shall comply with Section 802 for Class M Concrete. The Department will perform all acceptance sampling and testing at the frequencies shown for Contractor acceptance sampling and testing in Subsection 802.06.

(3) The steel anchor posts shall consist of structural shapes of the section shown on the plans, or as otherwise specified, and shall comply with AASHTO M 270, Grade 36 (250). The upper 15" (380 mm) of the anchor assembly shall be galvanized according to AASHTO M 111.

(c) Guardrail Anchor Posts.

(1) Concrete for the posts shall comply with Section 802 for Class A Concrete.

(2) Reinforcing steel shall comply with Section 804.

(3) Premolded joint filler shall comply with Subsection 501.02(h)(1)b Type 2.

(d) Guardrail. Guardrail material including hardware shall comply with AASHTO M 180, Class A, Type II. Chipped or damaged galvanizing shall be repaired as specified in AASHTO M 36.

(e) Connector Plate. Connector plates shall conform to AASHTO M270, Grade 36 (Grade 250), and shall be galvanized after fabrication. Galvanizing shall conform to Subsection 807.19. The connector plate shall be bolted to the special end shoe using 7/8”diameter (M22) high strength bolts, with heads placed on the traffic face. Bolts, nuts, and washers shall be galvanized and shall conform to Subsection 807.06.

(f) Guardrail Terminal (Type 2). The Contractor shall furnish a certification from the manufacturer or supplier that the guardrail terminal meets the requirements of NCHRP Report 350 or MASH for a TL-3 terminal. All materials shall be new. Rail elements and posts shall meet the requirements above. All steel components shall be galvanized. All parts shall be clearly identified for proper assembly and replacement.

The Contractor shall provide the Engineer with copies of all necessary manufacturer's details and installation manuals prior to the installation of the guard rail terminal on the project. These materials shall remain the property of the Department.

617.03 Construction Requirements. The alignment and location of guardrail shall be according to the plans, or as directed. When it is necessary to install posts in paved shoulders, the damage to the pavement caused by the installation shall be repaired. Depressed or heaved pavement shall be filled or cut out and filled with in kind material and finished to the line and grade shown on the plans or as directed by the Engineer. The Contractor may elect to cut out a section of pavement before installing the post and replacing the cut-out section as specified above. The repair or replacement of damaged pavement will not be paid for separately, but full compensation therefor will be considered included in the contract unit prices bid for Guardrail, Terminal Anchor Posts, Guardrail Anchor Posts, Thrie Beam Guardrail Terminals, and Guardrail Terminals (Type 2).

(a) Line Posts. Line posts shall be spaced as shown on the plans and set plumb in hand or mechanically dug holes, or by driving. The manner of driving shall be such as to avoid battering or distorting of posts. Post holes shall be backfilled with moist sand and thoroughly compacted as placed. Chipped or damaged galvanizing on steel posts shall be repaired in the field as specified in Subsection 617.02(d).

(b) Terminal Anchor Posts. Terminal anchor posts shall be constructed according to the plans. The guardrail may be bolted to the angle at the terminal anchor and the two assemblies positioned to proper alignment before placing concrete, or it may be bolted to the terminal anchor angle after the anchor posts have been placed and

the concrete sufficiently set, as approved by the Engineer. Welding shall comply with Section 807.

Unless specifically authorized by the Engineer, side forms shall not be used. Concrete shall be placed directly against bottom and sides of the excavation for the anchor. Mixing, placing, and curing concrete shall comply with Section 802.

(c) Guardrail Anchor Posts

(1) Excavation and Backfill. Excavation for post construction shall be done only to the extent necessary for construction. All loose material shall be removed from the excavated hole before placing the concrete for the lower portion of the post.

(2) Forms. Forms shall be of metal or wood, free from warp and of sufficient strength to resist springing during the process of depositing concrete. They shall be securely staked, braced, set, and held firmly to the required line and grade. All forms shall be cleaned and oiled before concrete is placed against them.

(3) Placing and Finishing. Concrete for the post shall be placed and finished according to Section 802.

(d) Guardrail. Guardrail shall be constructed according to the plans and in a manner resulting in a smooth, continuous installation. Fittings shall be secured to the posts and terminal anchors in a workmanlike manner. Laps shall be as shown on the plans.

(e) High Strength bolts shall be installed according to Subsection 807.71.

(f) Guardrail Terminal (Type 2). The guardrail terminal shall be fabricated and installed in accordance with the plans and the details provided by the manufacturer. Any damage caused by the Contractor to the materials required for the guardrail terminal shall be repaired or replaced immediately at no cost to the Department.

617.04 Method of Measurement. (a) Guardrail will be measured by the linear foot (meter) complete in place. As indicated on the plans, Sections 1 and 4 represent end sections and they will each be considered as 25' (7.5 m) in length. Intermediate sections will be measured along the roadway face of the guardrail from centerline of post to centerline of post.

(b) Terminal Anchor Posts will be measured by the unit.

(c) Guardrail Anchor Posts will be measured by the unit.

(d) Thrie Beam Guardrail Terminals will be measured by the unit. Each unit shall consist of thrie beam guardrail, the thrie beam connection to the concrete parapet wall, and the thrie beam transition to the W-beam guardrail.

(e) Guardrail Terminal (Type 2) with be measured by the unit.

617.05 Basis of Payment. (a) Guardrail completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Guardrail of the type called for and furnished, which price shall be full compensation for furnishing materials and erecting guardrail and line posts; for excavation and backfill; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(b) Terminal anchor posts completed and accepted and measured as provided above will be paid for at the contract unit price bid each for Terminal Anchor Posts of the type called for and furnished, which price shall be full compensation for excavation and backfill; furnishing, preparing, and erecting parts and materials; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(c) Guardrail anchor posts completed and accepted and measured as provided above will be paid for at the contract unit price bid each for Guardrail Anchor Posts, which price shall be full compensation for excavation and backfill; for furnishing materials, including concrete, reinforcing steel, bolts, nuts, washers, joint materials, forms, and bracing materials; for mixing, placing, finishing, and curing concrete; for the removal and disposal of excess materials; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(d) Thrie Beam Guardrail Terminals completed and accepted and measured as provided above will be paid for at the contract unit price bid each for Thrie Beam Guardrail Terminal, which price shall be full compensation for furnishing all hardware and materials necessary to erect thrie beam guardrail terminals, thrie beam guardrail, thrie beam guardrail transitions, blockouts and line posts; for connector plates, special end shoes and required hardware; for

excavation and backfill; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(e) Guardrail Terminal (Type 2) completed and accepted and measured as provided above will be paid for at the contract unit price bid per each for Guardrail Terminal (Type 2), which price shall be full compensation for furnishing all materials; for any additional length of guardrail needed to complete the 50 foot (15 meter) meter requirement; for all additional grading or site work necessary for the proper installation of the type of terminal used; and for all labor, equipment, tools and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Guardrail (Type___)	Linear Foot (Meter)
Terminal Anchor Posts (Type___)	Each
Guardrail Anchor Posts	Each
Thrie Beam Guardrail Terminal	Each
Guardrail Terminal (Type 2)	Each

SECTION 618
GUARD CABLE

618.01 Description. This item shall consist of furnishing and erecting guard cable in conformity with the lines and grades shown on the plans or as designed by the Engineer.

618.02 Materials. All materials used in this construction shall comply with the following requirements:

(a) Posts. Posts may be either wood or steel unless a specific type is indicated on the plans.

Wood posts shall be treated timber. All posts shall be of seasoned straight Southern yellow pine or Douglas Fir of the West Coast Region complying with Section 817 and the classification shown on the plans. The posts shall conform to the dimensions shown on the plans. Posts shall be pressure treated by the standard empty cell or full cell process according to AWPA practice with creosote to retain a minimum of 12 pounds per cubic foot (190 kg/cu m) of wood, or with pentachlorophenol or chromated

copper arsenate to retain a minimum of 0.6 pounds per cubic foot (9.6 kg/cu m) of wood.

Steel posts shall consist of structural shapes of the section shown on the plans. In lieu of the structural shapes specified, the Contractor may furnish comparable posts of welded beam construction fabricated by the electric-resistance welding process of ASTM A 769. The steel shall comply with AASHTO M 270, Grade 36 (250). Posts shall be galvanized according to AASHTO M 111.

(b) Guard Cable. Guard Cable shall be one of the following:

- Zinc coated steel wire strand cable, 1/2" (12 mm) in diameter, seven wire strand, common, Siemens-Martin or high strength grade, Class A coating, complying with ASTM A 475.
- Aluminum-zinc alloy coated steel wire strand cable, 1/2" (12 mm) in diameter, seven wire strand, Siemens-Martin or high strength grade, complying with ASTM A 474.

(c) Anchors and Fittings. Turnbuckles shall comply with AASHTO M 269 or FF-T-791b, Type I, Form 1, Class 2. Clips shall comply with FF-C-450d Type I, Class 1 or 2. Thimbles shall comply with FF-T-276b Type II or III. Eyebolts, anchors, stub ends, and other miscellaneous fittings shall comply with AASHTO M 102 or M 269 or M 183.

All fittings shall be galvanized according to AASHTO M 232, M 111, or ASTM B 695 Class 40 or 50.

(d) Bolts, Nuts, and Washers. Bolts, nuts, and washers shall conform to the plans and shall be steel complying with ASTM A 307, ASTM A325, or ASTM A449 (Heavy Hex), , galvanized according to AASHTO M 232. Threads on bolts and nuts shall conform to Unified Coarse Thread Series Class 2A, ANSI B 1.1 (Metric Coarse Thread Series, ANSI B 1.13M, 6g tolerance).

(e) Delineators. Delineators shall consist of white or yellow reflectors complying with Subsection 728.02.

A Type 1 (White or Yellow) delineator shall be a single 3" x 8" (75 x 200 mm) vertical rectangle with 3/4" (20 mm) corner radii and

two 13/64" (6 mm) diameter mounting holes spaced 6" (150 mm) on center.

A Type 2 delineator shall consist of the mounting of white delineators on both sides as shown on the plans.

The delineator shall be fabricated from 0.080" (2.0 mm) aluminum and shall comply with Section 723. Reflective sheeting shall comply with Section 728.

(f) Delineator Post Extensions. Metal delineator post extensions shall comply with Subsection 728.02 for U-Section channel. Wood line posts may be lengthened as shown on the plans for attachment of the delineators.

618.03 Construction Methods. The alignment and location of guard cable shall be according to the plans or as directed by the Engineer.

Posts shall be spaced as shown on the plans and set plumb in hand or mechanically dug holes, or by driving. The manner of driving shall be such as to avoid battering or distorting of posts. Post holes shall be backfilled with moist sand and thoroughly compacted as placed. Chipped or damaged galvanizing on steel posts shall be repaired in the field as stipulated in AASHTO M 36.

Guard cable shall be strung directly from the reel and shall be pulled tight after the initial anchoring. The cable shall then be attached to the second anchor assembly with all turnbuckles fully opened. The cables shall be completely anchored before being attached to the line posts.

Delineator post extensions shall be attached to the guard cable line posts and spaced as shown on the plans. White and/or yellow delineators shall be mounted on the delineator post extensions as required by the direction of traffic as shown on the plans.

618.04 Method of Measurement. Guard Cable will be measured by the linear foot (meter) complete in place. The measurement will be to the nearest linear foot (meter) and will be made from center of end post to center of end post. Guard Cable Anchor will be measured by the unit which will include all fittings, hardware, and the anchor device between the center of the post and into the ground.

618.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Guard Cable and per each for Guard Cable Anchor, which price shall be full compensation for furnishing all materials; for installing posts, guard cable, and delineators; for excavation and backfill; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Guard Cable	Linear Foot (Meter)
Guard Cable Anchor	Each

SECTION 619
FENCES

619.01 Description. This item shall consist of furnishing and erecting wire fence, chain link fence, and gates according to the plans and these specifications, and in reasonably close conformity to the lines, grades, and alignment shown on the plans or as directed. Types of wire fence specified will be as follows:

(a) Type A fence shall be constructed with woven and barbed wire mounted on wood or steel posts utilizing a selected grade of materials.

(b) Type B fence shall be constructed with barbed wire mounted on wood or steel posts utilizing a selected grade of materials.

(c) Type C fence shall be constructed with woven and barbed wire mounted on wood or steel posts utilizing a commercial grade of materials.

(d) Type D fence shall be constructed with barbed wire, mounted on wood or steel posts, utilizing a commercial grade of materials.

619.02 Materials. (a) General. The materials used shall be new and shall comply with the requirements for the class and type of material specified. All steel items shall meet the requirements of Subsection 106.01.

(1) Concrete for setting posts shall comply with Section 802 for Class M Concrete or may be a bagged commercial concrete mix which meets the strength requirements of Class M Concrete. The Department will perform all acceptance sampling and testing at the frequencies shown for Contractor acceptance testing in Subsection 802.06.

(2) Timber preservative shall comply with the applicable requirements of the current AWPA book of standards.

(3) Wood posts and braces shall be pressure treated, seasoned, sound, and reasonably straight southern pine or Douglas Fir of the West Coast Region. The posts shall be round and free from excessive end splits. Before pressure treatment, the posts and braces shall have the bark removed, the knots trimmed flush, and the ends cut square. Posts that are to be driven shall have the small end tapered.

(4) Metal posts and braces shall be of good commercial quality iron or steel and may be tubular, T, U, Y, or other shape manufactured for use as fence posts or braces. The minimum weight per foot (meter) and the length shall be according to the plans.

(b) Types A and B Wire Fence.

(1) Wood posts and braces of the size and length shown on the plans shall be treated by a standard empty cell or full cell process according to AWPA practice using creosote and retaining a minimum of 8 pounds per cubic foot (125 kg/cu m) of wood; or using pentachlorophenol, or chromated copper arsenate and retaining a minimum of 0.4 pounds per cubic foot (6 kg/cu m) of wood.

(2) Woven Wire farm fence shall be AASHTO M 279 design number 1047-6-11, Grade 60. Smooth line wire shall be 9 gage. Both woven wire and smooth line wire shall comply with AASHTO M 279, Class 3 galvanizing.

As an alternate to the woven wire farm fence specified above, AASHTO M 279 design number 1047-6-12½, Grade 125, shall be used, with each wire consisting of high tensile wire, complying with AASHTO M 279, with a minimum zinc coating at 0.90 oz/ft^2 (275 g/m^2) for 12½ gage wire and 0.95 oz/ft^2 (290

g/m^2) for 10½ gage wire. As an alternate to the smooth line wire specified above, 10½ gage, Grade 125 high tensile wire shall be used, with each wire complying with AASHTO M 279, with a minimum zinc coating at 0.95 oz/ft^2 (290 g/m^2).

(3) Barbed wire shall be 12½ gage with four point barbs and shall conform to AASHTO M 280, Class 3 galvanizing.

As an alternate to the barbed wire specified above, the wire may consist of two strands of high tensile wire, each having the same galvanizing and breaking strength as Class 3, 12½ gage wire, and complying with the remaining requirements of AASHTO M 280 for a four point barb.

The minimum gage of the high tensile barbed wire shall be as follows:

Strand wire gage	15½
Barb wire gage	17

(4) Staples used to attach the wire fencing to wood posts shall be galvanized 9 gage, 1½" (38 mm) in length.

(5) Steel line posts shall be galvanized and comply with AASHTO M 281. Tubular steel posts shall comply with Grade 1 or Grade 2 of AASHTO M 181, or an approved alternate of Grade 2. Alternates to Grade 2 steel posts shall equal or exceed the performance criteria of AASHTO M 181 as determined by the Engineer of Materials.

(6) Hardware and fittings shall comply with ASTM F 626. Any miscellaneous hardware or fittings not mentioned in ASTM F 626 shall be galvanized according to the applicable requirements of AASHTO M 111 or M 232.

(c) Types C and D Wire Fence.

(1) Wood posts and braces of the size and length shown on the plans shall be pressure treated with creosote, pentachlorophenol, or chromated copper arsenate.

(2) Metal posts, braces, and fittings, shall be galvanized or painted. Metal posts for each section of fence between property lines shall be all galvanized or all painted.

(3) Woven wire farm fence shall be AASHTO M 279 design number 939-6-12½, and conform to commercial galvanization. Smooth line wire shall be 9 gage and conform to commercial galvanization.

(4) Barbed wire shall be 12½ gage with four point barbs on 4″ to 5″ (100 mm to 125 mm) centers and shall conform to commercial galvanization. A 15½ gage high tensile wire may be used in lieu of 12½ gage wire.

(5) Staples used to attach the wire fencing to wood posts shall be galvanized 9 gage, 1½″ (38 mm) in length.

(d) Chain Link Fence.

(1) Material for chain link fence shall comply with AASHTO M 181 Type I, Class D; Type II; or Type III. Steel members for posts, rails, expansion sleeves, and gate frames may be either Grade 1 or Grade 2. The shape, size, and length of posts and rails, and the height, gage, and mesh size of fabric shall be as shown on the plans. Alternates to Grade 2 steel members shall equal or exceed the performance criteria of AASHTO M 181 as determined by the Engineer of Materials.

(2) Hardware and Fittings shall comply with ASTM F 626. Any miscellaneous hardware or fittings not mentioned shall be galvanized according to AASHTO M 111 or M 232.

Aluminum alloy fabric shall be used only with aluminum posts. Aluminum coated steel fabric and galvanized steel fabric, Class D, shall be used only with Grade 1 or Grade 2 steel posts.

(e) Gates.

(1) Frames for gates shall be galvanized steel or aluminum of the type and length shown on the plans. Frames shall be Grade 1 or Grade 2. They shall be fastened at the corners by clamps and braces or welded. If steel is used the entire weld shall be galvanized. Commercial gates may be used if they are equal to or better than the planned gates as determined and approved by the Engineer.

(2) The gate fabric shall be of the same type material and be in accordance with the same specifications as the adjoining fence.

619.03 Construction Requirements. (a) General. The fence shall be erected parallel to and at a specified distance from the right-of-way line, or as directed. The fence grade shall generally follow the ground contour, but shall present a uniform appearance. Minor grading along the fence line may be necessary to obtain the desired uniformity in fence grade. The fence alignment may be adjusted by the Engineer to preserve trees, land monuments, property corner markers, and the position of right-of-way monuments in place or planned. The Contractor may clear trees from a strip approximately 10' (3 m) wide adjacent to and within the right-of-way to accommodate fence erection equipment. Grubbing or scalping of the cleared strip shall not be permitted to prevent damage to trees, shrubs, grass, and other vegetation designated to remain. Clearing shall be performed according to Section 201.06.

(b) Wire Fence. Line posts and pull assemblies shall be spaced as shown on the plans. Wood line, corner, gate, and pull posts may be driven in place provided the driving does not damage the post; or they may be set in dug holes and backfilled with earth thoroughly compacted as placed; or set in concrete. Metal corner, gate, end, and pull posts shall be set in concrete. Wire shall not be stretched onto posts set in concrete until seven days after placement of posts. Posts shall be set plumb.

The Contractor has the option of using wood or steel posts and braces unless otherwise specified, but shall use the same material on the entire project. Wood end, corner, and pull posts may be used with steel line posts.

When solid rock is encountered, the posts shall be set to the required depth for soil unless the penetration into solid rock would exceed 10" (250 mm) for line posts and 16" (400 mm) for end, corner, gate, and pull posts. In such cases, the posts shall be set into the solid rock a minimum depth of 10" (250 mm) for line posts and 16" (400 mm) for end, corner, gate, and pull posts. The hole in the rock shall have a minimum cross section dimension 1" (25 mm) greater than the post to be set. The posts shall be cut before setting to give the proper length above ground surface. The hole shall be filled with Class M Concrete or a grout consisting of 1 part Portland cement and 3 parts concrete sand.

Wire tension braces for wood pull, end, and corner assemblies shall consist of a 9 gage wire passed around the posts to form a double wire. The wire shall be fastened to each post and the ends fastened together to form a continuous wire. The wires shall then be twisted together until the wire is in tension.

Where the new fence joins an existing fence, the two shall be attached in a satisfactory manner, with end posts being set as directed. Where the proposed fence intersects an existing fence, the end post shall be set for the existing fence clear of the proposed fence line as shown on the plans. The wire of the existing fence shall be stapled to the end post. When the point of intersection falls more than 2' (0.6 m) from a post on Type A and B fence, a line post shall be set at the intersection.

Pull post assemblies shall be placed at intervals of not more than 330' (100 m) in straight alignment on level or uniformly sloping ground, and at sharp vertical angle points in the line.

Corner post assemblies shall be placed at all horizontal angle points of 15° or more in the fence. When the distance from a corner post to the next corner or pull post is less than 165' (50 m), one approach span on the corner assembly may be omitted.

End post assemblies at fence ends, gates, bridge abutments, and on banks of streams shall be erected in the same manner as corner construction. Extra length posts shall be provided for crossing small streams, ditches, ravines, or soft ground. Additional depth of set shall be secured in soft ground as directed.

The wire shall be attached to the face of the post away from the highway, except on curves where the fencing shall be attached on the outside of the curve. The wire shall be attached to wood line posts with staples driven at right angles to the grain and at a slight downward angle to attain the best anchorage. The staples shall not be driven tightly against the wire but shall leave just enough free space for adjustment in tension due to changes in temperature. Wire shall be attached to steel line posts with approved galvanized clips. All barbed wire and alternate line wires of woven fabric shall be fastened to each line post. Barbed wire and all line wires of woven fabric shall be fastened to end, corner, and pull posts by wrapping the wire around the posts and tying the wire back on itself with not

less than 3 tightly wrapped twists. Splicing of barbed wire and woven wire shall be done according to the plans.

Tension for stretching the barbed wire and woven wire shall be applied by use of standard wire stretchers manufactured for that purpose. The use of trucks, tractors, and similar equipment will not be permitted in the tensioning operation, except as anchors.

(c) Chain Link Fence. All posts shall be set in concrete as shown on the plans, plumb, and true to line and grade. The concrete shall comply with Subsection 619.02, and shall be thoroughly tamped around the posts. The posts shall be equally spaced in the line of fence not to exceed the spacing shown on the plans. The top of the footing shall be domed to drain water away from the post. Concrete in post footings shall be at least 7 days old before stretching and securing fabric to posts, bracing, or hanging of gates.

Top rails, when required, shall pass through post caps and shall be securely fastened to end, brace, pull, and corner posts. Joints in top rails shall be made with expansion sleeve couplings to provide a substantial connection and allow for expansion and contraction of the rail.

Before the fence fabric is placed, the tension wire shall be placed at the proper location; stretched taut; securely anchored to each end, corner, or intermediate brace post; and satisfactorily fastened to each line post.

The fence fabric shall be attached to the face of the post away from the highway, except on curves, where the fabric shall be placed on the outside of the curve.

The end of the fabric shall be attached to the posts by means of a stretcher bar threaded through the end loops of the fabric and secured to the posts with clamps and bolts. The fabric shall be stretched to remove all slack with approved stretching equipment. The stretched fabric shall be secured to line posts, top rail, braces, and tension wire with specified fabric fasteners. Fabric fasteners shall be placed on line posts at not greater than 14" (350 mm) centers and on top rail, braces, and tension wire at not greater than 24" (600 mm) centers. Stretching operations shall be repeated at approximately every 100' (30 m) for each run of fence. The use of

trucks, tractors, and similar equipment will not be permitted in the stretching operation, except as anchors.

Splicing of the fabric shall be done by interweaving a wire picket through each end loop of each piece of fabric in a manner that will neatly and securely fasten the lengths of fabric together.

(d) Gates. Gates of the length and type shown on the plans shall be constructed at the locations shown on the plans or as directed.

619.04 Method of Measurement. (a) Fence will be measured by the linear foot (meter) in place along the midpoint in height of the fence from outside to outside of the end posts. The lengths of gates will be excluded from this measurement.

(b) Gates will be measured by the unit.

619.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for as follows:

(a) Wire Fence will be paid for at the contract unit price bid per linear foot (meter) for Wire Fence of the type specified.

(b) Chain Link Fence will be paid for at the contract unit price bid per linear foot (meter) for Steel Chain Link Fence or Aluminum Chain Link Fence of the height specified.

(c) Gates will be paid for at the contract unit price bid per each for Gates of the type and dimensions specified.

The contract unit prices mentioned above shall be full compensation for clearing, grading, setting posts, and erecting fence; for excavation and backfill; for furnishing materials; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Wire Fence (Type___)	Linear Foot (Meter)
___' (___m) Steel Chain Link Fence	Linear Foot (Meter)
___' (___m) Aluminum Chain Link Fence	Linear Foot (Meter)
___' (___m) Steel Gates	Each
___' (___m) Aluminum Gates	Each

SECTION 620
SEEDING

620.01 Description. This item shall consist of furnishing and applying lime, fertilizer, seed, mulch cover, asphalt, and water according to these specifications at locations shown on the plans or as directed.

The work under this item shall be accomplished as soon as practicable after the grading in an area has been completed in order to deter erosion of the roadway and siltation of streams.

620.02 Materials. **(a)** Lime shall be agricultural grade ground limestone or equivalent as approved by the Engineer.

(b) Fertilizer shall be a commercial grade, uniform in composition, free flowing, and suitable for application with mechanical equipment. It shall be delivered to the site in labeled containers conforming to current Arkansas fertilizer laws and bearing the name, trademark, and warranty of the producer.

(c) Except as modified herein, the seed shall comply with the current rules and regulations of the Arkansas State Plant Board and the germination test shall be valid on the date the seed is used. It shall have a minimum of 98% pure seed and 85% germination by weight, and shall contain no more than 1% weed seeds. A combined total of 50 noxious weed seeds shall be the maximum amount allowed per pound (110 per kg) of seed with the following exceptions: Johnson grass seed, wild onion seed, wild garlic seed, field bindweed seed, nut grass seed, sickle pod seed, sesbania seed, indigo seed, morning-glory seed, cocklebur seed, ballonvine, crotalaria spp., serrated tussock, and tropical soda apple will not be allowed in any amount. Seed shall be furnished in sealed, standard containers. Seed that has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable.

Crimson clover shall be inoculated with an approved culture as recommended by the manufacturer, just prior to seeding.

The Wildflower Mix shall be the following seed varieties and rates:

Common Name	Latin Name	lbs./acre	kg/ha
Black-eyed Susan	*Rudbeckia hirta*	0.5	0.6
Gay feather	*Liatris pycnostachya*	0.5	0.6
Purple coneflower	*Echinacea purpurea*	0.5	0.6
Showy primrose	*Oenothera speciosa*	0.5	0.6
Lanceleaf coreopsis	*Coreopsis lanceolata*	1.0	1.1
Plains coreopsis	*Coreopsis tinctoria*	1.0	1.1
		4.0	**4.6**

Wildflower seed not regulated by the Arkansas State Plant Board shall have a minimum of 95% pure seed and 65% germination by weight, and shall contain no more than 1% weed seeds.

Seed shall be composed of the varieties and amounts by weight as shown below.

Seed planted between June 16 and August 31 may require more water than that specified in Subsection 620.03(f) in order to survive. Therefore, watering shall continue after germination until growth is established.

The seeding mixture may be altered by the Engineer in selected areas with no adjustment in contract price. The alteration shall be on an equivalent cost basis.

Additional cereal grass seed may not be applied in excess of the rates shown below. The Engineer may permit the application of up to 15 lbs./acre (15 kg/ha) of additional cereal grass seed if the Contractor provides a written request which includes an agreement to mow the cereal grass growth before the seed heads form and prior to acceptance of the project to allow for the germination and growth of the other grasses in the seed mix. All mowing and additional seed will be done at no cost to the Department.

Seed Variety:	**lbs/acre**	**kg/ha**
Group I		
Districts 1, 2, 5, 6, and 10		
March 1 - June 15		
Bermuda Grass (Common) unhulled	5	5
Bermuda Grass (Common) hulled	10	10
Lespedeza (Kobe)	10	10

Wildflower Mix	4.0	4.6

June 16 - August 31

Bermuda Grass (Common) unhulled	5	5
Bermuda Grass (Common) hulled	10	10
Wildflower Mix	4.0	4.6

September 1 - February 28/29

Wheat	15	17
Crimson Clover (Dixie)	10	10
Bermuda Grass (Common) unhulled	20	20
Wildflower Mix	4.0	4.6

Group II

Districts 3, 4, 7, 8, and 9

March 15 - June 15

Bermuda Grass (Common) unhulled	5	5
Bermuda Grass (Common) hulled	10	10
Lespedeza (Korean)	10	10
Wildflower Mix	4.0	4.6

June 16 - August 31

Bermuda Grass (Common) unhulled	5	5
Bermuda Grass (Common) hulled	10	10
Wildflower Mix	4.0	4.6

September 1 - March 14

Annual Rye Grass or other Cereal Grasses	10	10
Crimson Clover (Dixie)	10	10
Bermuda Grass (Common) unhulled	20	20
Wildflower Mix	4.0	4.6

(d) Mulch cover shall consist of straw from threshed rice, oats, wheat, barley, or rye; of wood excelsior; or of hay obtained from various legumes or grasses, such as lespedeza, clover, vetch, soybeans, bermuda, carpet sedge, bahia, fescue, or other legumes or grasses; or a combination thereof. Mulch shall be dry and reasonably free from Johnson grass or other noxious weeds, and shall not be excessively brittle or in an advanced state of

decomposition. All material will be inspected and approved prior to use.

(e) Tackifiers. Tackifiers used in mulch anchoring shall be of such quality that the mulch cover will be bound together to form a cover mat that will stay intact under normal climatic conditions.

All tackifiers used shall have prior approval or be listed on the Department's Qualified Products List (QPL).

(f) Water shall be of irrigation quality and free of impurities that would be detrimental to plant growth.

620.03 Construction Requirements. (a) Seedbed Preparation. Areas to be seeded shall be dressed to the shape and section shown on the plans. If the plans call for replacing topsoil, this shall be done before any preparations for seeding. Before beginning the seedbed preparation, soil samples shall be obtained from each major soil area (such as cut backslope or fill foreslope) by the Engineer for lime requirement analysis.

Lime, at the rate determined by the lime requirement test, shall be uniformly spread on areas to be seeded prior to their being roughened or scarified. The seedbed shall be thoroughly pulverized by means of disk harrows or other approved methods, thoroughly mixing lime and soil to a depth of not less than 4" (100 mm) (2" [50 mm] for slopes 4:1 or steeper) below finish slope elevation. Regardless of the pulverizing method used, the soil shall be broken with the contour of the slope. Objectionable foreign matter shall be removed and the soil left in a suitable horticultural condition to receive the fertilizer and seed. Water may be applied before, during, and after seedbed preparation, as directed by the Engineer, in order to maintain the desired moisture content in the soil.

When no lime is required, seedbed preparation shall be accomplished as specified above regardless of the method used in the distribution of fertilizer, seed, and mulch cover.

(b) Fertilization. Fertilizer shall be applied at the rate of 800 pounds per acre (900 kg/ha) of 10-20-10, or the equivalent amount of plant food. Fertilizer shall be uniformly incorporated into the soil alone or in conjunction with the required lime. If the Contractor so elects, the fertilizer may be drilled into the soil or combined with the seed in the hydro-seeding operation.

(c) Seeding. (1) Broadcasting. Broadcast sowing may be accomplished by hand seeders or by approved power equipment. Either method shall result in uniform distribution and no work shall be performed during high winds. The area seeded shall be lightly firmed with a cultipacker immediately after broadcasting.

(2) Drilled in Rows. When seed is drilled in rows, the rows shall be horizontal (parallel to contour lines). Fertilizer and seed shall not be drilled together and shall not be mixed.

(3) Hydro-seeding. If a hydro-seeder is used for seeding, fertilizer and seed may be incorporated into one operation but a maximum of 800 pounds of fertilizer shall be permitted for each 1500 gallons (maximum of 95 kg for each 1500 L) of water. If the Contractor so elects, the fertilizer may be applied during preparation of the seedbed. The area shall be lightly firmed with a cultipacker immediately before hydro-seeding.

(d) Mulch Cover. Mulch cover shall be applied at the rate of 4000 pounds per acre (4500 kg/ha) immediately after seeding and shall be spread uniformly over the entire area by approved power mulching equipment. When approved by the Engineer, the Contractor may use hand methods to apply mulch cover to small or inaccessible areas. If the Contractor so elects, an approved mulching machine may be used whereby the application of mulch cover and tackifier may be combined into one operation. If this method is used, no change in application rates will be allowed. In its final position, the anchored mulch shall be loose enough to allow air to circulate, but compact enough to partially shade the ground and reduce the impact of rainfall on the surface of the soil. Care shall be taken to prevent tackifier materials from discoloring or marking structures, pavements, utilities, or other plant growth. Removal of any objectionable discoloration shall be at no cost to the Department.

(e) Mulch Anchoring. Immediately following or during the application of the mulch cover on seeded areas, the mulch shall be anchored by one of the following methods:

- **Tracking or Roller Method.** The mulch shall be effectively pressed into the soil using steel cleated track or cleated roller equipment. The anchoring shall be performed so that the grooves formed are perpendicular to the flow of water down

backslopes and foreslopes. The equipment and method used shall produce acceptable results.

- **Asphalt Tackifier.** Asphalt shall be applied at the rate of approximately 0.05 gallon per square yard (0.2 L/sq m). Application shall be made using a pressure distributor to ensure constant and uniform distribution. The use of asphalt may be reduced or eliminated by the Engineer at selected locations.
- **Other Tackifiers.** Tackifiers listed on the QPL shall be applied according to the rates recommended in the QPL.

The method used shall be at the Contractor's option unless otherwise specified or directed. In lieu of separate application of tackifiers, the Contractor may use equipment that combines the application of mulch and tackifier into one operation. Application shall be at the specified rates.

(f) Water. (1) Initial Application. From April 1 through December 31, either the day before the seeding is placed or on the day of the seeding operation (either before the seed is placed or after the application of the mulch cover), a minimum of 20.4 M Gallons per acre (188 cu m or 188 kL per ha) of water will be applied to thoroughly moisten the soil to the depth of pulverization and then as necessary to germinate the seed. This quantity may be reduced by the Engineer dependent on the soil moisture conditions immediately prior to the application of the seeding. Failure to apply the initial application of the quantity of water directed by the Engineer will result in a deduction in payment as shown below. Water used for hydro-seeding or tackifier application will not be measured or paid for, and will not be included in the quantity of water required for the initial water application. The initial application of water and deductions for failure to water will not be required from January 1 through March 31.

(2) Weekly Application. From April 1 – December 31, unless otherwise directed by the Engineer, the Contractor shall apply water in an amount such that, in conjunction with any rainfall, the seeded and mulched areas will receive an amount equivalent to a minimum of ¾" (19 mm) of water each week beginning the week after seeding and continuing for a minimum of four (4) weeks (¾" [19 mm] of water is equivalent to 20.4 M Gallons per acre [188 cu m or 188 kL

per ha]). The Engineer will adjust the amount of water required each week to deduct any rainfall received during the 7 calendar day period prior to the weekly watering. The weekly applications of water and deductions for failure to water will not be required from January 1 through March 31.

(3) Failure to Water. Failure to meet the requirements of (1) or (2) above will result in a permanent deduction in payment and/or permanent recovery of payments equal to the minimum bid price established below for each M.G. (kL) not applied as directed in accordance with these specifications. Additional work and materials required due to the Contractor's negligence in maintaining completed work or failure to water grass as directed shall be accomplished at no cost to the Department.

(4) Watering Equipment. The Contractor shall have on the project such equipment of adequate capacity and a suitable water supply to achieve the desired moisture level in the soil. The equipment and methods used will be such that the application of water will not cause erosion or excessive movement of the previously placed seed and mulch cover. Any slope that is eroded or any seed or mulch cover that is washed down the slope due to failure to follow the above requirement will be repaired and/or reseeded at no cost to the Department.

The time required for application of water will not be included in the computations of contract time for completion of the project provided all other work under the Contract has been completed.

(g) For areas seeded in the September 1-February 28/29 or September 1-March 14 season, final acceptance will be delayed until an acceptable stand of grass of uniform color and density is established to the satisfaction of the Engineer. The soil condition shall be suitable for preparation of the seedbed according to the above requirements in the areas to be seeded during the September 1-February 28/29 or September 1-March 14 season.

(h) Before final acceptance, the Contractor shall repair or replace any seeding or mulching that is defective or damaged. If the defect or damage is due to the Contractor's negligence, the work shall be done at no additional cost to the Department. If the damage or defect is not the Contractor's fault, the work will be measured and paid for according to these specifications.

620.04 Method of Measurement. (a) Lime will be measured by the ton (metric ton).

(b) Seeding will be measured by the acre (hectare) of actual area covered.

(c) Mulch Cover will be measured by the acre (hectare) of actual area covered.

(d) Water will be measured by the M.G., (1000 gallons) (kiloliter [1,000 L]). Payment will be made to the nearest 100 gallons (100 L), based on calibrated tank or meter measurements.

620.05 Basis of Payment. (a) Lime completed and accepted and measured as provided above will be paid for at the contract unit price bid per ton (metric ton) for Lime, which price shall be full compensation for furnishing, hauling, and placing; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(b) Seeding completed and accepted and measured as provided above will be paid for at the contract unit price bid per acre (hectare) for Seeding, which price shall be full compensation for seedbed preparation; for furnishing and applying fertilizer and seed; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(c) Mulch cover completed and accepted and measured as provided above will be paid for at the contract unit price bid per acre (hectare) for Mulch Cover, which price shall be full compensation for furnishing, hauling, and applying mulch material; for mulch anchoring; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(d) Water applied and measured as provided above will be paid for at the contract unit price bid per M.G. (kiloliter) for Water, which price shall be full compensation for furnishing, hauling, and applying water as directed; and for all labor, equipment, tools, and incidentals necessary to complete the work. Water used for hydro-seeding will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Seeding.

A minimum bid price shall be entered in the proposal for the item "Water", in accordance with the table below. Any unit bid price submitted in an amount less than the specified minimum will be automatically adjusted to the specified minimum to determine the correct total bid. This adjustment to the specified minimum will be automatically made, without any counter-adjustments in prices for other items.

Failure to water in accordance with these specifications or as directed will result in a loss to the Department of vegetative growth and vitality which is difficult to calculate. A permanent deduction in payment and/or permanent recovery of payments equal to the minimum bid price will be made as an item deduction for each M.G. (kL) not applied as directed in accordance with these specifications for damages sustained by the Department.

Total Plan Quantity for Seeding	Minimum Bid Price
Less than 5 acres (2 hectares)	$10.00 per M.G. ($4.00 per kL)
Greater than or equal to 5 acres (2 hectares)	$5.00 per M.G. ($2.00 per kL)

Payment will be made under:

Pay Item	**Pay Unit**
Lime	Ton (Metric Ton)
Seeding	Acre (Hectare)
Mulch Cover	Acre (Hectare)
Water	M.G. (Kiloliter)

SECTION 621
TEMPORARY EROSION CONTROL ITEMS AND DEVICES

621.01 Description. (a) Temporary Seeding. This item shall consist of the application of seed, fertilizer, and water according to these specifications to areas shown on the plans or as directed.

(b) Mulch Cover. This item shall consist of the application of mulch cover as a deterrent to soil erosion. The Engineer may make a determination to place mulch cover, without seeding, on areas that

require erosion control for a short period of time; when erosion control is necessary during the midwinter season when seed will not germinate; or because of the nature of material used for embankment construction. Mulch cover, including mulch anchoring when required, shall be applied to areas shown on the plans, or as directed by the Engineer.

(c) Erosion Control Matting. This item shall consist of the temporary placement of erosion control matting at locations shown on the plans or as directed by the Engineer. It will generally be used in diversion ditches at the ends of berms, or at other locations where the flow of water is concentrated. Areas receiving matting shall be shaped and seeded, when required, before placement of the matting.

(d) Baled Straw Filter Barrier. This item shall consist of baled straw staked and butted together to form a continuous barrier for the purpose of impeding or re-directing the flow of storm water as necessary to prevent its discharge off site or to a Water of the State.

(e) Silt Fence. This item consists of placing and securing a geotextile fabric to an existing support system or constructing a self-supporting geotextile fence where shown on the plans or as directed by the Engineer for the purposes of impeding the flow of water carrying silt toward existing streams and/or across adjacent property; redirecting the flow of silt-laden water to a sediment basin; and/or routing clean water through the construction area.

(f) Sand Bag Ditch Check. Where shown on the plans or as directed by the Engineer this item shall consist of preparing and placing sand bags in roadside ditches to impede run-off velocity of water and to prevent scouring and eroding of soil until permanent erosion control items can be placed.

(g) Diversion Ditch. Where shown on the plans or as directed by the Engineer this item shall consist of excavating or grading for diversion ditches to control soil erosion at selected locations. Diversion ditches will generally be excavated above the backslopes of cuts, along the top of embankments, or across foreslopes and backslopes to divert the run-off to vegetated areas, slope drains , downslope protection locations, or sediment basins. Sediment laden water shall not be discharged directly into natural drainage channels.

(h) Sediment Basin. This item shall consist of excavating and grading a storage area to detain sediment-laden runoff from

disturbed areas long enough to allow sediment to settle out. Sediment basins shall be placed at locations shown on the plans or as directed by the Engineer.

(i) Drop Inlet Silt Fence. This item shall consist of placing and securing geotextile to an adequate frame around a drop inlet to impede silt from entering the inlet. Drop inlet silt fence shall be placed at locations shown on the plans or as directed by the Engineer.

(j) Rock Ditch Checks. This item shall consist of constructing small dams across swales or ditches to slow concentrated storm water runoff to a non-erosive velocity. Ditch checks shall be constructed at locations shown on the plans or as directed by the Engineer.

(k) Sediment Removal and Disposal. This item shall consist of removing and disposing of silt collected in erosion and sediment control devices as directed by the Engineer.

(l) Mulch Control Netting. This item shall consist of furnishing and installing mulch control netting to be used over mulch cover in areas shown on the plans or designated by the Engineer. This is not a substitute for mulch anchoring or mulch cover. It is to be used where additional or long term control is needed for the mulch cover.

(m) Slope Drains. This work shall consist of installing a pipe and dumped riprap to convey concentrations of runoff from the top of a disturbed slope to the bottom and discharge the runoff onto either a stabilized area, sediment basin, or dumped rip-rap as directed by the Engineer. Slope drains shall be placed at locations shown on the plans or as directed by the Engineer.

(n) Wattles. This item shall consist of furnishing, installing, maintaining, and removing wattles at locations as directed by the Engineer for the purpose of controlling erosion and sedimentation.

(o) Triangular Silt Dikes. This item shall consist of furnishing, installing, maintaining, and the subsequent removal of a geotextile and urethane foam barrier designed to remove suspended soil particles from water passing through the barrier.

621.02 Materials. (a) Seed shall be of the fast germinating and growing variety such as common rye grass, the cereal grasses (wheat, barley, oats), or Brown Top Millet, complying with the

requirements of the Arkansas State Plant Board and Subsection 620.02(c). Fertilizer and water shall comply with Section 620.

(b) Mulch cover and tackifier, if applicable, shall comply with Section 620.

(c) Erosion Control Matting shall comply with Section 626.

(d) Straw for baled straw filter barrier shall consist of bales of rice, oats, barley, wheat, or rye straw, or of available grasses, free of an excessive amount of noxious weeds. Bales shall be a minimum of 30" (750 mm) in length. Straw in a state of decomposition will not be acceptable.

(e) Geotextile fabric for silt fence shall comply with the requirements of Section 625 for Type 3 or Type 4 or as shown on the plans. Supports for the fabric shall be of any material of sufficient strength and durability to support the fabric when loaded with silt for the entire time the barrier is needed for service.

(f) Sand for sand bags shall consist of a sandy type soil or clean sand that meets the approval of the Engineer. Bags for sand shall be of a tightly woven burlap or other material that is sufficiently durable to remain intact for the time intended.

(g) Geotextile for drop inlet silt fences shall be of the type shown on the plans and comply with Section 625. Framing shall be as shown on the plans and be of sufficient strength and durability to support the geotextile for the time needed.

(h) Material for rock ditch checks shall comply with Section 207. Rock having a different gradation may be used when determined by the Engineer to be suitable for the purpose intended.

(i) Dumped Riprap and geotextile for sediment basin spillway outlets shall comply with Section 816. Pipe culvert for a basin outlet shall comply with Subsection 606.02(c). Used pipe meeting these requirements may be used when determined by the Engineer to be suitable for the purpose intended. Rock filter shall comply with Subsection 207.02 for Stone Backfill.

(j) Mulch Control Netting shall be a uniformly extruded, rectangular, photodegradable plastic mesh with a minimum weight of 0.23 ounce per square yard (8 g/sq m) and a maximum mesh

opening of 2" x 2" (50 mm x 50 mm). Staples or wood stakes for use with mulch control netting shall be according to Section 626.

(k) Pipe for slope drains shall be 12" (300 mm) in diameter and shall comply with Subsection 606.02 or Type C corrugated polyethylene pipe complying with AASHTO M 294. Used pipe meeting these requirements may be used when determined by the Engineer to be suitable for the purpose intended. Dumped riprap shall comply with Section 816.

(l) Water shall comply with Section 620.

(m) Wattles shall consist of an elongated tube of netting filled with weed free organic material (coir, wood fibers, mulch, straw, or a combination of the previous materials) or rolls of organic material reinforced with biodegradable netting, in accordance with the Table 621-1. Wattles shall be installed in accordance with the size shown on the detail sheet or as directed by the Engineer.

Table 621-1
Wattles

Wattle Type		Material
Coir	Core	100% blended bristle and mattress grade coir fiber
	Netting	Woven knotted coir or knotless polypropylene net
Excelsior	Core	Excelsior fiber with interlocking barbs and 80% being 6" in length or longer
	Netting	Polyester with 1" triangular shaped openings
Straw	Core	Compacted straw such as rice straw
	Netting	Polyethylene, polypropylene, or polyester netting
Mulch	Core	Well decomposed organic material, 99% passing 2" Sieve
	Netting	HDPE ⅜" knitted mesh netting
Rolled	Core	70% straw fiber, 30% coconut fiber
	Netting	Leno woven jute netting or biodegradable equal. Biodegradable netting must be used with this option

Hardwood stakes shall have dimensions of 1½ in. x 1½ in. and sufficient length to provide 2' embedment into the ground. If a rocky soil is encountered, the stake embedment shall be approved by the Engineer.

(n) Triangular Silt Dikes shall be supported and shall have a height of at least eight to ten inches (8-10") in the center with equal sides and a sixteen to twenty inch (16-20") base. The outer cover shall be a woven geotextile fabric placed around the inner material and allowed to extend beyond both sides of the triangle 24-36 inches. The geotextile fabric shall be mildew resistant, rot proof and resistant to ultraviolet radiation meeting the requirements for silt fence in AASHTO M 288. The edges shall be treated to prevent unraveling. Seams and stress points shall be reinforced. The fabric cover and apron shall be a continuous wrapping of the fabric: the apron shall be a continuous extension of the upstream face. The triangular shaped inner material shall be urethane foam. Standard length of each silt dike will be seven feet (7') unless otherwise indicated on the plans.

621.03 Construction Requirements. (a) General The Contractor shall actively maintain the areas or items constructed under this subsection from the time of their completion until the Engineer determines the items are no longer required. Additional work and materials required because of loss from erosion or other causes beyond the Contractor's control will be paid for unless they were required due to Contractor's negligence, in which case the maintenance shall be at no cost to the Department.

Temporary erosion control items and devices shall be removed, or may remain in place as directed by the Engineer, after final stabilization has been achieved but must be removed before the Notice of Termination for the Construction Storm Water Permit has been submitted. After items have been removed, the affected areas shall be graded to conform to the adjacent contours, unless otherwise directed by the Engineer. Following this removal and grading, permanent stabilization shall be established in these areas.

Disposal, when required, shall be according to the requirements of Sections 110 and 201. Salvageable materials will become the property of the Contractor.

(b) Temporary Seeding. The area designated or directed to be temporarily seeded does not have to be brought to typical section or a garden-like condition, but shall be lightly tilled.

Rye or the cereal grasses shall be planted at the rate of 100 pounds per acre (110 kg/ha) between August 15 and January 20.

Brown Top Millet shall be planted at a rate of 50 pounds per acre (55 kg/ha) between January 21 and August 14. The seeding mixture may be altered by the Engineer in selected areas with no adjustment in contract price. The alteration will be made on an equivalent cost basis. Fertilizer shall be applied at the rate of 500 pounds per acre (560 kg/ha) of 10-20-10 or the equivalent amount of plant food.

The Engineer may adjust the seasonal limitations specified above when immediate erosion control measures are required and other methods are not considered practicable. The decision to adjust seasonal limitations will be based on the practicality of planting seed at that particular time, with consideration being given to the geographic location of the project and the period of time remaining before permanent erosion items can be applied.

From April 1 through December 31, either the day before the temporary seeding is placed or on the day of the temporary seeding operation (either before the seed is placed or after the application of the mulch cover) an application of water will be applied, in accordance with Subsection 620.03(f)(1). No subsequent weekly waterings will be required for Temporary Seeding.

Failure to meet this application of water requirement will result in a permanent deduction in payment and /or permanent recovery of payments equal to the minimum bid price established in Subsection 620.05(d) for each M.G. (kL) not applied as directed in accordance with these specifications. Equipment and methods used to place the water shall be in accordance with Subsection 620.03(f)(4).

(c) Mulch cover shall be applied according to Section 620.

(d) Erosion control matting shall be applied according to Section 626.

(e) Bales for baled straw filter barriers shall be installed so that the bindings are oriented around the sides of the bales and not along the tops and bottoms. The bales shall be keyed into the ground a minimum of 4" (100 mm) and securely held in place by staking, wiring, and/or other methods that will prevent floating and/or displacement. No gaps shall be left between bales. The number of bales required and the specific arrangement of them will vary with the conditions at each site. Bales that become displaced shall be retrieved and re-installed, if suitable. Bales that become

unserviceable in their original location shall be removed and replaced.

(f) Geotextile fabric for silt fence shall be attached to the supporting system in such manner that it will remain attached and fully supported for the entire time the barrier is needed for service. The fabric toe shall be buried to secure the base as shown on the plans. Splices shall be securely fastened. Re-anchoring of the toe of the installed silt fence and re-securing the geotextile fabric to the supports shall be considered normal maintenance and will be considered included in the unit price bid for silt fence.

After permanent stabilization has been completed, or simultaneously with the permanent stabilization, the silt fence and the silt trapped by it shall be removed and disposed of as directed by the Engineer. Disposal shall be according to the requirements of Sections 110 and 201. When directed by the Engineer, silt fences shall be left in place.

(g) For sand bag ditch checks, the sacks shall be filled approximately 3/4 full, shall weigh a minimum of 55 pounds (25 kg), and shall be securely closed.

Sand bags shall be placed in the ditches at locations shown on the plans or as directed by the Engineer. They shall be laid in horizontal courses and successive courses shall break joints with preceding ones. The sacks shall be rammed and packed against each other and tamped on the surface to secure a uniform surface. The overflow area in the center of the ditch check shall be constructed lower than the sides. The number of bags required and the arrangement at each installation will vary with on-site conditions.

(h) Excavation and grading for diversion ditches shall be according to the dimensions and at the locations shown on the plans or as directed by the Engineer.

(i) Geotextile for drop inlet silt fences shall be attached to the supporting system in such manner that it will remain attached and fully supported for the entire time the barrier is needed for service. The fabric toe shall be buried to secure the base as shown on the plans. Splices shall be securely fastened.

(j) Rock ditch checks shall be constructed as shown on the plans or as directed by the Engineer. The overflow area in the center of the ditch check shall be constructed lower than the sides.

(k) Sediment basins shall be constructed to the dimensions shown on the plans or as directed by the Engineer. The soil used in basin construction shall be compacted and stabilized. Dumped riprap and geotextile for a sediment basin with a spillway outlet shall be placed on the spillway as shown on the plans. For sediment basins with a pipe outlet, the rock filter material shall be placed around a perforated riser pipe that is connected with an elbow to a non-perforated corrugated metal pipe. Sufficient rock filter shall be used to cover the perforations and stabilize the riser. An anti-seep collar shall be installed.

Sediment basins shall not be obliterated until final stabilization has been achieved. The soil used to create the basin, the sediment trapped in the basin, and the dumped riprap and rock filter for the outlet may be used to fill the basin; however, all fill material used shall be compacted and stabilized. The area shall be graded to conform to the adjacent contours, unless otherwise directed by the Engineer.

(l) Sediment collected in the various erosion and sediment control devices shall be removed when needed and as directed by the Engineer. Sediment basins and ditch checks shall have sediment removed when their capacity is reduced by half. Silt fences shall have sediment removed when a deposit covers 1/3 the height of the structure. Sediment removed shall be deposited and stabilized as described in Section 110. Sediment will normally be incorporated back into the embankment construction as directed by the Engineer.

(m) Mulch control netting shall be installed over the mulch with the longitudinal length parallel to the slope. Adjacent netting widths shall be overlapped by not less than 4" (100 mm). Remaining fabric areas shall be stretched, then secured by pinning to the ground with approximately 1 staple per square yard (square meter) of area. Upslope ends, edges, bottom, and overlaps shall be stapled at 2 foot (0.6 meter) intervals.

(n) Slope drains shall be constructed as shown on the plans or as directed by the Engineer. Pipe for slope drains shall be installed

down the slope as shown on the plans and securely held in place by anchor stakes or other devices as approved by the Engineer.

(o) Wattles shall be placed on the ground and securely held in place by stakes as shown on the detail sheet. The number of wattles required will vary with the conditions at each site; therefore, a series of wattles shall either be butted together or overlapped as directed by the Engineer. A continuous segment of wattle shall be used in a ditch application.

Accumulated sediment shall be removed when it covers one-half the height of the wattle. Sediment removed shall be deposited and stabilized as described in Section 110. Payment for this work will be made under the item "Sediment Removal and Disposal." Repair of or complete replacement of torn or damaged wattles shall be performed as required or as directed by the Engineer. Wattles shall be temporarily removed and replaced as required to facilitate construction operations.

When the required work has been completed and the area has been stabilized and approved by the Engineer, the wattle netting is to be cut and the core material shall be spread out on the surrounding ground area. If non-biodegradable netting is used in the wattles, the netting shall be removed from the site. If biodegradable netting is used, it can remain in place under the organic core material. Upon completion of the spreading of the core material, the area is to be approximately level so that no barrier to water flow will exist.

(p) Install, align, and locate the triangular silt dikes as shown on the plans, or as directed by the Engineer. All triangular silt dikes shall be placed on the contour and in a row with ends tightly abutting the adjacent triangular silt dike. Filter material shall lap over the ends 6 inches to cover dike to dike junctions; each junction shall be secured with wire staples.

The approach apron shall be followed by the sewn seam and front side of the dike section. The exiting apron will lie underneath the dike section and extend out beyond the discharge side.

When triangular silt dikes are installed across surface drainage ditches, the highest point of the triangular silt dike in the center of the ditch must be lower than the lowest point of the triangular silt

dike at the end. This will direct water over the center of the triangular silt dike and not around the ends.

When installed as diversion devices, triangular silt dikes shall be placed along the contour or on a 1-2% gradient to a planned discharge point.

Accumulated sediment shall be removed when it covers one half the height of the triangular silt dike. During removal of sediment, the operator must exercise care within the range of the front apron to avoid damage to the device. The range of the apron is approximately eighteen to twenty four inches (18-24") from the base of the barrier. Sediment removed shall be deposited and stabilized as described in Section 110. Payment for this work will be made under the item "Sediment Removal and Disposal."

Inspect all triangular silt dikes after each rainfall event and/or each seven day period. Triangular silt dikes shall be temporarily removed and replaced as required to facilitate construction operations. Any deficiencies or damage shall be repaired at no cost to the Department. Repair of, or complete replacement of torn or damaged triangular silt dikes shall be performed as required or as directed by the Engineer at no additional cost to the Department.

621.04 Method of Measurement. (a) Temporary Seeding will be measured by the acre (hectare) of actual area covered.

(b) Mulch Cover will be measured according to Section 620.

(c) Erosion Control Matting will be measured according to Section 626.

(d) Baled Straw Filter Barriers will be measured by the bale in place as authorized by the Engineer.

(e) Silt Fence will be measured by the linear foot (meter) complete in place.

(f) Sand Bag Ditch Checks will be measured by the bag.

(g) Diversion Ditches will be measured by the linear foot (meter).

(h) Sediment Basins will be measured by the cubic yard (cubic meter) of volume contained in the basin below the spillway elevation or the top of the riser pipe. This volume will be calculated by measuring the length, width, and average depth or by using the

average end area method. Dumped riprap, geotextile, and rock filter for spillway outlets will be measured according to Sections 816, 625, and 207 respectively. Pipe for sediment basins will be measured by the linear foot (meter) along the center of the pipe and will include riser, elbow, and pipe outlet. Rock filter for sediment basins will be measured by the ton (metric ton).

Obliteration of Sediment Basin will be measured by the cubic yard (cubic meter). The quantity for purposes of payment will be the same quantity as was determined for the original construction of the basin, and no further measurement will be made.

(i) Drop Inlet Silt Fence will be measured by the linear foot (meter) in place along the midpoint in height of the outside perimeter of the completed structure.

(j) Rock Ditch Checks will be measured by the cubic yard (cubic meter) in place. The volume will be calculated by measuring the average length, width, and depth or by using the average end area method.

(k) Sediment Removal and Disposal will be measured by the cubic yard (cubic meter) of sediment removed. The volume will be calculated by measuring the length, width, and the average depth or by using the average end area method.

(l) Mulch Control Netting will be measured by the square yard (square meter) of actual area covered.

(m) Dumped Riprap for slope drains will be measured according to Section 816. Pipe for slope drains will be measured by the linear foot (meter) along the center of the pipe and will include elbows and tees.

(n) Water will be measured according to Section 620.

(o) Wattles will be measured by the linear foot complete in place; measurement will be made along the centerline of the top of each wattle. The overlap length will be paid for at the contract unit price.

(p) Triangular Silt Dikes will be measured by the linear foot, complete in place, with measurement being made along the centerline of the top of the barrier.

621.05 Basis of Payment. (a) Temporary seeding completed and accepted and measured as provided above will be paid for at the contract unit price bid per acre (hectare) for Temporary Seeding.

(b) Mulch cover will be paid for under Section 620.

(c) Erosion control matting will be paid for under Section 626.

(d) Baled straw filter barrier completed and accepted and measured as provided above will be paid for at the contract unit price bid per bale for Baled Straw Filter Barrier.

(e) Silt Fence completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Silt Fence.

(f) Sand bag ditch checks completed and accepted and measured as provided above will be paid for at the contract unit price bid per bag for Sand Bag Ditch Checks.

(g) Diversion ditches completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Diversion Ditch.

(h) Sediment basins completed and accepted and measured as provided above will be paid for at the contract unit price bid per cubic yard (cubic meter) for Sediment Basins. Dumped riprap and geotextile for sediment basins will be paid for under Sections 816 and 625 respectively. Pipe culvert for sediment basins completed and accepted and measured as above will be paid for at the contract unit price bid per linear foot (meter) for Pipe Culvert for Sediment Basins. Rock filter for sediment basins completed accepted and measured as provided above will be paid for at the contract unit price bid per ton (metric ton) for Rock Filter for Sediment Basins.

Obliteration of sediment basin completed and accepted and measured as provided above will be paid for at the contract unit price bid per cubic yard (cubic meter) for Obliteration of Sediment Basin, which price shall be full compensation for all work required to obliterate the sediment basin including furnishing, placing and compacting fill material; seeding; and applying mulch cover to the area.

(i) Drop inlet silt fence completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Drop Inlet Silt Fence.

(j) Rock ditch checks completed and accepted and measured as provided above will be paid for at the contract unit price bid per cubic yard (cubic meter) for Rock Ditch Checks.

(k) Work involved in the removal and disposal of sediment from erosion and sediment control devices completed and accepted and measured as provided above will be paid for at the contract unit price bid per cubic yard (cubic meter) for Sediment Removal and Disposal.

(l) Mulch control netting completed and accepted and measured as provided above will be paid for at the contract unit price bid per square yard (square meter) for Mulch Control Netting.

(m) Dumped riprap for slope drains will be paid for under Section 816. Pipe for slope drains completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Pipe for Slope Drains.

(n) Water will be paid for under Section 620. A permanent deduction in payment and/or permanent recovery of payments equal to the minimum bid price contained in Subsection 620.05(d) will be made as an item deduction for each M.G. (kL) not applied as directed in accordance with these specifications. Water used for hydro-seeding will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Temporary Seeding.

(o) Wattles completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot for Wattle, which price shall be full compensation for furnishing all materials; for initial wattle installation, including hardwood stakes (installation and removal); for routine inspection and maintenance of wattles; for temporarily removing and replacing wattles as required to facilitate construction operations; for removing the wattles (if directed); and for all labor, equipment, tools, and incidentals necessary to complete the work.

(p) Triangular Silt Dike work completed and accepted under this item and measured as provided above will be paid for at the contract

unit price bid per linear foot for Triangular Silt Dike, which price shall be full compensation for furnishing, placing, maintaining, temporarily removing and replacing as required to facilitate construction operations, and removal of the Triangular Silt Dike and for all other materials, labor, tools, equipment, and incidentals necessary to complete the work.

The contract unit prices mentioned above shall be full compensation for furnishing all materials; for site preparation; for acceptable maintenance of the completed items; for subsequent removal of the items when applicable; for permanent stabilization of the areas disturbed by the removal of these items, and for all labor, equipment, tools, and incidentals necessary to complete the work.

Other temporary erosion control measures may be ordered by the Engineer to establish control of soil erosion or sedimentation. These items will be measured and paid for according to the applicable portions of these specifications.

Payment will be made under:

Pay Item	**Pay Unit**
Temporary Seeding	Acre (Hectare)
Baled Straw Filter Barrier	Bale
Silt Fence	Linear Foot (Meter)
Sand Bag Ditch Checks	Bag
Diversion Ditch	Linear Foot (Meter)
Drop Inlet Silt Fence	Linear Foot (Meter)
Rock Ditch Checks	Cubic Yard (Cubic Meter)
Sediment Basin	Cubic Yard (Cubic Meter)
Rock Filter for Sediment Basin	Ton (Metric Ton)
Pipe Culvert for Sediment Basin	Linear Foot (Meter)
Obliteration of Sediment Basin	Cubic Yard (Cubic Meter)
Sediment Removal and Disposal	Cubic Yard (Cubic Meter)
Mulch Control Netting	Square Yard (Square Meter)
Pipe for Slope Drains	Linear Foot (Meter)
Wattle (_")	Linear Foot (Meter)
Triangular Silt Dike	Linear Foot (Meter)

SECTION 622
SOD MULCH

622.01 Description. This item shall consist of furnishing and applying lime, fertilizer, sod mulch, seed and mulch cover when required, and water according to these specifications at locations shown on the plans, or as directed.

The work under this item shall be accomplished as soon as practicable after the grading in an area has been completed in order to deter erosion of the roadway and siltation of streams.

622.02 Materials. **(a)** Lime shall comply with Subsection 620.02(a).

(b) Fertilizer shall comply with Subsection 620.02(b).

(c) Sod mulch shall consist of cuttings and root systems of live, growing Bermuda grass and shall be procured from areas where the soil is fertile as indicated by vigorous growth. The grass shall have a healthy virile root system of dense, thickly matted roots throughout the sod for a thickness of at least 3 inches (75 mm). The sod shall be reasonably free from noxious weeds or undesirable grasses and shall not contain any matter injurious to its growth or hardiness when transplanted. All sources of sod mulch shall be approved by the Engineer.

(d) Seed for overseeding sod mulch shall comply with Subsection 620.02(c).

(e) Mulch cover for overseeding sod mulch shall comply with Subsection 620.02(d).

(f) Tackifiers for mulch cover shall comply with Subsection 620.02(e).

(g) Water shall be according to Subsection 620.02(f).

622.03 Construction Requirements. (a) Preparation of Areas Receiving Sod Mulch. The areas to be sodded shall be brought to a reasonably smooth and uniform surface to conform to the finished grade and cross section shown on the plans. If the plans call for the item replacing topsoil, this shall be done before any other preparations for receiving sod mulch.

The area shall be thoroughly pulverized by means of disk harrows or other approved methods to a depth of not less than 3" (75 mm). Regardless of the pulverizing method used, the soil shall be broken with the contour of the slope. In areas consisting of shale or rock fragments, disking will be waived but lateral furrows 2" to 3" (50 mm to 75 mm) deep at 36" (1 m) intervals shall be constructed with the contour of the slope and sod mulch placed to provide a uniformly smooth surface susceptible to being mowed.

Objectionable foreign matter shall be removed and the soil left in a suitable horticultural condition to receive the sod mulch.

Water may be applied before, during, and after preparation as directed by the Engineer to maintain the desired moisture content in the soil. Watering shall be according to Section 620.

(b) Preparation of Areas Producing Sod Mulch. The area from which sod mulch is to be secured shall be closely mowed and raked to remove all weeds and long standing stems. This operation may be dispensed with at the discretion of the Engineer when the grass source has been pastured, or for any other reason is free of weeds, long standing stems, or other debris.

Before disking the mulch, soil samples shall be obtained from each major soil area or sod field by the Engineer for lime requirement analysis.

On the basis of soil analysis tests, lime shall be applied at 1/3 the rate determined per hectare (acre) by the lime requirement test for each 1" (25 mm) of depth sod mulch is excavated.

Fertilizer shall be applied at the rate of 270 pounds per acre (300 kg/ha) of 10-20-10, or the equivalent amount of plant food, for each 1" (25 mm) of depth sod mulch is to be excavated.

After mowing and raking, the required lime and fertilizer shall be uniformly spread over the sod mulch area. The grass shall then be disked thoroughly until the sod has been well mixed with lime and fertilizer to the depth the sod mulch is to be removed. Sod mulch shall be excavated to a minimum depth of 3" (75 mm) and to a maximum depth of 6" (150 mm). Immediately after disking, the sod mulch shall be cast into windrows. Care shall be exercised that only topsoil is included in the material excavated with the sod.

The sod mulch shall be procured only when the soil is in a moist, friable condition.

(c) Method of Placement. Sod mulch shall not be cut in the Spring until the Bermuda grass begins to show growth. Sod Mulch shall be hauled and placed before reduced viability has taken place. The sod mulch shall be spread uniformly upon the prepared area to the required approximate depth shown on the plans or directed by the Engineer.

After the sod mulch has been spread and shaped, the entire area shall be satisfactorily compacted by use of rollers, cultipackers, or other approved equipment. Any section not true to lines and typical cross section shall be corrected by the addition of sod material or by reshaping the materials previously placed.

The sod mulch shall be thoroughly watered immediately after being placed. The Contractor shall maintain growth areas from time of placement for a period of at least 3 weeks or until final acceptance of the project, whichever is greater. The time required for watering grass will not be included in computations for time required to complete the project provided all other work under the Contract has been completed. Additional watering to encourage growth beyond the 3-week period shall be applied as directed.

(d) Restoration. Additional work and materials required because of loss through erosion will be paid for under the pertinent contract items. Additional work and materials required due to the Contractors negligence in maintaining completed work shall be accomplished at no cost to the Department. The sod mulch source field shall be finished according to the agreement between the Contractor and Owner. A copy of the agreement will be provided to the Engineer before sod is removed. The agreement will stipulate the final condition of the source field. All restoration of the source field shall be done at no cost to the Department.

(e) Overseeding. Sod mulch placed after July 31 shall be overseeded as soon after placement as possible within the seasonal limitations specified in Subsection 620.02(c). If packing or hardening of the sod mulch has occurred prior to the time of overseeding, a surface preparation of light harrowing or other method approved by the Engineer shall be applied before seeding. No fertilizer will be applied to the areas requiring overseeding. The

applicable requirements of Subsections 620.03(c), (d), (e), and (f) shall govern the construction methods for overseeding.

622.04 Method of Measurement. (a) Lime will be measured according to Section 620.

(b) Sod Mulch will be measured by the cubic yard (cubic meter) in approved vehicles at the point of delivery on the road.

At the Contractor's option, solid sodding complying with Section 624, may be substituted for sod mulch. Measurement will be made at the planned rate of sod mulch over the actual area covered by solid sodding.

(c) Overseeding Sod Mulch will be measured by the acre (hectare) of actual area covered.

(d) Mulch Cover will be measured according to Section 620.

(e) Water will be measured according to Section 620.

622.05 Basis of Payment. (a) Lime will be paid for under Section 620.

(b) Sod mulch completed and accepted and measured as provided above will be paid for at the contract unit price bid per cubic yard (cubic meter) for Sod Mulch, which price shall be full compensation for preparing the areas receiving and the areas producing sod mulch; for furnishing fertilizer and sod mulch material; for hauling, spreading, finishing, and maintaining; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(c) Overseeding sod mulch completed and accepted and measured as provided above will be paid for at the contract unit price bid per acre (hectare) for Overseeding Sod Mulch, which price shall be full compensation for needed seedbed preparation; for furnishing and applying seed; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(d) Mulch cover will be paid for under Section 620.

(e) Water will be paid for under Section 620. Water for moistening the sod field and for hydro-seeding will not be paid for separately, but full compensation therefor will be considered included in the contract unit prices bid for Sod Mulch and Overseeding Sod Mulch.

Payment will be made under:

Pay Item	Pay Unit
Sod Mulch	Cubic Yard (Cubic Meter)
Overseeding Sod Mulch	Acre (Hectare)

SECTION 623
SECOND SEEDING APPLICATION

623.01 Description. This item shall consist of furnishing and applying seed and fertilizer on all seeded and sod mulched areas of the project during the planting season following the original seeding or sod mulch placement, according to these specifications and as directed.

The Contractor will not be required to hold a project over to the following planting season in order to complete this item when all other items of the Contract have been completed and accepted.

623.02 Materials. The seed and fertilizer shall comply with the applicable requirements of Subsection 620.02(b) and (c).

623.03 Construction Requirements. The seed and fertilizer may be placed with a hydro-seeder or broadcast with hand seeders or approved power equipment.

When an area is seeded during the Spring planting season or sod mulched before August 1, 20 pounds per acre (20 kg/ha) of Crimson Clover (Dixie) and 400 pounds per acre (450 kg/ha) of 6-24-24 fertilizer or the equivalent amount of plant food at these proportions shall be placed between September 1 and October 15.

When an area in Districts 5, 8, 9, 10, and the northern six counties of District 4 is seeded during the Fall planting season or sod mulched between August 1 and October 15, 35 pounds per acre (40 kg/ha) of Korean Lespedeza, 10 pounds per acre (10 kg/ha) of unhulled Bermuda Grass, 5 pounds per acre (5 kg/ha) of hulled Bermuda Grass, and 400 pounds per acre (450 kg/ha) of 6-24-24 fertilizer or the equivalent amount of plant food at these proportions shall be placed between March 1 and April 30 of the following year.

When an area in the remainder of the State is seeded during the Fall planting season or sod mulched between August 1 and October 15, 35 pounds per acre (40 kg/ha) of Kobe Lespedeza, 10 pounds per acre (10 kg/ha) of unhulled Bermuda Grass, 5 pounds per acre (5 kg/ha) of hulled Bermuda Grass, and 400 pounds per acre (450 kg/ha) of 6-24-24 fertilizer or the equivalent amount of plant food at these proportions shall be placed between March 1 and April 30 of the following year.

The seeding mixture may be altered by the Engineer in selected areas with no adjustment in contract price. The alteration will be made on an equivalent cost basis.

623.04 Method of Measurement. Second Seeding Application will be measured by the acre (hectare) of actual area covered.

623.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per acre (hectare) for Second Seeding Application, which price shall be full compensation for furnishing and applying seed and fertilizer; for water for hydro-seeding; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Second Seeding Application	Acre (Hectare)

SECTION 624
SOLID SODDING

624.01 Description. This item shall consist of furnishing and placing approved Bermuda sod, fertilizer, and water according to these specifications at locations shown on the plans, or as directed.

624.02 Materials. (a) The Bermuda sod shall be composed of either field grown grass or approved nursery grown grass and shall consist of a densely rooted growth of grass substantially free from noxious weeds and undesirable grasses.

The sod shall be sufficiently thick to secure a dense stand of live grass. The sod shall be live, fresh, and uninjured at the time of placing. It shall have a soil mat of sufficient thickness adhering

firmly to the roots to withstand all necessary handling. It shall be placed as soon as possible after being cut and shall be kept moist from the time it is cut until it is placed in its final position.

The source of field grown sod shall be inspected and approved by the Engineer before being cut for use in the work. After approval, the area from which the sod is to be harvested shall be closely mowed and raked as necessary to remove excessive top growth and debris.

Approved devices, such as sod cutters, shall be used for cutting the sod and due care shall be exercised to retain the native soil intact. The sod shall be cut in uniform strips. The width of the sod furnished for use on the project shall be satisfactory to the Engineer. Rolled sod may be backed with a netting material for added strength in handling if necessary.

(b) Fertilizer shall be in accordance with Subsection 620.02(b).

(c) Water shall be in accordance with Subsection 620.02(f).

624.03 Construction Requirements. (a) Preparation of Bed. The area to be sodded shall be dressed to the shape and section shown on the plans and the top and bottom of slopes shall be rounded to a radius of approximately 3′ (1 m) unless otherwise directed. The finished slopes shall be free of objectionable foreign matter and the top 1" (25 mm) of soil shall be loosened and finely divided. When directed, areas consisting of poor quality soil shall be loosened roughly and covered with a layer of topsoil not less than 2" (50 mm) in depth. Water may be applied before, during, and after slope preparation, as directed by the Engineer, in order to maintain the desired moisture content in the soil.

(b) Fertilization. Immediately before placement of sod, fertilizer shall be broadcast at the rate of 250 pounds per acre (280 kg/ha) (approximately 1 pound per 19 square yards [1 kg/35 sq m]) of 10-20-10, or the equivalent amount of plant food, and incorporated into the top 1" (25 mm) of soil.

(c) Placement of Sod. The bed shall be in a firm but uncompacted condition with a relatively fine texture at the time of sodding. Sod shall be moist and shall be placed on a moist earth bed. Sod strips shall be laid along contour lines, by hand, commencing at the base of the area to be sodded and working

upward. The transverse joints of sod strips shall be broken, and the sod carefully laid to produce tight joints. At the top of slopes the sod shall be turned into the embankment slightly and a layer of earth placed over it and compacted to conduct surface water over and onto the sod. The sod shall be firmed, watered, and refirmed immediately after it is placed. The firming shall be accomplished by use of a lawn roller or approved tamper, with care being taken to avoid tearing end strips of sod.

When sodding is completed, the sodded areas shall be cleared of loose sod, excess soil, or other foreign material; a thin application of topsoil shall be scattered over the sod as a top dressing; and the areas thoroughly moistened. Water shall be applied at a minimum rate of 20.4 M Gallons per acre (188 cu m or 188 kL per ha) or as directed by the Engineer for a period of at least 3 weeks. The Engineer will adjust the amount of water required each week to deduct any rainfall received during the 7 calendar day period prior to the weekly watering. The weekly applications of water and deductions for failure to water will not be required from January 1 through March 31. The time required for application of water will not be included in the computation of contract time for completion of the project provided all other work under the Contract has been completed.

Failure to meet this water application requirement will result in a permanent deduction in payment and /or permanent recovery of payments equal to the minimum bid price established in Subsection 620.05(d) for each M.G. (kL) not applied as directed in accordance with these specifications. Equipment and methods used to place the water shall be in accordance with Subsection 620.03(f)(4).The Contractor shall maintain sodded areas from the time of completion until final acceptance of the project by the Engineer.

(d) Restoration. Additional work and materials required because of the Contractor's negligence in maintaining the work shall be accomplished at no cost to the Department.

When sod is other than nursery supplied, the source field shall be finished according to the agreement between the Contractor and Owner in a condition, after removal of sod, which is acceptable to the property owner and conducive to re-establishment of turf. A copy of the agreement will be provided to the Engineer before sod is removed. The agreement will stipulate the final condition of the

source field. All restoration of the source field shall be done at no cost to the Department.

624.04 Method of Measurement. (a) Solid Sodding will be measured by the square yard (square meter) of actual area covered.

(b) Water will be measured according to Section 620.

624.05 Basis of Payment. (a) Solid sodding completed and accepted and measured as provided above will be paid for at the contract unit price bid per square yard (square meter) for Solid Sodding, which price shall be full compensation for bed preparation; for furnishing and applying fertilizer, topsoil, and sod; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(b) Water will be paid for under Section 620.

Payment will be made under:

Pay Item	**Pay Unit**
Solid Sodding	Square Yard (Square Meter)

SECTION 625
GEOTEXTILE FABRIC

625.01 Description. This item shall consist of furnishing and installing a geotextile fabric of the type specified at the locations shown on the plans or as directed by the Engineer.

625.02 Materials. Geotextile fabric shall be a woven or non-woven synthetic fiber fabric listed on the Department's Qualified Products List and complying with AASHTO M 288, as follows:

Type 1 shall comply with the requirements for Subsurface Drainage, Class 2. This geotextile is used by placing against a soil to allow for long-term passage of water into a subsurface drain system retaining the in-situ soil.

Type 2 shall comply with the requirements for Subsurface Drainage, Class 3. This geotextile is used by placing against a soil to allow for long-term passage of water into a subsurface drain system retaining the in-situ soil.

Type 3 shall comply with the requirements for Temporary Silt Fence, Supported Silt Fence. This geotextile is used as a vertical, permeable interceptor designed to remove suspended soil from overland water flow and shall be supported between posts with wire or polymeric mesh.

Type 4 shall comply with the requirements for Temporary Silt Fence, Unsupported Silt Fence(Self-Supporting). This geotextile is used as a vertical, permeable interceptor designed to remove suspended soil from overland water flow.

Type 5 shall comply with the requirements for Permanent Erosion Control, Class 1. This geotextile is used between energy absorbing armor systems and in the in-situ soil to prevent soil loss resulting in excessive scour and to prevent hydraulic uplift pressures causing instability of the permanent erosion control system.

Type 6 shall comply with the requirements for Permanent Erosion Control, Class 2. This geotextile is used between energy absorbing armor systems and in the in-situ soil to prevent soil loss resulting in excessive scour and to prevent hydraulic uplift pressures causing instability of the permanent erosion control system.

Type 7 shall comply with the requirements for Paving. This geotextile is used as a paving fabric, saturated with asphalt cement, between pavement layers.

Type 8 shall comply with the requirements for Separation, Class 2. This geotextile is used to prevent mixing of a subgrade soil and an aggregate cover material (subbase, base, select material, etc.). May also be used beneath pavements where separation of two dissimilar materials is required but water seepage through the geotextile is not a critical function.

Type 9 shall comply with the requirements for Separation, Class 3. This geotextile is used to prevent mixing of a subgrade soil and an aggregate cover material (subbase, base, select material, etc.). May also be used beneath pavements where separation of two dissimilar materials is required but water seepage through the geotextile is not a critical function.

Type 10 shall comply with the requirements for Stabilization, Class 1. This geotextile is used in wet, saturated conditions to provide the coincident functions of separation and filtration. In

some installations, the geotextile can also provide the function of reinforcement.

625.03 Construction Requirements. Types 1, 2, 5, and 6 geotextile shall be installed in such a manner that all splice joints are provided with a 12″ (300 mm) minimum lap. Types 5 and 6, when placed under water, and Types 8, 9, and 10 geotextiles shall be installed in such a manner that all splice joints are provided with a 1 m (3') minimum lap. Types 3, 4, and 7 shall be spliced as shown in the plans.

Care shall be taken during the placement and installation of the material to prevent damage to the fabric. Damages to Types 1 and 2 geotextiles shall be repaired by placing a geotextile patch over the damaged area, extending 12″ (300 mm) beyond the perimeter of the damaged area. Damage to Types 5, 6, 8, 9, and 10 geotextiles shall be repaired by placing a geotextile patch over the damaged area extending 3′ (1 m) beyond the perimeter of the damaged area.

625.04 Method of Measurement. Geotextile Fabric will be measured by the square yard (square meter). Laps and material used for patching damaged areas will not be measured.

625.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per square yard (square meter) for Geotextile Fabric of the type specified, which price shall be full compensation for furnishing and placing materials; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Geotextile Fabric (Type___)	Square Yard (Square Meter)

SECTION 626
EROSION CONTROL MATTING

626.01 Description. This item shall consist of furnishing, placing and maintaining erosion control matting according to these specifications at locations shown on the plans, or as directed.

626.02 Materials. Materials shall be furnished according to AHTD Class 1, Class 2, and Class 3. All materials shall be listed on the QPL.

The Class of matting shall be as shown on the plans and/or as specified in the project specifications. The type matting used within a particular Class shall be at the option of the Contractor, unless otherwise specified. Any matting from a higher numbered class may be used in lieu of the matting specified, but at no additional cost to the Department.

626.03 Construction Requirements. The matting shall be applied after the area has been properly shaped, fertilized, and seeded as specified on the plans.

The materials shall be applied according to the manufacturer's recommendations. Size and gage of staples, staple spacing, overlap of materials, direction of matting, etc., shall follow the manufacturer's instructions for installation for the site conditions. The Contractor shall supply the Engineer with manufacturer's guidelines before installation.

The Contractor shall maintain the matting areas until all work on the entire project has been completed and accepted.

626.04 Restoration. Additional work and materials required because of loss through erosion will be paid for under the pertinent contract items. Additional work and materials required due to the Contractor's negligence in maintaining the completed work shall be accomplished at no cost to the Department.

626.05 Method of Measurement. Matting will be measured by the square yard (square meter) of actual area covered.

626.06 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per square yard (square meter) for Erosion Control Matting of the Class specified, which price shall be full compensation for furnishing all labor, materials, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Erosion Control Matting (Class_____)	Square Yard (Square Meter)

SECTION 627 VACANT

SECTION 628
TOPSOIL FURNISHED AND PLACED

628.01 Description. This item consists of furnishing and placing topsoil on completed slopes and ditches according to these specifications and at locations shown on the plans or as directed by the Engineer.

628.02 Materials. Topsoil may be obtained from sources outside the right-of-way limits or from areas within the project limits that will be occupied by cuts and/or embankments. When topsoil is furnished from sources outside the right-of-way, the Contractor shall be responsible for locating and obtaining the material and for performing all work, including erosion control, prevention of water pollution, and restoration, according to the specifications. The cost of such work will be considered included in the contract unit price bid for Topsoil Furnished and Placed. At the request of the Engineer, the Contractor shall furnish copies of agreements with the property owners.

Topsoil from all sources shall be the surface layer of soil with no admixture of refuse or any material toxic to plant growth and shall be reasonably free from subsoil and stumps, roots, brush, stone, clay lumps, or similar objects larger than 2" (50 mm) in greatest diameter. In no case shall topsoil be excavated more than 12" (300 mm) from the original ground level. Brush and other vegetation that will not be incorporated with the soil during handling operations shall be cut and removed. Ordinary sods and herbaceous growth, such as grass and weeds, shall not be removed but shall be thoroughly broken up and intermixed with the soil during handling operations. Topsoil may contain a reasonable amount of waste from clearing operations, such as small twigs and roots, that can be expected to reach early decay.

628.03 Construction Operations. (a) Removing, Storing, and Handling Topsoil. Topsoil stripped from within the project shall be moved to areas on the right-of-way, or other approved locations, and stockpiled. When measurement is to be by the cross section method,

the stockpiles shall be uniformly shaped and susceptible to ready measurement by the cross section method. Stockpiles shall be located so that they will not interfere with any proposed construction nor constitute drainage, traffic, or other hazards, either to the project, the general public, or adjacent property. Storage should be in such locations that will afford easy access for loading, hauling, and replacement. The stored topsoil shall be protected from contamination.

If the condition of the soil is unsuitable due to excessive moisture, frost, or other conditions, the Contractor shall cease work under this item until the soil is in a suitable condition.

Topsoil stripped from within the project limits shall be removed prior to the taking of original cross sections. The Contractor shall schedule the work in coordination with the Resident Engineer so as to minimize any delay between the stripping of the topsoil, the taking of original cross sections, and the beginning of excavation and/or embankment construction. Failure of the Contractor to properly schedule the work will not be considered as grounds for extension of time nor for additional payment due to any resulting delays.

(b) Placing Topsoil. Topsoil shall be distributed over the completed slopes and ditches to a depth as shown on the plans or designated by the Engineer. Spreading and dressing of the topsoil layer shall be uniform insofar as possible. After spreading, any remaining large roots, branches, or other foreign substances shall be removed to leave a smooth and clean appearance.

Light rolling, disking, or other type manipulation, including sprinkling, shall be applied as necessary to cause the newly spread layer to pulverize, mix, and adhere to the slopes. Topsoil shall be placed on areas that are to receive seed or sod mulch as soon as practicable after the earthwork is completed, but shall not be placed until after final cross sections are taken. The Contractor shall schedule the work in coordination with the Resident Engineer so as to minimize any delay between the completion of the earthwork, the taking of final cross sections, and the placement of topsoil. Failure of the Contractor to properly schedule the work will not be considered as grounds for extension of time nor for additional payment due to any resulting delays.

(c) Restoration. Additional work and materials required because of loss through erosion will be paid for under the appropriate contract item. Additional work and materials required due to the Contractor's negligence in maintaining the completed work, including failure to apply and maintain seeding, mulch cover, sod mulch, and/or solid sod as required, shall be accomplished at no cost to the Department.

The storage sites for topsoil within the right-of-way shall be dressed to conform to the adjacent area after the storage piles have been removed.

If the Contractor elects to obtain topsoil from areas within the project limits that are to be occupied by embankments, additional borrow material required to replace the topsoil will be measured and paid for under the appropriate item.

628.04 Method of Measurement. Topsoil furnished from outside the right-of-way will be measured by the cubic yard (cubic meter) in vehicles at the point of delivery for use on the project. Topsoil obtained from within the project limits will be measured by the cubic yard (cubic meter) either in stockpiles by the cross section method or in vehicles at the point of delivery for spreading. No adjustment will be made for swell.

628.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per cubic yard (cubic meter) for Topsoil Furnished and Placed, which price shall be full compensation for furnishing, hauling, stockpiling, moving, and placing topsoil; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Topsoil Furnished and Placed	Cubic Yard (Cubic Meter)

SECTION 629
GABIONS

629.01 Description. This item shall consist of the construction of interconnected rectangular wire-mesh baskets filled with coarse nondegradable stone to be used as retaining walls according to these specifications and conforming to the lines, grades, dimensions, locations, and design shown on the plans, or as directed.

629.02 Materials. (a) All wire for gabion baskets shall meet the requirements of Subsection 106.01. Wire for gabion baskets shall be 11 gage (3.0 mm), or equivalent, with a tensile strength between 60,000 to 85,000 psi (415 and 585 MPa). The minimum zinc coating of the wire shall be 0.80 oz./sq. ft (245 g/sq m) of uncoated wire surface complying with AASHTO T 65. Lacing wire shall comply with the same specifications as wire used in the mesh and shall be 13½ gage (2.2 mm). All perimeter edges (mesh edge and selvage rod wires) of the mesh forming the gabion shall be securely selvaged with wire of 9 gage (3.8 mm) or greater. The wire mesh shall be fabricated in such a manner as to be nonraveling as defined by the ability to resist pulling apart at any of the twists or connections forming the mesh when a single wire in a section of mesh is cut. Openings of the mesh shall be approximately 4½" (115 mm) in the longest dimension by approximately 3¼" (80 mm).

(b) Gabion baskets shall be supplied as specified on the plans. Gabions shall be fabricated in such a manner that the sides, ends, lid, and diaphragms can be assembled at the construction site into a rectangular basket of the required size. Gabions are to be of single unit construction with the base, ends, and sides either woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that strength and flexibility at the point of connection are at least equal to that of the mesh.

(c) Stone for filling gabion baskets shall be obtained from an approved source and shall consist of sandstone, limestone, or other hard and durable stone that will be resistant to the action of air and water. The stone shall consist of field stone or rough unhewn quarry stone, angular, and with fractured faces. The stone shall weigh not less than 150 pounds per solid cubic foot (2400 kg per solid cu m) with a percent of wear not greater than 45 by the Los Angeles Test (AASHTO T 96). Based on any one hauling unit shipment or

delivery, the maximum piece size shall be not greater than 8" (200 mm) in any dimension. The minimum stone size shall be 4" (100 mm) except for dirt and fines accumulated from quarrying or loading operations, which shall not exceed 5%.

629.03 Construction Requirements. (a) Excavation. The existing material shall be excavated to the required depth. Soft and yielding material shall be removed and replaced with suitable material and the entire subgrade shall be thoroughly compacted.

(b) Backfilling. The area under the gabion walls shall be backfilled with granular material and thoroughly compacted.

(c) Gabion Baskets. Each gabion unit shall be assembled by binding together all vertical edges with wire ties on approximately 6" (150 mm) spacing or by a continuous piece of connecting wire stitched around the vertical edges with a coil spacing of 5" (125 mm). Empty gabion units shall be set to line and grade as shown on the plans or as directed by the Engineer. Gabion baskets shall be securely fastened to all adjacent gabion baskets to the satisfaction of the Engineer. It is not intended that the fastenings to adjacent gabions equal the strength of the baskets themselves. A standard fence stretcher, chain fall, or iron rod may be used to stretch the wire baskets and hold alignment.

The gabion baskets shall be filled with stone carefully placed by hand or machine to assure alignment and avoid bulges with a minimum of voids. After a gabion basket has been filled, the lid shall be bent over until it meets the sides and edges. The lid shall then be secured to the sides, ends, and diaphragms with wire ties or connecting wire in the manner described above.

(d) Filter Fabric. A filter fabric is to be placed on top and back of filled gabion baskets as shown on the plans.

(e) Backfill. The area behind gabion walls is to be backfilled with embankment material as approved by the Engineer. Care shall be taken so as not to damage filter fabric when placing backfill.

629.04 Method of Measurement. Gabions will be measured by the cubic yard (cubic meter) of gabion baskets in place using the specified dimensions.

629.05 Basis of Payment. Work completed and accepted under this item and measured as provided above will be paid for at the

contract unit price bid per cubic yard (cubic meter) for Gabions, which price shall be full compensation for furnishing materials; for assembling and securing baskets; for placing stone in baskets; and for all equipment, tools, and incidentals necessary to complete the work. Excavation, material for backfill, and filter fabric will be paid for under other appropriate contract items.

Payment will be made under:

Pay Item	**Pay Unit**
Gabions	Cubic Yard (Cubic Meter)

SECTION 630
ROCK BUTTRESS

630.01 Description. This item shall consist of the construction of a rock buttress as shown on the plans or as directed by the Engineer according to these specifications and to the lines, grades, and dimensions shown on the plans or as directed by the Engineer.

630.02 Materials. Stone used for construction of the rock buttress shall be obtained from an approved source and shall consist of sandstone, limestone, syenite, novaculite, or other hard and durable stone. Shale, slate, or similar materials shall not be used. The stone shall be greater than 1½" (40 mm) and less than 30" (750 mm) in any dimension. The stone shall be reasonably well graded and angular, with fractured faces on at least 75% of the surface and shall not contain more than 10% overburden or fines less than 1½" (40 mm) in maximum cross-section. The stone shall weigh not less than 150 pounds per solid cubic foot (2400 kg per solid cu m) and shall have a percent of wear not greater than 45 by the Los Angeles Test (AASHTO T 96) and when subjected to 5 cycles of the Soundness Test (Sodium Sulfate, AASHTO T 104) shall have a loss not to exceed 12 percent. The stone shall have an absorption rate (AASHTO T 85) of less than 3 percent. Relatively thin, layered rock shall not be used for the mass of the rock buttress, but may be used to face the outside surfaces of the buttress.

630.03 Construction Methods. Before placing the rock buttress, a trench shall be excavated and shaped as indicated on the plan drawings or as directed. The rock shall be dumped or placed

substantially to the shape indicated on the plan drawings. During stone placement operations, larger rock shall be pushed to the lower portion of the rock buttress. Objectionable voids between large rocks shall be filled with smaller stones or suitable granular material to provide adequate bearing surfaces for adjacent rocks.

Care shall be exercised to place rock along the outside face that will present a reasonably pleasing appearance.

Backfill shall be according to Subsection 210.09.

630.04 Method of Measurement. Rock Buttress completed and accepted will be measured by the cubic yard (cubic meter) in place. The volume will be computed by the average end area method.

630.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per cubic yard (cubic meter) for Rock Buttress, which price shall be full compensation for furnishing and hauling material; for placing and compacting the rock; for backfilling; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Required excavation for the trench will be measured and paid for as provided in Section 210 for the appropriate classification of excavation.

Payment will be made under:

Pay Item	**Pay Unit**
Rock Buttress	Cubic Yard (Cubic Meter)

SECTION 631
CONCRETE BARRIER WALL

631.01 Description. This item shall consist of the construction of a concrete barrier wall according to these specifications and conforming to the lines, grades, dimensions, and locations shown on the plans or as directed.

631.02 Materials. (a) The concrete used shall comply with the requirements for Class S or S(AE) Concrete as provided in Section 802, or for paving concrete as provided in Section 501. The maximum allowable slump shall be 4 inches (100 mm). The maximum water/cement ratio shall not be exceeded. The Contractor

shall perform quality control and acceptance sampling and testing in accordance with Subsection 802.06.

When an extrusion machine is used, the Contractor may modify the concrete mix design, upon approval of the Engineer, to improve workability while maintaining the above strength requirements.

(b) Anchor bolts shall be as specified on the plans.

(c) Reinforcing steel shall comply with Section 804.

(d) Premolded joint filler shall comply with Section 802.

631.03 Construction Requirements. (a) Excavation. Any existing shoulder or embankment slopes shall be excavated to the required depth. All soft and yielding material shall be removed and replaced with suitable material and the entire subgrade shall be thoroughly compacted.

(b) Removal & Reconstruction. Any existing shoulder material and concrete slope paving shall be removed only to the extent required for construction. After completion of concrete construction and backfilling, the shoulders and concrete slope paving shall be replaced with the same kind and quality of materials removed. Where it is necessary to remove a portion of the existing shoulder, concrete slope paving, curb, and/or approach slab gutter to comply with details shown on the plans, such work will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Concrete Barrier Wall.

Reconstructed approach curb and/or gutter shall comply with details shown on the plans and where adjacent to the barrier wall shall be placed integrally with the barrier wall footing. The gutter shall be constructed to the limits shown on the plans and shall be equivalent to the existing approach gutter thickness. This work will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Concrete Barrier Wall.

(c) Forms. Forms shall be of metal or wood, free from warp, and of sufficient strength to resist springing during the process of placing concrete. They shall be securely staked, braced, set, and held firmly to the required line and grade. All forms shall be cleaned and oiled before concrete is placed against them. Weep hole pipe of the size

shown on the plans shall be set in the forms true to line and grade as indicated.

In lieu of the conventional stationary forms, concrete median barrier wall may be constructed by using an extrusion machine or other equipment specifically designed for constructing cast-in-place barrier, provided that the finished barrier is well consolidated and true to line and grade.

(d) Placing, Finishing, and Curing. The concrete for the footing shall be deposited in the form upon the wetted subgrade and vibrated and spaded until mortar entirely covers the surface. The concrete in the riser shall be deposited in the forms and vibrated until mortar entirely covers the surface after which it shall be finished smooth and even by means of a wood float.

Face forms shall be removed within 24 hours and the face finished by rubbing with a wetted cement mortar brick or wood float until it is smooth. Plastering will not be permitted but minor defects shall be filled with a 1:2 cement mortar (1 part Portland cement to 2 parts concrete sand) float applied with a wood float.

As an alternate to rubbing concrete surfaces, the Contractor may apply a broomed finish to extruded concrete surfaces or use a textured coating finish complying with Subsection 802.19.

When completed, the concrete shall be cured as specified in Section 501 except a membrane curing compound shall only be permitted on extruded concrete surfaces with a broomed finish.

(e) Surface Test. Completed concrete barrier wall shall present a smooth, uniform appearance in the final position, conforming to the horizontal and vertical lines shown on the plans. Before the concrete is given the final finish, the surface of the top and face of the barrier wall shall be true to line and grade. The maximum variation in 10' (3 m) shall not exceed ¼" (6 mm).

(f) Joints. Joints shall be constructed at such intervals and locations and shall comply with the requirements and dimensions as shown on the plans.

(g) Backfilling. After the forms have been removed, the voids left shall be backfilled with suitable material and firmly compacted. The excavated areas around the completed structure shall then be backfilled to the required elevations with suitable material, deposited

in layers not to exceed 6" (150 mm). Compaction shall be accomplished with approved mechanical tampers until it is as firm and unyielding as the surrounding material.

631.04 Method of Measurement. Concrete Barrier Wall will be measured by the linear foot (meter).

631.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Concrete Barrier Wall (Median Type__), Concrete Barrier Wall (Parapet Type__), or Concrete Barrier Wall (Pier Protection Type__), which price shall be full compensation for excavation and backfill; for furnishing materials including concrete, reinforcing steel, bolts, nuts, washers, dowels, joint materials, and weep hole pipe; for performing mix designs and quality control and acceptance sampling and testing; for replacing shoulder materials, concrete slope protection, approach curbs, and gutters, and the preparation and placing of all other materials; for preparing the subgrade and forming; for mixing, placing, finishing, and curing concrete; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Concrete Barrier Wall (Median Type__)	Linear Foot (Meter)
Concrete Barrier Wall (Parapet Type__)	Linear Foot (Meter)
Concrete Barrier Wall (Pier Protection Type__)	Linear Foot (Meter)

SECTION 632
CONCRETE ISLAND

632.01 Description. This item shall consist of the construction of concrete islands according to these specifications and in conformity with the locations, lines, and grades shown on the plans or as directed.

632.02 Materials. The concrete used shall comply with Section 802 for Class A or S Concrete or Section 501 for paving concrete.

The maximum allowable slump shall be 4 inches (100 mm). The maximum water/cement ratio shall not be exceeded. The Department will perform all acceptance sampling and testing at the frequencies shown for Contractor acceptance testing in Subsection 802.06.

632.03 Construction Requirements. Unless the island is to be constructed on an existing base or pavement, the subgrade shall be shaped and compacted to the required grade and section. All soft and yielding areas shall be removed and replaced with suitable material and compacted. Any portion of the subgrade that is not accessible to normal compaction equipment shall be thoroughly compacted with manually operated mechanical tampers. Before depositing the concrete, the subgrade shall be cleared of all foreign materials that may have fallen on it and shall be in a moist condition.

When the island is being constructed on an existing base, the base shall be shaped and compacted as necessary to provide a firm foundation true to the required grade and section. The base shall be in a moist condition and free of loose material when depositing concrete.

When the island is to be constructed on an existing asphalt or concrete pavement, the pavement shall be cleaned of all loose material and moistened immediately before placing concrete. Any pot holes or other defects shall be repaired so as to provide a firm foundation for the island. At the Contractor's option and expense, pot holes and other defects may be cleaned of loose material and filled with concrete at the same time as the island concrete is placed.

After the concrete has been deposited and spread, it shall be thoroughly consolidated and finished to a uniform line and grade free of humps and depressions.

A space not less than ½" (12 mm) wide shall be left between the island and adjacent structures, except that no space shall be left between the sides of the island and adjacent curbs. The space shall be filled with approved joint filler complying with AASHTO M 213.

When completed, the concrete shall be cured as specified in Section 501.

632.04 Method of Measurement. Concrete Island will be measured by the square yard (square meter).

632.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per square yard (square meter) for Concrete Island, which price shall be full compensation for excavating and preparing the subgrade, existing base, and/or pavement; for furnishing, transporting, and placing all materials; for the preparation and processing of all materials; for all mixing, spreading, vibrating, finishing, and curing; and for all labor, equipment, tools, and incidentals necessary to complete the work. Work involved in preparing the subgrade, existing base, and/or existing pavement will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Concrete Island.

Payment will be made under:

Pay Item	Pay Unit
Concrete Island	Square Yard (Square Meter)

SECTION 633
CONCRETE WALKS, CONCRETE STEPS, AND HAND RAILING

633.01 Description. This item shall consist of the construction of concrete walks, concrete steps, and/or hand railing according to these specifications and in conformity with the locations, lines, and grade shown on the plans or as directed.

633.02 Materials. The concrete shall comply with the requirements for Class M Concrete as provided in Section 802. The maximum allowable slump shall be 4 inches (100 mm). The maximum water/cement ratio shall not be exceeded. The Department will perform all acceptance sampling and testing at the frequencies shown for Contractor acceptance testing in Subsection 802.06.

Steel pipe and fittings for hand railing shall be commercially available hot-dip galvanized Schedule 40 steel pipe meeting the requirements of Subsection 106.01. As an alternate, hand railing sections may be hot dipped galvanized after fabrication. Plates shall comply with AASHTO M 270 (Grade 36) and shall be galvanized

according to AASHTO M 111. Nuts, bolts, and washers shall comply with ASTM A 307, Grade A, or AASHTO M 314, Grade 36, and shall be galvanized according to AASHTO M 232 or, ASTM B695 Class 40 or 50. After galvanizing, the nuts shall be free running on the bolts.

633.03 Construction Requirements. (a) Subgrade. The subgrade shall be excavated or filled to the required grade. Soft and yielding material shall be removed and replaced with suitable material and the entire subgrade shall be thoroughly compacted with approved mechanical equipment.

(b) Forms. Forms shall be constructed of metal or wood, free from warp, and of sufficient strength to resist springing during the process of depositing concrete. They shall be securely staked, braced, set, and held firmly to the required line and grade. Forms shall be cleaned and oiled before concrete is placed against them.

(c) Placing and Finishing. The concrete shall be deposited in the forms upon the wetted subgrade to such depth that when it is compacted and finished, the top shall be at the required elevation. It shall be thoroughly consolidated and the edges along the forms spaded to prevent honeycomb. The top shall then be struck off with a straightedge and tamped or vibrated sufficiently to flush mortar to the surface, after which it shall be given a Class 6 finish according to Section 802.19. Edges shall be rounded with a ¼" (6 mm) radius, including edges at joints.

A weakened plane shall be formed to a depth of 1″ (25 mm) and the edges shaped using a ¼" (6 mm) wide jointing tool. These joints shall be formed at intervals not greater than the width of the walk being constructed, or as directed.

Forms shall be removed from exposed surfaces of steps within 24 hours, and the surfaces finished by rubbing with a wetted cement mortar brick or wood float until it is smooth. Plastering will not be permitted, but minor defects shall be filled with a 1:2 cement mortar (1 part Portland cement to 2 parts concrete sand) applied with a wood float.

When completed, the concrete shall be cured as specified in Section 501, except that only clear curing compound may be used.

(d) Backfilling. After the forms have been removed, the spaces on each side of the walks or steps shall be backfilled with suitable material, which shall be firmly compacted by means of approved mechanical equipment and neatly graded.

(e) Expansion Joints. A space not less than ½" (12 mm) wide shall be left between the sidewalks and adjacent structures. This space shall be filled with approved joint filler complying with AASHTO M 213. No space or joint filler is required between the sides of the walks and adjacent curbs.

Transverse expansion joints shall be placed at a maximum interval of 45′ (13.7 m). Transverse joints shall be constructed using a joint filler complying with AASHTO M 213.

(f) Hand Railing. Railing shall be erected in a workmanlike manner, straight and true to line and grade. The posts shall be set in concrete or bolted down by use of steel plates as shown in the plans. The joining of rails between posts by means of sleeves, couplings, or welding will not be permitted.

All joints shall be welded with ¼" (6 mm) fillet welds according to Subsection 807.26. Field galvanizing shall be performed using materials listed on the Department's Qualified Products List and shall be applied in accordance with the manufacturer's recommendations.

633.04 Method of Measurement. Concrete Walks and Steps will be measured by the square yard (square meter). The area measured for steps will be that of the treads only.

Hand Railing will be measured by the linear foot (meter) in place. The measurement will include the distance from the centers of each end post of each separate section of railing, within the limits shown on the plans or as designated by the Engineer.

633.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per square yard (square meter) for Concrete Walks or Concrete Steps, which price shall be full compensation for furnishing materials including joint filler; constructing the concrete walks or concrete steps; for excavation and backfilling; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Hand railing, completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Hand Railing, which price shall be full compensation for furnishing, preparing, hauling, and erecting all material; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Concrete Walks	Square Yard (Square Meter)
Concrete Steps	Square Yard (Square Meter)
Hand Railing	Linear Foot (Meter)

SECTION 634
CURBING

634.01 Description. This item shall consist of the construction of integral curb, concrete curb, or concrete combination curb and gutter according to these specifications and in conformity with the locations, lines, and grades shown on the plans or as directed.

634.02 Materials. The concrete shall comply with the requirements for Class A or S Concrete as provided in Section 802, or for paving concrete in Section 501. The maximum allowable slump shall be 4 inches (100 mm). The maximum water/cement ratio shall not be exceeded. The Contractor shall perform quality control and acceptance sampling and testing in accordance with Subsection 802.06.

When an extrusion machine is used, the Contractor may modify the concrete mix design, upon approval of the Engineer, to improve workability while maintaining the above strength requirements.

Material for joint filler shall comply with AASHTO M 213.

634.03 Construction Requirements. (a) Subgrade. The subgrade shall be shaped to the required depth below the finished surface, according to the dimensions shown on the plans, and shall be compacted to a firm, even surface. When possible, the subgrade shall be shaped and compacted at the same time and in the same manner as the subgrade for the pavement slab. All soft and yielding areas shall be removed and replaced with suitable material and compacted.

When the curb is to be constructed on a concrete surface previously placed, the area of the concrete surface shall be roughened sufficiently to secure a good bond.

(b) Forms. Forms shall be constructed of metal or wood, free from warp, and of sufficient strength to resist springing during the process of depositing concrete. They shall be securely staked, braced, set, and held firmly to the required line and grade. Forms shall be cleaned and oiled before concrete is placed against them. Face forms or templates matching the shape of the planned curb will be required when a curb machine is not used.

(c) Placing and Finishing. (1) Integral Curb. After the concrete pavement has been struck off, the curb forms shall be clamped or otherwise securely fastened in place to the slab form and additional concrete for the curb shall then be deposited and thoroughly tamped. The concrete shall be placed within 30 minutes after the pavement slab has been finished and care shall be taken to secure monolithic construction. The concrete shall be spaded or vibrated sufficiently to eliminate voids and shall be tamped to bring the mortar to the surface. It shall then be finished smooth and even with a wood float and given a Class 2 or 6 finish according to Section 802.19. The edges shall be rounded with an approved finishing tool to the radius shown on the plans.

The curb may be placed after completion of the pavement provided dowels are placed in the pavement of the size, type, and spacing shown on the plans. No additional cost to the Department shall result from placing the curb by this method.

(2) Concrete Curb or Concrete Combination Curb and Gutter. The concrete shall be deposited in the forms upon the wetted subgrade and vibrated and spaded until mortar entirely covers the surface, after which it shall be finished smooth and even by means of a wood float and given a Class 2 or 6 finish according to Section 802.19. Edges shall be rounded as shown on the plans while the concrete is still plastic. Face forms shall be removed from curbs within 24 hours and the face finished by rubbing with a wetted cement mortar brick or wood float until it is smooth. Plastering will not be permitted but minor defects shall be filled with a 1:2 cement mortar (1 part Portland cement to 2 parts concrete sand) applied with a wood float.

(d) Joints. Expansion joints for concrete curb or concrete combination curb and gutter shall be installed at stationary structures such as catch basins, drop inlets, etc., and at ends of curb returns. Where curb and gutter is constructed adjacent to or on rigid pavements, the location and width of joints shall coincide with those in the pavement, where practicable. Expansion joints shall have a thickness of ½" (12 mm) and shall be filled with joint filler shaped to the cross section of the curb and constructed at right angles to the curb line.

Contraction joints for concrete curb or concrete combination curb and gutter shall be 1/8" to 3/8" x 1½" (3 mm to 10 mm x 38 mm) and shall be constructed at 15' (4.5 m) intervals. They shall be constructed at right angles to the centerline and perpendicular to the surface of the curb and gutter. Where curb and gutter is constructed adjacent to or on rigid pavements, the location and width of joints shall coincide with those in the pavement, where practicable. Contraction joints shall be formed by sawing, unless otherwise specified, and filled according to the requirements for Joint Seals as specified in Section 501, or with a commercially available silicone product approved by the Engineer. When the plans show the horizontal surface of the gutter to be overlaid by the surface course, that surface shall be sawed and sealed before the surface course is applied.

(e) Surface Tests. Before the concrete is given the final finishing, the surface of the gutter and the top of the curb shall be true to line and grade. The maximum variation in 10' (3 m) shall not exceed 3/8" (10 mm).

(f) Curing. When completed, the concrete shall be cured as specified in Section 501.

(g) Backfilling. After the concrete has set sufficiently, the space behind the curb shall be refilled to the required elevation with suitable material, which shall be firmly compacted by means of approved mechanical equipment and neatly graded.

634.04 Method of Measurement. Curbing will be measured by the linear foot (meter) along the face of the curb at the gutter line, excluding the curb and/or curb and gutter within the limits of drop inlets and drop inlet extensions as shown in the standard drawings.

634.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for the respective types or sizes of Integral Curb, Concrete Curb, or Concrete Combination Curb and Gutter, which price shall be full compensation for furnishing materials, including joint filler; for forms; for mixing, placing, and finishing concrete; for performing mix designs and quality control and acceptance sampling and testing; for excavation and backfilling; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Integral Curb (Type__)	Linear Foot (Meter)
Concrete Curb (Type__)	Linear Foot (Meter)
Concrete Combination Curb and Gutter (Type__)(__'__" [__ mm])	Linear Foot (Meter)

SECTION 635
ROADWAY CONSTRUCTION CONTROL

635.01 Description. When this item is included in the proposal, it shall consist of furnishing and maintaining all lines, grades, and measurements necessary for the proper execution of the roadway work under the Contract, all according to the plans and specifications.

635.02 Materials. The Contractor shall furnish all stakes, templates, straightedges, surveying equipment, and other devices necessary for establishing, setting, checking, marking, and maintaining points, lines, grades, and layout of the work called for on the plans and in the specifications.

635.03 Construction Requirements. (a) Department Responsibilities. The Department will establish the bench marks and horizontal control points referenced on the plans, certified correct by the Engineer, and furnish the data to the Contractor at the beginning of work. The Department will establish and stake and/or monument the right-of-way limits as shown on the plans. The Engineer will verify the locations, flow lines, and lengths of all pipe

culverts and box culverts and furnish this information to the Contractor.

Any additional information provided by the Department shall be verified by the Contractor before use and the Contractor shall accept full responsibility for any costs incurred as the result of the use of such additional information. Any checking performed by the Department will not relieve the Contractor of the responsibility for the final results.

The Department will be responsible for taking all measurements to establish both current estimate and final estimate pay quantities, including any horizontal and vertical control points necessary to complete such measurements. When making these measurements, the Engineer may use any points, stakes, lines, or elevations that have been set by the Contractor. Borrow pit layout and cross-sectioning of borrow pits will be the responsibility of the Department, except that the Department will not measure borrow pits when Compacted Embankment is included in the Contract and direct payment for borrow is not made. The Department will determine earthwork quantities according to Section 210.

(b) Contractor Requirements. Roadway Construction Control shall include use by the Contractor of the plans and the vertical and horizontal control points established by the Department as described above to perform all required construction surveying and layout. The Contractor shall make all necessary calculations and set all stakes including, but not limited to: centerline stakes; offset stakes; reference point stakes; additional bench marks as needed; slope stakes; pavement lines; curb lines; grade stakes; roadway drainage; pipe culverts; box culverts; underdrains; clearing and grubbing limits; guardrail; fence; blue tops for subgrade, subbase, and base courses; and any other points, lines, or elevations deemed necessary for proper control of the work.

All additional control points established by the Contractor shall be occupied, measured, and adjusted with direct survey measurements to the project control provided by the Engineer. These additional control points shall not be independent of the control provided by the Engineer. The additional control point horizontal coordinates shall have a positional accuracy of 20mm +20ppm

(1:50,000) and the elevations shall meet NGS 3rd order accuracy relative to the nearest control points provided by the Engineer.

On projects that include an ACHM overlay and/or Asphalt Surface Treatment, the Contractor shall mark the stationing by setting a stake at least every 200 feet (50 m) along the roadway. These stakes shall be placed on the shoulder or slope so that they will not interfere with the construction operations, but will be usable for determining locations along the roadway.

On projects with widening sections where a grade line is not shown on the plans, the Contractor shall profile the existing pavement at the centerline and edges of pavement. This profile data shall be furnished to the Department for the Department's use in the establishment of the finished grade line. This finished grade line will be furnished to the Contractor for use in computing and setting all grades required to construct the finished roadway section.

The Contractor shall be responsible for joining the work to contiguous roadways and/or bridges in an acceptable manner. This shall include making minor adjustments to the plan grade and/or typical section as necessary to construct a smooth transition from the new work to match the existing roadway.

The Contractor shall provide sufficient qualified personnel to complete the work accurately. The supervision of the Contractor's surveying and layout personnel shall be the responsibility of the Contractor, and any errors resulting from the operations of such personnel shall be adjusted or corrected by the Contractor at no cost to the Department.

The Contractor shall maintain adequate survey notes as the work progresses and make them available to the Engineer on request. Copies of survey notes designated by the Engineer shall be provided for the Department's permanent project records.

The Contractor shall be responsible for the accuracy and uniformity of the construction stakes, lines, grades, and layouts. Any errors in the work constructed due to errors in the Contractor's Roadway Construction Control shall be adjusted or corrected by the Contractor at no cost to the Department.

635.04 Method of Measurement. Roadway Construction Control will be measured as a complete unit.

635.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract lump sum price bid for Roadway Construction Control, which price shall be full compensation for furnishing and maintaining all necessary lines, grades, and measurements; and for furnishing all engineering personnel, equipment, materials, tools, and incidentals necessary to complete the work.

No adjustments in the lump sum price bid will be made for Roadway Construction Control required due to normal increases or decreases in Contract quantities. However, if the amount of Roadway Construction Control required is increased or decreased in connection with a Change Order, compensation will be adjusted accordingly.

Partial payments for Roadway Construction Control will be made in proportion to the amount of work accomplished on this item.

No additional payment will be made for re-staking needed to maintain the control.

Payment will be made under:

Pay Item	**Pay Unit**
Roadway Construction Control	Lump Sum

SECTION 636
BRIDGE CONSTRUCTION CONTROL

636.01 Description. When this item is included in the proposal, it shall consist of furnishing and maintaining all lines, grades, and measurements necessary for the proper execution of the work under the Contract, all according to the plans and specifications.

636.02 Materials. The Contractor shall furnish all stakes, templates, straightedges, surveying equipment, and other devices necessary for establishing, setting, checking, marking, and maintaining points, lines, grades, and layout of the work called for on the plans and in the specifications.

636.03 Construction Requirements. (a) Department Responsibilities. The Department will establish the bench marks and horizontal control points referenced on the plans, certified

correct by the Engineer, and furnish the data to the Contractor at the beginning of work. The Department will establish and stake and/or monument the right-of-way limits as shown on the plans.

Any additional information provided by the Department shall be verified by the Contractor before use and the Contractor shall accept full responsibility for any costs incurred as the result of the use of such additional information. Any checking performed by the Engineer will not relieve the Contractor of the responsibility for the final results.

The Department will be responsible for taking all measurements to establish both current estimate and final estimate pay quantities, including any horizontal and vertical control points necessary to complete such measurements. When making these measurements, the Engineer may use any points, stakes, lines, or elevations that have been set by the Contractor.

(b) Contractor Requirements. Bridge Construction Control shall include use by the Contractor of the plans and the vertical and horizontal control points established by the Department as described above to provide all required bridge construction surveying and layout. The Contractor shall make all necessary calculations and set all stakes including, but not limited to: centerline stakes; offset stakes; reference point stakes; control points; additional bench marks as needed; bridge piers, abutments, and footings; pile cutoff; pile layout; caps; bridge seats; anchor bolt layout; beam grades; girder or beam profiles; deck grades; screed elevations; and any other points, lines, or elevations deemed necessary for proper control of the work.

All additional control points established by the Contractor shall be occupied, measured, and adjusted with direct survey measurements to the project control provided by the Engineer. These additional control points shall not be independent of the control provided by the Engineer. The additional control point horizontal coordinates shall have a positional accuracy of 20mm +20ppm (1:50,000) and the elevations shall meet NGS 3rd order accuracy relative to the nearest control points provided by the Engineer.

The Contractor shall be responsible for joining the work to contiguous roadways and/or bridges in an acceptable manner. This shall include making minor adjustments to the grade and/or typical

section as necessary to provide a smooth connection between the new work and the existing construction.

The Contractor shall provide sufficient qualified personnel to complete the work accurately. The supervision of the Contractor's surveying and layout personnel shall be the responsibility of the Contractor, and any errors resulting from the operations of such personnel shall be adjusted or corrected by the Contractor at no cost to the Department.

The Contractor shall maintain adequate survey notes as work progresses and make them available to the Engineer on request. Copies of survey notes designated by the Engineer shall be provided for the Department's permanent project records.

The Contractor shall be responsible for the accuracy and uniformity of all construction stakes, lines, grades, and layouts. Any errors in the work constructed due to errors in the Contractor's Bridge Construction Control shall be adjusted or corrected by the Contractor at no cost to the Department.

636.04 Method of Measurement. Bridge Construction Control will be measured as a complete unit.

636.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract lump sum price bid for Bridge Construction Control, which price shall be full compensation for furnishing and maintaining all necessary lines, grades, and measurements; and for furnishing all engineering personnel, equipment, materials, tools, and incidentals necessary to complete the work.

No adjustments in the lump sum price bid will be made for Bridge Construction Control required due to normal increases or decreases in Contract quantities. However, if the amount of Bridge Construction Control required is increased or decreased in connection with a Change Order, compensation will be adjusted accordingly.

Partial payment for Bridge Construction Control will be made in proportion to the amount of work accomplished on this item.

No additional payment will be made for re-staking needed to maintain the control.

Payment will be made under:

Pay Item	Pay Unit
Bridge Construction Control	Lump Sum

SECTION 637
MAILBOXES

637.01 Description. This item shall consist of furnishing and erecting mailbox posts and installing existing mailboxes on the new posts according to the plans and these specifications. When required, it shall also include furnishing and installing new mailboxes.

637.02 Materials. The mailbox post shall be either metal or coniferous wood and shall be the size shown on the plans. Wood posts shall be pressure treated with creosote, pentachlorophenol or chromated copper arsenate. Metal posts shall be either galvanized or painted.

Mailbox support hardware, including shelf, platform and bracket shall be as shown on the plans. Anti-twist plate, clamps, spacers, nuts, bolts, and washers shall be painted or galvanized steel.

New mailboxes, when specified on the plans or directed by the Engineer, shall comply with the U.S. Postal Service and shall be the same size as the existing mailbox.

637.03 Construction Methods. Mailboxes shall be located on the right-hand side of the roadway in the direction of the delivery route. The bottom of the box shall be set at an elevation 3'-6" (1 m) above the roadway surface. The roadside face of the box shall be 6" (150 mm) from the edge of the shoulder or 6" (150 mm) from the face of the curb. Where a mailbox is located at a driveway entrance, it shall be placed on the far side of the driveway in the direction of the delivery route. Where a mailbox is located at an intersecting road, it shall be located a minimum of 100' (30 m) beyond the center of the intersecting road in the direction of the delivery route. If requested by the local postmaster, height and placement of mailboxes may vary slightly as directed by the Engineer.

No more than two mailboxes may be mounted on one post. Post spacing for multiple mailbox installations shall be a maximum of 36″ (1 m).

The mailbox post shall be embedded a minimum of 24" (600 mm) into the ground. A metal post shall have an anti-twist plate that extends no more than 10″ (250 mm) below the ground surface.

The existing mailbox shall be separated from the existing post and attached to the new post. If the existing mailbox is damaged beyond repair by the Contractor, the mailbox shall be replaced at no cost to the Department. If the existing mailbox cannot physically be removed from the existing post and re-used, the mailbox shall be replaced under the item Mailboxes. When a mailbox is replaced, the Contractor shall be responsible for placing identification markings on the new mailbox corresponding to the markings on the original mailbox.

Unless otherwise specified, all existing mailbox supports shall be removed and replaced with new supports. If directed by the Engineer the existing mailbox shall be restored under the Contract item Remove and Restore Mailboxes.

637.04 Method of Measurement. Mailbox Supports, Mailboxes, and Remove and Restore Mailboxes will be measured by the unit.

637.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per each for Mailbox Supports of the type specified, for Mailboxes, or for Remove and Restore Mailboxes, which price shall be full compensation for furnishing all materials: for setting posts; for removing and reattaching existing mailboxes; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Mailbox Supports (single)	Each
Mailbox Supports (double)	Each
Mailboxes	Each
Remove and Restore Mailboxes	Each

SECTION 638
PAINTING OF MISCELLANEOUS STEEL

638.01 General. Miscellaneous steel is normally all metal used on the project except that used in bridges. When painting of miscellaneous steel is specified, the Contractor may, at Contractor option, elect to use either the paint system specified for painting bridges on the project or the paint system specified in this Section. Existing bridge steel may also be painted by this system when specified in the plans and cleaned according to Subsection 820.05(b).

The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent pollution of rivers, streams, or impoundments. Painting and cleaning operations conducted over or in the vicinity of public waters shall be controlled to prevent materials or waste, considered a contaminant by the ADEQ, from falling into the water. Any material or waste that falls into the water or onto areas where there is a likelihood that it will be picked up by rising water levels shall be retrieved and properly disposed of in approved locations.

The Contractor shall protect pedestrian, vehicular, or other traffic against damage or disfigurement by drift, spatters, splashes, and smirches of paint or paint materials.

638.02 Aluminum Epoxy Paint System. This system shall consist of a two component, high solids, high build aluminum epoxy coating that will provide long term protection even when applied over marginally prepared steel. Marginally prepared steel is defined as steel that has been cleaned according to SSPC-SP 2 (Hand Tool Cleaning), SSPC-SP 3 (Power Tool Cleaning), or SSPC-SP 7 (Brush-Off Blast Cleaning). The coating shall be a one-coat system that is self priming, compatible with existing topcoats, and capable of being satisfactorily applied over tightly adhered rust.

The volume of the solids in the mixed material shall be 85% or greater when measured according to ASTM D 2697. The coating shall be capable of being applied in a single coat of at least 5 mils (125 μm) dry film thickness without sagging and shall have a minimum theoretical application rate of 1 gallon per 1,400 square feet (1 L/34 sq m) at 1 mil (25 μm) dry film thickness. Lead and chromium pigments will not be permitted. The paint manufacturer

shall provide certification that the paint provided meets the preceding requirements. Thinning will be allowed according to manufacturer's recommendations. The paint shall be one listed on the QPL.

638.03 Materials. (a) Qualitative Requirements. All coating systems shall meet the following general requirements:

(1) Condition in Container. Neither the paint nor the paint components shall show excessive settling, curdling, livering, caking, or color separation in a freshly opened can and shall be easily mixed to a smooth homogeneous state using a power mixer.

(2) Brushing or Spraying Properties. Paints shall brush or spray easily, possess good leveling properties, and show no running or sagging tendencies when applied by brush.

(3) Appearance. Paints shall dry to a smooth finish, free from roughness, grit, unevenness, and other surface imperfections.

638.04 Paint Film Thickness. The minimum dry film thickness of the coat shall be 5 mils (125 μm). Upon completion of the paint coat, a dry film thickness gauge shall be used by the Engineer for verification of paint thickness. Dry film thickness will be determined by methods described by the Steel Structures Painting Council. Any paint coat found to be deficient in paint thickness shall be repainted at no cost to the Department.

638.05 Application of Paint. Paint shall be applied according to the manufacturer’s recommendations including mixing, weather limitations, thinning, spraying, brushing, or rolling. The steel shall receive one coat applied either in the shop or in the field; however, any damaged paint shall be re-cleaned, if necessary, and re-painted prior to final acceptance. The color shall be Aluminum unless otherwise specified.

638.06 Removal of Unsatisfactory Paint. If any painting application produces a coat that is unsatisfactory to the Engineer, the paint shall be removed and the metal thoroughly cleaned and repainted.

638.07 Cleaning Surfaces. (a) General. Surfaces of metal to be painted shall be thoroughly cleaned by removing rust, loose mill scale, dirt, oil or grease, and other foreign substances. Unless

cleaning is accomplished by blast cleaning, all weld areas shall be neutralized with a proper chemical before cleaning is begun, after which it shall be thoroughly rinsed with water.

As a minimum, miscellaneous steel shall be cleaned by the Hand Tool (SSPC-SP 2), Power Tool (SSPC-SP 3), or Brush-Off Blast (SSPC-SP 7) cleaning methods as defined by the Structural Steel Painting Council. When applicable, bridge steel will be cleaned according to Subsection 820.05(b).

(b) Hand Tool Cleaning. The removal of rust, scale, and dirt shall be accomplished by the use of metal brushes, scrapers, chisels, hammers, or other effective means. Oil and grease shall be removed by the use of a suitable effective solvent. Bristle or wood fiber brushes shall be used for removing loose dust. Hand tool cleaning of structural steel surfaces shall provide a surface preparation conforming to SSPC-SP 2, Hand Tool Cleaning.

(c) Surfaces Inaccessible After Fabrication. The inside surfaces of boxed members and other surfaces that will be inaccessible to the cleaning operation after fabrication shall be cleaned before assembly.

638.08 Shop Painting. When shop painting is used, miscellaneous steel shall be painted before it is shipped from the plant.

Surfaces not in contact but that will be inaccessible after assembly or erection shall be painted before leaving the plant. Shop contact surfaces shall not be painted. Field contact surfaces shall receive a shop coat of the paint system. Field contact surfaces not painted with the shop coat shall be given a coat of approved lacquer or other protective coating if it is expected that there will be a prolonged period of exposure before erection.

Surfaces that will be in contact with concrete shall not be painted. Paint inadvertently sprayed on such surfaces need not be removed.

Miscellaneous steel that is to be welded shall not be painted before welding is complete. Steel that is to be field welded shall be given one coat of boiled linseed oil or other approved protective coating for 3″ (75 mm) either side of the field weld. The remainder of the member may be given the specified shop coat of the paint system.

Unless otherwise specified, surfaces of iron and steel castings, either milled or finished, shall be given one coat of the paint system.

With the exception of abutting joints and base plates, machine finished surfaces shall be coated with a graphite dry film lubricant or other approved coating. The coating shall be applied as soon as practicable after being accepted and before removal from the shop.

When steel is painted in the shop, erection and weight marks shall be painted upon surface areas that have previously been painted with the shop coat. Material shall not be loaded for shipment until it has thoroughly dried, and in no case less than 24 hours after the paint has been applied.

638.09 Field Painting. When erection work is complete, any adhering rust, scale, dirt, grease, or other foreign materials shall be removed as specified in Subsection 638.07.

On field bolts, welds, and surfaces where the shop paint has worn off or has otherwise become defective, the area shall be cleaned and thoroughly covered with one coat of field paint.

Contact surfaces to be bolted and surfaces that will be in contact with concrete shall not be painted. Surfaces that will be inaccessible after erection shall be painted before erection. Small cracks and cavities that were not sealed in a water-tight manner shall be filled with an additional application of paint.

The following provision shall apply to the application of field paint: To secure a maximum coating on edges of plates, shapes, bolts, and other parts subjected to special wear, the edges shall first be coated with a longitudinal motion and the bolts with a rotary motion followed immediately by the general painting of the whole surface, including the edges and bolts.

The Contractor shall, at no cost to the Department, take all precautions necessary to prevent dust and dirt from coming in contact with surfaces to be painted or with freshly painted surfaces.

The application of the field paint shall be deferred until the adjoining concrete work has been placed and finished. If concreting operations damage the paint applied in the shop, the damaged area shall be cleaned and re-painted.

638.10 Method of Measurement and Basis of Payment. Painting miscellaneous steel will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for the various items of the Contract.

SECTION 639
GUARDRAIL MOVED AND RECONSTRUCTED

639.01 Description. This item shall consist of the moving and reconstructing of existing guardrail and the installation of back-up plates on the reconstructed rail according to the Standard Drawings and these specifications at the locations shown on the plans or as directed by the Engineer.

639.02 Materials. Posts and rail that are not in a serviceable condition shall be replaced with new posts or rail of the same size and type of material removed. New posts, rail, and back-up plates shall comply with Section 617.

639.03 Construction Methods. The guardrail shall be removed and reconstructed as shown on the plans or as directed by the Engineer. The posts shall be thoroughly tamped into place and the rail firmly attached to the posts according to the standard drawings and specifications.

If the reconstructed rail is galvanized steel, any damaged areas shall be repaired according to Subsection 807.88.

All new material, including back-up plates, required to place the reconstructed guardrail in a satisfactory condition shall be furnished by the Contractor. The Contractor shall have the option of using new guardrail in lieu of reconstructing used guardrail.

If the Contractor elects to use new guardrail, the existing guardrail that is in a serviceable condition, as determined by the Engineer, shall become the property of the Department. The guardrail and posts shall be carefully removed to avoid damage and stacked in a neat stack at the project site. The guardrail and posts that are in a good condition will be picked up by Department forces. The remainder will become the property of the Contractor.

639.04 Method of Measurement. Guardrail Moved and Reconstructed will be measured by the linear foot (meter) complete in place. End sections will each be considered as 25 feet (7.5 m) in length. Intermediate sections will be measured along the roadway face from centerline of post to centerline of post.

639.05 Basis of Payment. Work completed and accepted under this item and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Guardrail Moved and Reconstructed, which price shall be full compensation for moving and reconstructing existing guardrail; for furnishing and installing additional materials, including back-up plates; for disposing of unusable materials; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Guardrail Moved and Reconstructed	Linear Foot (Meter)

SECTION 640
MODIFYING DROP INLETS AND JUNCTION BOXES

640.01 Description. This item shall consist of modifying existing drop inlets and/or junction boxes by removing the top and the walls to the dimensions shown on the plans, raising the walls if necessary, and constructing a new top and walls of the design shown on the plans.

640.02 Materials. New materials used in the grade adjustment shall comply with Subsection 609.02. The Department will perform all concrete acceptance sampling and testing at the frequencies shown for Contractor acceptance testing in Subsection 802.06.

640.03 Construction Requirements. Construction methods, as modified below, shall comply with Subsection 609.03, except that painting of existing rings and covers or grates and frames will not be required.

The existing rings and covers or grates and frames shall be removed in a manner to avoid breaking or cracking and cleaned of

old mortar before resetting at the specified elevation. Structures damaged because of the Contractor's negligence shall be repaired or replaced at no cost to the Department.

The existing top and walls shall be removed carefully to prevent damage to the walls that are to remain. Unless noted on plans to raise drop inlet or junction box, the existing flow line is to be maintained when the new top and walls are constructed. Any damage to the remaining walls shall be repaired to make them as strong and stable as before the removal in a manner approved by the Engineer. Any portions of pipe or box culvert requiring removal for the proposed modifications shall be done carefully to prevent damage or fracture of the structure to remain in place. Any damage due to the Contractor's negligence shall be repaired at no cost to the Department. The new walls or top for the structure shall be placed in a manner to bond them to the existing walls either by keying to the walls, placement of concrete grout or incorporating steel from the walls.

The area around the finished drop inlet or junction box shall be backfilled and compacted with material approved of by the Engineer. All debris from the existing top, walls, forms or other trash shall be removed and disposed of by the Contractor in accordance with Section 202.

640.04 Method of Measurement. Modifying Drop Inlets and Modifying Junction Boxes will be measured by the unit.

640.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid each for Modifying Drop Inlets or Modifying Junction Boxes, which price shall be full compensation for all excavation and backfill; for removing the existing top; lowering or raising the walls as required; reconstructing the top and walls; removal and disposal of all debris; compacting backfill material; and for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Modifying Drop Inlets	Each
Modifying Junction Boxes	Each

SECTION 641
WHEELCHAIR RAMPS

641.01 Description. This item shall consist of the construction of wheelchair ramps in accordance with these specifications and the Standard Drawings at the locations shown on the plans or as directed by the Engineer.

641.02 Materials. The concrete used shall meet the requirements for Class M Concrete as provided in Section 802. The maximum allowable slump shall be 4 inches (100 mm). The maximum water-cement ratio for the mix selected shall not be exceeded. The Department will perform all acceptance sampling and testing at the frequencies shown for Contractor acceptance testing in Subsection 802.06.

The cast-in-place tactile panels used shall be composed of a vitrified polymer composite material. The color of the tactile panels shall conform to Federal Color No. 33538, and shall be homogeneous throughout the product. The tactile panels shall be cast into the wet concrete. Surface applied products shall not be allowed. The cast-in-place tactile panels shall meet the size and spacing requirements shown in the plans.

641.03 Construction Requirements. When a wheelchair ramp is to be constructed on an existing sidewalk, any items that are planned to be retained but are damaged during the removal or construction operations shall be repaired at no cost to the Department.

Wheelchair Ramps shall be constructed in accordance with Subsection 633.03 and the Standard Drawing WR-1.

The concrete island portion of the ramps shall be constructed in accordance with Subsection 632.03 and Standard Drawing DR-1.

The cast-in-place tactile panels shall be installed into the wet concrete per the manufacturer's specifications and in accordance with Standard Drawing WR-1.

641.04 Method of Measurement. Wheelchair Ramps will be measured by the square yard (square meter).

641.05 Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit

price bid per square yard (square meter) for Wheelchair Ramps of the type specified, which price shall be full compensation for excavation and backfilling; for furnishing materials including joint filler; for constructing the wheelchair ramp, including the concrete island; for furnishing and placing cast-in-place tactile panels; and for all equipment, tools, labor, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Wheelchair Ramps (Type __)	Square Yard (Square Meter)

SECTION 642
RUMBLE STRIPS

642.01 Description. This item shall consist of constructing rumble strips on asphalt shoulders or Portland cement concrete shoulders according to these specifications and conforming to the details shown on the plans.

642.02 Equipment. The equipment used for cutting rumble strips shall consist of a rotary-type cutting head of such size to produce cuts of the dimensions shown on the plans. The cutting tool shall be equipped with guides to provide consistent alignment for each cut in relation to the roadway and to provide uniformity and consistency throughout the project. The cutting head shall have the cutting tips arranged in a pattern that will produce a relatively smooth cut (approximately 1/16″ [2 mm] between peaks and valleys). The cutting head(s) shall be suspended from the power unit in a manner that will allow the tool to self-align itself with the slope of the shoulder and/or any irregularities in the shoulder surface.

642.03 Construction Requirements. (a) Rumble Strips in Asphalt Shoulders. The rumble strips shall be cut in the existing shoulders at the locations shown on the plans or as designated by the Engineer. Prior to commencement of the work, the Contractor shall demonstrate to the Engineer the ability to achieve the desired results without damaging the existing pavement.

At the end of each working day, all equipment shall be removed roadway or parked no closer than 30′ (15 m) from the traveled lane. The pavement shall be thoroughly cleaned by sweeping or flushing. All excess material shall be disposed of in a manner approved by the Engineer.

(b) Rumble Strips in Portland Cement Concrete Shoulders. The Contractor shall have the option of cutting the rumble strips according to the above requirements or forming the rumble strips in the fresh concrete according to the requirements of Section 506.

642.04 Method of Measurement. (a) Rumble Strips in Asphalt Shoulders. Rumble Strips in Asphalt Shoulders will be measured by the linear foot (meter) longitudinally along the shoulder on which the rumble strips are constructed.

(b) Rumble Strips in Portland Cement Concrete Shoulders. Rumble Strips in Portland Cement Concrete Shoulders will be measured by the linear foot (meter) longitudinally along the shoulder on which the rumble strips are constructed.

642.05 Basis of Payment. (a) Rumble Strips in Asphalt Shoulders. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Rumble Strips in Asphalt Shoulders, which price shall be full compensation for constructing the rumble strips; for cleaning the pavement; for disposing of excess material; and for all labor, equipment, tools and incidentals necessary to complete the work.

(b) Rumble Strips in Portland Cement Concrete Shoulders. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot (meter) for Rumble Strips in Portland Cement Concrete Shoulders, which price shall be full compensation for constructing the rumble strips; for cleaning the pavement; for disposing of excess material; and for all labor, equipment, tools and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Rumble Strips in Asphalt Shoulders	Linear Foot (Meter)
Rumble Strips in Portland Cement Concrete Shoulders	Linear Foot (Meter)

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