

SECTION 600 INCIDENTAL CONSTRUCTION



Section 601 - Mobilization

DESCRIPTION

601.01
Work This work shall consist of preparatory work and operations necessary for the movement of personnel, equipment, supplies, and incidentals to the project site, and for all other work and operations that must be performed or that cause costs to be incurred prior to beginning work on the various items on the project site.

MEASUREMENT

601.02
Method The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

PAYMENT

601.03
Basis Mobilization will be paid for at the contract unit price for the item as shown in the SCHEDULE OF ITEMS.

Progress payments will be made as follows:

(a) When 5 percent or more of the original contract amount is earned from other pay items, 50 percent of the amount for mobilization, or 5 percent of the original contract amount, whichever is less, will be paid.

(b) When 10 percent or more of the original contract amount is earned from other pay items, 100 percent of the amount for mobilization, or 10 percent of the original contract amount, whichever is less, will be paid.

(c) Upon completion of all work on the project, any unpaid amount for mobilization will be paid.

The total of all payments, including bonding, shall not exceed the original contract amount for this item.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
601(01) Mobilization	L.S.

Section 602 - Minor Concrete Structures

DESCRIPTION

602.01 This work shall consist of constructing reinforced or
Work unreinforced minor concrete structures.

MATERIALS

602.02 Materials shall meet the requirements of the following Subsections:
Requirements

Mortar	701.03
Portland Cement	701.01
Aggregate	703.01(c)
Reinforcing Steel	709.01
Curing Materials	711.01
Air-Entraining Admixtures	711.02
Water	712.01
Fly Ash	712.14

602.03 The concrete composition method shall be as shown in the SCHEDULE
Concrete Composition OF ITEMS.

Method A. A mix design showing the proposed weights of aggregate, water, and cement per cubic yard of concrete shall be furnished to the Engineer. Cement, aggregate, and water shall be proportioned to obtain concrete with good workability. Slump shall not be more than 4 inches as determined by AASHTO T 119. Air-entrainment shall be 5 percent plus or minus 1 percent as determined by AASHTO T 152 or T 196.

The concrete shall develop a 28-day minimum compressive strength of 3,000 psi unless otherwise SHOWN ON THE DRAWINGS. Concrete for specimens shall be furnished by the contractor at no cost to the Government. Strength will be determined by test cylinders made and cured in accordance with AASHTO T 23 and tested in accordance with AASHTO T 22.

Failure of any test cylinder for any structural element tested will be considered evidence of noncompliance with the strength requirement of this specification.

Method B. The contractor shall submit for approval the following information:

- (a) The type, grading, and sources of aggregate.
- (b) Type and source of cement, blended cement, or fly ash.
- (c) Proposed scale weights of each aggregate in pounds per cubic yard of concrete.
- (d) Proposed quantity of water in pounds per cubic yard of concrete.
- (e) Proposed quantity of cement in pounds per cubic yard of concrete.
- (f) Admixtures.
- (g) Air content.
- (h) Slump.
- (i) 28-day compressive strength.

The concrete shall contain not less than 5.5 sacks of cement per cubic yard. Slump shall not be more than 4 inches as determined by AASHTO T 119.

When a commercial supplier is used, the contractor shall furnish a certification with each truckload of concrete certifying that the material and mix proportions used are in conformance with the approved mixture.

Method C. The concrete shall be made using a dry, preproportioned, blended, and bagged mix meeting the requirements of ASTM C 387 and mixed at the jobsite in accordance with the manufacturer's recommendations.

Fly Ash or Pozzolan Modified Concrete - Fly ash, at the contractor's option, may be substituted for cement at the rate of 1.2 pounds of fly ash for 1.0 pounds of Portland cement. After substitution, design aggregate volumes shall be reduced by an amount equal to the net increase in volume of the combined cement and fly ash. Not less than 10 percent nor more than 20 percent of the weight of Portland cement required may be replaced with fly ash at the above rate. For purposes of controlling the maximum water/cement ratio of 0.49, the water/cement ratio for fly ash modified concrete shall be the ratio of the weight of water to the combined weights of Portland cement and 60 percent of the weight of the fly ash.

The standard 28-day curing period for compressive strength tests shall be extended for fly ash modified concrete by 1 day (rounded to the nearest whole day) for each 1.5 percent of Portland cement replaced with fly ash at the selected rate. (Example: If the maximum of 20 percent cement is replaced, the curing period for cylinders would be 41 days.)

CONSTRUCTION

602.04 Forms

Forms shall be designed and constructed so they can be removed without damaging the concrete. They shall be free of bulge and warp, and constructed so the finished concrete shall be of the form and dimensions SHOWN ON THE DRAWINGS and true to line and grade. Concrete may be placed without forms where SHOWN ON THE DRAWINGS.

Forms for concrete containing a retarding admixture, fly ash, or other pozzolan replacement for cement shall be designed to contain the lateral pressures exerted by the full anticipated height of fluidized concrete, unless documented information in regard to initial set is provided by the manufacturer.

602.05 Placing Concrete

All reinforcing steel shall be placed in position SHOWN ON THE DRAWINGS and securely held in place by approved supports during placing of concrete. Concrete shall not be placed until the grading, forms, and steel reinforcements have been inspected and approved by the Engineer. The contractor shall give the Engineer 24 hours notice prior to placement of any concrete.

Method A & B concrete shall be discharged into the forms within 1-1/2 hours after the introduction of the cement to the aggregate. Method C concrete shall be discharged into the forms within 1-1/2 hours after the introduction of water to the mixture. Retempering concrete shall not be permitted. The cement shall be added to the mixer at the jobsite whenever this condition cannot be met, or when required in the SPECIAL PROJECT SPECIFICATIONS. Concrete shall not be mixed or placed when the daily minimum atmospheric temperature is, or is expected to be, less than 40 °F unless adequate provisions are made to protect the concrete.

Concrete shall be placed to avoid segregation. High-frequency internal vibrators shall be used for consolidating concrete in the forms. Vibrators shall be operated to produce concrete free of voids, but shall not be held so long in one place as to result in segregation or formation of laitance on the surface.

Method C concrete shall be placed in forms and may be rodded instead of internally vibrated as necessary to remove voids.

The use of aluminum pipe, conduit, or troughs for transporting concrete will not be permitted. When concrete is pumped, sampling shall be from the discharge stream at the point of placement.

602.06
Finishing

(a) Formed Surfaces. Unless otherwise SHOWN ON THE DRAWINGS, all fins and irregular projections exceeding 1/4 inch shall be removed from the exposed surfaces. Holes produced by removal of form ties shall be filled with dry-pack mortar or other approved patching compounds.

(b) Unformed Surfaces. Unformed surfaces shall be struck off with a straight-edge and finished to a smooth uniform texture by floating and traveling. Final finish of the surface will be as SHOWN ON THE DRAWINGS.

602.07
Curing Concrete

Beginning immediately after finishing, all concrete shall be cured a minimum of 7 days or, if high early strength cement is used, a minimum of 3 days. For fly ash modified concrete placed in structures, the required moisture controlled curing period shall be:

<u>Percentage of Cement Replaced by Weight</u>	<u>Required Curing Period</u>
10%	9 days
11-15%	10 days
16-20%	11 days

For cold weather concreting, controlled temperature shall be maintained for the required curing period. The above requirement for an extended curing period may be waived if a compressive strength of 65 percent of the specified 28-day design strength is achieved in 6 days.

Curing shall be accomplished to maintain a minimum concrete temperature of 40 °F and to maintain concrete in a continuously moist condition. Concrete shall be maintained in a moist condition by supplying additional moisture or by preventing moisture loss.

Acceptable methods of supplying additional moisture are by ponding or sprinkling, and covering with burlap cloth maintained in a saturated condition. Surfaces SHOWN ON THE DRAWINGS may be covered with saturated sand or 6 inches of saturated hay or straw to retain moisture.

Acceptable methods of preventing moisture loss are by applying liquid membrane-forming compounds, or waterproof paper or polyethylene sheet materials. Liquid membrane-forming compounds shall be applied by spraying at the coverage rates and patterns recommended by the manufacturer. Sheet materials shall have overlapped sealed joints and form a complete waterproof cover over the entire concrete surface.

602.08
Backfilling

Backfilling shall be in accordance with Subsection 206A.05.

602.09
(Reserved)

MEASUREMENT

602.10
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

PAYMENT

602.11
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
602(01) Concrete Method A	C.Y.
602(02) Concrete Method B	C.Y.
602(03) Concrete Method C	L.S.

Section 603 - Metal Pipe

DESCRIPTION

603.01
Work This work shall consist of furnishing and installing, or installing only, metal pipe and pipe appurtenances, including all bedding and backfilling required to complete the work. The term metal refers to aluminum, and steel.

MATERIALS

603.02
Requirements Materials shall meet the requirements of the following Subsections:

Flexible Plastic Gaskets	705.09
Corrugated Steel Pipe and Pipe Arches.	707.01
Bituminous-Coated Corrugated Steel Pipe and Pipe Arches	707.02
Polymeric-Precoated Steel Pipe, Pipe Arches, and Underdrains	707.03
Corrugated Aluminum Alloy Culvert Pipe	707.06
Bituminous-Coated Corrugated Aluminum Alloy Culvert Pipe	707.08
Rubber Gaskets	705.03
Aluminum-Coated Type 2 Corrugated Steel Pipe and Pipe Arches	707.13
Aluminum-Zinc Coated Corrugated Steel Pipe and Pipe Arches	707.14
Bituminous-Coated Polymeric-Precoated Steel Pipe, Pipe Arches and Underdrains	707.15

Bedding material shall meet the requirements of Subsection 603.04.

Backfill materials shall meet the requirements of Subsection 603.08.

Damaged spelter coating caused by welding, field cutting, or mishandling shall be cleaned and painted as specified in AASHTO M 36.

End sections shall be constructed of a material meeting the requirements of AASHTO M 218 or AASHTO M 36.

Bituminous-coated end sections shall be coated to meet the requirements of AASHTO M 243 or AASHTO M 190.

The materials used in each pipe installation shall be compatible with each other to prevent electrolysis or physical failure.

Either annular or helical pipe corrugations will be acceptable; and helical corrugated pipe containing annular rerolled ends may be used in conjunction with annular pipe of like or compatible materials.

A fabricators Certification shall be furnished certifying that the sheet and pipe fabrication are in accordance with AASHTO M 36, M 196, and M 245 as applicable. The Certification shall be submitted prior to installation of the pipe.

The lengths and locations of individual pipe SHOWN ON THE DRAWINGS are approximate. Pipe shall not be ordered until culvert locations are DESIGNATED ON THE GROUND and a written list of the correct lengths is issued by the Engineer.

CONSTRUCTION

603.03
Excavation Excavation shall be in accordance with the requirements of Section 206A.

Pipe that is installed in or that will affect streams SHOWN ON THE DRAWINGS as important fisheries shall be installed only during those periods SHOWN ON THE DRAWINGS.

603.04
Bedding

Bedding shall consist of bedding the pipe to a depth of not less than 10 percent of its total height. The foundation surface, after excavation in accordance with Subsection 206A.03 (b), shall be compacted in accordance with Subsection 603.08 and shaped to fit the pipe.

The bedding material shall be selected mineral soil meeting the requirements for backfill in Subsection 603.08. The completed bedding shall have a longitudinal camber when SHOWN ON THE DRAWINGS.

603.05
Laying Pipe

The lower segment of the pipe shall be in contact with the bedding for the required depth throughout its entire full length. Outside circumferential laps shall be placed facing upstream.

Paved or partially lined pipe shall be laid so the longitudinal centerline of the paved segment coincides with the flowline. Elliptical pipe shall be placed with the major axis within 5 degrees of a vertical plane through the longitudinal axis of the pipe.

The final installed alignment shall be such that no reverse grades exist and no point shall vary from a straight line drawn from inlet to outlet by more than 2 percent horizontally and vertically of the culvert length or 1 foot, whichever is less, unless otherwise SHOWN ON THE DRAWINGS.

No pipe shall be placed in service until a suitable outlet is provided.

Helically corrugated lock-seam pipe shall be installed with the seam at the inlet end placed below the horizontal centerline. This requirement applies to the outlet end when the outlet is less than 5 feet below subgrade.

Longitudinal laps on riveted or spot-welded pipe shall be positioned at any location between 45 degrees above or below horizontal.

603.06
Joining Pipes

Pipe shall be firmly joined by form-fitting coupling bands. End sections shall be attached to pipe by connecting bands or other means as recommended by the manufacturer. Gaskets shall be installed at each joint to form a watertight connection when SHOWN ON THE DRAWINGS. Dimpled bands shall not be used when the slope of the pipe is greater than 15 percent.

The coupling bands shall meet the strength requirements of field joints for Non-Erodible Soil Condition--Special Joint Type according to Division II, Section 23 of the "Standard Specifications for Highway Bridges" by AASHTO.

603.07
Shop Elongation

When SHOWN ON THE DRAWINGS, the vertical diameter of round pipe shall be increased 5 percent by shop elongation.

603.08
Backfilling

Pipe meeting any of the following conditions shall not be placed or backfilled until the excavation and foundation have been approved by the Engineer:

- (a) Embankment height greater than 10 feet at subgrade centerline.
- (b) Installation in a live stream.
- (c) Round pipe with a diameter of 48 inches or greater.
- (d) Pipe arches with a span of 50 inches or greater.

After the bedding is prepared and the pipe is placed, selected material shall be placed in layers not exceeding 6 inches loose thickness and compacted under the haunches and alongside the pipe. The material shall be readily compactible material free of frozen lumps, chunks of highly plastic clay (Plasticity Index greater than 10), or other objectionable material. Rocks larger than 3 inches in greatest dimension shall not be used within 1 foot of the pipe. On each side of the pipe there shall be an area of compacted material at least as wide as one diameter of the pipe. Backfill shall be compacted without damaging or displacing the pipe. The density shall be Method A or B as shown in the SCHEDULE OF ITEMS.

Method A. Backfill density shall exceed the density of the surrounding embankment.

Method B. Backfill density shall exceed 95 percent of the maximum density as determined by AASHTO T 99-Method C or D.

Backfilling and compacting shall be continued until the backfill is a minimum of 12 inches above the top of the culvert.

After being bedded and backfilled, pipe shall be protected by an adequate cover of embankment before heavy equipment is permitted to cross during roadway construction.

Pipe distorted more than 5 percent of nominal dimensions, ruptured, or broken shall be replaced.

603.09
(Reserved)

MEASUREMENT

603.10 The method of measurement, as described in Section 106, will be
Method DESIGNATED in the SCHEDULE OF ITEMS.

When shown in the SCHEDULE OF ITEMS, backfill material adjacent to the pipe will be measured 1 foot horizontally and vertically from the outside dimensions of the pipe with a deduction for the volume of the pipe along the full length of the backfill.

PAYMENT

603.11 The accepted quantities will be paid for at the contract unit price
Basis for each pay item shown in the SCHEDULE OF ITEMS.

Payment will made under:

<u>Pay Item</u>	<u>Pay Unit</u>
603(01) ___-Inch Corrugated Metal Pipe, ___ ___-Inch Thickness for Steel or ___-Inch Thickness for Aluminum, Method ___	L.F.
603(02) ___-Inch Span, ___-Inch Rise, Corrugated Metal Pipe Arch, ___-Inch Thickness for Steel, or ___-Inch Thickness for Aluminum, Method ___	L.F.
603(03) ___-Inch Metal End Section	EA.
603(04) ___-Inch Span, ___-Inch Rise Metal End Section	EA.
603(05) ___-Inch Corrugated Steel Pipe, ___-Inch Thickness, Method ___	L.F.
603(06) ___-Inch Span, ___ ___-Inch Rise, Corrugated Steel Pipe Arch, ___ ___-Inch Thickness, Method ___	L.F.

603(07)	____-Inch Steel End Section	EA.
603(08)	____-Inch Span, ____-Inch Rise Steel End Section	EA.
603(09)	____-Inch ____ Type ____ Coated Corrugated Steel Pipe, ____-Inch Thickness, Method ____	L.F.
603(10)	____-Inch, ____ Type ____ Coated Paved Invert, Corrugated Steel Pipe, ____-Inch Thickness, Method ____	L.F.
603(11)	____-Inch Span, ____-Inch Rise, ____ Type ____ Coated Corrugated Steel Pipe Arch, ____-Inch Thickness, Method ____	L.F.
603(12)	____-Inch ____ Type ____ Coated Steel End Section	EA.
603(13)	____-Inch Span, ____-Inch Rise, ____ Coated Steel End Section	EA.
603(14)	____-Inch Corrugated Aluminum Pipe, ____-Inch Thickness, Method ____	L.F.
603(15)	____-Inch Paved Invert Corrugated Aluminum Pipe, ____-Inch Thickness, Method ____	L.F.
603(16)	____-Inch Span, ____-Inch Rise, Corrugated Aluminum Pipe Arch, ____-Inch Thickness, Method ____	L.F.
603(17)	____-Inch Aluminum End Section	EA.
603(18)	____-Inch Span, ____-Inch Rise Aluminum End Section	EA.
603(19)	Pipe Elbow, ____-Inch Diameter, ____-Inch Thickness	EA.
603(20)	Branch Connection, ____-Inch Diameter, ____-Inch Thickness	EA.
603(21)	Furnishing and Placing Backfill Material for Pipe	C.Y.

When materials are furnished by the Forest Service, the note "Government-furnished materials" will be added to the description of the pay item.

Section 603A - Concrete Pipe

DESCRIPTION

603A.01 This work shall consist of furnishing and installing, or
Work installing only, concrete pipe and pipe appurtenances, including
all bedding and backfilling required to complete the work.

MATERIALS

603A.02 Materials shall meet the requirements specified in the following
Requirements Subsections:

Flexible Plastic Gaskets	705.09
Bituminous Mastic	705.10
Reinforced Concrete Pipe	706.02
Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe	706.14
Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe	706.15
Rubber Gaskets	705.03
Plastic Gaskets	705.11

End sections shall be constructed of the same material as the main section of the pipe.

Bedding material shall conform to the requirements of Subsection 603A.04. Backfill material shall conform to the requirements of Subsection 603A.06, or as SHOWN ON THE DRAWINGS.

The lengths and locations of individual pipe SHOWN ON THE DRAWINGS are approximate. Pipe shall not be ordered until culvert locations are DESIGNATED on the ground and a written list of the correct lengths is issued by the Engineer.

CONSTRUCTION

603A.03 Excavation shall be in accordance with the requirements of
Excavation Section 206A. The trench shall be excavated a minimum of
4 inches below grade.

Pipe that is installed in or that will affect streams that are SHOWN ON THE DRAWINGS as important fisheries shall be installed only during those periods SHOWN ON THE DRAWINGS.

603A.04 Unless otherwise SHOWN ON THE DRAWINGS, the method of bedding
Bedding shall consist of backfilling the trench with bedding material to grade. Bedding material shall extend to a minimum height of one-sixth the pipe diameter above the bottom of the pipe, and compacted in accordance with Subsection 603A.06.

Bedding material shall consist of select excavated material from the roadway in the vicinity of the pipe or material from the source SHOWN ON THE DRAWINGS. The material shall contain no rocks exceeding 1 inch in maximum size. The bedding surface shall provide a foundation of uniform density and support throughout the entire length of the pipe, shall provide for camber as SHOWN ON THE DRAWINGS, and shall have recesses shaped to receive the bell of bell and spigot pipe.

603A.05 No pipe shall be placed or backfilled until the excavation and
Placing & Joining foundation have been approved by the Engineer and a suitable outlet has been provided. The bell or groove ends shall face upstream. The pipe section shall be joined so that the inner surfaces are reasonably flush and even, and the ends are entered as required. Joints shall be made with either a cold applied bituminous mastic, rubber, or plastic ring gaskets as SHOWN ON THE DRAWINGS. When using mastic material, the joints shall be filled with the material prior to joining the pipe.

603A.06
Backfilling

Backfill shall be readily compactible material free from frozen lumps and chunks of highly plastic clay or other objectionable material. No rock larger than 3 inches in greatest dimension shall be used within 1 foot of the pipe.

Backfill material shall be placed at or near optimum moisture content and compacted in layers not exceeding 6 inches loose thickness on both sides and to an elevation of 1 foot above the top of the pipe. Care shall be exercised to thoroughly compact the backfill under the haunches of the pipe. The backfill shall be brought up evenly on both sides of the pipe for the full length. The width of backfill on each side of the pipe shall be equal to the diameter of the pipe.

The backfill shall be compacted to at least 95 percent of the maximum density as determined by AASHTO T 99, Method C or D, unless otherwise SHOWN ON THE DRAWINGS.

Density of the compacted material will be determined during the process of the work in accordance with AASHTO T 191, T 205, or T 238; AASHTO T 217, T 239, or T 255. Corrections for coarse particles may be made in accordance with AASHTO T 224.

The final installed alignment of all pipe shall be such that no reverse grades exist, and horizontal and vertical alignments do not vary from a straight line drawn from center of inlet to center of outlet by more than 2 percent of pipe center length or 1 foot, whichever is less.

603A.07
(Reserved)

MEASUREMENT

603A.08
Method

The method of measurement, as described in Section 106, will be DESIGNATED on the SCHEDULE OF ITEMS.

When shown in the SCHEDULE OF ITEMS, backfill material adjacent to the pipe will be measured 1 foot horizontally and vertically from the outside dimensions of the pipe, with a deduction for the volume of the pipe along the full length of the backfill.

PAYMENT

603A.09
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown on the SCHEDULE OF ITEMS. Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
603A(01) <u> </u> -Inch, Reinforced Concrete Pipe, Class <u> </u>	L.F.
603A(02) <u> </u> -Inch Span, <u> </u> -Inch Rise Reinforced Concrete Pipe, Class <u> </u>	L.F.
603A(03) <u> </u> -Inch, Reinforced Concrete End Section . .	EA.
603A(04) <u> </u> -Inch Span, <u> </u> -Inch Rise Reinforced Concrete End Section	EA.
603A(05) Furnishing and Placing Backfill Material for Pipe	C.Y.

When materials are furnished by the Forest Service, the note "Government-furnished materials" will be added to the description of the pay item.

Section 603B - Corrugated Polyethylene Pipe

DESCRIPTION

603B.01 Work This work shall consist of furnishing and installing, or installing only, polyethylene pipe and pipe appurtances, including all bedding and backfilling required to complete the work.

MATERIALS

603B.02 Requirements Materials shall meet the requirements of the following Subsections:

Corrugated Polyethylene Pipe, 12- to 24-Inch Diameter	706.20
Rubber Gaskets	705.03

Bedding material shall meet the requirements of Subsection 603B.04, or as SHOWN ON THE DRAWINGS.

Backfill materials shall meet the requirements of Subsection 603B.06, or as SHOWN ON THE DRAWINGS.

The lengths and locations of individual pipe SHOWN ON THE DRAWINGS are approximate. Pipe shall not be ordered until culvert locations are DESIGNATED on the ground and a written list of the correct lengths is issued by the Engineer.

CONSTRUCTION

603B.03 Excavation Excavation shall be in accordance with the requirements of Section 206A. The excavation shall be a minimum of 8 inches below the designed invert elevation.

Pipe that is installed in or that will affect streams that are SHOWN ON THE DRAWINGS as important fisheries shall be installed only during those periods SHOWN ON THE DRAWINGS.

603B.04 Bedding Bedding shall consist of placing bedding material in the excavated section and compacting the material to ensure a uniform foundation bed for the pipe.

The bedding material shall be selected mineral soil meeting the requirements for backfill in Subsection 603B.06.

The completed bedding shall have a longitudinal camber when SHOWN ON THE DRAWINGS.

603B.05 Placing & Joining Pipe shall be firmly jointed by form-fitting corrugated coupling bands matching the pipe corrugations. Rubber gaskets shall be on each joint to form a watertight connection when SHOWN ON THE DRAWINGS.

Protection of portions of the pipe that will be exposed shall be accomplished when SHOWN ON THE DRAWINGS.

The final installed alignment shall be such that no reverse grades exist and no point shall vary from a straight line drawn from center of inlet to center of outlet by more than 2 percent horizontally and vertically of the culvert length or 1 foot, whichever is less, unless otherwise SHOWN ON THE DRAWINGS.

Pipe meeting any of the following conditions shall have the pipe bed approved by the Engineer prior to placing the pipe:

- (a) Embankment height greater than 10 feet at subgrade centerline.
- (b) Installation in a live stream.

603B.06 Backfilling Backfill shall be readily compactible material, free from frozen lumps and chunks of highly plastic clay (plasticity index greater

than 10) or other objectionable material. No rocks larger than 1 inch in greatest dimension shall be used within 1 foot of the pipe.

Backfill material shall be placed at or near optimum moisture content and compacted in layers not exceeding 6 inches loose thickness on both sides and to an elevation of 1 foot minimum above the top of the pipe. Care shall be exercised to thoroughly compact the backfill under the haunches of the pipe. The backfill shall be brought up evenly on both sides of the pipe for the full length. The width of the compacted backfill shall extend a minimum of 1 foot on each side of the pipe.

The density shall be Method A or B as shown in the SCHEDULE OF ITEMS.

Method A. Backfill density shall exceed the density of the surrounding embankment.

Method B. Backfill density shall exceed 95 percent of the maximum density as determined by AASHTO T 99, Method C or D.

After being bedded and backfilled, pipe shall be protected by an adequate cover of embankment before heavy equipment is permitted to cross during roadway construction.

Pipe distorted more than 5 percent of nominal dimensions, ruptured, or broken shall be replaced.

603B.07
(Reserved)

MEASUREMENT

603B.08
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

When shown in the SCHEDULE OF ITEMS backfill material adjacent to the pipe will be measured 1 foot horizontally and vertically from the outside dimensions of the pipe with a deduction for the volume of the pipe along the full length of the backfill.

PAYMENT

603B.09
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown on the SCHEDULE OF ITEMS. Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
603B(01) -Inch, Corrugated Polyethylene Pipe Method A	L.F.
603B(02) -Inch, Corrugated Polyethylene Pipe Method B	L.F.
603B(03) Furnishing and Placing Backfill Material for Pipe	C.Y.

When materials are furnished by the Forest Service, the note "Government-furnished materials" will be added to the description of the pay item.

Section 604 - Manholes, Inlets, & Catch Basins

DESCRIPTION

604.01 This work shall consist of the construction and installation of
Work manholes, inlets, and catch basins.

MATERIALS

604.02 Concrete shall meet the requirements of Section 602. Concrete
Requirements composition shall be Method A or B as SHOWN ON THE DRAWINGS.
Other materials shall meet the requirements of the following
Subsections:

Clay or Shale Brick	704.01
Concrete Brick	704.02
Concrete Masonry Blocks	704.03
Joint Fillers	705.01
Joint Mortar	705.02
Rubber Gaskets	705.03
Zinc Oxide Paint	708.03
Reinforcing Steel	709.01
Welded Wire Fabric	709.01
Precast Concrete Units	712.07
Frames, Grates and Covers, and Ladder Rungs	712.08
Corrugated Metal Units	712.09

Welding shall be done in accordance with the best modern practice and applicable requirements of AWS D1.1.

Metal drop inlets shall be fabricated of the same type of material and shall have the same coatings as the culvert on which they are to be placed.

CONSTRUCTION

604.03 Concrete construction shall meet the requirements of Section 602.
Performance Concrete units may be cast-in-place or precast.

Joints for precast concrete manhole sections shall be made with Portland cement mortar, rubber gaskets, mastic joint fillers, or by a combination of these types to form a water-tight seal.

Metal frames shall be set in a full mortar bed. Pipe sections smaller in diameter than the structure shall be flush on the inside of the structure wall and project outside enough for proper connection with the next pipe section. Pipe sections larger in diameter than the structure shall be constructed as monolithic tee sections. Masonry shall fit neatly and tightly around the pipe.

When grade adjustment of existing structures is required, the frames, covers, and gratings shall be removed and the walls reconstructed as required. The cleaned frames shall be reset at the required elevation. After completion, each structure shall be cleaned of any accumulation of silt, debris, or other foreign matter and kept clean of these accumulations.

Excavation and backfill shall be in accordance with Section 206A.

MEASUREMENT

604.04 The method of measurement, as described in Section 106, will be
Method DESIGNATED in the SCHEDULE OF ITEMS.

Manholes, inlets, and catch basins, new and reconstructed, will be divided into two types.

Type 1. Structures connected to pipe 42 inches or less in diameter, regardless of the pipe skew.

Type 2. Structures connected to pipe 48 inches in diameter or larger, regardless of the pipe skew.

"Manhole Additional Depth" will be in linear feet, and is defined as that depth exceeding the upper 6 feet. "Manhole Additional Depth" shall be classed as follows:

(a) Class 1. Manholes 10 linear feet or less in depth.

(b) Class 2. Manholes exceeding 10 linear feet but not exceeding 20 linear feet in depth.

PAYMENT

604.05
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
604(01) Manhole, Type _____	EA.
604(02) Inlets, Type _____	EA.
604(03) Catch Basins, Type _____	EA.
604(04) Manhole, Type _____, Additional Depth, Class _____	L.F.

Section 605 - Underdrains

DESCRIPTION

605.01 Work This work shall consist of furnishing and installing, or installing only, underdrains using geotextile, pipe, and granular filter material; underdrain pipe outlets; and blind drains using granular filter material, with or without geotextile.

MATERIALS

605.02 Requirements Materials shall meet the requirements of the following Section or Subsections:

Granular Backfill Filter Material	703.01(b)
Perforated Concrete Pipe	706.03
Drain Tile	706.04
Porous Concrete Pipe	706.05
Clay Pipe	706.07
Cradle Invert Clay Pipe	706.09
Asbestos Cement Pipe	706.10
Perforated Asbestos Cement Pipe	706.11
Bituminized-Fiber Pipe	706.12
Perforated Bituminized-Fiber Pipe	706.13
Polyvinylchloride (PVC) Drainage Pipe (Slot Perforated or Nonperforated)	706.17
Corrugated Polyethylene (PE) Drainage Pipe (Slot Perforated or Nonperforated)	706.18
Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings	706.19
Polymeric-Precoated Steel Pipe for Underdrains	707.03
Corrugated Steel Pipe for Underdrains, Plain Galvanized or Precoated	707.04
Bituminous-Coated Corrugated Steel Pipe for Underdrains	707.05
Corrugated Aluminum Alloy Pipe for Underdrains	707.07
Bituminous-Coated Corrugated Aluminum Alloy Pipe Underdrain	707.09
Aluminum-Coated Type 2 Corrugated Steel Pipe for Underdrains	707.13
Aluminum-Zinc-Alloy-Coated Corrugated Steel Pipe and Pipe Arches	707.14
Bituminous-Coated Polymeric-Precoated Steel Pipe, Pipe Arches, and Underdrains	707.15
Geotextiles	720

Granular filter material gradation will be SHOWN ON THE DRAWINGS.

When material is furnished by the contractor, a manufacturer's Certificate of Compliance shall be furnished to the Engineer. Only one type of pipe material shall be used in any one underdrain installation. Outlet pipe for underdrains shall be nonperforated or perforated pipe of like diameter or larger. When slot-perforated pipe is required, the size and spacing of the slots shall be as SHOWN ON THE DRAWINGS.

During shipment and storage, geotextile shall be wrapped in burlap or similar heavy-duty protective covering. The storage area shall provide protection from mud, dirt, dust, debris, and direct sunlight.

CONSTRUCTION

605.03 Trenches Excavated material from trenches covered in this section shall be utilized or disposed of as SHOWN ON THE DRAWINGS.

605.04 Pipe Installation Trenches shall be excavated to the dimensions and grades SHOWN ON THE DRAWINGS and as adjusted to meet field conditions. A minimum

4-inch bedding layer of granular filter material shall be placed and compacted in the bottom of the trench for its full width and length.

Underdrain pipe shall be embedded firmly in the bedding material.

Perforated pipe shall be placed with the perforations down. The pipe section shall be joined securely with coupling fittings or bands.

Nonperforated pipe shall be laid with the bell end upgrade and with open joints wrapped with suitable material to permit entry of water, or unwrapped as SHOWN ON THE DRAWINGS. Upgrade end sections of all subdrainage pipe installations shall be plugged to prevent entry of soil materials.

After the pipe installation has been inspected and approved by the Engineer, granular filter material shall be placed, without compaction, to a height of 1 foot above the top of the pipe. contractor shall not displace the pipe or the covering at open joints. The remainder of the granular filter backfill material shall then be placed and compacted in layers not exceeding 6 inches loose thickness. Any remaining portion of trench above the granular filter backfill shall be filled with either granular or impervious material, as SHOWN ON THE DRAWINGS, and compacted.

605.05
Underdrain
Outlets

Trenches for underdrain outlets shall be excavated to the width and depth SHOWN ON THE DRAWINGS and adjusted to meet field conditions. Pipe shall be laid in the trench with all ends firmly joined. After inspection and approval by the Engineer of the pipe installation, the trench shall be backfilled in accordance with Subsection 603.08, Method A.

605.06
Blind Drains

Trenches for blind drains shall be excavated to the width and depth SHOWN ON THE DRAWINGS. The trench shall be filled with granular backfill material of the size, type, and depth SHOWN ON THE DRAWINGS. Any remaining upper portion of trench shall be backfilled using approved material provided from borrow or excavation.

605.07
Geotextile

The geotextile shall be placed in the manner and at the locations SHOWN ON THE DRAWINGS. The surface to receive geotextile shall be prepared to a relatively smooth condition that is free of obstructions, depressions, and debris. The geotextile shall be laid loosely without wrinkles or creases.

The geotextile strips shall be overlapped a minimum of 1 foot at joints. Securing pins shall be inserted through both strips of overlapped geotextile at maximum intervals of 3 feet.

Securing pins shall be installed as necessary to prevent slippage of the geotextile and to attach the geotextile to the foundation.

The installed geotextile shall be approved by the Engineer prior to covering or backfilling.

The geotextile shall be protected from contamination and damage during installation of other materials. Granular filter material shall be carefully placed on the geotextile by methods that will not cause damage to the geotextile.

MEASUREMENT

605.08
Method

The method of measurement, as described in Section 106, will be DESIGNATED in SCHEDULE OF ITEMS. Geotextile material will be measured on surface area covered according to the dimensions SHOWN ON THE DRAWINGS.

PAYMENT

605.09
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS. The term "metal" refers collectively to aluminum and steel. Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
605(01) _____-Inch, Perforated Corrugated Metal Pipe	L.F.
605(02) _____-Inch, Nonperforated Corrugated Metal Pipe	L.F.
605(03) _____-Inch, Perforated Corrugated Steel Pipe	L.F.
605(04) _____-Inch, Nonperforated Corrugated Steel Pipe	L.F.
605(05) _____-Inch, _____ Coated Perforated Corrugated Steel Pipe	L.F.
605(06) _____-Inch, _____ Coated Nonperforated Corrugated Steel Pipe	L.F.
605(07) _____-Inch, Perforated Concrete Pipe, Class _____	L.F.
605(08) _____-Inch, Concrete Drain Tile, Class _____	L.F.
605(09) _____-Inch, Perforated Asbestos Cement Pipe	L.F.
605(10) _____-Inch, Nonperforated Asbestos Cement Pipe	L.F.
605(11) _____-Inch, Perforated Clay Pipe, Class _____	L.F.
605(12) _____-Inch, Nonperforated Clay Pipe, Class _____	L.F.
605(13) _____-Inch, Cradle-Invert Clay Pipe	L.F.
605(14) _____-Inch, Perforated Bituminized- Fiber Pipe, Type _____	L.F.
605(15) _____-Inch, Nonperforated Bituminized- Fiber Pipe, Type _____	L.F.
605(16) _____-Inch, Perforated Corrugated Aluminum Pipe	L.F.
605(17) _____-Inch, Nonperforated Corrugated Aluminum Pipe	L.F.
605(18) _____-Inch _____ Pipe	L.F.
605(19) Blind Drain	L.F.
605(20) Pipe Elbow _____ x _____	EA.
605(21) Pipe Tee, Size _____	EA.
605(22) Granular Filter Material	C.Y.
605(23) Granular Filter Material	TON

- 605(24) Granular Filter Material L.F.
- 605(25) Geotextile (Underdrain Function) S.Y.

When materials are furnished by the Forest Service, the note "Government-furnished materials" will be added to the description of the pay item.

Section 606 - Guardrail

DESCRIPTION

606.01 This work shall consist of furnishing and installing guardrail.
Work

MATERIALS

606.02 Materials shall meet the requirements of the following Subsections:
Requirements

Wire Rope or Wire Cable	709.02
Chain Link Fabric	710.03
Metal Beam Rail	710.04
Timber Rail	710.05
Guardrail Posts	710.07
Guardrail Hardware	710.08
Box Beam Rail	710.09
Concrete	602.03

High-strength, unpainted, ungalvanized, weathering steel shall meet the following requirements:

(a) AASHTO M 180 Type 4.

(b) Two to six times the resistance to atmospheric corrosion of carbon steel and able to develop a tightly adherent, impervious, oxide coating as the steel weathers.

High tensile strength bolts for weathering-steel guardrail shall meet the mechanical properties of AASHTO M 164, Type 3.

CONSTRUCTION

606.03 Posts shall be plumb. Posts shall not be battered or distorted
Posts when driven. Post holes shall be backfilled with acceptable material placed in layers of not more than 4 inches loose thickness and thoroughly compacted. When it is necessary to cut post holes in existing pavement, all loose material shall be removed and the pavement replaced in kind.

606.04 The class and type of rail elements shall be as SHOWN ON THE
Rail Elements DRAWINGS. The installation shall be smooth and continuous with laps in the direction of traffic flow. All bolts, except adjustment bolts, shall be drawn tight. Bolts shall be of sufficient length to extend beyond the nuts by not more than 1 inch. Rails shall be shop bent for curves with 150-foot radius or less.

Galvanized surfaces that have been abraded to expose the base metal, threaded portions of all fittings and fasteners, and cut ends of bolts shall be cleaned and coated with a commercially available, zinc-rich paint (pure zinc in vehicle).

When concrete anchors are poured in place, the anchors shall not be connected to the guardrail until 7 days after the concrete has been placed. Concrete shall meet the requirements of Section 602, Method A or B as SHOWN ON THE DRAWINGS.

MEASUREMENT

606.05 The method of measurement, as described in Section 106, will be
Method DESIGNATED in the SCHEDULE OF ITEMS.

The length of guardrail will be from end to end of the rail except where end connections are made to concrete or steel structures, in which case the length will be to the face of these structures. Double-faced rail attached to the same post will be measured as a single unit.

The quantity of end anchorages and terminal sections will be the number of units of each kind specified and installed. Guardrail length will not include end anchorage or terminal sections.

PAYMENT

606.06
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
606(01) Rustic Guardrail	L.F.
606(02) Untreated Wood Guardrail	L.F.
606(03) Preservative-Treated Wood Guardrail	L.F.
606(04) Box Beam-Type Guardrail, Class _____	L.F.
606(05) Galvanized _____, Beam-Type Guardrail, Class _____, Type _____	L.F.
606(06) High-Strength Weathering Beam-Type Guardrail, Class _____, Type _____	L.F.
606(07) End Anchorage, Type _____	EA.
606(08) Terminal Section, Type _____	EA.

Section 607 - Fences, Gates, & Cattleguards

DESCRIPTION

607.01 Work This work shall consist of furnishing and installing, or installing only, fences, gates, and cattleguards.

MATERIALS

607.02 Requirements Materials shall meet the requirements of the following Sections and Subsections:

Barbed Wire	710.01
Woven Wire	710.02
Chain Link Fabric	710.03
Timber Rails	710.05
Fence Posts	710.06
Material for Timber Structures	716
Structural Metal	717

Materials may be approved by the Engineer based upon the manufacturer's Certificate of Compliance.

Materials for gates and cattleguards shall meet the requirements as SHOWN ON THE DRAWINGS. Concrete for cattleguard units may be cast-in-place or precast. Concrete shall meet the requirements of Section 602, Method A or B as SHOWN ON THE DRAWINGS.

CONSTRUCTION

607.03 Fences & Gates Trees, brush, and other obstacles along the fence line that interfere with the fence shall be removed. Continuous grubbing or grading along the fence line shall not be done. Where possible, the fence shall be erected on natural ground. The clearing width and disposal of materials shall be as SHOWN ON THE DRAWINGS.

When drilling into solid rock is required to set a post, the post may be shortened, provided a minimum of 12 inches of post is grouted into the rock.

Where breaks in a run of fencing are required, or at intersections with existing fences, post spacing shall be adjusted to meet the requirements for the type of closure.

When posts, braces, or anchors are to be imbedded in concrete, temporary guys or braces shall be installed as required to hold the posts in proper position until the concrete has set. No materials shall be installed on posts or strain placed on guys and bracing set in concrete until 7 days have elapsed from the time the concrete was placed.

All posts shall be set vertically and to the grade and alignment SHOWN ON THE DRAWINGS. Tops of posts shall not be cut unless approved by the Engineer.

Wire or fencing shall be stretched taut and firmly attached to the posts and braces as SHOWN ON THE DRAWINGS.

At each location where an electric line crosses a fence containing metal, grounding of the fencing shall be accomplished in accordance with the following: A galvanized or copper-coated steel grounding rod 8 feet long with a minimum diameter of 1/2 inch shall be installed directly below the point of crossing. The rod shall be driven vertically until the top is 6 inches below the ground surface. A Number 6 solid copper conductor or equivalent shall be used to connect each metal fence element to the grounding rod. The connections shall be either brazed or fastened with noncorrosive clamps approved by the Engineer.

When a powerline is within 500 feet and runs parallel or nearly parallel to the fence, the fence shall be grounded at each end, at gate posts, and at intervals not to exceed 1,500 feet.

When acceptable vertical penetration of the grounding rod cannot be obtained, an equivalent horizontal grounding system shall be submitted by the contractor for approval by the Engineer.

The bottom of the fence fabric shall generally follow the contour of the ground. Grading shall be performed where necessary to provide a neat appearance. Where abrupt changes in the ground profile make it impractical to maintain the specified ground clearance, longer posts may be used and multiple strands of barbed wire stretched thereon. The vertical spacing between strands of barbed wire shall be 6 inches unless otherwise SHOWN ON THE DRAWINGS. At grade depressions, where stresses tend to pull posts from the ground, sag bracing shall be installed as SHOWN ON THE DRAWINGS.

Wire splicing shall be as SHOWN ON THE DRAWINGS.

All posts shall be repaired in accordance with approved procedures after cutting or drilling.

607.04
Cattleguards

Work required under Section 203 or 306 shall be completed at the location of the cattleguard before excavation for the cattleguard is started. Cattleguard shall be installed at grade elevation SHOWN ON THE DRAWINGS or staked on the ground. Drainage shall be provided at time of installation so cattleguard will drain. Bypass and gate shall be constructed as SHOWN ON THE DRAWINGS.

Excavation shall be in accordance with Section 206A.

After cattleguard is bedded, selected material shall be placed in layers not exceeding 6 inches loose thickness, compacted alongside the cattleguard uniformly on all sides. Backfill shall be readily compactible material, free of frozen lumps, chunks of highly plastic clay, or other objectional material. Backfill shall be compacted without damaging or displacing the cattleguard. Backfilling and compacting shall be continued to the top of the cattleguard foundation.

After being bedded and backfilled, the cattleguard shall be protected by adequate ramps on each side, before heavy equipment is permitted to cross during roadway construction.

MEASUREMENT

607.05
Method

The method of measurement as described in Section 106 will be DESIGNATED in the SCHEDULE OF ITEMS.

Fence length will be along the top of the fence from outside to outside of end posts for each continuous run of fence.

When brace panels and by-pass gates are SHOWN ON THE DRAWINGS, payment for cattleguards shall include these items.

PAYMENT

607.06
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
607(01) Cattleguard, _____ Foundation, Loading _____, Width _____	EA.

607(02) Fence _____, Type _____, L.F.
Height _____
607(03) Gate _____, Type _____, EA.
Size _____

When materials are furnished by the Forest Service, the note "Government-furnished materials" will be added to the description of the pay item.

Section 608 - Sidewalks

DESCRIPTION

608.01 This work shall consist of the construction of bituminous or
Work Portland cement concrete sidewalks.

MATERIALS

608.02 Materials shall meet the requirements of the following Subsections:
Requirements

Bed Course Material	703.15
Joint Fillers	705.01
Reinforcing Steel	709.01

Concrete for sidewalks shall meet the requirements of Section 602, Method A or B, as SHOWN ON THE DRAWINGS.

Materials for bituminous sidewalks shall meet the requirements of Section 403 or 406.

Bituminous mixes will be subject to inspections and tests at the mixing plants for compliance with quality requirements.

CONSTRUCTION

608.03 Portland Cement
Concrete Sidewalks

(a) Excavation. Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the forms for the section SHOWN ON THE DRAWINGS. The foundation shall be shaped and compacted to a firm, even surface. All soft and yielding materials shall be removed and replaced with acceptable material.

(b) Forms. Forms shall be made of wood, metal, or other suitable material and shall extend to the full depth of the concrete. All forms shall be straight, free from warp, and strong enough to resist the pressure of the concrete without displacement. Bracing and staking of forms shall keep the forms in horizontal and vertical alignment until their removal. All forms shall be cleaned and coated with an approved form-release agent before concrete is placed. After the forms have been set to line and grade, the foundation shall be brought to the required grade and wetted, approximately 12 hours before placing the concrete. Machine slip forming may be used.

(c) Placing Concrete. The foundation shall be thoroughly moistened immediately before placing the concrete. The proportioning, mixing, and placing of the concrete shall be in accordance with the requirements of Section 602 for the concrete method used and shall be deposited without segregation in one course.

(d) Finishing. The concrete shall be struck off with a straightedge and finished to a smooth, uniform texture by troweling and floating. The surfaces shall be crossbroomed, burlap-finished, lightly grooved, or marked into squares or other shapes as SHOWN ON THE DRAWINGS.

All outside edges of the slab and all joints shall be edged with a 1/4 inch radius edging tool.

(e) Joints. Expansion joints and joint filler shall be as SHOWN ON THE DRAWINGS. The sidewalk shall be divided into sections by dummy joints formed by a jointing tool or sawing. The dummy joints shall extend into the concrete at least one-fourth to one-fifth of the depth and shall be approximately 1/8 inch wide. Joints shall match as nearly as possible adjacent joints in curb or pavements.

Construction joints shall be formed around all appurtenances, such as manholes, utility poles, and so forth, which extend into and through the sidewalks. Premolded expansion joint filler 1/2 inch thick shall be installed in these joints. Expansion joint filler shall be installed between concrete sidewalks and any fixed structure such as a building or bridge. This expansion joint material shall extend to the full depth of the walk.

(f) Curing. Concrete shall be cured by application of a Type 1-D liquid membrane-forming compound applied uniformly to damp concrete by pressure spray methods, or by keeping the concrete moist with burlap or mats for at least 72 hours. All materials shall meet the requirements of Section 711.

During the curing period, all traffic, both pedestrian and vehicular, shall be excluded. Vehicular traffic shall be excluded for such additional times as the Engineer may direct.

608.04
Bituminous Concrete
Sidewalks

(a) Excavation and Forms. Excavation and forms shall meet the requirements of Subsection 608.03(a) and Subsection 608.03(b), except wetting will not be required under the latter.

(b) Bed Course. Bed course material shall be placed in layers not exceeding 4 inches loose depth, and each layer shall be thoroughly compacted to a firm even surface.

(c) Placing Bituminous Sidewalk Materials. The mixture shall be placed only when the bed is dry and weather conditions are suitable for the proper handling and finishing of the mixture. Bituminous sidewalk material shall be placed on the compacted bed course in one or more courses as SHOWN ON THE DRAWINGS so as to give the required depth when rolled. Compaction shall be accomplished by means of a type of power compactor. In areas inaccessible to the roller, hand tamping will be permitted. In any case, the bituminous sidewalk material shall be uniformly compacted.

MEASUREMENT

608.05
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

PAYMENT

608.06
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
608(01) Portland Cement Concrete Sidewalk	S.Y.
608(02) Bituminous Concrete Sidewalk	TON
608(03) Bituminous Concrete Sidewalk	S.Y.
608(04) Bed Course Material	TON
608(05) Bed Course Material	S.Y.

Section 609 - Curb or Curb & Gutter

DESCRIPTION

609.01 This work shall consist of the construction or resetting of curb, gutter, or combination curb and gutter.
Work

MATERIALS

609.02 Materials shall meet the requirements of the following Sections and Subsections:
Requirements

Bituminous Materials (for tack coat)	702
Bed Course Material	703.15
Joint Fillers	705.01
Joint Mortar	705.02
Reinforcing Steel	709.01
Stone Curbing	712.05
Precast Concrete Curbing	712.06

Concrete shall meet the requirements of Section 602, Method A or B as SHOWN ON THE DRAWINGS.

Bituminous mixtures as SHOWN ON THE DRAWINGS shall meet the requirements of Section 403 or 406.

Concrete, bituminous mixes, and manufactured curbing materials will be subject to inspection and tests at the plants for compliance with quality requirements.

CONSTRUCTION

609.03 Cast-in-Place Portland Cement Concrete Curbing or Curb & Gutter

(a) Excavation. Excavation shall be made to the depth SHOWN ON THE DRAWINGS. The foundation shall be compacted to a firm even surface. All soft, yielding material shall be removed and replaced with acceptable material.

(b) Forms. Forms shall be made of wood, metal, or other suitable material and shall extend to the full depth of the concrete. All forms shall be straight, free of warp, and of sufficient strength to resist the pressure of the concrete without displacement. Bracing and staking of forms shall keep the forms in both horizontal and vertical alignment until their removal. All forms shall be cleaned and coated with an approved form-release agent before concrete is placed. Divider plates shall be of metal. After the forms have been set to line and grade, the foundation shall be brought to the grade required and well wetted approximately 12 hours before placing the concrete. Machine slip forming may be used.

(c) Mixing and Placing. Concrete shall be proportioned, mixed, and placed in accordance with the requirements of Section 602 Method A or B, as described in Section 602, as SHOWN ON THE DRAWINGS, and shall be deposited without segregation in one course. Consolidation of concrete placed in the forms shall be by vibration or other acceptable methods. Forms shall be left in place for 24 hours or until the concrete has set sufficiently so that they can be removed without injury to the curbing. The concrete shall be struck off to the cross section SHOWN ON THE DRAWINGS, after which it shall be finished smooth and even by means of a wooden float.

For the purpose of matching adjacent concrete finishes or for other reasons, the Engineer may permit other methods of finishing. No plastering will be permitted.

(d) Contraction Joints. Curbing shall be constructed in sections having a uniform length of 10 feet unless otherwise approved by the Engineer. Sections shall be separated by open joints

approximately 1/8-inch wide and at least 1-inch deep, except at expansion joints. Where the curb is constructed adjacent to concrete pavement, the contraction or open joints in the curb shall match the contraction joints in the pavement.

(e) Expansion Joints. Expansion joints shall be formed at the intervals SHOWN ON THE DRAWINGS using a preformed expansion joint filler having a thickness of 1/2 inch. When the curb is constructed adjacent to or on concrete pavement, expansion joints shall be located at expansion joints in the pavement.

(f) Curing. Immediately upon completion of the finishing, the curbing shall be moistened and kept moist for 3 days, or the curbing shall be cured by the use of membrane forming material. All materials shall meet the requirements of Section 711.

(g) Backfilling. After the concrete has set sufficiently, the curb shall be backfilled to the required elevation with suitable material, which shall be compacted in accordance with Subsection 203.15(b), Method 4, in layers of not more than 6 inches loose thickness.

(h) Curb Machine. The curb or curb and gutter may be constructed by the use of a curb forming machine meeting the requirements of Subsections 609.06(c), 1 and 2.

(i) Curb Template. Exposed curb face may be constructed and finished by use of trowel-type templates, shaped to produce the desired contours when operated along approved forms set to the established lines and grades.

While the concrete is green, the top, front, or other exposed surfaces of the curb or combined curb and gutter shall be floated with a moist wooden float. Form marks and any other irregularities shall be removed.

609.04
Precast Concrete
Curbing

The curb shall be set so that the top surfaces of adjoining sections are true and even. All spaces under the curbing shall be filled with material meeting the requirements of the material for bed course, and this material shall be compacted.

609.05
Reflecting
Concrete Curbing

Construction methods for this item shall meet the requirements of Subsection 609.03, with the following exceptions:

The reflecting surface of the curbing shall be a mortar mix consisting of one part white Portland cement to 1.75 parts of light-colored, washed mortar sand. This mortar mix shall have a thickness of approximately 1 inch.

Alternatively, the entire curbing may be constructed of concrete with white Portland cement.

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

Scoring or surface deformation and finish of the reflecting surface shall be in accordance with the details SHOWN ON THE DRAWINGS.

609.06
Bituminous
Concrete Curbing

(a) Excavation. Excavation shall meet the requirements of Subsection 609.03(a).

(b) Preparation of Bed. When curbing is to be constructed on a cured or aged Portland cement concrete base, on bituminous pavement, or on a bituminous-treated base, the bed shall be thoroughly swept and cleaned by compressed air. The surface shall be thoroughly dried and, immediately before placing of the

bituminous mixture, shall receive a tack coat of bituminous materials of the type and grade SHOWN ON THE DRAWINGS. The rate of application of the tack coat material shall be between 0.05 and 0.15 gallon per square yard of surface. The contractor shall prevent the tack coat from spreading to areas outside of the area to be occupied by the curb.

(c) Placing. Bituminous curbing shall be constructed by use of a self-propelled, automatic curber or curb machine or a paver with curbing attachments. The automatic curber or machine shall meet the following requirements:

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

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

(3) The construction of curbing by means other than the automatic curber or machine are acceptable when short sections or sections with short radii are required. The resulting curbing shall conform in all respects to the curbing produced by the use of the machine.

The mixture shall be placed only when the bed is dry and weather conditions are suitable for the proper handling and finishing of the mixture.

The bituminous mixture shall be placed at a workable temperature of not less than 225 °F. The curbs shall be placed to an accurate alignment and shall have a high density free of honeycombs. When joining to a section of curb that has become cold, the contact surface of the cold curb shall be given a thin uniform tack coat of bituminous material prior to placing the fresh bituminous mixture against the cold joint. The curbs shall be protected from traffic by barricades or other suitable method until the curb has hardened.

(d) Painting and Sealing. Sealing or painting shall be performed only on a curbing that is clean and dry and that has reached an ambient temperature.

(e) Backfilling. Backfilling shall meet the requirements of Subsection 609.03(g).

609.07
Resetting Curb

(a) Salvage of Curbing. Curbing specified for resetting shall be carefully removed, stored, and cleaned. The contractor shall replace any existing curbing that is to be reset, lost from storage, or damaged through improper handling.

(b) Excavation. Excavation and bedding shall meet the requirements of Subsection 609.03(a).

(c) Resetting Curb. The curb shall be set on a firm bed with the top surface of adjoining sections true and even. All sections of curbing shall be set so that the maximum opening between adjacent sections is not more than 3/4 inch wide for the entire exposed top and face. The ends of the curbing shall be dressed as necessary to meet this requirement.

After the curb has been set, the joints shall be completely filled with mortar as SHOWN ON THE DRAWINGS.

(d) Backfilling. The curb shall be backfilled to the required elevation with suitable material. This material shall be thoroughly tamped in layers of not more than 6 inches loose thickness.

(e) Cutting and Fitting. Cutting or fitting shall be done as necessary to install the curbing.

MEASUREMENT

609.08
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

Curbing will be measured along the front face of the section at the finished grade elevation. The length of combination curb and gutter will be measured along the face of the curb. No deduction in length will be made for drainage structures installed in the curbing section or for driveway openings where the gutter is carried across the drive.

PAYMENT

609.09
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
609(01) Portland Cement Concrete Curb, _____-Inch Depth, Type _____	L.F.
609(02) Portland Cement Concrete Gutter, Type _____	L.F.
609(03) Portland Cement Concrete Curb and Gutter, _____ Inch Depth, Type _____	L.F.
609(04) Bituminous Concrete Curb, _____-Inch Depth	L.F.
609(05) Reset Curb	L.F.
609(06) Bed Course Material	TON
609(07) Bed Course Material	C.Y.

Section 610 - Stone Masonry Structures

DESCRIPTION

- 610.01 Work This work shall consist of the construction of stone masonry structures and stone masonry portions of composite structures.
- 610.02 Classes of Masonry The class of masonry required for each part of a structure will be SHOWN ON THE DRAWINGS.
- Cement rubble masonry shall consist of roughly dressed stones of various sizes and shapes laid in random courses in cement mortar.
- Class A and Class B masonry shall consist of stones shaped, dressed, and laid broken-coursed in cement mortar.
- Dimensioned masonry shall consist of broken-coursed ashlar masonry composed of stones having two or more dimensions SHOWN ON THE DRAWINGS.

MATERIALS

- 610.03 Stone The stone shall be sound and durable. Stone for dimensioned masonry shall be free of reeds, rifts, seams, laminations, and minerals that, by weathering, would cause discoloration or deterioration.
- (a) Sizes and Shapes. Stones shall be furnished in the sizes and face areas necessary to produce the general characteristics and appearance as SHOWN ON THE DRAWINGS.
- In general, stones shall have a thickness not less than 5 inches, a width not less than one and one-half times their thickness, with a minimum width of 12 inches, and a length of not less than one and one-half times their width. Where headers are required, their lengths shall be not less than the width of the bed of the widest adjacent stretcher plus 12 inches.
- At least 50 percent of the total volume of the masonry shall be stones having a volume of at least 1 cubic foot each.
- (b) Dressing. The stone shall be dressed to remove any thin or weak portions. Face stones shall be dressed to provide bed and joint lines with a maximum variation from true line as follows:
- | <u>Type of Masonry</u> | <u>Maximum Variation</u> |
|------------------------|--------------------------|
| Cement rubble masonry | 1-1/2 inches |
| Class A masonry | 3/4 inch |
| Class B masonry | 1/4 inch |
| Dimensioned masonry | Reasonably true |
- (c) Bed Surfaces. Bed surfaces of face stones shall be normal to the faces of the stones for about 3 inches and from this point may depart from normal not to exceed 1 inch in 12 inches for dimensioned masonry and 2 inches in 12 inches for all other classes.
- (d) Joint Surfaces. In all classes of masonry except dimensioned masonry, the joint surfaces of face stones shall form an angle with the bed surfaces of not less than 45 degrees.
- In dimensioned masonry, the joint surfaces shall be normal to the bed surfaces. They shall also be normal to the exposed faces of the stone for at least 2 inches, from which point they may depart from normal by not more than 1 inch in 12 inches.
- The corners at the meeting of the bed and joint lines shall not be rounded in excess of the following radii:

Type of Masonry	Dimensions
Cement rubble masonry	1-1/2 inches
Class A masonry	1 inch
Class B masonry	No rounding
Dimensioned masonry	No rounding

(e) Arch Ring Stone Joint Surfaces. Arch ring stone joint surfaces shall be radial and at right angles to the front faces of the stones. They shall be dressed for a distance of at least 3 inches from the front faces and soffits, from which points they may depart from a plane normal to the face not to exceed 3/4 inch in 12 inches. The back surface in contact with the concrete of the arch barrel shall be parallel to the front face and shall be dressed for a distance of 6 inches from the intrados. The top shall be cut perpendicular to the front face and shall be dressed for a distance of at least 3 inches from the front.

When concrete is to be placed after the masonry has been constructed, adjacent ring stones shall vary at least 6 inches in depth.

(f) Stratification. Stratification in arch ring stones shall be parallel to the radial joints and other stones shall be parallel to the beds.

(g) Finish for Exposed Faces. Face stones shall be pitched to the line along all beds and joints. The kind of finish for exposed faces shall be SHOWN ON THE DRAWINGS. The following symbols will be used, and they shall be understood to represent the type of surface or dressing specified below:

(1) Fine Pointed (F.P.). The point depressions shall be approximately 3/8 inch apart with surface variation not to exceed 1/8 inch from the pitch line.

(2) Medium Pointed (M.P.). The point depressions shall be approximately 5/8 inch apart with surface variations not to exceed 1/4 inch from the pitch line.

(3) Coarse Pointed (C.P.). The point depressions shall be approximately 1 to 1-1/4 inches apart with surface variations not to exceed 3/8 inch from the pitch line.

(4) Split or Seam Face (S.). The surface shall present a smooth appearance, be free from tool marks, and have no depressions below the pitch line and no projection exceeding 3/4 inch beyond the pitch line.

(5) Rock Faced (R.F.). The face shall be an irregular, projecting surface without indications of tool marks, with no concave surfaces below the pitch line, and with projections beyond the pitch line, when measured in inches, not exceeding the figure preceding the symbol as SHOWN ON THE DRAWINGS; for example, "1-1/2 R.F." means projections beyond the pitch line not exceeding 1-1/2 inches. Where a "variable rock face" is specified, stones of the same height of projection shall be distributed.

Removal of drill and quarry marks from the faces of stones in cement rubble masonry will not be required.

610.04
Quarry Operations

Quarry operations and delivery of stone to the point of use shall be organized to ensure that deliveries are well ahead of masonry operations. A sufficiently large stock of stone shall be kept on the site at all times to permit adequate selection of stone by the masons.

610.05
Mortar

Mortar shall meet the requirements of Subsection 705.05.

CONSTRUCTION

610.06 Excavation & Backfill

Excavation and backfill shall meet the requirements of Section 206A modified as follows:

For filled spandrel arches, the backfill shall be carefully placed to load the ring uniformly and symmetrically. The backfill material shall be approved by the Engineer and placed in horizontal layers, carefully tamped, and brought up simultaneously from both haunches. Wedge-shaped sections of backfill material shall not be placed against spandrels, wings, or abutments.

610.07 Falsework

Arch centering shall be constructed in accordance with construction drawings submitted by the contractor. Wedges shall be provided for raising or lowering the forms to the exact elevation and taking up any settlement occurring during loading. Centering shall be lowered gradually and symmetrically to avoid overstresses in the arch.

Centering shall rest upon jacks in order to take up and correct any slight settlement that may occur after the placing of masonry has begun. In general, centering shall be struck and the arch made self-supporting before the railing or coping is placed. For filled spandrel arches these portions of the spandrel walls shall be left for construction subsequent to the striking of centers as may be necessary to avoid jamming of the expansion joints.

610.08 Sample Section

When SHOWN ON THE DRAWINGS, the contractor shall build an L-shaped sample section of wall not less than 5 feet high and 8 feet long, showing examples of face wall, top wall, method of turning corners, and method of forming joints, that shall be subject to the Engineer's approval. No masonry, other than the foundation masonry, shall be laid prior to the approval of such samples.

610.09 Arch Ring Template

A full-size template of the arch ring shall be laid out near the quarry site, showing face dimensions of each ring stone and thickness of joints. The template shall be approved by the Engineer before the shaping of any ring stone is started, and no ring stone not corresponding to approved configuration shall be placed in the structure.

610.10 Selection & Placing

When the masonry is to be placed on a prepared foundation bed, the bed shall be firm and normal to, or in steps normal to, the face of the wall and shall be approved by the Engineer before any stone is placed. When it is to be placed on foundation masonry, the bearing surface of this masonry shall be cleaned thoroughly and wetted immediately before the mortar bed is spread.

Face stones shall be set in random bond to produce the effect SHOWN ON THE DRAWINGS and to correspond with the sample section approved by the Engineer.

Care shall be taken to prevent the bunching of small stones or stones of the same size. When weathered or colored stones or stones of varying texture are being used, the various kinds of stones shall be uniformly distributed throughout the exposed faces of the work. Large stones shall be used for the bottom courses and large selected stones shall be used in the corners. In general, the stones shall decrease in size from the bottom to the top of work.

All stones shall be cleaned thoroughly and wetted immediately before being set. The bed shall be cleaned and moistened before the mortar is spread. Stones shall be laid with their longest faces horizontal in full beds of mortar, and the joints shall be flushed with mortar.

The exposed faces of individual stones shall be parallel to the faces of the walls in which the stones are set.

Stones already set shall not be jarred or displaced. Equipment shall be provided for setting stones larger than those that can be handled by two men. Stones shall not be rolled or turned on the walls. If a stone is loosened after the mortar has taken initial set, it shall be removed, the mortar cleaned off, and the stone relaid with fresh mortar.

Arch ring stone shall be carefully set to exact positions and held in place with hardwood wedges until the joints are packed with mortar.

610.11
Beds & Joints

The thickness of beds and joints of face stones shall be as follows:

Type of Masonry	Beds (Inches)	Joints (Inches)
Cement rubble masonry	1/2 to 2-1/2	1/2 to 2-1/2
Class A masonry	1/2 to 2	1/2 to 2
Class B masonry	1/2 to 2	1/2 to 1-1/2
Dimensioned masonry	(See note)	3/4 to 1

Note: The thickness of beds in dimensioned masonry may vary from 3/4 to 1 inch from the bottom to the top of the work, but in each course the beds shall be of uniform thickness throughout.

Beds shall not extend in an unbroken line through more than 5 stones, and joints through more than 2 stones.

Joints in dimensioned masonry shall be vertical. In all other masonry, joints may be at angles with the vertical from zero to 45 degrees.

Each face stone shall bond with all contiguous face stones at least 6 inches longitudinally and 2 inches vertically.

The corners of four stones shall not be adjacent to each other.

Cross beds for vertical walls shall be level and for battered walls may vary from level to normal to the batter line of the face of the wall. All arch ring joints shall be completely filled with mortar.

610.12
Headers

Headers shall be distributed uniformly throughout the walls of structures to form at least one-fifth of the faces.

610.13
Backing

The backing shall be built chiefly of large stones and in a workmanlike manner. The individual stones composing the backing and hearting shall be well bonded with the stones in the face wall and with each other. All openings and interstices in the backing shall be completely filled with mortar or with spalls completely surrounded by mortar.

610.14
Coping

Copings shall be as SHOWN ON THE DRAWINGS. If copings are not SHOWN ON THE DRAWINGS, the top of the wall shall be finished with stones wide enough to cover the top of the wall, from 1-1/2 to 5 feet in length, and of random heights, with a minimum height of 6 inches. Stones shall be laid so the top course is an integral part of the wall. The tops of the top courses of stone shall be aligned in both vertical and horizontal planes.

610.15
Parapet Walls

Selected stones, squared and pitched to line and with heads dressed, shall be used in the ends of parapet walls and in all exposed angles and corners. Headers shall be well interlocked and as many as possible shall extend entirely through the wall. Both the headers and stretchers in the two faces of the wall shall be well interlocked in heart and shall comprise practically the whole volume of the wall. All interstices in the wall shall be completely filled with cement grout or with spalls completely surrounded with mortar or grout.

610.16
Facing for Concrete

The stone masonry shall be constructed before placing concrete. Concrete may be placed before constructing the stone masonry if approved by the Engineer.

(a) Stone Masonry Constructed Prior to Placing Concrete. Hooked steel anchors, consisting of No. 4 bars each bent into an elongated "S" shape, shall be spaced 2 feet apart both horizontally and vertically unless closer spacing is SHOWN ON THE DRAWINGS. To improve the bond between the stone masonry and the concrete backing, the back of the former shall be made as uneven as the stones will permit. Each anchor shall be rigidly embedded in a horizontal joint of the masonry with one end 2 inches from the faces of the stones. The other end shall project approximately 10 inches into the concrete backing.

When the stone facing has been laid and the mortar has attained sufficient strength, all surfaces against which concrete is to be placed shall be cleaned carefully and all dirt, loose material, and accumulations of mortar droppings removed. Picks, scrapers, and wire brooms shall be used for this purpose if necessary. If compressed air is available, it shall be used to blow out the dust and dirt. Just before the concrete is placed, the surfaces shall be washed thoroughly. Water shall be dashed forcibly against the stones and into the joints. Use of a stream from a hose is preferable for this purpose. In depositing concrete, the top surface immediately adjacent to the stones shall be held slightly low, and a neat cement grout of the consistency of cream shall be carried on top of the concrete and against the masonry at all times, so the entire exposed areas of all the stones are coated with grout. All interstices of the masonry shall be filled and the concrete thoroughly spaded and worked until it is brought into intimate contact with every part of the back of the masonry.

(b) Concrete Placed Before Constructing Masonry. Except where otherwise SHOWN ON THE DRAWINGS, a thickness of 9 inches shall be allowed for facing. Galvanized metal slots with anchors for the stone work, or other approved type of metal anchor, shall be set vertically in the concrete face at a horizontal spacing not to exceed 24 inches. The slots shall have a temporary filling of felt or other material to prevent them from being filled with concrete. During the setting of the stone facing, the metal anchors shall be fitted tightly in the slots at an average vertical spacing of 24 inches. The Engineer will mark on the concrete backing the approximate location of the anchors, and the anchor shall be placed in the stone joint nearest to the mark. At least 25 percent of the metal anchors shall have a short right-angle bend to engage a recess to be cut into the stone. The anchors shall extend to within 3 inches of the exposed face of the stone work.

Where the shape of the concrete face is unsuitable for the use of metal slots, ties consisting of U.S. Standard Gauge No. 9 galvanized iron wire shall be placed as approved by the Engineer, with not less than one wire tie for each 1.5 square feet of exposed stone surface. In laying the stone, the concrete face shall be kept wet continuously for 2 hours preceding the placing of the stone, and all spaces between the stone and concrete shall be thoroughly filled with mortar. Immediately after laying, all exposed stone surfaces shall be cleaned and kept clean of loose mortar and cement stains.

610.17
Pointing

The pointing or finishing of all joints shall be as SHOWN ON THE DRAWINGS.

When raked joints are called for, all mortar in exposed faced joints and beds shall be raked out squarely to the depth SHOWN ON THE DRAWINGS. Stone faces in the joints shall be cleaned free of mortar.

When weather joints are called for, the beds shall be weather struck. The joints shall be slightly raked to conform to the bed weather joint, and in no case shall the mortar be flush with the faces of the stones.

The mortar in joints on top surfaces shall be crowned slightly at the center of the masonry to provide drainage.

610.18
Weep Holes

All walls and abutments shall be provided with weep holes as SHOWN ON THE DRAWINGS.

610.19
Cleaning Exposed
Faces

Immediately after being laid and while the mortar is fresh, all face stone shall be thoroughly cleaned of mortar stains and shall be kept clean until the work is completed. Before the final acceptance, the surface of the masonry shall be cleaned using wire brushes and acid if necessary.

610.20
Weather
Limitations

Placing of stone shall not be done in freezing weather except by written approval from the Engineer, and then only by the use of precautionary methods prescribed for doing the work and protecting it at all times. This permission and the use of the prescribed methods will not release the contractor from an obligation to build a satisfactory structure. All work damaged by cold weather shall be removed and replaced. In hot or dry weather, the masonry shall be satisfactorily protected from the sun and shall be kept wet for a period of at least 3 days after completion.

MEASUREMENT

610.21
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

Sample sections of wall, unless permitted to be incorporated in the work, will not be included.

The dimensions used in computing yardage will be those determined by the lines SHOWN ON THE DRAWINGS. No deductions will be made for weep holes, drain pipes, or other openings of less than 2 square feet in area, or for chamfers or other ornamental cuts that amount to 5 percent or less of the volume of the stone in which they occur.

PAYMENT

610.22
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
610(01) Cement Rubble Masonry	C.Y.
610(02) Class A Masonry	C.Y.
610(03) Class B Masonry	C.Y.
610(04) Dimensioned Masonry	C.Y.

Section 611 - Development of Pits & Quarries

DESCRIPTION

611.01
Work This work shall consist of clearing, grubbing, topsoil stripping, removal of overburden, access road development, restoration, and other incidental work required for pit or quarry development.

CONSTRUCTION

611.02
General All work shall be performed in accordance with Sections 201, 203, 625, landscape preservation requirements, and the pit and quarry development and/or restoration plan as SHOWN ON THE DRAWINGS.

611.03
Source Designation of sources will be in accordance with requirements SHOWN ON THE DRAWINGS or specified in the SPECIAL PROJECT SPECIFICATIONS.

611.04
Clearing, Grubbing
& Slash Cleanup Clearing, grubbing, and slash cleanup requirements shall be in accordance with Section 201 and as SHOWN ON THE DRAWINGS.

611.05
Access Roads Access roads to the pit or quarry shall be constructed or reconditioned in accordance with Section 203 or 306 and as SHOWN ON THE DRAWINGS.

611.06
Topsoil Stripping, stockpiling, and placing of topsoil obtained from the site shall be in accordance with Section 203 and as SHOWN ON THE DRAWINGS.

611.07
Overburden Removal of overburden to expose rock material for aggregate production and the stockpiling or placement of overburden in embankment within the limits of the pit or quarry shall be in accordance with Section 203 and as SHOWN ON THE DRAWINGS.

611.08
Ground Control
& Haulways The work shall be in accordance with MSHA 30 CFR-Part 56 that relate to ground control and haulways. Any deterioration of overburden slopes, safety benches, protective berms, or encroachment on clearing limits shall be immediately corrected.

611.09
Oversize Material All material suitable for aggregate, developed in stripping, overburden removal, and excavation of rock material, regardless of size, shall be utilized for aggregate unless other disposition is SHOWN ON THE DRAWINGS.

611.10
Restoration After excavation has been completed in a part or all of the area, the sides shall be sloped and graded and the general pit area smoothed as SHOWN ON THE DRAWINGS. Oversize material, if left in the pit or quarry, shall be evenly distributed and overburden material spread over the bottom of the pit prior to spreading topsoil.

Access roads SHOWN ON THE DRAWINGS for obliteration shall be ripped, drained, blocked to traffic, and seeded in accordance with Section 625.

MEASUREMENT

611.11
Method The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

PAYMENT

611.12
Basis The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
611(01) Pit Development	EA.
611(02) Quarry Development	EA.

Section 613 - Reinforced Earth Walls

DESCRIPTION

613.01 This work shall consist of constructing Reinforced Earth
Work (trademark), or equal, walls with standard-sized concrete or steel
face panels.

MATERIALS

613.02 (a) Concrete Face Panels. Cement shall meet the requirements of
Concrete & Subsection 701.01. Air-entraining, retarding, or accelerating
Steel Panels agents or any additive containing chloride shall not be used
without approval of the Engineer.

Tie strips, connecting pins, and PVC pin form and lifting and
handling devices shall be set in place as SHOWN ON THE DRAWINGS
prior to casting.

(1) Testing and Inspection. Acceptability of the precast
units will be determined on the basis of compression tests and
visual inspection. The contractor shall furnish facilities and
perform all necessary sampling and testing. Panels shall be
considered acceptable for placement in the wall when 7-day
strengths exceed 65 percent of 28-day requirements.

(2) Casting. The panels shall be cast on a flat area and
have the front face of the form at the bottom and the back face at
the top.

Tie strip guides shall be set on the rear face. The concrete
in each unit shall be placed without interruption and shall be
consolidated by the use of an approved vibrator, supplemented by
hand tamping as necessary to force the concrete into the corners
of the forms and prevent the formation of stone pocket or cleavage
planes. Clear-form oil of the same manufacture shall be used
throughout the casting operation.

(3) Curing. The units shall be cured for a sufficient
length of time so that the concrete will develop the specified
compressive strength.

(4) Removal of Forms. The forms shall remain in place until
they can be removed without damage to the unit.

(5) Concrete Finish. Concrete surface for the front face
shall have the finish SHOWN ON THE DRAWINGS. Rear face of the
panel shall be roughly screeded to eliminate open pockets of
aggregate and surface distortions in excess of 1/4 inch.

(6) Tolerances. All units shall be manufactured within the
following tolerances:

- a. All dimensions within 3/16 inch.
- b. Angular distortions with regard to the height of the
panel shall not exceed 0.20 inch in 5 feet.
- c. Surface defects on formed surfaces measured with a 5
foot straightedge shall not exceed 0.1 inch.

(7) Compressive Strength. Acceptance of the concrete face
panels with respect to compressive strength will be determined on
a lot basis. The lot will consist of all production units
(batches of concrete or panels) produced within a week's or 7-day
production. Production units shall be randomly selected in
accordance with the production day sample sizes of table 613-1 and
tested for compressive strength. Compression tests shall be made
on standard 6-inch by 12-inch test specimens prepared in

accordance with AASHTO T 23 or cores obtained and prepared in accordance with AASHTO T 24. Compressive strength testing shall be conducted in accordance with AASHTO T 22.

Table 613-1.--Production day sample sizes.

Production Day Quantities	Sample Size
0-35 cu yds (0-50 panels)	1
36-70 cu yds (51-100 panels)	2
71-105 cu yds (101-150 panels)	3
Over 106 cu yds (+151 panels)	5

When standard 6-inch by 12-inch test specimens are utilized, a minimum of four cylinders shall be cast for each production unit sampled. Two of these specimens shall be cured in the same manner as the panels and tested at 7 days. The remaining two cylinders shall be cured in accordance with AASHTO T 23 and tested at 28 days. The test value of each two-cylinder group will be their average compressive strength.

Acceptance of the lot will be made if all acceptance tests in a lot are greater than 4,500 psi or no individual 28-day compressive strength test result falls below 4,000 psi and the average 28-day compressive strength of all test results for the lot equals or exceeds the acceptance limits set forth in table 613-2. The acceptance limits of table 613-2 shall also apply to core compressive strength test results.

Table 613.2.--Lot acceptance limits.

Number of Lot Acceptance Tests	Average of All Lot Acceptance Tests Must Equal or Exceed These Limits
3-7	4500 + 0.33R ^a
8-15	4500 + 0.44R ^a
16+	4500 + 0.46R ^a

^a(Range) - The difference between the largest and smallest acceptance test result.

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

- a. Defects that indicate imperfect molding.
- b. Defects indicating honeycombed or open texture concrete.

(9) Marking. The date of manufacture shall be clearly scribed on the rear face of each panel.

(10) Handling, Storage, and Shipping. All units shall be handled, stored, and shipped in a manner to eliminate the danger of chipping, cracks, fractures, and excessive bending stresses. Panels in storage shall be supported on firm blocking located immediately adjacent to tie strips to avoid bending the tie strips.

(11) Concrete Footing. Concrete shall meet the requirements of Section 602, Method A or B as SHOWN ON THE DRAWINGS.

(b) Steel Face Panels. Steel face panels shall be fabricated of cold-rolled galvanized steel. Steel shall meet the requirements of ASTM A 446, Grade C, and galvanizing shall meet the requirements of ASTM A 525, Coating Class G 90.

(c) Reinforcing and Tie Strips. Tie strips shall be shop fabricated of hot-rolled steel meeting the requirements of ASTM A 570, Grade C, or equivalent. They shall be hot-dip galvanized in accordance with ASTM A 123. Reinforcing strips shall be hot rolled from bars to the required shape and dimensions.

Their physical and mechanical properties shall be in accordance with ASTM A 36 or equivalent.

They shall be cut to the lengths and tolerances SHOWN ON THE DRAWINGS. Holes for bolts shall be punched as SHOWN ON THE DRAWINGS.

All reinforcing and tie strips shall be carefully inspected to ensure they are true to size and free of defects that may impair their strength and durability.

(d) Fasteners, Bolts, and Nuts. Hardware shall be hexagonal cap screws AASHTO M 164, nominal size 1/2 inch by 1 inch, with a 3/4 thread length, hot-dip galvanized.

(e) Joint Filler for Use with Concrete Face Panels.

(1) Filler for vertical joints between panels shall be flexible open cell polyether foam strips, Grade 1035, 2 inches by 2 inches, meeting the requirements of ASTM D 1564.

(2) Filler for horizontal joints between panels shall be resin-bonded cork filler meeting the requirements of ASTM D 1752 (Type II) or an approved equal.

(f) Joint Covers for Use with Steel Face Panels. Joint covers shall be fabricated of cold-rolled galvanized steel. Steel shall meet the requirements of ASTM A 446, Grade C, and galvanizing shall meet the requirements of ASTM A 525, Coating Class G 90.

(g) Select Granular Backfill Material. All backfill material used in the structure volume shall be free of organic or otherwise deleterious materials and shall meet the following gradation limits as determined by AASHTO T 27:

Sieve Size	Percent Passing
6 inches	100
3 inches	100-75
No. 200	0-15

This material shall exhibit an angle of internal friction of not less than 25 degrees as determined by standard triaxial or direct shear testing methods.

Material meeting the above specifications shall be obtained from sources SHOWN ON THE DRAWINGS.

613.02a
Certification

The contractor or the supplier shall furnish a copy of all test results and Certificates of Compliance certifying that the materials comply with the applicable contract specifications. Approval will be based on the Certificate of Compliance, accompanying test reports, and inspection by the Engineer.

CONSTRUCTION

613.03
Wall Excavation

Excavation shall be in accordance with the requirements of Section 203 and the limits and construction stages SHOWN ON THE DRAWINGS.

613.04
Foundation
Preparation

The foundation for the structure shall be graded level for a width equal to or exceeding the length of reinforcing strips or as SHOWN ON THE DRAWINGS. Prior to wall construction, the foundation shall be compacted in accordance with Subsection 613.06 with a smooth-wheel vibratory roller meeting the requirements of Subsection 212.02(c) unless constructed on rock.

At each panel foundation level, an unreinforced concrete leveling footing shall be provided as SHOWN ON THE DRAWINGS when concrete face panels are specified. The footing shall be cured a minimum of 12 hours before placement of wall panels.

613.05
Wall Erection

(a) Concrete Face Panels. Panels shall be placed in successive horizontal lifts in the sequence SHOWN ON THE DRAWINGS as backfill placement proceeds. Panels shall be maintained in vertical position as backfill material is placed behind a panel.

Vertical tolerance (plumbness) and horizontal alignment tolerance shall not exceed 3/4 inch when measured along a 10-foot straight edge. The maximum allowable offset in any panel joint shall be 3/4 inch. The overall vertical tolerance of the wall (plumbness from top to bottom) shall not exceed 1/2 inch per 10 feet of wall height.

(b) Steel Face Panels. Skin elements shall be placed by hand in successive horizontal lifts as SHOWN ON THE DRAWINGS. Backfill must be maintained at a level of not more than two skin elements below the top of the wall. Panels shall be maintained in a vertical position as backfill material is placed behind a panel.

Vertical and horizontal alignment tolerances shall be the same as for (a) above.

613.06
Backfill Placement

Backfill placement shall closely follow the erection of each lift of panels. Backfill should be roughly leveled at each reinforcing strip level before placing and bolting strips. Reinforcing strips shall be placed normal to the face of the wall as SHOWN ON THE DRAWINGS. The maximum lift thickness shall not exceed 8 inches (loose). The lift thickness shall be decreased if necessary to obtain the specified density. The last level of backfill, at the end of each day's construction, shall be shaped to permit runoff of rainwater away from the wall face. Backfill shall be compacted in accordance with Subsection 203.15, Method 4, Method 5, or Method 6 as SHOWN ON THE DRAWINGS. Backfill compaction shall be accomplished without disturbance or distortion of reinforcing strips and panels. Compaction within 3 feet of the wall shall be achieved using light mechanical tampers.

613.07
(Reserved)

MEASUREMENT

613.08
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

PAYMENT

613.09
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS. Excavation will be measured and paid for as provided in accordance with Section 203.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
613(01) Concrete Face Panels	S.F.
613(02) Steel Face Panels	S.F.
613(03) Select Granular Backfill	C.Y.

Section 614 - Damp-Proofing

DESCRIPTION

614.01 Work This work shall consist of damp-proofing concrete or masonry surfaces with asphalt.

MATERIALS

614.02 Requirements Materials shall meet the requirements of the following Subsections:

Primer 702.06 (a)
Asphalt 702.06 (b)

CONSTRUCTION

614.03 Performance After the concrete has been finished and cured in accordance with the requirements of Section 602, the surfaces to be damp-proofed shall be allowed to dry at least 10 days. They shall be coated thoroughly with four coats of primer applied cold with a brush or spray gun. Each coat shall be absorbed before the succeeding one is applied. After absorption of the fourth coat, a seal coat shall be applied at the specified temperature and brushed or sprayed thoroughly into all surfaces. The seal coat shall have hardened before any water or earth is placed against it. No coat shall be applied to damp surfaces.

MEASUREMENT

614.04 Method The method of measurement as described in Section 106 will be DESIGNATED in the SCHEDULE OF ITEMS. Area computations will be based on surface area covered.

PAYMENT

614.05 Basis The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
614(01) Damp-Proofing	S.Y.
614(02) Damp-Proofing	L.S.
614(03) Damp-Proofing	GAL.

Section 615 - Waterproofing

DESCRIPTION

615.01 This work shall consist of the waterproofing of concrete surfaces.
Work

MATERIALS

615.02 Materials shall meet the requirements of the following
Requirements Subsections:

Primer for Use With Asphalt	702.06(a)
Asphalt for Mop Coat	702.06(b)
Waterproofing Fabric	702.06(c)
Mortar	702.06(d)
Asphalt Plank	702.06(e)
Asphalt Roll Roofing	702.06(f)
Membrane Material	702.07
Joint Fillers	705.01
Oakum	705.04
Welded Wire Fabric	709.01(e)

CONSTRUCTION

615.03 Membrane waterproofing shall be a firmly bonded membrane composed
Membrane of two layers of asphalt-treated fabric, three moppings of
Waterproofing asphalt, and a coating of primer, applied as follows:

Concrete surfaces to be waterproofed shall be smooth and free of projections or depressions that might cause puncture of the membrane.

The surface shall be dry and free of dust and loose materials. Waterproofing shall not be applied in wet or freezing weather.

Asphalt shall be applied at a temperature between 300 °F and 350 °F.

A coating of primer shall be applied and allowed to dry before any mop coat is applied.

The fabric shall be laid so that drainage will be over and not against or along the laps. It shall be shingled so there will be two thicknesses at all points. Edge laps shall be at least 4 inches and end laps at least 12 inches. One ply of fabric shall not touch another or the primed concrete surface.

Beginning at the lowest point of the surface to be waterproofed, a primed section about 20 inches wide shall be mopped with the hot asphalt. A strip of fabric of half the width of the roll shall be placed immediately on the hot asphalt and pressed carefully into place to expel all entrapped air and obtain close conformity with the surface. This strip and an adjoining area of concrete surface, slightly more than one-half the width of a roll, shall then be mopped with hot asphalt and a full-width strip of fabric shall be pressed into place as before, to cover completely the first strip. The second strip and an adjoining area of concrete surface shall then be mopped with hot asphalt and the third strip of fabric placed to lap the first by not less than one-half the width plus 4 inches. This process shall be continued until the entire surface is covered, each strip of fabric lapping at least one-half the width plus 4 inches over the past strip. The entire surface shall then be mopped with hot asphalt. The work shall be so regulated that at the close of the day's work the required mopping shall have been applied to all the fabric in place. All laps shall be thoroughly sealed down.

Under no circumstances shall one layer of fabric touch another layer at any point or touch the unmopped surface. In all cases the mopping on concrete shall cover the surface so no gray spots appear, and on cloth it shall be sufficiently heavy to completely conceal the weave. On horizontal surfaces, not less than 12 gallons of asphalt shall be used for each 100 square feet of finished work and on vertical surfaces not less than 15 gallons shall be used for each 100 square feet.

At the edges of the membrane and at any points where it surrounds such appurtenances as drains or pipes, provisions shall be made to prevent water from getting between the waterproofing and the concrete surface.

All flashing at curbs and against girders, spandrel walls, etc., shall have separate sheets lapping the main membrane not less than 12 inches. Flashing shall be closely sealed with a metal counter-flashing or by embedding the upper edges of the flashing in a groove poured full of joint filler.

Joints that are essentially open joints but not designed to provide for expansion shall be calked with oakum and lead wool and then filled with hot joint filler.

Horizontal and vertical expansion joints shall be provided with approved waterstops as SHOWN ON THE DRAWINGS and in accordance with Section 616. The membrane shall be continuous across all expansion joints.

At the ends of the structure, the membrane shall be carried well down on the abutments and suitable provision made for all movement.

615.03A
Bridge Deck
Waterproofing

Subsection 615.03 shall apply, except:

Bridge deck waterproofing shall be composed of an asphalt primer coat, two layers of asphalt-coated glass fabric, and three moppings of asphalt.

The asphalt primer coat shall be applied by brush or hand roller to penetrate the concrete and provide a bond between the concrete and the waterproofing. Primer shall be applied at the rate of 0.05 to 0.10 gallon per square yard, and only when the ambient air temperature is greater than 35 °F. Primer shall be allowed to cure a minimum of 4 hours prior to application of the waterproofing.

Surfaces shall be dry when the hot asphalt is applied. No waterproofing shall be done in wet weather or when the temperature is below 50 °F.

The bituminized glass fabric shall be shingled so there will be at least two thicknesses at all points. Edge laps shall be at least 2 inches. One ply of fabric shall not touch another or the primed concrete surface, since there must be three unbroken moppings.

The first strip of fabric shall be one-half of the width of the roll; the second shall be the full width of the roll lapped with the full width of the first strip; the third shall be the full width of the roll lapped one-half the width of the second strip plus 2 inches. Each succeeding strip shall lap one-half the width of the preceding strip so that there will be at least two layers of fabric at all points. No strips less than 12 inches wide shall be used.

On horizontal surfaces, not less than 3 gallons and not more than 4 gallons of asphalt mop coat shall be used for each mopping per 100 square feet of finished work; on vertical surfaces, not less than 4 gallons and not more than 5 gallons for each mopping per 100 square feet shall be used.

Each strip of fabric shall be carefully pressed into place to eliminate all air bubbles and provide a smooth, flat surface.

Waterproofing applied to surfaces that change abruptly in direction shall be reinforced at these points by application of an extra layer of fabric of suitable dimensions.

The waterproofing strips and course shall not be damaged during the placing of the pavement or by any other construction operation. Planks, plywood, or suitable sheet material shall be laid over the waterproofing when any trucking or tracking is unavoidable.

Special waterproofing at the juncture of the concrete deck slab and the curb shall be installed as SHOWN ON THE DRAWINGS and in conjunction with the placement of the bridge deck waterproofing. Approximately 1-1/2 inches of the waterproofing strip nearest the curbs shall be turned up into a specially provided recess directly beneath the face of the curb. The joint filler shall then be installed between the concrete deck and the underside of the curb and in front of the turned-up waterproofing.

Waterproofing at the juncture of the deck slab and scuppers, expansion joints, and manholes shall be accomplished by turning up the waterproofing at such junctures, with the waterproofing snug against the face to a point that will be flush with the wearing surface when placed.

615.04
Membrane
Waterproofing
with Mortar
Protection

Waterproofing membrane to be protected with mortar shall be constructed in accordance with Subsection 615.03.

Every part of the membrane, except undercut surfaces, shall be covered with a 2-inch course of reinforced mortar. Undercut surfaces are the undersides of parts of the structure that make an angle of less than 90 degrees with a horizontal plane. Reinforcement shall be 12-gauge welded wire fabric with 6-inch mesh or its equivalent, placed midway between the top and bottom surfaces of the mortar. The top surface of the mortar course shall be troweled to a smooth, hard finish. The protective mortar course shall be cured by burlap held in close surface contact and kept wet for 72 hours.

On undercut surfaces, the membrane shall be protected with a layer of asphalt roll roofing laid in hot asphalt instead of the mortar covering. The bituminous material shall be the same as used in mopping the membrane.

615.05
Membrane
Waterproofing with
Asphalt Plank
Protection

Waterproofing membrane to be protected with asphalt plank shall be constructed in accordance with Subsection 615.03.

The membrane shall then be covered with asphalt plank. The plank shall be laid in regular, straight courses as SHOWN ON THE DRAWINGS. Whole planks shall be used in all cases, except as otherwise required for closures and for fitting around openings and obstructions. Closing and trimming pieces shall be cut carefully to size. Before the planks are laid, all surplus talc or other powder shall be removed with a stiff brush or broom. Each piece shall be laid in a mopping of hot asphalt and the edges and ends of pieces in place shall be coated with the hot asphalt or tar before another piece is placed against them. Each individual piece shall be pressed tightly against the piece next to it and the completed work shall have a uniform, smooth surface with open joints.

MEASUREMENT

615.06
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS. Area computation will be based on the surface actually covered.

PAYMENT

615.07
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
615(01) Membrane Waterproofing (Asphalt)	S.Y.
615(02) Membrane Waterproofing (Asphalt) with Mortar Protection	S.Y.
615(03) Membrane Waterproofing (Asphalt) with Asphalt Plank Protection.	S.Y.
615(04) Membrane Waterproofing	L.S.
615(05) Bridge Deck Waterproofing	S.Y.

Section 616 - Waterstops

DESCRIPTION

616.01 This work shall consist of constructing waterstops formed of
Work rubber or plastic in expansion and construction joints.

MATERIALS

616.02 Materials shall meet the requirements of the following Subsections:
Requirements

Rubber Waterstops	705.07
Plastic Waterstops	705.08

CONSTRUCTION

616.03 The size, type, and locations of waterstops shall be as SHOWN ON
Performance THE DRAWINGS.

616.04
(Reserved)

616.05 Splices shall be made watertight in accordance with the
Rubber Waterstops manufacturer's instructions. If splices are used, the contractor shall make at least one preliminary field splice sample for testing by the Engineer. No splicing shall be done until tests indicate a tensile strength of at least 50 percent of the tensile strength of the unspliced rubber waterstops.

616.06 Splices shall be made water-tight without damage to the plastic,
Plastic Waterstops in accordance with the manufacturer's instructions. Preliminary splice samples shall be made and tested in accordance with Subsection 616.05 and no splices shall be made in the work until a tensile strength for splices of at least 80 percent of the unspliced plastic waterstops is indicated by tests.

616.07 Waterstops shall be placed at the locations SHOWN ON THE DRAWINGS.
Placing Waterstops Waterstops shall not be displaced or damaged. All surfaces of the waterstops shall be kept free of oil, grease, dried mortar, or any other foreign matter while the waterstops are being embedded in concrete. All portions of the waterstops designed for embedment shall be tightly enclosed by concrete.

MEASUREMENT

616.08 The method of measurement, as described in Section 106, will be
Method designated in the SCHEDULE OF ITEMS.

PAYMENT

616.09 The accepted quantities will be paid for at the contract unit
Basis price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
616(01) Rubber Waterstop	S.F.
616(02) Rubber Waterstop _____ Width	L.F.
616(03) Rubber Waterstop	L.S.
616(04) Plastic Waterstop	S.F.
616(05) Plastic Waterstop _____ Width	L.F.
616(06) Plastic Waterstop	L.S.

Section 617 - Structural-Plate Pipe, Pipe Arches, & Arches

DESCRIPTION

617.01 Work This work shall consist of furnishing and installing, or installing only structural-plate pipe, or pipe arches, and arches.

This work shall also include joints and connections to pipes, catch basins, headwalls, and other appurtenances required to complete the structure.

MATERIALS

617.02 Requirements Materials shall meet the requirements of the following Subsections:

Grout	701.02
Structural Steel Plate for Pipe, Pipe Arch, and Arches.	707.10
Full Bituminous-Coated Structural-Plate Pipe,	
Pipe Arch and Arches	707.11
Aluminum Alloy Structural Plate for Pipe, Pipe Arch, and Arches	707.12

CONSTRUCTION

617.03 Excavation, Bedding, & Backfill Excavation shall be in accordance with the requirements of Section 206A.

Pipe that is installed in or that will affect streams SHOWN ON THE DRAWINGS as important fisheries shall be installed only during those periods SHOWN ON THE DRAWINGS.

Bedding shall consist of bedding the pipe to a depth of not less than 10 percent of its total height. The foundation surface shall be excavated in accordance with Subsection 206A.03(b).

The bedding material shall be selected mineral soil meeting the same requirements as backfill material.

Pipe shall not be placed or backfilled until the excavation and foundation have been approved by the Engineer.

After the bedding is prepared and the pipe is placed, selected material shall be placed in layers not exceeding 6 inches loose thickness and compacted under the haunches and alongside the pipe. The material shall be readily compactible material free of frozen lumps, chunks of highly plastic clay, or other objectionable material. Rocks larger than 3 inches in greatest dimension shall not be used within 1 foot of the pipe. On each side of the pipe there shall be an area of compacted material at least as wide as one diameter of the pipe or 12 feet, whichever is less. Backfill shall be compacted without damaging or displacing the pipe.

Backfill density shall exceed 95 percent of the maximum density as determined by AASHTO T 99, Method C or D.

Backfilling and compacting shall be continued until the backfill is 12 inches above the top of the pipe.

After being hedded and backfilled, pipe shall be protected by an adequate cover of embankment as indicated in applicable cover height tables before heavy equipment is permitted to cross during roadway construction.

Pipe distorted more than 5 percent of nominal dimensions, ruptured, or broken shall be replaced.

When filling around and over arches before headwalls are in place, the first embankment material shall be placed midway between the ends of the arch, forming as narrow a ramp as possible, until the top of the arch is reached. The ramp shall be built evenly from both sides, and the embankment material shall be compacted as it is placed. After the two ramps have been built to the top of the arch, the remainder of the embankment material shall be deposited from the top of the arch both ways from the center to the ends, and as evenly as possible on both sides of the arch.

If the headwalls are built before any embankment material is placed around and over the arch, the embankment material shall first be placed adjacent to one headwall until the top of the arch is reached, after which it shall be dumped from the top of the arch toward the other headwall, depositing the material evenly on both sides of the arch.

The procedures specified above shall be followed in multiple installations and the embankment material shall be brought up evenly on each side of each arch so that unequal pressure will be avoided.

617.04
Fabrication

Plates for structural plate pipe, arches, and pipe arches shall be fabricated in accordance with AASHTO M 167 or M 219.

Plates shall be formed to provide lap joints. The bolt holes shall be punched so that all plates having like dimensions, curvature, and the same number of bolts per foot of seam shall be interchangeable. Each plate shall be curved to the proper radius so that the cross sectional dimensions of the finished structure will be as SHOWN ON THE DRAWINGS.

Plates for forming skewed or sloped ends shall be cut to give the angle of skew or slope SHOWN ON THE DRAWINGS. Legible identification numerals shall be placed on each plate to designate its proper position in the finished structure.

617.05
Footings for Arches

Footings for arches shall be constructed as SHOWN ON THE DRAWINGS.

617.06
Erection

Structural-plate pipe, arches, and pipe arches shall be erected in their final position by connecting the plates with bolts at longitudinal and circumferential seams. Drift pins may be used to facilitate matching of holes. All plates shall be placed in the order recommended by the manufacturer with joints staggered so that not more than three plates come together at any one point. All bolts shall be drawn tight, without overstressing, before beginning the backfill.

Steel bolts for structural-plate sections shall be torqued during installation to a minimum of 100 foot-pounds, and a maximum of 300 foot-pounds. The bolts for aluminum structural-plate sections shall be torqued during installation to a minimum of 100 foot-pounds, and a maximum of 200 foot-pounds.

Bolts shall be of sufficient length to completely engage the nut threads.

After steel pipe or arches have been erected, all damaged spelter shall be wire brushed and painted as specified in AASHTO M 167.

617.07
(Reserved)

MEASUREMENT

617.08
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

PAYMENT

617.09
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
617(01) Steel Structural-Plate, Size _____, _____ Coated, _____ Thickness, . . .	L.F.
617(02) Aluminum Structural-Plate, Size _____, _____ Coated, _____ Thickness, . . .	L.F.
617(03) Installation Only.	EA.

When materials are furnished by the Forest Service, the note "Government-furnished materials" will be added to the description of the pay item.

Section 617A - Structural-Plate Long-Span Structures

DESCRIPTION

617A.01
Work

This work shall consist of furnishing and installing, or installing only, structural-plate long-span structures including such shapes as horizontal ellipse, low profile arch, and high profile arch. The work shall include the furnishing and placement of stiffening ribs or reinforced concrete thrust beams or other special structural features.

This work shall also include joints and connections to pipes, catch basins, headwalls, and other appurtenances required to complete the structure.

MATERIALS

617A.02
Requirements

Materials shall meet the requirements of the following Sections and Subsections:

Grout	701.02
Structural Steel Plate for Pipe, Pipe Arch, and Arches	707.10
Full Bituminous-Coated Structural-Plate Pipe, Pipe Arch and Arches	707.11
Aluminum Alloy Structural Plate for Pipe, Pipe Arch and Arches	707.12
Reinforcing Steel	709

The thickness of the structural plate shall not be less than the plate thickness SHOWN ON THE DRAWINGS.

Concrete shall meet the requirements of Section 602, Method A or B as SHOWN ON THE DRAWINGS.

CONSTRUCTION

617A.03
Excavation,
Bedding, & Backfill

Excavation and backfilling shall be to the limits SHOWN ON THE DRAWINGS. Excavation shall be in accordance with the requirements of Section 206A.

Pipe that is installed in or that will affect streams SHOWN ON THE DRAWINGS as important fisheries shall be installed only during those periods SHOWN ON THE DRAWINGS.

Bedding shall consist of bedding the pipe to a depth of not less than 10 percent of its total height. The foundation surface shall be excavated in accordance with Subsection 206A.03(b).

The bedding material shall be selected mineral soil meeting the same requirements as backfill material.

Pipe shall not be placed or backfilled until the excavation and foundation have been approved by the Engineer.

After the bedding is prepared and the pipe is placed, selected material shall be placed in layers not exceeding 6 inches loose thickness and compacted under the haunches and alongside the pipe. The material shall be readily compactible material free of frozen lumps, chunks of highly plastic clay (Plasticity Index greater than 10), or other objectionable material. Rocks larger than 3 inches in greatest dimension shall not be used within 1 foot of the pipe. On each side of the pipe there shall be an area of compacted material at least as wide as one diameter or span of the structure or 12 feet, whichever is less. Backfill shall be compacted without damaging or displacing the pipe.

Backfill density shall exceed 95 percent of the maximum density as determined by AASHTO T 99, Method C or D.

Backfilling and compacting shall be continued until the backfill is 12 inches minimum above the top of the pipe.

After being bedded and backfilled, pipe shall be protected by an adequate cover of embankment before heavy equipment is permitted to cross during roadway construction.

Pipe distorted more than 5 percent of nominal dimensions, ruptured, or broken shall be replaced.

Prior to construction, a meeting shall be held at a time and place agreed to by the Engineer to discuss construction procedures. The meeting shall include the contractor, any involved subcontractor, and a qualified representative of the manufacturer of the arch structure.

Before backfilling, the erected structure shall meet the design shape within tolerances permitted by the manufacturer. If the structure is not within the allowable tolerances, suitable temporary supports shall be required to bring it into the proper shape.

The contractor shall monitor and record the horizontal and vertical displacement of the structure periodically during placement of backfill and embankment. These records shall be made available upon request to the Engineer. Displacements shall be measured to the nearest 1/8 inch at locations and frequencies established by the manufacturer's representative to ensure that the rate of change will not produce ultimate displacement beyond allowable tolerances. Structural backfill shall extend a minimum of 6 feet behind each thrust beam. Wheel or track machines shall be kept a safe distance away from the arch. If the rate of shape change for the structure exceeds the manufacturer's recommendation during backfill, backfill methods or materials, or both, shall be modified to keep structure shape within the manufacturer's tolerance.

A manufacturer's representative shall be on the site during all backfilling operations.

617A.04
Design &
Fabrication

Four sets of shop drawings of the plate structure shall be submitted to the Engineer a minimum of 21 days in advance of planned construction. Shop drawings shall be accompanied by all calculations used to determine the size, shape, location, and spacing of stiffening ribs, thrust beams, or other special structural features.

Plates shall be fabricated in accordance with AASHTO M 167 or M 219.

Plates shall be formed to provide lap joints. The bolt holes shall be punched so that all plates having like dimensions, curvature, and the same number of bolts per foot of seam shall be interchangeable. Each plate shall be curved to the proper radius so that the cross sectional dimensions of the finished structure will be as SHOWN ON THE DRAWINGS.

Plates for forming skewed or sloped ends shall be cut to give the angle of skew or slope SHOWN ON THE DRAWINGS. Legible identification numerals shall be placed on each plate to designate its proper position in the finished structure.

617A.05
Footings,
Headwalls,
& Collars

Footings, headwalls, collars and other associated concrete work shall be constructed as SHOWN ON THE DRAWINGS. Concrete work and placement of reinforcing steel shall be in accordance with Section 602.

617A.06
Erection

Long-span structural-plate structures shall be erected in their final position by connecting the plates with bolts at longitudinal and circumferential seams. Drift pins may be used to facilitate

matching of holes. All plates shall be placed in the order recommended by the manufacturer with joints staggered so that not more than three plates come together at any one point. All bolts shall be drawn tight, without overstressing, before beginning the backfill.

Steel bolts for structural-plate sections shall be torqued during installation to a minimum of 100 foot-pounds, and a maximum of 300 foot-pounds. The bolts for aluminum structural-plate sections shall be torqued during installation to a minimum of 100 foot-pounds, and a maximum of 200 foot-pounds.

Bolts shall be of sufficient length to completely engage the nut threads.

After steel structures have been erected, all damaged spelter shall be wire brushed and painted as specified in AASHTO M 167.

617A.07
(Reserved)

MEASUREMENT

617A.08
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

The quantity of concrete or reinforcing steel used in thrust beams or additional structural metal or plates used in stiffening ribs or other special structural feature will not be included in the quantities for payment.

Concrete and reinforcing steel for footings, headwalls, and collars or other concrete work will be included under other items as indicated in the SCHEDULE OF ITEMS.

PAYMENT

617A.09
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
617A(01) Steel Long Span Structures Coated, _____ Span, _____ Rise, _____ Thickness, Shape _____ . .	L.F.
617A(02) Aluminum Long Span Structures Coated, _____ Span, _____ Rise, _____ Thickness, Shape _____ . .	L.F.

When materials are furnished by the Forest Service, the note "Government-furnished materials" will be added to the description of the pay item.

Section 618 - Cleaning & Reconditioning Existing Drainage Structures

DESCRIPTION

618.01
Work This work shall consist of cleaning and reconditioning existing pipe and appurtenant structures.

MATERIALS

618.02
Requirements Materials used for repair or replacement shall meet the applicable requirements of Sections SHOWN ON THE DRAWINGS or specified in the SPECIAL PROJECT SPECIFICATIONS for the materials being used.

CONSTRUCTION

618.03
Pipe Removed
& Cleaned The pipe and appurtenant structures shall be carefully removed and cleaned of foreign material inside the barrel and at the jointed ends.

618.04
Pipe Cleaned
in Place All foreign material inside the barrel shall be removed by methods which do not damage the pipe. Pipe shall not be hydraulically cleaned in place unless adequate measures are taken to protect the drainageway and prevent stream siltation or increased turbidity.

If approved by the Engineer, all or part of the pipe DESIGNATED to be cleaned in place may be removed, cleaned, and relaid in accordance with the requirements of Section 603. In these cases, the contractor shall furnish all material required to replace damaged pipe and joints, perform all excavation and backfill, and relay the pipe.

618.05
Relaying or
Stockpiling
Salvaged Pipe The locations of pipe and appurtenant structures to be removed, cleaned, and relaid will be SHOWN ON THE DRAWINGS. Relaying of pipe shall be in accordance with the requirements of Section 603. The contractor shall furnish all jointing material and shall replace pipe damaged during removing or handling, in sufficient lengths to complete the DESIGNATED length to be relaid, without added compensation. Salvaged pipe DESIGNATED to be stockpiled shall be placed where SHOWN ON THE DRAWINGS. All pipe shall be carefully removed and handled to avoid breaking or damaging the pipe. Pipe that has sustained structural damage shall not be placed in stockpiles. The contractor shall dispose of damaged pipe at an approved location.

618.06
Reconditioning
Drainage Structure Structures, such as manholes, inlets, etc., SHOWN ON THE DRAWINGS to be reconditioned shall have all debris removed, leaks repaired, missing or broken metalwork replaced, and be left in operating condition.

MEASUREMENT

618.07
Method The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

The quantity of pipe and appurtenant structures removed, cleaned, and relaid will be the length in final position.

The quantity of pipe and appurtenant structures removed, cleaned, and stockpiled will be the total lengths of all pipe acceptably removed, cleaned, and placed in the stockpile.

The quantity of pipe and appurtenant structures cleaned in place will be the length along the flow line.

If the contractor chooses to remove pipe for cleaning, no additional payment will be made for material to replace damaged pipe and joints, excavation, relaying pipes, or backfill.

PAYMENT

618.08
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
618(01) Removing, Cleaning, and Stockpiling Salvaged _____	L.F.
618(02) Removing, Cleaning, and Relaying Salvaged _____	L.F.
618(03) Cleaning _____ in Place	L.F.
618(04) Cleaning _____ in Place	EA.
618(05) Reconditioning Drainage Structures	EA.

Section 619 - Riprap

DESCRIPTION

619.02
Work

This work shall consist of furnishing and placing erosion-resistant and protective materials on the slopes of embankments, dikes, or streambanks, at culvert inlets and outlets, on bottoms and side slopes of channels, at abutment wings, at structure foundations, and at other locations SHOWN ON THE DRAWINGS.

MATERIALS

619.02
Hand-Placed,
Machine-Placed,
& Dumped Riprap

Rock used for riprap shall be hard angular rock meeting the following requirements for durability absorption ratio as defined below.

<u>Durability Absorption Ratio</u>	<u>Acceptability</u>
Greater than 23	Passes
10 to 23	Passes only if Durability Index is 52 or greater
Less than 10	Fails

$$\text{Durability Absorption Ratio} = \frac{\text{Durability Index (Coarse)}}{\text{Percent Absorption} + 1}$$

The durability index and percent absorption shall be determined by AASHTO T 210 and AASHTO T 85 respectively. The minimum apparent specific gravity of stone shall be 2.5 as determined by AASHTO T 85.

Neither the breadth nor thickness of any piece of riprap shall be less than one-third its length. Stone shall be free from overburden, spoil, shale, and organic material; shall meet the following gradation requirements for the class specified; and shall be used at the locations SHOWN ON THE DRAWINGS:

<u>Size of Stone</u>	<u>Percent of Total Weight Smaller Than the Given Size</u>
Class I	
25 pounds	100
15 pounds	80
5 pounds	50
1 pound not to exceed	10
Class II	
50 pounds	100
35 pounds	80
10 pounds	50
2 pounds not to exceed	10
Class III	
100 pounds	100
60 pounds	80
25 pounds	50
2 pounds not to exceed	10
Class IV	
150 pounds	100
100 pounds	70
50 pounds	30
10 pounds not to exceed	10
Class V	
250 pounds	100
150 pounds	70
50 pounds	30
15 pounds not to exceed	10

Class VI		
400 pounds		100
250 pounds		70
100 pounds		30
20 pounds	not to exceed	10
Class VII		
700 pounds		100
400 pounds		70
200 pounds		30
25 pounds	not to exceed	10
Class VIII		
1,600 pounds		100
800 pounds		70
400 pounds		30
50 pounds	not to exceed	10
Class IX		
2,700 pounds		100
1,600 pounds		70
800 pounds		30
100 pounds	not to exceed	10
Class X		
4,000 pounds		100
2,000 pounds		80
500 pounds		50
70 pounds	not to exceed	10
Class XI		
6,000 pounds		100
3,000 pounds		80
1,000 pounds		50
200 pounds	not to exceed	10

Each load of riprap shall be well graded from the smallest to the maximum size specified.

When allowed in the SPECIAL PROJECT SPECIFICATIONS, stone from the project site may be utilized.

Control of gradation will be by visual inspection. When SHOWN ON THE DRAWINGS, the contractor shall provide two samples of the specified class of rock of at least 5 tons each or 10 percent of the total riprap weight, whichever is less. The sample at the construction site may be a part of the finished riprap covering. The other sample shall be provided at the quarry. These samples shall be used as a frequent reference for judging the gradation of the riprap supplied. Any difference of opinion between the Engineer and the contractor shall be resolved by dumping and checking the gradation of two random truck loads of stone. When specified in the SPECIAL PROJECT SPECIFICATIONS, the contractor shall provide mechanical equipment, a sorting site, and labor needed to assist in checking gradation at no additional cost.

619.03
Wire-Enclosed
Riprap

Rock used for wire-enclosed riprap shall meet the durability requirements of Subsection 619.02. The rock shall be well graded within the sizes available and 70 percent, by weight, shall exceed in least dimension the wire mesh opening. The maximum size of rock, measured normal to the slope, shall not exceed the mat thickness.

Wire mesh or woven wire, tie wire, and lacing wire shall be galvanized and of the type, quality, and size SHOWN ON THE DRAWINGS. Wire mesh or woven wire shall be furnished in maximum lengths and widths to reduce the number of splices as much as practical. Materials shall meet the requirements of ASTM A 116 "Zinc-Coated (Galvanized) Iron or Steel Farm-Field and Railroad Right-of-Way Fencing" Class 1 or better; or FS-QQ-W-461, Finish 5, Class 3 weight of zinc coating.

619.04
Grouted Riprap

Grout for grouted riprap shall consist of one part Portland cement and three parts sand, thoroughly mixed with water to a thick creamy consistency. The minimum amount of water shall be used to prevent excess shrinkage of the grout after placement. The cement and sand shall meet the requirements of Subsection 705.05.

The rocks for grouted riprap shall meet the durability requirements of Subsection 619.02. The size and gradation will be SHOWN ON THE DRAWINGS for each particular project. Rock shall be free of fines that prevent penetration of grout, and care shall be taken when placing the rock to keep earth or sand from filling the spaces between the rocks.

619.05
Sacked Concrete
Riprap

(a) Type A sacked concrete riprap shall consist of concrete containing at least three and one-half sacks of cement per cubic yard, aggregate with a maximum size of 2-1/2 inches, and water limited to that necessary to ensure good workability without loss of cement by seepage through the sacks. Reasonably clean and strong aggregate of appropriate size gradation shall be used. Sacks shall be at least 10-ounce burlap or equivalent. Minimum weight of the filled sack shall be 50 pounds. Sacks will be placed while contents are in a moist condition. Premixed concrete, meeting the requirements of this Section, is acceptable.

(b) Type B, (premixed) sacked concrete riprap shall be commercially packaged, dry, combined materials for concrete. The minimum weight for each sack shall be 60 pounds, and each sack shall have an approximate size of 12 by 18 by 6 inches. The strength of each shall be adequate for the mass of concrete it contains. Each sack shall be water permeable. Each sack shall be free of tears and imperfections and the concrete shall not have taken an initial set prior to placing.

619.06
Sacked Soil
Cement Riprap

Sacked soil cement riprap may be composed of any combination of gravel, sand, silt, and clay with the following limitations: top soil shall not be used; at least 55 percent of the mixed soil shall pass the No. 4 sieve, with not more than 15 percent passing the No. 200 sieve; and the maximum size gravel shall pass the 1-1/2 inch sieve. Excluding rocks, the soil shall be pulverized so that no lumps exceed 1/2 inch in diameter. The cement, soil, and water shall be thoroughly and uniformly mixed before placing in sacks. Moisture content shall be limited to that necessary for good mixing without seepage. Sacks shall be at least 10-ounce burlap or equivalent. Minimum weight of filled sack shall be 50 pounds. Sacks shall be placed while the contents are in a moist condition.

The cement requirements in percent by volume for each soil group are shown below:

AASHTO Classification (M 145) Soil Group	Percent Cement by Volume
A-1-a	7
A-1-b	9
A-2	10
A-3	12
A-4	12
A-5	13
A-6	14
A-7	15

619.07
Granular Filter
Blanket

Filter blanket material shall be in accordance with Subsection 703.01(b).

619.08
Geotextile with
Gravel Cushion

Geotextile shall meet the requirements of Section 720 and shall be the function type SHOWN ON THE DRAWINGS. Gravel cushion shall meet the gradation requirements SHOWN ON THE DRAWINGS and the quality requirements of Subsection 703.06.

619.09
Anchor Stakes

Soil-anchor stakes shall be of the type and length SHOWN ON THE DRAWINGS.

CONSTRUCTION

619.10
General

Slopes to be protected by riprap shall be free of brush, trees, stumps, and other objectionable material and shall be dressed to a smooth surface. All soft or spongy material shall be removed to the depth SHOWN ON THE DRAWINGS and replaced with approved material. Backfilled areas shall be compacted as specified in Subsection 203.15, Method 4. A toe trench, if SHOWN ON THE DRAWINGS, shall be dug and maintained until the riprap is placed. The riprap blanket shall be constructed to its full thickness as the placement proceeds up the slope.

All riprap to be located beneath bridge superstructures shall be placed before bridge girders or stringers are installed.

Foundation beds and slopes shall be approved before placing riprap.

When SHOWN ON THE DRAWINGS, a granular filter blanket or geotextile with gravel cushion shall be placed on the prepared slope or area before the stone is placed.

619.11
Hand-Placed
Riprap

The rock shall be securely bedded. Spalls and small rocks shall be used to fill voids. Any spaces back of the hand-placed riprap shall be filled with compacted material.

619.12
Machine-Placed
Riprap

Riprap stone shall be placed to produce a well-keyed mass of rock with the least practicable amount of void spaces. Rocks shall be placed with their longitudinal axis normal to the embankment face and arranged so each rock above the foundation course has a three-point bearing on the underlying rocks. The foundation course is the course placed on the slope in contact with the ground surface. Bearing shall not be on smaller rocks that may be used for filling voids.

The finished riprap slopes shall present a reasonably uniform and regular surface, free of humps and depressions, and not steeper than SHOWN ON THE DRAWINGS.

619.13
Dumped Riprap
(Loose)

Riprap shall be placed to its full course thickness in one operation producing a well-graded uniform mass without displacing the underlying material.

The larger rocks shall be well distributed, and the entire mass of stone shall meet approximately the gradation specified.

The riprap shall be placed in conjunction with the construction of the embankment, with only sufficient lag in placement of the riprap as necessary to allow for proper construction of the protected portion of the embankment and to prevent mixing of embankment and riprap material.

The finished riprap slopes shall present a reasonably uniform and regular surface, free of humps and depressions, and not steeper than SHOWN ON THE DRAWINGS.

619.14
Wire-Enclosed
Riprap

Wire enclosure segments shall be placed, anchored, laced, and filled to provide a uniform, dense, protective coat over the area SHOWN ON THE DRAWINGS.

619.15
Grouted Riprap

Rocks shall be thoroughly moistened and any excess of fines shall be sluiced to the underside of the riprap before grouting.

The grout shall be delivered to the place of final deposit by a method that will ensure uniformity and prevent segregation of the grout. The grout shall be spaded or rodded into the interstices to completely fill the voids in the riprap. Pressure grouting shall not unseat the rocks. Penetration of the grout shall be to the depth SHOWN ON THE DRAWINGS. When a rough surface is SHOWN ON THE DRAWINGS, stone shall be brushed until one-quarter to one-half of the depth of surface stone is exposed. For a smooth surface, grout shall fill the interstices to within 1/2 inch of the surface.

Weep holes shall be provided where SHOWN ON THE DRAWINGS.

Where the depth SHOWN ON THE DRAWINGS for grouting is in excess of 12 inches, the riprap shall be placed in lifts of 12 inches or less. Each lift shall be grouted prior to placing the next lift. The succeeding lifts shall be constructed and grouted before the grout in the previous lift has hardened.

Grout shall not be placed in freezing weather or when there is frost on the riprap. Grout shall be protected from freezing and cured in accordance with Section 602.

619.16
Sacked Concrete
Riprap

(a) Type A. The sacks, filled with concrete, shall be loosely placed to leave room for folding at the top. The fold shall be just enough to retain the concrete at the time of placing. Immediately after being filled with concrete, the sacks shall be placed and lightly trampled to cause them to conform with the earth face and with adjacent sacks.

All dirt and debris shall be removed from the top of the sacks before the next course is laid thereon. Stretchers shall be placed so the folded ends will not be adjacent. Headers shall be placed with the folds toward the earth face. Not more than four vertical courses of sacks shall be placed in any tier until initial set has taken place in the first course of any such tier.

(b) Type B. Sacks shall be placed and lightly compressed to cause them to conform with the earth surface and with adjacent sacks. Location of placement and special instructions shall be as SHOWN ON THE DRAWINGS. When more than one layer of sacks is required, joints shall be staggered one-half sack width. Not more than four vertical courses (one tier) of sacks shall be placed until initial set has taken place in the first course of any such tier.

After placement, each sack shall be penetrated at least six times from the top through the entire sack thickness, leaving at least a 1/2 to 1 inch diameter void in the concrete mixture. These penetrations shall not damage the sack to the extent that the concrete mixture is spilled or wasted.

When there will not be proper bearing or bond for the concrete because of delays in placing succeeding layers of sacks or because the work is hampered by storms, mud, or other causes, a small trench shall be excavated behind the row of sacks already in place, and the trench shall be filled with fresh concrete before the next layer of sacks is laid.

Sacked concrete riprap shall be kept moist and protected from freezing for a period of 4 days after placement.

619.17
Sacked Soil Cement
Riprap

Sack soil cement riprap shall be placed as SHOWN ON THE DRAWINGS.

619.18
Granular Filter
Blanket

A filter blanket shall be placed where SHOWN ON THE DRAWINGS to the full specified thickness of each layer in one operation, using methods that will not cause segregation of particle sizes within the layer. The surface of the finished layer shall be reasonably even and free of mounds or windrows. Additional layers of filter material shall be placed in a manner that will not cause mixture of the material in the different layers.

619.19
Geotextile

The geotextile shall be placed as SHOWN ON THE DRAWINGS. The surfaces upon which the geotextile is to be placed shall have a uniform slope, shall be reasonably smooth and free of obstructions, depressions, and debris that could damage the geotextile, and shall be approved prior to placing of geotextile.

The geotextile shall be laid loosely without wrinkles or creases. Adjacent strips shall be sewn or overlapped at joints. Securing pins shall be inserted through both strips of overlapped geotextile at maximum intervals of 3 feet, but not closer than 2 inches to each edge. Displacement of the geotextile shall be prevented.

The installed geotextile shall be approved prior to covering with a gravel cushion or other materials. The gravel cushion shall be carefully placed on the geotextile to the depth SHOWN ON THE DRAWINGS by methods that will not cause damage to the geotextile. Riprap placed on the gravel cushion shall not be dropped a distance greater than 3 feet.

MEASUREMENT

619.20
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

Area computations will be based upon surface measurements. Cross sectional measurements of filter blanket material will not exceed the dimensions SHOWN ON THE DRAWINGS.

PAYMENT

619.21
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
619(01) Hand-Placed Riprap, Class _____	C.Y.
619(02) Hand-Placed Riprap, Class _____	TON
619(03) Machine-Placed Riprap Class _____	C.Y.
619(04) Machine-Placed Riprap Class _____	TON
619(05) Dumped Riprap, Class _____	C.Y.
619(06) Dumped Riprap, Class _____	TON
619(07) Dumped Riprap, Class _____	S.Y.
619(08) Wire-Enclosed Riprap	C.Y.
619(09) Wire-Enclosed Riprap	S.Y.
619(10) Grouted Riprap	C.Y.
619(11) Grouted Riprap	S.Y.
619(12) Sacked Concrete Riprap Type _____	C.Y.

619(13)	Sacked Concrete Riprap Type _____	S.Y.
619(14)	Sacked Soil Cement Riprap	C.Y.
619(15)	Sacked Soil Cement Riprap	S.Y.
619(16)	Granular Filter Blanket	C.Y.
619(17)	Geotextile with Gravel Cushion (Function _____, Type _____)	S.Y.
619(18)	Geotextile without Gravel Cushion (Function _____, Type _____)	S.Y.

Section 621 - Corrugated Metal Spillways

DESCRIPTION

621.01
Work

This work shall consist of furnishing and installing, or installing only, corrugated metal spillway inlet assemblies, outlet pipes, half-round outlet pipe, rectangular flumes, and other appurtenances for downdrains.

MATERIALS

621.02
Requirements

Spillway inlet assemblies, outlets, and connectors shall be of the type and thickness SHOWN ON THE DRAWINGS and shall be constructed of corrugated sheet metal meeting the requirements of Section 603. Bulkheads and connections for outlet pipes shall be fillet welded or riveted to the inlet chamber to form watertight joints. Anchors, lips, and skirts shall be securely riveted or welded. Connections for outlet pipes shall meet the requirements of Section 603.

Outlets shall be of the type, size, and arrangement SHOWN ON THE DRAWINGS, and shall meet the requirements for corrugated metal pipe in Section 603. Half-round pipe shall have end sections punched to permit riveting of joints in the field. Elbows shall be of the full-circle type. Flexible downpipe shall meet the requirements of Section 719.

Anchor assemblies for the downdrains and other components shall be as SHOWN ON THE DRAWINGS.

Coating for spillway inlet assemblies and outlet pipes shall meet the requirements for coated corrugated pipe in Section 603.

A gasket or equivalent material shall be installed on circular pipe at the joints on each side of elbows and at each joint on the downdrain to make the connections watertight. Gaskets shall be installed on the entire circumference. Gasket material shall be sponge rubber or synthetic rubber compound specifically designed for such installations and recommended by the coupling band fabricator. Approved joint compounds, such as Thiocaulk or Plastiflex, may be used instead of gaskets.

CONSTRUCTION

621.03
Performance

Spillway inlets shall be placed where SHOWN ON THE DRAWINGS. The earth backfill shall be compacted in accordance with Method B of Subsection 603.08.

Outlet pipes shall be installed in accordance with Section 603. Outside laps shall be placed facing upstream.

Damaged coating on the inlet assemblies or pipe and all field rivet heads shall be repaired as required in Section 707.

The final installed alignment shall be such that no reverse grades exist and no point shall vary from a straight line drawn from inlet to outlet by more than 2 percent horizontally and vertically of the spillway length or 1 foot, whichever is less, unless otherwise SHOWN ON THE DRAWINGS.

MEASUREMENT

621.04
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS. The quantity of outlet pipes will be the length from end to end of each outlet pipe, excluding elbows and spillway assemblies.

PAYMENT

621.05
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
621(01) Spillway Inlet Assemblies	EA.
621(02) Spillway Inlet Assemblies with _____ Coating	EA.
621(03) _____-Inch Half-Round Outlet Pipe	L.F.
621(04) _____-Inch Half-Round Outlet Pipe with _____ Coating	L.F.
621(05) _____-Inch Flexible Downpipe	L.F.
621(06) Anchors for Downdrains for _____-Inch Pipe . .	EA.
621(07) _____-Inch Full-Circle Outlet Pipe	L.F.
621(08) _____-Inch Full-Circle Outlet Pipe with _____ Coating	L.F.
621(09) Pipe Elbow _____	EA.
621(10) Pipe Elbow, _____ Coated _____	EA.
621(11) _____-Inch Pipe End Section	EA.
621(12) Starter Section, Type _____	EA.
621(13) Flume, Type _____	L.F.
621(14) Anchor Stakes _____	EA.
621(15) Energy Dissipator, Type _____	EA.

When materials are furnished by the Forest Service, the note "Government-furnished materials" will be added to the description of the pay item.

Section 622 - Paved Waterways

DESCRIPTION

622.01
Work

This work shall consist of paving ditches, gutters, spillways, and other similar waterways with concrete, grouted rubble, ungrouted rubble, mortared rubble, concrete and rubble, or a mixture of aggregate and bituminous material. This work shall also include the construction of a bed course.

MATERIALS

622.02
Requirements

Concrete shall meet the requirements of Section 602, Method A or B as SHOWN ON THE DRAWINGS.

Materials shall meet the requirements of the following Sections or Subsections:

Bituminous Materials	702
Aggregates for Bituminous Mixture	703
Filter	703.01(b)
Bed Course	703.15
Mortar and Grout	705.05
Reinforcing Steel	709.01

Materials and proportions for bituminous mixtures will be as SHOWN ON THE DRAWINGS.

Rubble for pavement shall consist of approved, sound, durable rock of the sizes SHOWN ON THE DRAWINGS. All rock will be inspected before and after laying, and all rejected material shall be removed immediately.

CONSTRUCTION

622.03
Bed

The bed shall be formed to the required depth below and parallel with the finished surface of the waterway. All soft, yielding, or otherwise unsuitable material shall be replaced with suitable material. The bed shall be compacted and finished to a smooth, firm surface.

Bed will be approved, in writing, by the Engineer prior to construction of the paved waterway.

When SHOWN ON THE DRAWINGS, bed course material shall be placed and compacted to the required thickness.

622.04
Grouted Rubble

The pavement stones shall be bedded in the foundation with flat faces up and their longest dimensions at right angles to the centerline of the waterway.

Joints shall be broken and not exceed 1 inch in width. The rocks shall be rammed until the surface is firm and reasonably true to the finished surface in grade, alignment, and cross section. Any rock causing an irregular or uneven surface shall be taken up and satisfactorily relaid or replaced. After the rocks have been rammed into place and the surface is satisfactory, the spaces or voids between and around the stones shall be filled with filler aggregate to within 4 inches of the surface, after which cement grout shall be poured and broomed into the spaces between the stones. This operation shall continue until the grout remains about 1 inch below the tops of the stones. The grout shall be of such consistency that it will flow readily into the spaces between the rocks, but not so wet that solid matter separates from the water.

622.05
Ungrouted Rubble

The pavement rocks shall be bedded in the foundation with flat faces up and their longest dimension at right angles to the centerline of the waterway. Joints shall be broken and shall not

exceed 1/2 inch in width. The rocks shall be rammed until the surface is firm and reasonably true to the finished surface in grade, alignment, and cross section. Any rock causing an irregular or uneven surface or any rock not in reasonably close contact with adjacent rocks shall be taken up and satisfactorily relaid or replaced.

622.06
Mortared Rubble

The pavement rocks shall be laid with flat faces up and their longest dimensions parallel to the gutter line.

Joints shall be broken and shall not exceed 1 inch in width. After each rock has been rammed into place and the surface is satisfactory, mortar shall be applied on the exposed side in such quantities that when the adjacent rock is placed and rammed into position the mortar shall fill, to within an inch of the surface, the interstices between the rock and not protrude above their tops. The finished rock surface shall be free from mortar stain.

622.07
Reinforced Concrete
& Rubble

A reinforced concrete foundation shall be constructed upon a prepared foundation as SHOWN ON THE DRAWINGS. This foundation shall be constructed progressively with the laying of surface rocks and the rocks shall be securely bedded in the concrete before it hardens. The faces of the rocks in contact with the concrete shall be clean and free of any defects that will impair their bond with the concrete.

Rocks shall be thoroughly wetted prior to laying, with an ample time allowance for absorption to near saturation. Joints between rocks shall be filled with mortar. The bedded reinforcement steel shall be kept within the middle third of the depth of the concrete as construction proceeds.

622.08
Bituminous Mixture

(a) Preparing Mixture. The mixing shall be done in either a rotary or pugmill-type mixer or by spreading the aggregate on a flat, firm surface off the area to be surfaced, and mixed by road-mix methods. Pugmills may be either the batch or continuous type.

Except when emulsified asphalt is used, the aggregate shall not contain more than 2 percent moisture at the time it is mixed with the bituminous materials. However, if an approved additive is used, the aggregate may contain moisture up to a maximum of 5 percent.

Bituminous material shall be applied to the aggregate or introduced into the mixture at the temperature at which the aggregate will be coated uniformly and completely.

When mixing is done in a mixer, the mixing period, measured from the time all materials are in the mixer until they are discharged, shall not be less than 40 seconds. When road mix methods are used, the mixing shall continue until all aggregate particles are uniformly coated with bituminous material.

(b) Forms. Forms approved by the Engineer shall be staked securely into position at the correct line and elevation.

(c) Placing Mixture. The mixture shall be placed on the prepared bed only when the bed is sufficiently dry and weather conditions are suitable. The mixture shall be placed and compacted in one or more courses to the thickness SHOWN ON THE DRAWINGS. Each course shall be smoothed by raking or screeding and shall be thoroughly compacted by rolling with a hand-operated roller weighing not less than 300 pounds, or with an approved small power roller. Areas that cannot be reached with rollers may be compacted with hand tampers. After compaction, the surfacing shall be smooth and even, and of a dense and uniform texture.

622.09
Concrete Paving

Concrete paving shall be plain or reinforced as SHOWN ON THE DRAWINGS and meet the requirements of Section 602.

622.10
Finishing Work

Forms shall be removed from paved waterways, and necessary repairs shall be made to edges. The adjacent slopes and shoulders shall be shaped and compacted to the cross section SHOWN ON THE DRAWINGS.

MEASUREMENT

622.11
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS. Area computations will be based upon surface measurements.

PAYMENT

622.12
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
622(01) Grouted Rubble Paved Waterway	S.Y.
622(02) UngROUTED Rubble Paved Waterway	S.Y.
622(03) Mortared Rubble Paved Waterway	S.Y.
622(04) Concrete and Rubble Paved Waterway	S.Y.
622(05) Bituminous Paved Waterway	S.Y.
622(06) Concrete Paved Waterway	S.Y.
622(07) Bed Course Material	TON

Section 623 - Monuments & Markers

DESCRIPTION

623.01 Work This work shall consist of furnishing and installing right-of-way monuments, milepost markers, underdrain markers, and culvert markers.

MATERIALS

623.02 Requirements Materials for the various types of monuments and markers shall be as SHOWN ON THE DRAWINGS.

CONSTRUCTION

623.03 Performance Fabrication and installation of the various types of monuments and markers shall be as SHOWN ON THE DRAWINGS and shall include the painting of posts if required. Each monument and post shall be set accurately at the required location and elevation.

MEASUREMENT

623.04 Method The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

PAYMENT

623.05 Basis The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
623(01) Right-of-Way Monument	EA.
623(02) Milepost Marker	EA.
623(03) Underdrain Marker	EA.
623(04) Culvert Marker	EA.

Section 624 - Topsoiling

DESCRIPTION

624.01 This work shall consist of furnishing, excavating, or removing from
Work stockpiles, hauling, depositing, and spreading topsoil.

MATERIALS

624.02 Topsoil shall be obtained from sources SHOWN ON THE DRAWINGS or
Source specified in SPECIAL PROJECT SPECIFICATIONS.

624.03 Topsoil shall meet the requirements of Subsection 713.01.
Quality

CONSTRUCTION

624.04 The topsoil shall be deposited and spread to the depth and at the
Spreading locations SHOWN ON THE DRAWINGS.

Topsoil shall not be spread when the ground or topsoil is frozen, excessively wet, or in a condition detrimental to the work.

Large clods, rocks larger than 2 inches in any dimension, roots, stumps, and other litter shall be removed, and disposed of as SHOWN ON THE DRAWINGS.

624.05 The roadbed surfacing shall be kept clean during hauling
Hauling operations. Topsoil or other soil deposited upon the surfacing shall be removed before it becomes compacted by traffic.

624.06 After stripping operations have been completed, the source area
Source Area Other shall be rough graded and cleaned of refuse material. The area
Than Roadway shall be left in a neat condition. A minimum 3 inches of topsoil shall be left on the source and the area shall be seeded as SHOWN ON THE DRAWINGS.

MEASUREMENT

624.07 The method of measurement, as described in Section 106, will be
Method DESIGNATED in the SCHEDULE OF ITEMS.

Topsoil, paid for by the cubic yard and furnished by the contractor, will be measured in the vehicles at the point of delivery. The volume of topsoil from designated stockpiles will be measured in the original stockpile.

When paid for by the square yard, the quantity will be computed along slope dimensions.

PAYMENT

624.08 The accepted quantities will be paid for at the contract unit price
Basis for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
624(01) Furnishing and Placing Topsoil	C.Y.
624(02) Furnishing and Placing Topsoil	S.Y.
624(03) Placing Topsoil	C.Y.
624(04) Placing Topsoil	S.Y.

Section 625 - Seeding & Mulching

DESCRIPTION

625.01
Work This work shall consist of preparing seedbeds and furnishing and placing required seed, fertilizer, limestone, mulch, and net and blanket material.

MATERIALS

625.02
Requirements Materials shall meet the requirements of the following Subsections:

Agricultural Limestone	713.02
Fertilizer	713.03
Seed	713.04
Mulch	713.05
Net and Blanket Material	713.07
Water	713.08(a)

Tackifier shall be emulsified asphalt Grade SS-1, SS-1h, CSS-1 or as specified in the SPECIAL PROJECT SPECIFICATIONS.

CONSTRUCTION

625.03
Seeding Seasons The normal seasonal dates for seeding shall be as specified in the SPECIAL PROJECT SPECIFICATIONS. Seeding materials shall not be applied during windy weather or when the ground is excessively wet or frozen. Work shall be performed during each specified seeding season on all completed and previously untreated sections.

625.04
Soil Preparation The areas to be seeded shall be finished as required by other applicable Sections to the lines and grades SHOWN ON THE DRAWINGS. Areas that are damaged by erosion or other causes shall be restored. The surface soil shall be in a roughened condition favorable for germination and growth. Limestone, when required, shall be applied uniformly either prior to or after soil preparation at the rate specified in the SPECIAL PROJECT SPECIFICATIONS.

625.05
Application Methods for Seed, Fertilizer, & Limestone Material may be placed by the following methods:

(a) Hydraulic Method. The seed or seed and fertilizer shall be mixed with water in the amounts and mixtures specified in the SPECIAL PROJECT SPECIFICATIONS to produce a slurry and then applied under pressure at the rates specified in the SPECIAL PROJECT SPECIFICATIONS. When wood cellulose or grass straw mulch materials are to be incorporated as an integral part of the slurry mix, they shall be added after all other materials have been thoroughly mixed in the tank.

Legume seed shall be inoculated with approved cultures in accordance with instructions of the manufacturer. The inoculum used for hydraulic seeding shall be four times that recommended for dry seeding.

(b) Dry Method. Mechanical seeders, seed drills, landscape seeders, cultipacker seeders, fertilizer spreaders, or other approved mechanical seeding equipment shall be used to apply the seed or seed and fertilizer in the amounts and mixtures specified in the SPECIAL PROJECT SPECIFICATIONS.

Fertilizer in dry form and ground limestone shall be spread separately at the rates specified in the SPECIAL PROJECT SPECIFICATIONS and incorporated in one operation to the required depth on those areas SHOWN ON THE DRAWINGS.

Hand-operated seeding devices may be used when seed, fertilizer, and ground limestone are applied in dry form.

625.06
Application of
Mulch

(a) Hydraulic Method. Wood cellulose or grass straw fiber mulch and fertilizer may be applied in one operation by means of hydraulic equipment that uses water as the carrying agent. A continuous agitator action that keeps the materials in uniform suspension must be maintained throughout the distribution cycle. The discharge line shall provide an even distribution of the solution to the seedbed. Mulching shall not be done in the presence of free surface water. Application to areas SHOWN ON THE DRAWINGS shall start at the top of the slope and work downward. If necessary, the use of extension hoses may be required to reach the extremities of slopes. The rate of application shall be as specified in the SPECIAL PROJECT SPECIFICATIONS.

(b) Dry Method. Mulch shall be applied after seeding and fertilizing are completed, unless otherwise specified in the SPECIAL PROJECT SPECIFICATIONS. The mulch shall be applied uniformly at the rate specified in the SPECIAL PROJECT SPECIFICATIONS.

When a binder is to be used for mulch, the material shall be applied at the rate specified in the SPECIAL PROJECT SPECIFICATIONS. It shall be immediately distributed evenly over the mulch. The contractor shall prevent asphalt adhesive materials from marking or defacing structures, appurtenances, pavements, utilities, or plant growth.

625.07
(Reserved)

625.08
Installation of
Netting & Erosion
Control Blankets

Nettings and erosion control blankets shall be installed as SHOWN ON THE DRAWINGS and in accordance with the manufacturer's recommendations.

625.09
Care During
Construction

The contractor shall be responsible for protecting and caring for seeded areas until final acceptance of the work. The contractor shall repair all damage to seeded areas caused by his construction operations without additional compensation.

MEASUREMENT

625.10
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

Area computations will be upon surface measurements.

PAYMENT

625.11
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
625(01) Seeding, Hydraulic Method (without mulch)	ACRE
625(02) Seeding, Hydraulic Method (without mulch)	M.S.F.
625(03) Seeding, Hydraulic Method (with mulch)	ACRE
625(04) Seeding, Hydraulic Method (with mulch)	M.S.F.
625(05) Seeding, Dry Method (without mulch)	ACRE
625(06) Seeding, Dry Method (without mulch)	M.S.F.
625(07) Seeding, Dry Method (with mulch)	ACRE

625(08)	Seeding, Dry Method (with mulch)	M.S.F.
625(09)	Seeding, Hydraulic or Dry Method (with mulch)	ACRE
625(10)	Seeding, Hydraulic or Dry Method (with mulch)	M.S.F.
625(11)	Seeding, Hydraulic or Dry Method (without mulch)	ACRE
625(12)	Seeding, Hydraulic or Dry Method (without mulch)	M.S.F.
625(13)	Seeding and Mulching	ACRE
625(14)	Seeding and Mulching	M.S.F.
625(15)	Mulch (SUPPLEMENTAL APPLICATION)	TON
625(16)	Fertilizer (SUPPLEMENTAL APPLICATION)	TON
625(17)	Seed Mix (SUPPLEMENTAL APPLICATION)	LBS.
625(18)	Netting, Type_____	S.Y.
625(19)	Erosion Control Blanket, Type_____	S.Y.

Section 626 - Trees, Shrubs, Vines, & Ground Cover

DESCRIPTION

626.01 This work shall consist of furnishing and planting trees, shrubs, vines, and ground cover plants.
Work

MATERIALS

626.02 Materials shall meet the requirements of the following Subsections:
Requirements

Topsoil	713.01
Fertilizer	713.03
Mulch	713.05
Plant Materials	713.06
Water	713.08
Miscellaneous	713.08

CONSTRUCTION

626.03 (a) Planting Seasons. The planting shall be done during the seasons specified in the SPECIAL PROJECT SPECIFICATIONS. No planting shall be done in frozen ground, when snow covers the ground, or when the soil is in an unsatisfactory condition for planting.
Performance

(b) Delivery and Inspection. The contractor shall notify the Engineer not less than 15 days in advance of delivery of plants. The contractor shall furnish information to the Engineer concerning the source of supply and the shipping dates for all plant material. All plant materials shall comply with State and Federal laws controlling inspection for plant diseases and insect infestations. The contractor shall deliver to the Engineer all required certificates of inspection.

(c) Protection and Temporary Storage. All plant material shall be kept moist and protected from drying out. Plants shall be protected when in transit, in temporary storage, or on the project site awaiting planting.

(d) Layout. Plant material locations and bed outlines shall be DESIGNATED on the project site by the contractor to conform to the lines, grades, and elevations SHOWN ON THE DRAWINGS. The Engineer may adjust plant material locations to meet field conditions.

(e) Excavation for Plant Pits and Beds. The layout shall be approved prior to excavating for plant pits and beds. All sod, weeds, roots, and other objectionable material unsuitable for backfill shall be removed from the site and disposed of by the contractor.

For root spreads from 2 to 4 feet, pit diameters shall be 2 feet greater. For root spreads over 4 feet, the pit diameter shall be one and one-half times the root spread.

The depth of all pits shall be adequate to permit a minimum of 6 inches of loam-humus backfill under all roots or balls. The following depths shall be used:

TYPE	DEPTH
Trees (deciduous):	
Under 1-1/2 inch diameter	2 feet
Over 1-1/2 inch diameter	3 feet
Trees (evergreen):	
Under 5 feet high	8 inches + height of ball
Over 5 feet high	12 inches + height of ball

Shrubs (deciduous):	
Under 2 feet high	1 foot
Over 2 feet high	2 feet
Shrubs (evergreen)	18 inches
Vines (deciduous and evergreen)	
Not under 6-inch diameter	18 inches

The soil at the bottom of the plant pit shall be loosened to a depth of at least 6 inches before backfilling or planting begins.

(f) Prepared Backfill Soil. The prepared backfill soil shall consist of a mixture of four parts topsoil, loam, or selected soil, and one part peat moss or peat humus.

(g) Setting Plants. All plants shall be set approximately plumb and at the same level or not more than 1 inch lower than the depth at which they were grown in the nursery or collecting field.

(1) Bare Root Stock. Prepared backfill soil shall be placed in the plant pit to the required depth. Bare-rooted plants shall then be placed in the center of the plant pit and the roots spread out in a natural position. All broken or damaged roots shall be cleanly cut back to sound root growth.

Backfill soil shall then be carefully worked around and over the roots and settled by firming or tamping. Thorough watering or puddling shall accompany backfill around bare-rooted plants. Earth saucers or water basins, at least 4 inches in depth for trees and 3 inches in depth for shrubs, shall be formed around individual plants with a diameter equal to the plant pit.

(2) Balled and Burlapped Stock. Balled and burlapped plants shall be carefully placed in the prepared pits on the required depth of tamped backfill soil to rest in a firm, upright position. Backfill soil shall then be filled in around the plant ball to half the depth of the ball, then tamped and thoroughly watered. The burlap shall then be cut away and removed from the upper half of the ball or loosened and folded back after which the remainder of the backfill shall be placed. Earth saucers or water basins shall be provided and the plant thoroughly watered.

(h) Fertilizing. The types and rates of fertilizer application for the varieties of plants used shall be specified in the SPECIAL PROJECT SPECIFICATIONS. Fertilizer shall be uniformly applied and cultivated into the top 2 inches of the plant pit area or shrub bed within 5 days after planting. Fertilizer in the proper amounts for each type of plant may be worked into the prepared backfill material. Fertilizer shall be applied prior to mulching of plant pits or shrub beds.

(i) Watering. All plants shall be watered during and immediately after planting and at intervals specified in the SPECIAL PROJECT SPECIFICATIONS. Water shall not contain elements toxic to plant life. The soil around each plant shall be thoroughly saturated at each watering.

(j) Guying and Staking. All trees shall be guyed and staked as SHOWN ON THE DRAWINGS immediately after planting.

(k) Wrapping. Only deciduous trees shall be wrapped. Trunks of trees 2 inches in diameter and larger shall be completely wrapped with burlap or other approved material. Wrapping shall begin at the base of the tree, extend to the first branches, and be adequately tied. Tree trunks shall not be wrapped until inspected and approved. Wrapping of tree trunks shall be completed within 24 hours after approval.

(l) Antidesiccant Spray. An approved antidesiccant spray may be used in place of wrapping.

(m) Pruning. Pruning shall be done before or immediately after planting in a manner that will preserve that natural character of the plant. Pruning shall be done by experienced personnel, with proper equipment, and in accordance with accepted horticultural practice. Cuts over 3/4 inch in diameter shall be painted with an approved tree wound dressing.

(n) Mulching. Mulch material shall be furnished and placed over all pit or saucer areas of individual trees and shrubs and over the entire area of shrub beds to the depth SHOWN ON THE DRAWINGS. Mulch material shall be as SHOWN ON THE DRAWINGS or specified in the SPECIAL PROJECT SPECIFICATIONS. Plants to be mulched with wood chips or bark shall receive 8 pounds of nitrogen per cubic yard of mulch material in addition to the normal dressing of commercial fertilizer. Mulch shall be placed within 24 hours after fertilizing is completed.

626.04
Restoration &
Cleanup

Existing grass areas that have been damaged or scarred during planting operations shall be restored to their original condition. Debris, spoil piles, containers, etc., shall be cleaned up.

625.05
Plant Establishment
Period & Replacement

The acceptability of the plant material furnished and planted as specified will be determined at the end of the period of establishment during which the contractor shall employ all possible means to preserve the plants in a healthy growing condition. The plant establishment period shall be one full growing season. Care during the establishment period may include watering, cultivating, pruning, repair and adjustment of guys and stakes, and other maintenance work. Dead or unsatisfactory plants shall be promptly removed from the project. A semifinal inspection will be held to determine the acceptability of the plant material 15 days before the end of the full growing season. During the next planting season following completion of spring or fall planting, all dead and unsatisfactory plants shall be replaced in kind with lively, healthy plants installed as originally specified. Alternative or substitute varieties of plants shall be used only if approved. A final inspection of all plant material will be held within 15 days after the replacement planting has been completed.

MEASUREMENT

626.06
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS. Only living plants in healthy condition at the time of final inspection (626.05) will be included in the quantities.

PAYMENT

626.07
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
626(01) _____, (Name of plant) (Size)	EA.
626(02) Plant Materials	L.S.

Section 629 - Sodding

DESCRIPTION

629.01 This work shall consist of preparing the sod bed, furnishing, Work cutting, hauling, and laying live sod of perennial turf-forming grasses.

MATERIALS

629.02 Materials shall meet the requirements of the following Subsections: Requirements

Ground Limestone	713.02
Fertilizer	713.03
Water	713.08(a)
Sod	713.10
Pegs for Sod	713.11

CONSTRUCTION

629.03 Sodding operations shall be done during the season SHOWN ON THE Season DRAWINGS or as specified in the SPECIAL PROJECT SPECIFICATIONS.

629.04 Sod obtained from other than commercial sources shall be approved Sources of Sod by the Engineer in the original position before cutting and delivery to the project. The contractor shall notify the Engineer at least 5 days before cutting begins.

629.05 Before delivery of sod, areas to be sodded shall be brought to the Soil Preparation & Cleanup lines and grades SHOWN ON THE DRAWINGS and then plowed, disked, or harrowed or otherwise loosened. Cleanup shall include removal of stones larger than 2 inches in diameter, sticks, stumps, and other debris that might interfere with the proper laying or subsequent growth of sod.

629.06 Topsoil shall be placed where SHOWN ON THE DRAWINGS. Large clods, Topsoiling stones larger than 2 inches in any dimension, roots, stumps and other litter shall be removed and disposed of at locations SHOWN ON THE DRAWINGS.

629.07 Following soil preparation, cleanup, and topsoiling, fertilizer and Applying Fertilizer & Ground Limestone ground limestone, when specified, shall be uniformly spread at the rate SHOWN ON THE DRAWINGS or specified in the SPECIAL PROJECT SPECIFICATIONS. Mechanical spreaders, blower equipment, or other approved methods may be used for spreading fertilizer and ground limestone, after which the materials shall be incorporated into the soil by disking or other tillage.

629.08 Sod shall be laid on the prepared sod bed within 24 hours after Laying Sod cutting, except when stored in stacks or piles, grass to grass and roots to roots for not more than 5 days. Sod shall be protected against drying from sun or wind and from freezing. The moving and laying of sod shall be done when weather conditions and soil moisture are favorable.

Sod shall be laid under one or more of the following methods as shown in the SCHEDULE OF ITEMS.

(a) Solid sodding shall be laid when soils are moist. Dry sod bed areas shall be well moistened before sod is laid. Sections of solid sod shall be laid edge to edge with staggered joints. Openings shall be plugged with sod or filled with acceptable loamy topsoil. After laying and joint filling, the sod shall be rolled or tamped to eliminate air pockets and provide an even surface. On slopes of 2:1 or steeper and in channels, sod shall be pegged on approximate 2-foot centers after tamping. Pegs shall be driven flush with the sod bed surface.

(b) Strip sod shall be laid in parallel rows of the width SHOWN ON THE DRAWINGS and shall be laid in a shallow trench and firmly rolled or tamped until the surface of the sod is level with or below the adjacent soils. If SHOWN ON THE DRAWINGS or specified in the SPECIAL PROJECT SPECIFICATIONS, the ground between strips of sod shall be seeded with grass seeds of the kind and at the rates specified. Seeded areas shall then be raked or dragged to cover the seed.

(c) Spot sodding shall consist of sod blocks laid as SHOWN ON THE DRAWINGS. The pieces of sod shall be firmly rolled or tamped into the soil until the surfaces of sod blocks are slightly below the surrounding ground surface.

629.09
Care During
Construction,
Watering, &
Temporary
Maintenance of
Sodded Areas

Sod shall be watered when laid and kept moist until final acceptance of the contract. Water shall be evenly distributed at a measured rate per unit of area. Watering shall be done so as to avoid erosion and prevent damage to sodded areas.

The contractor shall erect necessary warning signs and barriers, shall mow sodded areas, shall repair or replace those sodded areas failing to show a uniform growth of grass or those damaged by construction operations, and shall otherwise maintain the sod until final acceptance of the contract.

Replacement of dried-out or damaged sod shall be at the contractor's expense.

MEASUREMENT

629.10
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

Area computations will be based upon surface measurement.

PAYMENT

629.11
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
629(01) Solid Sodding	S.Y.
629(02) Strip Sodding	S.Y.
629(03) Spot Sodding	S.Y.

Section 630 - Gabions

DESCRIPTION

630.01
Work This work shall consist of furnishing and constructing wire gabion structures.

MATERIALS

630.02
Requirements Gabions shall be constructed of wire mesh. The wire mesh shall be made of soft tempered galvanized steel wire having a minimum size of 0.120 inch diameter (U.S. Wire Gauge Number 11). The tensile strength of the wire shall be in the range of 60,000 to 85,000 psi. The minimum zinc coating of the wire shall be 0.80 ounces per square foot of uncoated wire surface as determined by tests conducted in accordance with ASTM A 90.

Samples for testing shall include at least one sample of each component of the mesh. Selvege wire used through all the edges (perimeter wire) shall be not less than nine gauge (U.S.).

Tie wire shall meet the same specifications for wire used in the mesh, except that tie wire for gabion cages shall not be more than two gauges lighter.

630.03
Soil Anchor Stakes Soil anchor stakes shall be of the type and length SHOWN ON THE DRAWINGS.

630.04
Rock Rock shall be obtained from sources SHOWN ON THE DRAWINGS. Rocks to be placed in the gabions shall be clean, hard, dense, sound, and of a quality that will resist the action of water or weathering. The smallest dimension of the rocks shall be at least one and one-half times the size of the mesh and up to 12 inches in the greatest dimensions. The rock shall be reasonably well graded between the limiting sizes.

630.05
Geotextile Geotextile shall meet the requirements of Section 720 and shall be the type SHOWN ON THE DRAWINGS.

630.06
Fabrication Gabions shall be fabricated so the sides, end, lid and diaphragms can be assembled at the construction site into rectangular baskets of the required sizes. Gabions shall be of single unit construction; the base, ends, and sides shall be woven into a single unit or one edge of these members connected to the base section of the gabion so the strength and flexibility at the point of connection are at least equal to that of the mesh.

Where the length of the gabion exceeds its width, it shall be equally divided into cells by diaphragms of the same mesh and gauge as the body of the gabions. The cell length shall not exceed the width.

All perimeter edges, including diaphragm edges, shall be securely woven or bound so the joints formed by tying shall have approximately the same strength as the body of the mesh.

Gabion lengths shall be integer multiples (2, 3, or 4) of the horizontal width. The heights shall be fractions (1/1, 1/2, or 1/3) of the horizontal width. The horizontal width shall be not less than 36 inches. All gabions shall be of uniform width.

All gabion dimensions are subject to a tolerance limit of plus or minus 3 percent of the manufacturer's stated sizes.

630.07
Mesh Openings Openings of the mesh shall not exceed 4 inches in the longest dimension.

630.08
Nonraveling
Construction

The wire mesh shall be nonraveling. This is defined as the ability to resist pulling apart at any of the twists or connections forming the mesh when a single wire strand in a section of mesh is cut and the section of mesh is then subjected to the load test described in Subsection 630.10.

630.09
Mesh Elasticity

When subjected to the load test described in Subsection 630.10, the wire mesh shall have elasticity sufficient to permit elongation of the mesh equivalent to a minimum of 10 percent of the length of the section of mesh under test without reducing the gauge or tensile strength of individual wire strands to values less than those for similar wire 1 gauge smaller in diameter.

630.10
Load Test

An uncut section of mesh 6 feet in length and not less than 3 feet in width, including all selvedge bindings, shall have the ends securely clamped for 3 feet along the width of the sample. When the width of the section under test exceeds 3 feet, the clamps shall be placed at the center of the width and the excess width will be allowed to fall free on each side of the clamped section. The sample shall then be subjected to tension sufficient to cause 10 percent elongation of the sample section between the clamps. After elongation and while clamped as described above (and otherwise unsupported), the section shall be subjected to a load applied to a one square foot area in the approximate center of the sample section between the clamps and in a direction perpendicular to the direction of the tension force. The sample shall withstand, without rupture of any strand or opening of any mesh fastening, an actual load applied equaling or exceeding 6,000 pounds. The ram head used in the test shall be circular and have its edges beveled or rounded to prevent cutting of the wire strands.

630.11
Certification

Before gabions are installed, the contractor shall furnish a certified report to the Engineer of tests made by an approved testing laboratory showing that materials equal or exceed the above specifications.

This requirement may be waived if the contractor certifies the gabions furnished are of the same specific material and manufacture as previously tested, and for which reports of an approved testing laboratory have already been submitted to the Engineer. Tie and connecting wire shall be supplied in sufficient quantity to securely fasten all edges of the gabion and diaphragms and to provide for four cross-connecting wires in each cell whose height is one-third or one-half the width of the gabion and eight connecting wires in each cell whose height equals the width of the gabion.

CONSTRUCTION

630.12
Performance

Excavation and backfill shall be in accordance with Section 206A.

630.13
Gabion Installation

Gabions shall be installed according to the manufacturer's recommendations. The gabions shall be placed on a smooth foundation approved by the Engineer.

Each gabion unit shall be assembled by binding together all vertical edges with wire ties on approximately 6-inch spacing or by a continuous piece of connecting wire stitched around the vertical edges with a coil about every 4 inches. The gabion units shall be set to the lines and grades as SHOWN ON THE DRAWING. Wire ties or connecting wire shall be used to join the units together in the same manner described above for assembling. Internal tie wires shall be uniformly spaced and securely fastened in each cell of the structure.

Empty gabions shall be stretched to ensure alignment and grade before filling with rock.

The gabions shall be filled with stone carefully placed by hand or machine to ensure alignment and avoid bulges with a minimum of voids. Alternate placing of rock and connection wires shall be performed until the gabion is filled. After a gabion 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 the wire ties or connecting wire in the manner described above for assembling.

Soil anchor stakes shall be placed as SHOWN ON THE DRAWINGS.

Areas SHOWN ON THE DRAWINGS shall be backfilled with suitable material placed in layers not to exceed 6 inches in thickness and shall be tamped or consolidated to meet the requirements of Section 203.15, Method 4. The gabion structure height may not exceed the backfill by more than 4 feet. All vegetable matter and unstable soil shall be excluded from the backfill. The puddling method of backfilling shall not be used. Existing slopes that might cause a wedge action of the backfill on the gabion wall shall be step cut or benched before backfilling.

630.14
Geotextile
Installation

The geotextile shall be placed as SHOWN ON THE DRAWINGS. The surfaces upon which geotextile is to be placed shall have a uniform slope and shall be reasonably smooth and free of obstructions, depressions, and debris that could damage the geotextile. The surface shall be approved by the Engineer prior to placing of geotextile.

The geotextile shall be laid loosely without wrinkles or creases. Adjacent strips shall be sewn or overlapped a minimum of 12 inches at joints. Securing pins shall be inserted through both strips of overlapped geotextile at maximum intervals of 3 feet, but no closer than 2 inches to each edge, to prevent displacement of the geotextile.

The installed geotextile shall be approved by the Engineer prior to covering.

MEASUREMENT

630.15
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS. Area computations will be based upon surface measurements. Overlap quantities will not be included.

PAYMENT

630.16
Basis

The accepted quantities will be paid at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
630(01) Gabions	C.Y.
630(02) Geotextile (Function _____, Type _____).	S.Y.

Section 631 - Bin Walls

DESCRIPTION

631.01 This work shall consist of furnishing and constructing concrete, Work treated timber, aluminum or galvanized, or weathering steel, cellular or bin-type retaining walls.

MATERIALS

631.02 Materials shall meet the requirements of the following Sections or Requirements Subsections:

Concrete	552
Corrugated Aluminum	707.06
Corrugated Steel	707.04
Reinforcing Steel	709.01
Structural Timber and Lumber	716.01
Hardware for Timber Structures	716.02
Treated Timber	716.03
Metal Bins (Galvanized)	717.19
Metal Bins (High Strength, Low Alloy)	717.01(i)
Bed Course Material	703.15

(a) Timber Bins.

(1) Certification. The contractor shall furnish certifications as required in Subsection 557.02.

(2) Workmanship. Workmanship shall meet the requirements of Subsection 557.05.

(b) Metal Bins. Crib type or cellular.

(1) Thickness. The various members shall be constructed of metal of the thickness SHOWN ON THE DRAWINGS.

(2) Fabrication. All metal members or parts shall be completely fabricated in the plant prior to shipment to the site. All units shall be fully interchangeable. No drilling, punching, or drifting to correct defects in manufacture will be permitted. Any member or parts having holes improperly punched or drilled shall be replaced.

(3) Hardware. All hardware shall be of the size SHOWN ON THE DRAWINGS. Nuts, bolts, and miscellaneous hardware for steel bins shall meet the requirements of ASTM A 307. Where galvanized bins are indicated, the hardware shall be galvanized in accordance with AASHTO M 232.

Nuts, bolts, and miscellaneous hardware for high strength steel bins shall meet the requirements of AASHTO M 164 and shall be galvanized or left plain to match the bin. If galvanized, hardware shall be galvanized as indicated above.

Nuts, bolts, and miscellaneous hardware for aluminum bins shall be galvanized steel bolts of the type specified for galvanized steel bins.

(c) Concrete Bins.

(1) Coloring admixtures, such as carbon black, shall be used when SPECIFIED in the SPECIAL PROJECT SPECIFICATIONS.

(2) Concrete bin members shall be free of cracks or depressions, spalled, patched, or plastered surfaces or edges, or any other defect that may impair their strength or durability.

(d) General. Design of the bin members shall be as SHOWN ON THE DRAWINGS. Minor variations in design and dimensions will be permitted to allow the use of bin members that meet manufacturer's standards, subject to approval in writing by the Engineer.

CONSTRUCTION

631.03
Excavation

Excavation shall meet the requirements of Section 206. Excavation for the site of the wall shall be made to the elevations as SHOWN ON THE DRAWINGS. The prepared foundation of the bin walls shall be firm and normal to the face of the wall. When the bin wall is set upon a solid rock foundation, an 8-inch layer of compressible soil shall be placed under each base plate. The foundation-bearing material key at the toe of the bin shall not be removed during the site preparation. The foundation shall be approved by the Engineer prior to bin wall assembly.

Underdrain shall be installed prior to placing the cribbing and in accordance with requirements in Section 605.

When unstable foundation soil is encountered, it shall be removed to a suitable depth and the excavation backfilled with gravel or other approved material. Select replacement material shall be compacted to a uniform density of not less than 95 percent of the maximum density as determined by AASHTO T 99, Method C or D.

The density of the embankment material will be determined during the progress of the work in accordance with AASHTO T 191, T 205 or T 238; AASHTO T 217, T 239, or T 255; and AASHTO T 224.

631.04
Erection

The bin members shall be erected as SHOWN ON THE DRAWINGS.

Bin members shall be carefully handled and erected to avoid any damage. Any damaged members shall be completely removed and replaced.

The proper curvature for the face of a bin wall on a curve shall be obtained by the use of shorter stringers in the front or rear panels of walls as SHOWN ON THE DRAWINGS.

The bin wall height and thickness may be varied. Two or more of the bin designs SHOWN ON THE DRAWINGS may be incorporated in the same wall by use of standard split columns to make the connection of the step-back.

Bolts and parts shall be furnished for complete assembly of the units into a continuous closed face wall of connected bins.

The portion of the bins where the metal, other than aluminum or galvanized steel, comes into contact with the soil and fill material shall be field coated with roofing asphalt.

631.05
Backfilling

The interior fill of bin walls shall consist of all material placed in the area enclosed by the bins. Materials for interior and exterior backfill shall be obtained from locations as SHOWN ON THE DRAWINGS.

Filling of the interior of the bins shall progress simultaneously with the erection of the bins. The fill shall be placed in approximately 6-inch layers and tamped or compacted to a density of at least 95 percent of maximum dry density as determined by AASHTO T 99, Method C or D.

The density of the embankment material will be determined during the progress of the work in accordance with AASHTO T 191, T 205 or T 238; AASHTO T 217, T 239, or T 255; and AASHTO T 224.

When applicable, a layer of hand-placed rock, 8 inches in least dimension shall be placed against the front members of the structure to prevent loss of fill material through the openings.

The fill material used should be free-draining granular material and shall be free of roots, logs, limbs, boulders, or any other deleterious material that will prevent solid compaction. Compaction by the puddling method will not be permitted.

When backfilling bin walls, the material to be placed on the uphill side of the bin shall be placed and compacted concurrently with material inside the bin. Exterior backfill shall be placed in approximately 6-inch layers and compacted to a density of at least 95 percent of maximum dry density as determined by AASHTO T 99, Method C or D.

631.06
(Reserved)

MEASUREMENT

631.07
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS. The quantity of concrete, timber, and galvanized or weathering steel bin walls will be the front surface area.

Aluminum cellular bin walls areas will be computed by multiplying the diameter of the bin by the total height of all bins.

PAYMENT

631.08
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
631(01) Bin Type, Galvanized Steel	S.F.
631(02) Bin Type, Aluminum	S.F.
631(03) Bin Type, High Strength, Low Alloy Steel	S.F.
631(04) Bin Type, Treated Timber	S.F.
631(05) Bin Type, Weathering Steel	S.F.
631(06) Bin Type, Concrete	S.F.
631(07) Bed Course Material	C.Y.
631(08) Bed Course Material	TON

Section 633 - Signs

DESCRIPTION

633.01
Work This work shall consist of installing only or furnishing and installing delineators, signs, sign supports, panels, and posts or removing and disposing of existing signs, posts and hardware.

633.02
Traffic Control Sign Details Traffic control sign details not SHOWN ON THE DRAWINGS shall meet the requirements of the MUTCD.

MATERIALS

633.03
Requirements Materials shall meet the requirements of the following subsections:

Sign Panels	718.01
Posts	718.02
Fittings	718.03
Reflective Materials	718.04
Letters, Numerals, Arrows, Symbols, Borders	718.05
Delineators	718.06

All concrete shall meet the requirements of Section 602, Method B or C as SHOWN ON THE DRAWINGS.

Reinforcing steel as SHOWN ON THE DRAWINGS shall meet the requirements of Subsection 709.01.

CONSTRUCTION

633.04
Fabrication of Sign Panels Fabrication of all parts shall be accomplished in a uniform manner. All panel fabrication, including cutting, punching, and drilling of holes, shall be completed prior to final surface preparation and application of reflective sheeting, except where required for the fabrication of diecut or sawed letters on processed and mounted signs. Metal panels shall be cut to size and shape and shall be free of buckles, warp, dents, cockles, burrs, and defects resulting from fabrication. The surface of all sign panels shall be flat.

Field drilling of holes in any part of the structural assembly will not be permitted without the approval of the Engineer.

(a) Aluminum Panels. Aluminum sign panels shall be fabricated from standard widths of aluminum sheet. The thickness shall be in accordance with Subsection 718.01(b) unless otherwise SHOWN ON THE DRAWINGS.

The blanks shall be cleaned, degreased, and chromated or otherwise properly prepared in accordance with approved methods recommended by the sheeting manufacturer.

(b) Steel Panels. The finished plate for steel panels shall be free of twist or buckle, and the background shall be substantially a plane surface. The finished sign panel shall be of continuous coat mill-galvanized phosphate-coated steel that meets the requirements of Subsection 718.01(c). The panels shall be cleaned, degreased, or otherwise prepared in accordance with approved methods recommended by the sheeting manufacturer.

(c) Plywood Panels. The face of the plywood panel shall be abraded, cleaned, and degreased in accordance with approved methods recommended by the manufacturer of the reflective sheeting. The edges of the plywood panel shall be sealed with 2 mil dry film thickness, (in 2 coats); one coat shall be applied before application of reflective sheeting, the other, after.

Paint used shall be ready-mixed, exterior type, polysilicone alkyd resin base enamel, Benjamin Moore No. 120-60 (Federal color chip no. 20059).

(d) Durability Treatment. After all reflective sheeting legend has been applied, sign panels with Type II sheeting shall be recycled in the heat and vacuum applicator for 2 minutes at a temperature of approximately 190 °F under 21 inches of vacuum. When the sign panel has cooled, the top edge of each sign shall be covered with a clear 3-inch wide polyester film with a sun-resistant, pressure-sensitive adhesive that does not turn yellow under exposure to ultraviolet radiation. Scotchcal Brand Film #639 or Engineer approved equal shall be used. Film shall be applied in lengths of 24 inches. Where more than one piece is required, film shall be applied from each corner of the top edge toward the center of the top edge. End overlap of 2 inches or more shall be required where one film piece joins another piece.

633.05 Delineator Posts & Housing Delineator posts shall be driven at locations and to the depth SHOWN ON THE DRAWINGS. The delineator housing shall be attached to the post in accordance with the manufacturer's direction.

633.06 Sign Erection Sign supports shall be erected plumb and in accordance with the details SHOWN ON THE DRAWINGS.

The sign panels shall be securely fastened to the posts as SHOWN ON THE DRAWINGS.

To reduce specular glare, sign panel face shall be erected in accordance with MUTCD.

633.07 Sign Removal Sign assemblies to be removed shall be SHOWN ON THE DRAWINGS. Where signs are to be replaced, signs shall be removed just before the installation of replacement signs. All sign material removed shall become the property of the contractor. Posts shall be removed to a minimum of 3 inches below natural ground line. Post holes remaining shall be backfilled with suitable material and compacted.

MEASUREMENT

633.08 Method The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

Quantities of sign face area will be computed using the dimensions SHOWN ON THE DRAWINGS.

No deduction will be made for rounded corners.

The area for irregularly shaped signs, such as "Stop" signs, will be computed by multiplying the extreme width by the extreme height of the sign face.

For sign removal, an assembly of posts and signs shall be considered as only one sign when these materials are integrally connected and standing at one location.

PAYMENT

633.09 Basis The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
633(01) Wood Posts	L.F.
633(02) Steel Posts	L.F.

633(03)	Aluminum Posts	L.F.
633(04)	Aluminum Sign Panels	S.F.
633(05)	Plywood Sign Panels	S.F.
633(06)	Steel Sign Panels	S.F.
633(07)	Delineators	EA.
633(08)	Sign	EA.
633(09)	Sign Removal	EA.
633(10)	Sign and Post(s), Installation Only	EA.
633(11)	Regulatory Signs	EA.
633(12)	Warning Signs & Markers	EA.

Section 634 - Painted Traffic Markings

DESCRIPTION

634.01 This work shall consist of furnishing and painting traffic markings
Work on a finished paved area.

MATERIALS

634.02 Unless otherwise specified in the SPECIAL PROJECT SPECIFICATIONS,
Requirements traffic paint shall be the alkyd resin type, ready-mixed white or yellow, Type III, meeting the requirements of AASHTO M 248. Glass beads shall meet the requirements of AASHTO M 247, Type I, moisture resistant with flotation properties. The paint color and type (single, double or edge striping on both sides) shall be as DESIGNATED in the SCHEDULE OF ITEMS.

CONSTRUCTION

634.03 The area to be painted shall be dry, clean, and free of loose
Performance particles. The paint machine shall be of the spray type, capable of uniformly applying the paint under pressure through nozzles spraying directly upon the pavement. Each machine shall be capable of simultaneously applying three separate stripes, either solid or skip. Each paint tank shall be equipped with a mechanical agitator. Each nozzle shall be equipped with cutoff valves that will apply broken or skip lines automatically. A mechanical bead dispenser that will distribute the beads in a uniform pattern at the rate specified shall be located directly behind and synchronized with the spray nozzle. Each nozzle shall also be equipped with line guides consisting of metallic shrouds or air blasts.

The contractor shall be responsible for preliminary spotting of the lines to be painted and approval by the Engineer must be obtained before striping may begin.

Painted traffic marking details not SHOWN IN THE DRAWINGS shall meet the requirements of MUTCD.

Stripes shall be 4 inches wide. Broken line segments (dashed or skip traffic stripe) shall be 10 feet in length with 30-foot gaps, or 2 feet in length with 6-foot gaps as SHOWN ON THE DRAWINGS.

Arrows and letters shall be of the dimensions as SHOWN ON THE DRAWINGS.

The paint shall be thoroughly mixed prior to application, and shall be applied when the air temperature is above 40 °F.

The rate of application for 4-inch wide solid traffic stripes shall be at least 19.2, but not more than 21.1, gallons per mile. For broken traffic striping the rate of application shall be at least 4.8, but not more than 5.3, gallons per mile.

For narrower or wider striping, paint shall be applied at a rate in proportion with the 4-inch stripes.

The minimum rate of application for arrows and letters shall be 0.01 gallon per square foot of markings.

Glass beads shall be applied at a minimum rate of 6 pounds of beads for each gallon of paint and shall be applied by dropping on the fresh paint.

The painted area shall be protected from traffic until the paint is thoroughly dry.

All markings shall present a clean-cut, uniform appearance. All markings that fail to have a uniform appearance, either day or night, shall be corrected by the contractor.

MEASUREMENT

634.04
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

Linear measurement will be along the centerline of the road for each single, double and edge stripe, with no deduction for the unpainted area caused by broken stripe.

PAYMENT

634.05
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
634(01) Traffic Markings, Single Reflectorized, Broken, Color _____	L.F.
634(02) Traffic Markings, Single Reflectorized, Broken, Color _____	MI.
634(03) Traffic Markings, Single Reflectorized, Solid, Color _____	L.F.
634(04) Traffic Markings, Single Reflectorized, Solid, Color _____	MI.
634(05) Traffic Markings, Double Reflectorized, Solid, Color _____	L.F.
634(06) Traffic Markings, Double Reflectorized, Solid, Color _____	MI.
634(07) Traffic Markings, Reflectorized, Symbols and Letters, _____	EA.

Section 637 - Equipment Rental

DESCRIPTION

637.01
Work

This work shall consist of performing bulldozer, road grader, backhoe, end loader, and dump truck work on an equipment rental basis as directed by the Engineer through the contractor.

EQUIPMENT

637.02
Requirements

Equipment rented under this section shall be furnished on a fully operated basis, of modern design, and in good operating condition, with a competent qualified operator. Exhaust stacks of all engines, except those with exhaust-driven turbochargers, shall be equipped with spark arresters that will prevent the expulsion of sparks from the engine into the atmosphere. All equipment except dump trucks shall have rollover protective canopies.

Requirements, in addition to those listed above, are shown for each item of equipment in the following paragraphs.

637.03
Items of Equipment

(a) Large Crawler Tractor with Dozer.

- (1) Engine flywheel horsepower (for torque converter models only), not less than 210 horsepower; or,
- (2) Drawbar horsepower rating in first gear (for gear driven models), not less than 180 horsepower.
- (3) Hydraulically controlled straight or angle blade dozer with standard blade, having a minimum lift above ground (blade straight) of 36 inches.
- (4) The following shall be all heavy duty: full-length belly pan, engine guard, track roller guards, and radiator guard.
- (5) Track pad grousers or cleats shall be at least 2 inches high.
- (6) Rear-mounted winch, equipped with a minimum of 100 feet of 5/8 inch minimum diameter cable and two chokers, when listed in the SCHEDULE OF ITEMS.
- (7) Hydraulically controlled ripper with at least one shank and having a penetration capability of at least 25 inches, when listed in the SCHEDULE OF ITEMS.

(b) Small Crawler Tractor with Dozer.

- (1) Engine flywheel horsepower (for torque converter models only), not less than 120 horsepower, or
- (2) Drawbar horsepower rating in first gear (for gear driven models), not less than 80 horsepower.
- (3) Hydraulically controlled straight or angle blade dozer with standard blade, having a minimum lift above ground (blade straight) of 36 inches.
- (4) The following shall be all heavy duty: full-length belly pan, engine guard, track roller guards, and radiator guard.
- (5) Track pad grousers or cleats shall be at least 1.75 inches high.
- (6) Rear-mounted winch, equipped with a minimum of 100 feet of 1/2-inch cable and two chokers.

(c) Road Grader.

- (1) The engine shall be rated at least 100 horsepower.
- (2) Blade assembly dimensions shall be at least 12 feet by 24 inches by 0.75 inch.
- (3) The grader shall also have:
 - a. An operating weight of at least 20,000 pounds.
 - b. A wheelbase of at least 18 feet.
 - c. A tandem drive.

(d) Rubber-Tire End Loader.

- (1) The engine shall be rated at least 100 horsepower.
- (2) The minimum capacity of the end loader bucket shall be 2 cubic yards.
- (3) The end loader shall be designed and the weight distributed so the machine is balanced when the bucket is full and raised.
- (4) The machine shall be equipped with a standard heavy-duty radiator guard.
- (5) The loader shall be all-wheel drive.

(e) Tractor Mounted Backhoe.

- (1) Bucket width, 24 inches, with digging teeth.
- (2) Rubber-tired.
- (3) Diesel engine with a minimum of 70 horsepower.
- (4) Backhoe reach of 16 feet.

(f) Small Dump Truck.

- (1) The engine shall be rated at least 150 brake horsepower.
- (2) The dump box shall be at least 3 cubic yards struck capacity.

(g) Large Dump Truck.

- (1) Minimum capacity of 10 cubic yards struck capacity.
- (2) Tandem drive.
- (3) Year of manufacture shall be 1975 or later.
- (4) The engine shall be rated at least 185 brake horsepower.

(h) Large Crawler Loader.

- (1) The engine shall be rated at least 125 horsepower.
- (2) The minimum capacity of the end loader bucket shall be 2 cubic yards.
- (3) The end loader shall be designed and the weight distributed so that the machine is balanced when the bucket is full and raised.

(4) The following shall be all heavy duty: full-length belly pan, engine guard, track roller guard, and radiator guard.

(5) The track pad grousers or cleats shall be at least 3/4 inch high.

(6) The rear-mounted winch, shall be equipped with a minimum of 100 feet of 1/2 inch minimum diameter cable and two chokers, when listed in the SCHEDULE OF ITEMS.

(i) Small crawler-loader with backhoe attachments.

(1) The engine shall be rated at least 60 horsepower.

(2) Backhoe bucket width, 24 inches, with digging teeth.

(3) Backhoe reach of 14 feet.

(4) The minimum capacity of the end loader bucket shall be 1.25 cubic yards.

(5) The following shall be all heavy duty: full-length belly pan, engine guard, track roller guards, and radiator guard.

(6) The track pad grousers or cleats shall be at least 1/2 inch.

(j) Other equipment. Other pieces of equipment shall be as shown in the SPECIAL PROJECT SPECIFICATIONS.

637.04
Moving of Equipment

Moving of the above equipment to and from the job shall be at the expense of the contractor. Moving the equipment from one portion of the job to another after it has been initially delivered to a working place will be paid for at the contract price per hour for the particular equipment item moved.

637.05
Hours of Operation

The hours of operation shall be the same as the contractor's regular working shift, unless otherwise directed in writing by the Engineer.

637.06
Availability

The contractor shall furnish the above equipment within three calendar days after being ordered to do so by the Engineer. The Engineer may release the equipment whenever it is not needed.

MEASUREMENT

637.07
Method

The method of measurement, as described in Section 106, will be DESIGNATED in the SCHEDULE OF ITEMS.

Quantities will include the actual hours, to the nearest half hour, that the equipment is in operation performing the required work. The actual hours the equipment is in operation on the required work will be recorded daily.

PAYMENT

637.08
Basis

The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
637(01) Large Crawler Tractor with Dozer	HR.
637(02) Large Crawler Tractor with Dozer and Winch	HR.
637(03) Large Crawler Tractor with Dozer and Ripper	HR.
637(04) Small Crawler Tractor with Dozer and Winch	HR.

637(05)	Road Grader	HR.
637(06)	Rubber Tired End Loader	HR.
637(07)	Tractor Mounted (Rubber Tired) Backhoe	HR.
637(08)	Large Crawler Loader	HR.
637(09)	Small Crawler Loader with Backhoe	HR.
637(10)	Small Dump Truck	HR.
637(11)	Large Dump Truck	HR.

Section 640 - Road Closure Devices

DESCRIPTION

640.01
Work This work shall consist of furnishing and installing, or installing only, road closure devices using fabricated gates and accessories, combination post and rail barriers, concrete barriers, and earth mound barriers.

MATERIALS

640.02
Requirements Materials to be used in fabricating gates and barriers shall be as SHOWN ON THE DRAWINGS.

Metal beam elements, steel posts, structural steel and steel pipe shall meet the requirements SHOWN ON THE DRAWINGS.

All hardware shall be galvanized in accordance with AASHTO M 232 and shall meet the requirements of ASTM A 307. Plain or cut washers shall be American Standard Washers.

Timber posts, rails and lumber shall meet the requirements of AASHTO M 168. The timber specie and type and rate of preservative treatment shall be as SHOWN ON THE DRAWINGS.

Concrete shall meet the requirements of Section 602, Method B or C as SHOWN ON THE DRAWINGS.

Earth mound barriers shall be constructed as SHOWN ON THE DRAWINGS from excavated material adjacent to the barrier location or from other locations as SHOWN ON THE DRAWINGS.

CONSTRUCTION

640.03
Performance Road closure devices shall be placed at the location SHOWN ON THE DRAWINGS. All devices shall be constructed to the dimensions SHOWN ON THE DRAWINGS.

Welding required in assembling gates shall be done in accordance with the best modern practice and the applicable requirements of AWS D1.1.

After assembly, nongalvanized steel pipe gates shall be cleaned and painted with one coat of zinc-rich primer and two coats of exterior enamel of the type and color SHOWN ON THE DRAWINGS or in the SPECIAL PROJECT SPECIFICATIONS.

All posts shall be set vertically and embedded to the depth SHOWN ON THE DRAWINGS. Concrete for embedment shall be placed against undisturbed earth within an excavation sized to achieve the embedment dimensions. Backfill shall be compacted in 6-inch layers to finished grade.

All signs and/or reflective warning markers accessory to the road closure device as SHOWN ON THE DRAWINGS shall be furnished and installed by the contractor.

MEASUREMENT

640.04
Method The method of measurement, described in Section 106, will be designated in the SCHEDULE OF ITEMS.

Installation of signs and/or markers shall be considered incidental to other pay items and additional payment will not be made.

PAYMENT

640.05
Basis The accepted quantities will be paid for at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
640(01) Furnish and Install Road Closure Device, Type _____, Size _____	EA.
640(02) Install Road Closure Device, Type _____, Size _____	EA.
640(03) Furnish and Install Road Closure Barrier, Type _____, Size _____	EA.
640(04) Install Road Closure Barrier, Type _____, Size _____	EA.

