

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	10
Class VII	
700 pounds	100
400 pounds	70
200 pounds	30
25 pounds	10
Class VIII	
1,600 pounds	100
800 pounds	70
400 pounds	30
50 pounds	10
Class IX	
2,700 pounds	100
1,600 pounds	70
800 pounds	30
100 pounds	10
Class X	
4,000 pounds	100
2,000 pounds	80
500 pounds	50
70 pounds	10
Class XI	
6,000 pounds	100
3,000 pounds	80
1,000 pounds	50
200 pounds	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

Pock 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
Ungouted 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 624 - Topsoiling

DESCRIPTION

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

MATERIALS

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

624.03 Quality Topsoil shall meet the requirements of Subsection 713.01.

CONSTRUCTION

624.04 Spreading The topsoil shall be deposited and spread to the depth and at the 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 Hauling The roadbed surfacing shall be kept clean during hauling operations. Topsoil or other soil deposited upon the surfacing shall be removed before it becomes compacted by traffic.

624.06 Source Area Other Than Roadway After stripping operations have been completed, the source area shall be rough graded and cleaned of refuse material. The area 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 Method The method of measurement, as described in Section 106, will be 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 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>
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.

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.

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

MATERIALS

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

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

CONSTRUCTION

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

629.04 Sources of Sod Sod obtained from other than commercial sources shall be approved 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 Soil Preparation & Cleanup Before delivery of sod, areas to be sodded shall be brought to the 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 Topsoiling Topsoil shall be placed where SHOWN ON THE DRAWINGS. Large clods, 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 Applying Fertilizer & Ground Limestone Following soil preparation, cleanup, and topsoiling, fertilizer and 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 Laying Sod Sod shall be laid on the prepared sod bed within 24 hours after 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 This work shall consist of furnishing and constructing wire gabion
Work structures.

MATERIALS

630.02 Gabions shall be constructed of wire mesh. The wire mesh shall be
Requirements 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. Selvedge 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 shall be of the type and length SHOWN ON THE
Soil Anchor Stakes DRAWINGS.

630.04 Rock shall be obtained from sources SHOWN ON THE DRAWINGS.
Rock 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 shall meet the requirements of Section 720
Geotextile and shall be the type SHOWN ON THE DRAWINGS.

630.06 Gabions shall be fabricated so the sides, end, lid and diaphragms
Fabrication 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 Openings of the mesh shall not exceed 4 inches in the longest
Mesh Openings 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 selvage 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
Work This work shall consist of furnishing and painting traffic markings on a finished paved area.

MATERIALS

634.02
Requirements Unless otherwise specified in the SPECIAL PROJECT SPECIFICATIONS, 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
Performance The area to be painted shall be dry, clean, and free of loose 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 ~~bank~~ 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.

