INCIDENTAL CONSTRUCTION

300 - PILING

300-1.1 Description. This item shall consist of furnishing and driving untreated timber, treated timber, concrete or structural steel piles of the kind and dimensions designated, complying with these specifications, and driven to the required penetration and in accordance with the lines and spacing shown on the plans.

-1.2 Concrete piles when properly designed, constructed and placed may be subjected to loads as determined by tests or formula, but not to exceed 300 pounds per square inch of total cross section at the smallest effective point and generally not to exceed 25 tons per pile, with a maximum limit of 30 tons per pile.

-1.3 When piles are cast in strong metal shells which have been driven in accordance with the specifications for driving concrete piles and which remain in place after the concrete has set, the safe loads for piles completely embedded in firm earth may be assumed the same as specified for other concrete piles. Piles cast in place without metal reinforcement shall not be used in water or in ground so soft, in either wet or dry condition, as not to give firm lateral support.

-1.4 When called for in the Bid Schedule the contractor shall make actual loading tests, as directed, in order to determine the size and number of piles of any kind to be used. In general these tests shall consist of the application of a test load placed upon a suitable platform supported by the pile, together with suitable apparatus for accurately determining the superimposed weight and the settlement of the pile under each increment of load. The safe allowable load shall be considered as 50 percent of that load, which, after 48 hours application, causes a permanent settlement, measured at the top of the pile, of not more than 1/4 inch. When loading tests are required at least one pile for each group of 100 piles shall be thus tested.

-1.5 When called for in the Bid Schedule, the contractor shall drive test piles of a length and at the location designated by the engineer. These piles shall be of greater length than the length assumed in the design in order to provide for any variation in soil conditions.

-1.6 In the absence of tests as above described the safe bearing power of each timber pile shall be determined by that one of the following formula appropriate to the case:

For gravity hammers $P = \frac{2WH}{S+1}$

For single-acting steam hammers $P = \frac{2WH}{S+0.1}$

For double-acting steam hammers $P = \frac{2H(W+Ap)}{S+0.1}$

In the above formulas P = safe load per pile in pounds; W = weight of falling hammer in pounds; H = height of fall in feet; A = area of piston in square inches; p = steam pressure in pounds per square inch at hammer; S = the average penetration per blow in inches for the last 5 blows of a gravity hammer or the last 20 blows of a steam hammer.

The above formulas are applicable only when

1. The hammer has a free fall.
2. The head of the pile is free from broomed or crushed wood-fiber or other serious impairment.
3. The penetration is at a reasonably quick and uniform rate.
4. There is no sensible bounce after the blow. Twice the height of the bounce shall be deducted from "H" before inserting the value in the formula.
5. The weight of pile is not more than the weight of the hammer used, if the hammer used is of the gravity type.

The bearing powers of timber piles as determined by the foregoing formulas shall be considered effective only when they are less than the crushing strength of the piles. The formulas specified above for timber piling may be used as a rough approximation for the bearing power of precast concrete and structural steel piles and of cast-in-place piles.

-1.7 In all cases, when tested by formula, piles shall be driven if possible until their safe bearing power is not less than 20 tons for timber piles and 30 tons for concrete piles.

-1.8 In case the safe bearing power of any pile is found by test, or by formula if not tested, to be less than the load that it was intended to carry, additional piles shall be driven until the load per pile is reduced to the safe bearing power found, or plans showing the necessary modification of the design of the footings and the number and location of the piles required will be furnished by the engineer and the work constructed accordingly.

-1.9 The carrying capacity of jetted piles shall be determined by actual tests or by the same method and formula as in the case of unjetted piles, provided that no jet be used during the test blows.

-2.1 Materials. Unless otherwise specified, untreated timber foundation pile may be of any species which will stand driving satisfactorily, and they may be either round or square.

Timber piles which will be below water level at all times may be of any species of wood which will withstand driving satisfactorily.

In untreated piling for use in exposed work, the diameter of the heart-wood shall be not less than eight-tenths of the required diameter of the pile.

All timber piling shall be cut from sound and live trees, preferably during the winter season. They shall contain no unsound knots. Sound knots will be permitted, provided the diameter of the knot does not exceed 4 inches, or one-third of the diameter of the stick at the point where it occurs. Any defect or combination of defects which will impair the strength of the pile more than the maximum allowable knot shall not be permitted. The butts shall be sawed square and the tips shall be sawed square or tapered to a point not less than 4 inches in diameter as directed by the engineer.

Unless otherwise specified, all piles shall be peeled by removing all of the rough bark and at least 80 percent of the inner bark. No strip of inner bark remaining on the stick shall be over 3/4-inch wide or over 8 inches long, and there shall be at least 1 inch of clean wood surface between any two such strips. Not less than 80 percent of the surface on any circumference shall be clean wood.

Round piles shall be cut above the ground swell and shall taper from butt to tip. A line drawn from the center of the tip to the center of the butt shall not fall outside of the center of the pile at any point more than 1 percent of the length of the pile. In short bends, the distance from the center of the pile to a line stretched from the center of the pile above the bend to the center of the pile below the bend shall not exceed 4 percent of the length of the bend or a maximum of 2-1/2 inches. All knots shall be trimmed close to the body of the pile.

Round piles shall have a minimum diameter at the tip, measured under the bark, as follows:

Length of pile	Tip diameter
Less than 40 feet	8 inches
40 to 60 feet	7 inches
Over 60 feet	6 inches

The minimum diameter of piles at a section 4 feet from the butt, measured under the bark, shall be as follows:

	Diameter in inches	
Length of Pile	Douglas Fir Southern yellow pine Southern cypress	All other species
Less than 20 feet	11	11
20 to 30 feet	12	12
30 to 40 feet	12	13
Over 40 feet	13	14

The diameter of the pile at the butt shall not exceed 20 inches.

Square piles shall have the dimensions shown on the plans.

-2.2 Untreated trestle piles and untreated foundation piles for trestle bents shall meet the requirements for timber foundation piles and in addition shall be of a durable species, as required on the plans or called for in the specifications. In general, untreated timber piles shall be used only below permanent ground-water level and shall not be used in water which is infested by marine borers.

-2.3 Treated Timber Piles. Treated foundation piles, treated trestle piles and treated foundation piles for trestle bents shall be of the species called for in the specifications and shall conform to the corresponding requirements for untreated timber piling. In addition they shall be treated by pressure methods with preservative as prescribed in the specifications for "Treated and Untreated Timber." Round piles shall retain preservative in the minimum amounts set out in Table I below, and shall be so treated as to secure penetration of all sapwood or to secure at least the penetration stipulated in Table I.

TABLE I

Minimum Retention Pounds of the Preservative per Cubic Foot of Wood and Minimum Penetration

	Creosote Oil or Creosote Coal Tar Solution				50-50 Creosote Petroleum Blend	
	Empty Cell lb.	Min. Penetration inches	Full Cell lb.	Min. Penetration inches	Empty Cell lb.	Min. Penetration inches
Piling - General Use	8	2½"			10	3"
Piling - Marine Use						
Southern Pine			20	3½"		
Douglas Fir			15	All sapwood		

Sawn piles containing sapwood shall have a penetration on heart faces of not less than 1/2 inch, and for sawn piles not containing sapwood the requirements for penetration stipulated in the item "Treated and Untreated Timber" shall apply.

-2.4 Concrete Piles. All concrete materials and their preparation and placing shall be in accordance with the requirements for Class A concrete, except that the maximum size of aggregate shall be not over one inch.

Reinforcement shall conform to the requirements for "Reinforcing Steel" of these specifications and the weight and dimensions shall be as shown on the plans.

-2.5 Precast Concrete Piles. Precast piles shall be made in accordance with the plans and reinforcement shall be accurately placed and secured rigidly in such manner as to insure its proper location in the completed pile. Special reinforcement at top and bottom to prevent damage in driving shall be provided. Centers of main reinforcing bars shall be not closer to the surface of the concrete than 2-1/2 inches. Concrete shall be placed carefully, tamped and spaded, care being taken to fill every part of the form and to work the concrete around and under the reinforcement without displacing it. The piles shall be cast separately, or, if alternate piles are cast in a tier, the intermediate piles shall not be poured until four days after pouring the adjacent piles. Piles cast in tiers shall be separated by tar paper carefully placed. The concrete shall be placed continuously in each pile. The completed piles must be free from stone pockets, porous spots, or other defects, and be straight and true to the form specified. The forms shall be true to line, built of dressed lumber and a 1-inch chamfer strip shall be used in all corners; they shall be water-tight and shall not be removed within 24 hours after the concrete is placed. All exposed surfaces of the pile shall be given a rubbed finish. The piles shall be cured at least 40 days at a temperature of not less than 40°F., or 30 days at a temperature of not less than 60°F. Piles shall be at least 30 days old when driven. When concrete piles are lifted or moved they shall be supported at the

quarter points. They shall be so designed that the unit stresses produced by handling, as described above, will not exceed 650 pounds per square inch compression in concrete nor 16,000 pounds per square inch tension in steel.

-2.6 Manufacture of Cast-in-Place Concrete Piles. Cast-in-place concrete piles shall be, in general, reinforced and cast in strong metal shells which shall remain permanently in place. However, other types of cast-in-place concrete piles, plain or reinforced, cased or uncased, may be used if, in the opinion of the engineer, the soil conditions permit their use and if the method of placing is approved by the engineer.

The metal shell shall be of sufficient thickness and reinforced so that it will hold its original form and show no signs of distortion after the core has been withdrawn. The design of the shell shall be approved by the engineer before any driving is done.

After the shell has been driven and the core withdrawn, the shell shall be inspected and approved before any concrete is placed. Any improperly driven, broken, or otherwise defective shell shall be removed and replaced.

Class "A" concrete shall be used for cast-in-place concrete piles.

Reinforcement for cast-in-place piles shall be of the unit type, fastened together rigidly and lowered into the shell before concrete is placed. No loose bars will be permitted. The reinforcement shall be secured in such a manner as to insure its proper location in the finished pile.

Preferably no concrete shall be placed until all driving within a radius of 15 feet has been completed, nor until all the shells for any one bent have been completely driven. If this cannot be done, all driving within the above limits shall be discontinued until the concrete in the last pile cast has set at least seven days.

Concrete shall be placed as specified for piles precast in the vertical position, except that the forms shall not be vibrated. Accumulations of water in the shells shall be removed before the concrete is placed.

-2.7 Extensions of "Build-Ups." Extensions, splices or "build-ups" on concrete piles, preferably, shall be avoided, but when necessary they shall be made as follows:

After the driving is completed the concrete at the end of the pile shall be cut away, leaving the reinforcing steel exposed for a length of 40 diameters. The final cut of the concrete shall be perpendicular to the axis of the pile. Reinforcement similar to that used in the pile shall be fastened securely to the projecting steel and the necessary form work shall be placed, care being taken to prevent leakage along the pile. The concrete shall be of the same quality as that used in the pile. Just prior to placing concrete the top of the pile shall be wetted thoroughly and covered with a thin coating of neat cement, retempered mortar or other suitable bonding material. The forms shall remain in place not less than seven days and shall then be removed carefully and the entire exposed surface of the pile finished as above specified.

-2.8 Structural steel piles shall be of the weight and shape called for on the plans. They shall be copper bearing structural steel of the quality prescribed under the item "Structural Steel."

-3.1 Construction Methods. Piles shall be used only in places where a minimum penetration of 10 feet in firm material, or 20 feet in soft material, can be obtained. For foundation work, no piling shall be used to penetrate a very soft upper stratum overlying a hard stratum unless the piles penetrate the hard material a sufficient distance to fix the ends rigidly. For foundation of arch, continuous span, or movable bridges or high abutments, the piles shall be embedded completely in firm earth, sand or gravel which will afford good lateral support. When this result is impracticable, the soft material shall be excavated from the pit and replaced by heavy riprap, for such distance and depth as the plans indicate or the engineer directs in writing.

All excavation of the foundation in which piles are to be driven shall be complete before driving is commenced. After driving is completed, all loose and displaced materials shall be removed from around the piles, leaving a clean solid surface to receive the concrete.

When subject to transverse forces, batter piles shall be driven in sufficient numbers to resist the transverse forces without assistance from the vertical piles.

-3.2 Driving Piles. All piles shall be driven as shown on the plans or ordered in writing within an allowed variation as to direction of pile of not more than 1/4 inch per foot of pile length. Timber piles shall be provided with a metal collar when necessary to prevent splitting in driving. Metal shoes of an approved design shall also be used when ordered in writing. When water jets are used the number of jets and nozzle volume and pressure shall be sufficient to erode the material adjacent to the piling freely. The plant shall have sufficient capacity to deliver at all times a pressure of at least 100 pounds per square inch at two 3/4-inch jet nozzles. Before the desired penetration is reached the jets shall be shut off and the piles driven by hammer to final penetration.

The heads of all concrete piles, and the heads of timber piles, when the nature of the driving is such as to injure them unduly, shall be protected by caps of approved design, preferably having a rope or other suitable cushion next to the pile head and fitting into a casting which in turn supports a timber shock block. When the area of the head of any timber pile is greater than that of the face of the hammer, a suitable cap shall be provided to distribute the blow of the hammer throughout the cross section of the pile and thus avoid, as far as possible, the tendency to split or shatter the pile.

Piles, preferably, shall be driven with steam hammers, or a combination of water jets and hammers. Concrete piles, preferably, shall be driven by means of a combination of hammer and jets.

If gravity hammers for driving timber piles are permitted, they shall weigh not less than 2,000 pounds and preferably not less than 3,000 pounds. The fall shall be regulated so as to avoid injury to the piles, and in no case shall exceed 20 feet.

Concrete piles preferably shall be driven with steam hammers. Steam hammers for this purpose shall develop an energy per blow at each full stroke of the piston of not less than 3,500 foot-pounds per cubic yard of concrete in the pile being driven. The total energy developed by the hammer shall be not less than 6,000 foot-pounds per blow. Gravity hammers, when used, shall have a weight not less than that of the pile, and the maximum drop shall not exceed 8 feet.

Pile driver leads shall be constructed in such a manner as to afford freedom of movement of the hammer, and they shall be held in position by guys or steel braces to insure support to the pile during driving. Except where piles are driven through water, the leads, preferably, shall be of sufficient length so that the use of a follower will not be necessary, and shall be so designed as to permit proper placing of batter piles.

The driving of piling with followers shall be avoided if practicable and shall be done only under written permission of the engineer. When followers are used, one pile from every group of 10 shall be a long pile driven without a follower, and shall be used as a test pile to determine the average bearing power of the group.

-3.3 Defective Piles. The procedure incident to the driving of piles, whether of wood or of concrete shall not subject them to excessive and undue abuse producing crushing and spalling of the concrete or injurious splitting, splintering and brooming of the wood. Any pile broken by reason of internal defects, or by improper driving or driven out of its proper location shall be removed or, at the option of the engineer, a second pile may be driven adjacent thereto, if this can be done without detriment to the structure. All piles so driven shall be at the expense of the contractor.

Wooden piles driven below the elevation fixed by the plans or by the engineer shall be withdrawn and replaced by new and, if necessary, longer piles at the expense of the contractor. Concrete piles driven below the fixed elevation shall be extended upward by a build-up constructed as provided in "Extensions" or "Build-ups."

All piles pushed up by the driving of adjacent piles or by any other cause shall be driven down again if required by the engineer.

-3.4 Utilizing Test Piles and Loaded Test Piles. After the completion of the loading tests, the load shall be removed as directed and the piles utilized in the structure if found satisfactory for use or disposed of in such other manner as ordered by the engineer. Test piles not loaded shall be utilized similarly.

-3.5 Cutting Off and Capping Piles. Tops of foundation piles shall be embedded in the concrete footing at least one foot and where seals of concrete deposited in water are used, piles shall project at least 6 inches above top of seal concrete. Timber piles shall be cut off level at the elevation indicated on the plans. The distance from the side of any pile to the nearest edge of the footing shall be not less than 9 inches.

Timber foundation piles for framed bents shall be cut off level at the elevations indicated on the plans and the cap secured to each pile rigidly by driftbolts extending at least 9 inches into the pile.

Timber trestle piles shall be cut off at the elevation shown on the plans and the caps secured as described above. If the cut-off is 10 feet or more above the ground line, timber piles shall be braced by diagonal cross-bracing secured to the piles by 3/4-inch bolts.

The tops of all woodpiling shall be sawed to a true plane, as shown on the plans, and at the elevation fixed by the engineer. Piles which support timber caps or grillage shall be sawed to conform to the plane of the bottom of the superimposed structure. In general, the length of pile above the elevation of cut-off shall be sufficient to permit the complete removal of all material injured by driving.

-3.6 Protecting Untreated Piles. The heads of untreated piles shall be given that one of the two following treatments which is designated in writing by the engineer:

(a) The sawed surface shall be brush-coated immediately and thoroughly with two applications of hot creosote oil.

(b) The sawed surface shall be brush-coated immediately with hot creosote oil, hot zinc chloride solution or other approved preservative. The sawed surface shall then be coated heavily with red-lead paint and covered with cotton duck, of at least 8-ounce weight, which shall be folded down over the sides of the pile and secured firmly thereto with large headed roofing nails. The edges of the duck shall be trimmed to give a workmanlike appearance. The duck shall then be waterproofed by being saturated thoroughly and coated with one or more applications of red-lead paint.

-3.7 Protecting Treated Piles. All cuts in treated piles or timbers and all abrasions after having been carefully trimmed shall be coated with at least three applications of hot creosote oil and covered with hot roofing pitch. Before driving bolts hot creosote oil shall be poured into all bolt holes in such a manner that the entire surface of the hole shall be coated thoroughly with the oil. Any unfilled holes after being treated with creosote oil shall be plugged with creosoted plugs.

After the necessary cutting has been done to receive the cap, the heads of treated piles shall be given three coats of hot creosote oil. They shall be then covered with a coat of hot tar-pitch, over which shall be placed a sheet of three-ply roofing felt or galvanized iron, or a covering may be built up of alternate layers of hot tar-pitch and loose-woven fabric as specified for membrane waterproofing, using four layers of pitch and three of the fabric. The cover shall measure at least 6 inches more in each dimension than the diameter of the pile and shall be bent down over the pile and the edges fastened with large-headed nails or secured by binding with galvanized wire.

Treated piles and timbers shall be handled carefully without sudden dropping, breaking of outer fibers, bruising or penetrating the surface with tools. They shall be handled with rope slings. Cant dogs, hooks, or pike poles shall not be used.

-4.1 Method of Measurement. The footage of piles to be paid for shall be the actual number of linear feet of piles left in place in the completed work and accepted by the engineer. No allowance will be made for any piles which are not driven in accordance with the specifications and plans. The footage and number of piles ordered shall be the responsibility of the contractor and no allowance will be made for cut-offs or broken piles or piles ordered and not used, except that where lengths of concrete piles are shown on the plans or specified by the engineer, the length of cut-off shall be paid for at one-half the contract unit price bid, which shall be full compensation for materials, etc., and cutting off.

The number of test piles to be paid for shall be the number of individual timber test piles or of concrete test piles, as the case may be, furnished and driven as directed by the engineer. Piles paid for as test piles will not be included in the measurement of pay footage. Cut-offs of test piles will not be included in any pay footage.

The number of load tests to be paid for shall be the number of load tests made, completed and accepted. The number of pile shoes to be paid for shall be the number of shoes of approved design ordered and used on accepted piles.

-5.1 Basis of Payment. The footage of piles determined as provided above shall be paid for at the contract unit prices per linear foot bid for "Untreated Timber Piling," "Treated Timber Piling" or "Concrete Piling," as the case may be, complete in place, which prices and payment shall be full compensation for all materials, equipment, treatment, tools, labor and incidentals necessary to complete the item. When test piles are called for in the Special Provisions and Bid Schedule they will be measured and paid for as provided therein.

Heavy riprap for lateral support in soft material or sheet piling, if ordered in writing, shall be paid for as specified under the item "Loose Riprap."

Pile shoes will be paid for at the price per each bid for "Pile Shoes" which price and payment shall constitute full compensation both for furnishing the shoes and for utilizing same on piles as ordered.

The number of individual load tests, as accepted, shall be paid for at the contract unit price per test load bid for "Loading Tests of Piles," which price and payment shall constitute full payment for building the load platform, procuring and placing the loading material, and removing and disposing of the platform and material.

The number of test piles accepted, whether or not tested under actual load, and whether or not utilized in the structure, shall be paid for at the contract unit price per each bid for "Test Piles," which price and payment shall constitute full compensation for furnishing and driving the piles as required for the purposes of the test and then incorporating them with the structure, or otherwise utilizing or disposing of them as ordered.

301 HAND LAID ROCK EMBANKMENT

301-1.1 Description. This item shall consist of hand laid rock embankment constructed in accordance with these specifications at the locations, and of the form and dimensions shown on the plans or directed by the engineer.

-2.1 Materials. The stones used for this work shall be sound and durable and not less than 1/2 cubic foot in volume with 75 percent of the stones at least one cubic foot in volume. Only weathered faces shall be exposed. Stones obtained from work under this contract may be used. Additional stones required may be obtained from sources within the area of the Forest or Park as designated by the engineer where available. The picking up of stones from fields will not be permitted, unless authorized in writing by the engineer.

-3.1 Construction Methods. Sufficient excavation shall be made as to expose a foundation bed satisfactory to the engineer. The stones shall be founded on this bed and laid up to the lines and dimensions required. The stones shall be bonded to some extent and securely bedded. Spalls shall be used to fill voids. Any spaces back of the hand laid rock embankment shall be filled entirely with compacted material.

-4.1 Method of Measurement. The yardage to be paid for shall be the number of cubic yards of hand laid rock embankment measured in place. If the stones are taken from excavations under this contract, no deduction from excavation otherwise payable will be made. No measurements for payment under other items will be made for such work as excavation, backfill and/or overhaul, when such work is incidental to the satisfactory completion of the hand laid rock embankment, but the cost thereof will be considered included in the price and payment for this item.

-5.1 Basis of Payment. The yardage measured as provided above shall be paid for at the contract unit price per cubic yard bid for "Hand Laid Rock Embankment," which price and payment shall constitute full compensation for furnishing, selecting, transporting and placing stones by hand, excavating for foundation bed, backfilling, and for all labor, equipment, tools, and incidentals necessary to complete the item.

302 LOOSE RIPRAP

302-1.1 Description. This item shall consist of furnishing and placing riprap stones for bank protection in accordance with these specifications at the locations indicated and in conformity with the lines, grades, and dimensions shown on the plans or directed by the engineer.

-2.1 Materials. The stones shall be hard, angular, quarry stones of a quality that will not disintegrate on exposure to the water or atmospheric conditions and shall be of the grade usually known as riprap stones. The entire quantity shall consist of pieces that vary in weight from 20 to 400 pounds. 75 percent of the total weight shall be pieces weighing from 20 to 200 pounds each and 25 percent pieces weighing from 200 to 400 pounds each.

-3.1 Construction Methods. The stones shall be handled or dumped into place so as to form the cross section shown on the plans. Unless changes are ordered by the engineer, the riprap shall extend from 2 feet below the bed of the stream to the mean high water line. The stones above the low water line shall be trimmed to a uniform surface free from humps or depressions and with no excessively large cavities below, or individual stones projecting above the general surface. The work shall be finished to a uniform line along the top. Such foundation trenches or other excavation as determined necessary shall be performed as specified under "Excavation" of the class in which it falls.

-4.1 Method of Measurement. The yardage to be paid for under this item shall be the number of cubic yards of riprap measured in final place, completed and accepted.

-5.1 Basis of Payment. The yardage, measured as provided above shall be paid for at the contract unit price per cubic yard bid for "Loose Riprap" which price and payment shall be full compensation for furnishing and placing all materials, backfilling, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Excavation. The foundation trenches and any other excavation performed as ordered, shall be measured and paid for as "Unclassified Excavation for Structures."

303 CONCRETE CRIBBING

303-1.1 Description. This item shall consist of cribbing, composed of concrete crib members furnished and made in accordance with these specifications and in conformity with the dimensions shown on the plans, constructed and placed at the locations shown on the plans and as ordered by the engineer.

-2.1 Materials. The crib members shall be made of Class A concrete, provided however, that the maximum size of aggregate shall be not over one inch. Drift-bolts shall be of wrought-iron or galvanized steel not less than one inch in diameter and of the required length.

Casings for drift-bolts shall be of galvanized steel or iron pipe not less than 1-1/4 inches in diameter.

The details of the crib members and their arrangement shall be as shown on the plans. If specific details for reinforcement are not shown on the plans, or if the contractor is permitted to purchase the crib members from manufacturers, he shall submit detailed specifications and plans for the approval of the engineer and such plans must be approved before delivery of the material is begun.

All members shall be free from depressions and spalled, patched, or plastered surfaces or edges, or any other defect which may impair their strength or durability. Cracked or otherwise defective members will be rejected.

-3.1 Construction Methods. The foundation or bed for the cribbing shall be excavated as required, shall be firm and shall have been approved by the engineer before any of the crib work is placed. In general, transverse concrete sill members shall be used to support the lower cribbing course. Crib members shall be handled carefully. Any members which are damaged shall be removed and new members substituted at the contractor's expense. Each member shall be secured by means of drift-bolts passing through galvanized casings or other effective locking devices. Any members which become cracked or otherwise injured during erection shall be renewed completely and replaced.

The filling for the interior of the crib shall progress simultaneously with the erection of the cribbing, and shall be of approved material placed in layers not to exceed 12 inches in thickness and tamped or consolidated to the satisfaction of the engineer. A layer of rock shall be laid against the front members of the cribbing to prevent loss of fill material through the openings. All vegetable matter and adobe soil shall be excluded from the backfill, and the puddling method of backfilling shall not be used.

-4.1 Method of Measurement. The footage of concrete cribbing to be paid for shall be the number of cubic feet of concrete crib members placed as ordered in the completed structures, and accepted.

-5.1 Basis of Payment. The footage determined as provided above shall be paid for at the contract unit price per cubic foot bid for "Concrete Cribbing" which price and payment shall constitute full compensation for furnishing, making, handling and installing of the concrete crib members, excavating for foundation bed, furnishing and placing the interior filling materials, and all labor, equipment, tools and incidentals necessary to complete the item.

304 METAL CRIBBING

304-1.1 Description. This item shall consist of metal cribbing constructed in accordance with these specifications and in conformity with the lines, grades and dimensions shown on the plans.

-2.1 Materials. Cribbing shall consist of box-like metallic headers and stretchers with the appurtenances necessary for complete assembly in the field. Each header and stretcher shall be fabricated completely in the plant prior to shipment to site. The dimensions of the headers shall be approximately 6 inches by 6 inches with lengths of 4, 6 and 8 feet, and the stretchers shall have a dimension of approximately 6 inches by 8 inches with lengths of 4, 6 and 8 feet.

The sheets from which all headers and stretchers are manufactured shall be made by the open hearth process, and of material meeting the requirements for chemical composition and spelter coating specified for "Corrugated Galvanized Metal Pipe."

The various members of the crib shall be constructed of metal of not less than 16 gage, and the average weight of the various members shall not underrun the following weights more than 5 percent:

Headers	4	feet	long	-	32	pounds	Stretchers	4	feet	long -	26 pounds
"	6	"	"	-	40	"	"	6	"	" -	38 "
"	8	"	"	-	49	"	"	8	"	" -	47 "

The headers and stretchers, upon assembly, shall interlock by means of a flexible bolt connection, thus transmitting the load from one member to the other.

The ends of all headers and stretchers shall be reinforced with a metallic insert and also at locations where heavy loads are imposed at points of contact between headers and stretchers.

Fillers for placing between stretchers on the face of the wall and end caps for the outside end of the headers shall be furnished if called for on the plans.

-3.1 Construction Methods. The foundation or bed for the cribbing shall be excavated as required, shall be firm and shall have been approved by the engineer before any of the crib work is placed.

The crib members shall be erected as shown on the plans. The members shall be handled carefully and any which are damaged shall be removed and new members substituted at the contractor's expense.

The filling for the interior of the crib shall progress simultaneously with the erection of the cribbing and shall be of approved material placed in layers not to exceed 12 inches in thickness and tamped or consolidated to the satisfaction of the engineer. A layer of rock shall be laid against the front members of the cribbing to prevent loss of fill material through openings. All vegetable matter and adobe soil shall be excluded from the backfill, and the puddling method of backfilling shall not be used.

-4.1 Method of Measurement. The quantity to be paid for shall be the number of square feet in the outside face of the structure complete in place and accepted, measured between lines of intersection of respective surfaces.

-5.1 Basis of Payment. The quantity, determined as provided above, shall be paid for at the contract unit price per square foot bid for "Metal Cribbing," which price and payment shall be full compensation for the furnishing, handling and installing of the metal crib members including all materials, bolts and hardware, for excavation for foundation bed, and backfilling and for all labor, equipment, tools and incidentals necessary to complete the item, but shall not include structure excavation.

305 TIMBER AND LOG CRIBBING

305-1.1 Description. This item shall consist of cribbing, composed of timber or log members as called for by the Bid Schedule, furnished and prepared in accordance with these specifications, constructed and placed at the locations shown on the plans and as ordered by the engineer.

-2.1 Materials. Timber for crib members shall conform to the requirements for caps, posts and sills as the appropriate case may be as prescribed under "Treated and Untreated Timber" and shall be treated or untreated as called for in the Bid Schedule.

Logs for crib members shall conform to the requirements for logs for "Log Bridges" herein elsewhere specified.

Sawn timber shall be not less than 8 inches in least dimension and face timbers in the base tier shall be not less than 10 inches in least dimension.

Any necessary accessory lumber, hardware, etc., shall conform to the requirements given under "Timber Bridges" herein elsewhere specified.

-3.1 Construction Methods. The foundation or bed for the cribbing shall be excavated to exact grade and shall have been approved as to bearing quality by the engineer before any of the crib work is placed.

-3.2 Preparation. All framed surfaces and cuts shall receive a thorough coating with approved preservative immediately before assembling. When timbers or logs are to be treated all framing indicated on the plans shall be completed before treating.

-3.3 Framing and Assembling. All timber and log framing shall be done in a workmanlike manner and true to line and angle. Care shall be exercised in the erection of all cribs to produce a true face as shown on the plans and all timbers or logs in faces shall be horizontal. The cribbing shall be supported on mud sills with flattened lower surfaces, placed as shown on the plans.

The minimum lengths and sizes of timbers and logs shall be as shown on the plans. Each course shall break joints with the adjacent courses. The timbers or logs in the base tier of the face and in alternate tiers of the face above the base shall be as long as practicable and preferably shall extend the full length of the face. In intermediate tiers they shall have a length of not less than 8 feet and shall be arranged to break joints. Crib faces shall be laid solid or with spaces as indicated on the plans.

-3.4 The face and tie logs are to be so notched together, and hewn if necessary, that the face logs will be in contact with each other throughout their entire length, except that in case a satisfactory rock backing is placed against the face logs, the engineer may permit open spaces not exceeding 4 inches in width between the face logs. When permission to use such spaces is given, the rock backfill shall be carefully placed, using the larger rocks adjacent to the logs and backing up with the smaller rocks in such manner that no material may escape or be washed out.

-3.5 Ties. The length of the ties required for the proper support and anchorage of the cribbing shall be as determined by the engineer. The length of ties shall be sufficient to develop the required anchorage against overturning, and in no case shall the length of tie extending into the fill be less than two-thirds of the height of fill above the tie in question. Ties shall be anchored to the face walls by framing, either dovetailed or by sufficient projection beyond the face of the crib to form the proper anchorage. Ties shall be anchored at the fill end to cross pieces fastened to them at right angles by drift-bolts or other suitable means. Ties shall be spaced not more than 8 feet center to center in any horizontal tier and shall be staggered with the next tier of ties. Tiers of ties shall be not more than 3 feet apart vertically.

-3.6 Fastening. All logs including face logs, tie logs, mud sills and anchor logs shall be notched together properly as shown on the plans, and in all cases, shall be drift-bolted together except where stipulated to the contrary on the plans.

In the case of sawn timbers each successive tier of timbers shall be drift-bolted to the one upon which it rests by drift-bolts not less than 3/4-inch diameter and of sufficient length to extend through 2 tiers and not less than 4 inches into the third tier.

Drift bolts shall be staggered and not more than 8 feet center to center in each tier. All end joints and splices shall be half-lapped for 10 inches and drifted at the center.

-3.7 Filling. In all cases filling inside and around cribs shall be of the material specified and shall be placed in a careful manner so as to avoid distortion of the crib. Filling shall be placed in even horizontal layers and compacted as ordered.

-4.1 Method of Measurement. The footage of timber cribbing to be paid for shall be the number of thousand feet board measure of timber remaining in the finished structure.

The footage of log cribbing to be paid for shall be the number of square feet in the outside face of the structure complete in place and accepted, measured between lines of intersection of respective surfaces.

-5.1 Basis of Payment. Where the Bid Schedule calls for timber cribbing the board measure of timber cribbing determined as provided above shall be paid for at the contract unit price per thousand feet board measure bid for "Untreated Timber Cribbing" or "Treated Timber Cribbing" as the case may be; where the Bid Schedule calls for log cribbing, the face square footage of log cribbing, determined as provided above, shall be paid for at the contract unit price per square foot bid for "Log Cribbing" in place; in all cases the above prices and payment shall constitute full compensation for the completed cribbing place, including excavating the foundation bed and backfilling, furnishing and placing transverse mud sills, tie timbers and logs, anchor timbers and logs, drift-bolts and hardware, and all materials, labor, equipment, tools and incidentals necessary to complete the item.

306 UNDERDRAINS

306-1.1 Description. This item shall consist of underdrains of the kinds and sizes designated on the plans or by the engineer, constructed in accordance with these specifications and conforming to the lines, grades, dimensions and designs shown on the plan or directed by the engineer.

-2.1 Materials. Pipes used in underdrains shall conform to the following requirements respectively.

Plain concrete pipe shall conform to Federal Specification WW-P-371.

Clay sewer pipe shall conform to Federal Specification SS-P-361.

Perforated corrugated metal pipe shall conform to the specifications for "Perforated Pipe" as prescribed in the item for "Corrugated Galvanized Sheet Metal Pipe" as herein elsewhere given, provided, however, that the pipe may be the riveted type or the crimped, and when the Bid Schedule calls for 6-inch perforated galvanized sheet metal pipe the metal shall be of No. 18 gage; provided further that where the Bid Schedule calls for Bituminous Coated Perforated Corrugated Sheet Metal Pipe Underdrain the requirement under the erosion test for nine additional testing periods for the bottom one-quarter of the pipe shall not apply.

-3.1 Construction Methods. The trench shall be excavated to the width, line and grade given by the engineer, the depth of trench to vary from 2-1/2 to 4-1/2 feet below the finished surface at the top of the trench where the construction is under the gutter or ditch or under the roadway and to depths required for proper drainage at other locations, provided, however, that wherever the plans show the depth, such depth shall govern the construction. A 2-inch bed (unless otherwise stated on the plans, in which case the plan dimension shall govern) of stone or gravel, all passing a 1-inch sieve and retained on the No. 4 sieve, shall be spread in the bottom of the trench throughout its entire length and brought to a uniform grade.

-3.2 Pipe of the kind and size required shall be embedded firmly in the bottom course of stone. Bell and spigot pipe shall be laid with the bell end upgrade and the spigot end fully entered in the adjacent bell after which the joints shall be covered

with two-ply tar paper strips not less than 6 inches in width and of sufficient length to permit the ends being turned outward and laid flat on the bottom course of stone on either side of the pipe for a distance of 3 inches.

Perforated pipe shall be laid with the perforated side of the pipe down and separate sections shall be firmly joined together.

After the pipe has been laid and has received the inspection and approval of the engineer, clean gravel, or broken stone filling, all passing a 3-inch sieve and retained on a 3/4-inch sieve (unless otherwise stated on the plans in which case the plans shall govern) shall be placed carefully, so as not to displace the pipe or joint covering around and over the pipe to within 12 inches of the finished ground surface. The upper 12 inches of the trench shall then be filled with suitable material of either the porous or impervious type as shown on the plans or as directed by the engineer. Stone and any other surface filling shown on the plans shall be tamped firmly.

-3.3 Blind Drain. Where blind drains are called for they shall be dug to the cross section shown on the plans and to the depth staked by the engineer. The trench thus prepared shall be filled with stones, broken stone, or gravel of the approximate sizes shown on the plans, or directed by the engineer, to within 12 inches of the finished ground surface. The upper 12 inches of the trench shall be then filled with suitable material of either the porous or impervious type as shown on the plans or directed by the engineer. Both stone and surface filling shall be firmly tamped.

-4.1 Method of Measurement. The footages to be paid for shall be the number of linear feet of underdrain with the several kinds and sizes of pipe or of blind drain measured separately in place, completed and accepted.

-5.1 Basis of Payment. The footages, measured as provided above, shall be paid for at the contract unit price per linear foot bid for "Clay Sewer Pipe Underdrain," "Plain Concrete Pipe Underdrain," "Perforated Corrugated Sheet Metal Pipe Underdrain," and "Bituminous Coated Perforated Corrugated Sheet Metal Pipe Underdrain," of the several sizes or "Blind Drain," as the case may be, which prices and payment shall be full compensation for furnishing and installing all the pipe and other materials, backfilling the trench as required and for all labor, equipment, tools and incidentals necessary to complete the item, except excavation.

Excavation of the ditch for the underdrain shall be measured and paid for as "Unclassified Excavation for Structures."

307 DROP INLETS AND CATCH BASINS

307-1.1 Description. This item shall consist of drop inlets or catch basins, as the case may be, with cast iron frames and gratings or reinforced concrete slab covers as required, constructed where called for on the plans or directed by the engineer in accordance with these specifications and in conformity with the dimensions, elevations and design shown on the plans.

-2.1 Materials. The materials entering into the construction, and their combination, construction and/or fabrication, shall conform to the appropriate requirements therefor as stipulated elsewhere.

-2.2 Cast iron frames and gratings shall conform to the requirements of Federal Specification No. QQ-I-651. They shall be free from pouring faults, blow holes, cracks and other imperfections. The castings shall be sound, true to form and thickness, clean and neatly finished, and shall be coated with coal tar pitch varnish. Gratings which are to rest on frames shall bear thereon evenly. They shall be assembled before shipment, inaccuracy of bearing corrected by machining if necessary, and so marked that the same pieces may be readily reassembled in the same position when installed. A frame and the grating to be used therewith shall constitute one pair.

-2.3 Reinforced concrete slab covers shall be constructed of Class D concrete reinforced as shown on the plans. When so required by the plans or special provisions, the concrete shall be colored by the addition of sufficient emulsified carbon black to approach the natural color of the rock encountered on the project. To determine the quantity of carbon black required, the contractor will be required to cast at his own expense, sample blocks of concrete 6 by 6 by 4 inches, adding varying quantities as directed until the required shade is acquired to the satisfaction of the engineer. The finished slab shall present a neat and smooth appearance and shall have a uniform color. The steel handles shall be coated with coal tar pitch varnish. The handles shall be omitted when the engineer so directs.

-3.1 Construction Methods. Inlets or catch basins as constructed shall be of the type indicated on the plans or as directed by the engineer, and shall conform to the requirements therefor as shown on the plans.

-3.2 Excavation shall be made to the required depth and the subgrade or base upon which the inlet or basin is to be constructed shall be compacted to a firm, even surface.

-3.3 For concrete inlets or basins forms shall be used conforming to the requirements therefor as specified under "Concrete." All concrete shall be Class A except that reinforced concrete slab covers shall be Class D. The concrete shall be tamped or spaded into place thoroughly. It shall be covered with suitable material and kept moist for three days or longer, if necessary, and shall be protected in a satisfactory manner, until thoroughly hardened.

Cast iron or other metal frames shall be set on full mortar beds composed of one part of portland cement and two parts of fine aggregate.

Concrete slabs shall be separated from the remainder of the structure by 4-ply roofing paper separators at all points of contact.

Sections of connection pipe shall be incorporated into the construction, placed at the elevation, direction and grade required. The inner ends of the pipe shall be flush with the inner faces of the walls, unless otherwise ordered.

-3.4 The excavated areas which are not occupied by the structure shall be refilled to the original ground elevation with suitable material which shall be tamped in layers of not more than 6 inches until firm and solid.

-4.1 Method of Measurement. The number of drop inlets or catch basins, as the case may be, to be paid for shall be the number completed in place and accepted. They will not be considered complete until the covers or frame and cover intended are installed and accepted. The number of reinforced covers or of frames and grating shall be the number completed in place and accepted.

-5.1 Basis of Payment. The number of drop inlets and the number of catch basins, determined as provided above, shall be paid for at the contract unit prices per each, bid for "Drop Inlets" and "Catch Basins," as the case may be, which prices and payment shall constitute full compensation for furnishing and placing all materials, excavating and refilling around the structure, for installing the covers or frames and gratings, for disposal of surplus material, and for all labor, equipment, tools and incidentals necessary to complete the item except furnishing the cover or the frame and grating, but shall not constitute payment for grouted rubble gutter in aprons.

The number of reinforced covers and the number of pairs of cast iron frames and gratings furnished and installed shall be paid for at the prices per each bid for "Reinforced Concrete Inlet Cover" and per pair bid for "Cast Iron Frame and Grating," as the case may be, which prices and payment shall constitute full compensation for procuring and delivering the covers or frames and gratings at the site.

308 GROUTED RUBBLE GUTTER

308-1.1 Description. This item shall consist of a grouted rubble gutter constructed of stones 6 to 8 inches in size, laid on a broken stone or gravel foundation approximately 4 inches in depth, the whole constructed on a prepared bedding in conformity with the dimensions indicated on the plans and in accordance with these specifications.

-2.1 Materials. The material for the foundation shall consist of approved clean, sound, durable broken stone, slag or gravel of such size that it will all pass through a laboratory sieve having 1/2 inch square openings and not more than 10 percent will pass a No. 10 sieve.

-2.2 The gutter stones shall consist of approved, sound, durable, rubble stone, not less than 6, nor more than 8 inches in thickness, with approximately flat top surface, and with a width of not less than 2 inches and a length of not less than 6 inches. All gutter stones shall be inspected before and after laying, and all rejected material shall be removed immediately from the work.

-2.3 Aggregate for filling the spaces between gutter stones shall consist of approved clean broken stone, slag or gravel of such size that it will all pass a laboratory sieve having 3/8 inch square openings and not more than 10 percent will pass a No. 4 sieve.

-2.4 The cement grout for filling the spaces between the gutter stones shall be composed of 1 part portland cement, and 2 parts of fine aggregate. The portland cement, fine aggregate and water shall meet the requirements for these materials as specified under "Concrete."

-3.1 Construction Methods. The bedding shall be formed at the required depth below and parallel with the finished surface of the gutter. All soft and yielding or other unsuitable material shall be removed and the subgrade shall be compacted thoroughly and finished to a smooth, firm surface.

-3.2 The foundation material shall be spread on the prepared subgrade to form a bed approximately 4 inches in depth. The gutter stone shall be bedded in the foundation perpendicular to the finished surface, with the flat surface up, in straight rows with the longest dimension at right angles to the center line of the gutter and in close contact. They shall break joints satisfactorily and no interstices exceeding 1 inch in width shall exist.

-3.3 The stones shall be rammed thoroughly until the surface is firm and conforms to the finished grade, alignment and cross section. Any gutter having an irregular or uneven surface shall be taken up and reset satisfactorily.

After the stone has been rammed into place and the surface is satisfactory, the spaces or voids between and around the stone shall be filled with broken stone, slag, or gravel to within 4 inches of the surface, after which cement grout shall be poured and broomed into the spaces between the stones, this operation being continued until the grout remains about one inch below the tops of the stone. The grout shall be of a consistency which will flow readily into the spaces between the stones, but not separate.

-4.1 Method of Measurement. The yardage to be paid for shall be the actual area measured in horizontal projection, expressed in square yards, of grouted rubble gutter measured complete in place and accepted.

-5.1 Basis of Payment. The yardage determined as provided above shall be paid for at the contract unit price per square yard bid for "Grouted Rubble Gutter" which price and payment shall be full compensation for furnishing all materials, for excavation below the finished grade of the gutter, refilling, tamping, and disposing of surplus materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

309 CONCRETE CURB AND

COMBINATION CONCRETE CURB AND GUTTER

309-1.1 Description. This item shall consist of concrete curb or combination concrete curb and gutter of the designs and depths required on the plans, made of portland cement concrete, constructed in accordance with these specifications at the locations, and of the form, dimensions and designs shown on the plans or directed in writing by the engineer.

-2.1 Materials. Portland cement, fine aggregate, coarse aggregate, reinforcing steel and water for the concrete shall conform to the requirements for these materials as contained in the specification hereinbefore given for "Concrete."

-3.1 Construction Methods. Excavation shall be made to the required depth and the subgrade or base upon which the curb or combination curb and gutter is to be set shall be compacted to a firm even surface. All soft and unsuitable material shall be removed and replaced with suitable material.

A bed of cinders or clean sand and gravel or other approved porous material having the compacted thickness shown on the plans shall be placed under the combination curb and gutter.

Forms for placing the concrete shall be built and set in place as described in the section "Concrete" in these specifications.

The composition of the concrete shall be Class A as described in the section "Concrete." The concrete shall be mixed as specified in the section "Concrete" and shall be placed in the forms to the depth specified in layers of 4 or 5 inches, and tamped and spaded until mortar entirely covers its surface. The top of the curb or curb and gutter shall be floated smooth and the edges rounded to the radius shown on the plans. Before the concrete is given the final finishing, the surface of the gutter shall be checked with

a 10-foot straightedge and any irregularities of more than one-quarter inch in 10 feet shall be eliminated.

The curb or curb and gutter shall be constructed in uniform sections 10 feet in length except where shorter sections are necessary for closures, but no section shall be less than 4 feet. These sections shall be separated by sheet steel templets set perpendicular to the face and top of the curbing. These templets shall be one-eighth of an inch in thickness, of the width of the curb or curb and gutter, and not less than 2 inches deeper than the depth of the curb or curb and gutter. The templet shall be set carefully and held firmly during the placing of the concrete and shall be allowed to remain in place until the concrete has set sufficiently to hold its shape, but shall be removed while the forms are still in place.

Expansion Joints shall be formed in the curbs at intervals of 40 feet using premolded filler 1/2 inch in thickness conforming to the requirements for this material as given in the section "Concrete" in these specifications. When the curb is placed adjacent to concrete pavement expansion joints in the curb shall be located opposite expansion joints in the pavement.

The forms shall be removed within 24 hours after the concrete has been placed, and minor defects filled with mortar composed of 1 part of portland cement to 2 parts of fine aggregate. Plastering shall not be permitted on the face of the curb or curb and gutter and all rejected curb or curb and gutter shall be removed and replaced without additional compensation. The exposed surfaces of the combination curb and gutter and the top of the curb and the face from the top to the batter point shall be finished while the concrete is still green by wetting a soft brick or a wood block and rubbing the surfaces until they are smooth. Where the curb is constructed in advance of the surfacing course the face of the curb shall be finished from the top to a point 2 inches below the batter point. Plenty of water shall be used, either by dipping the brick or block in water, or by throwing water on the curb or curb and gutter with a brush. After the concrete has been rubbed smooth, it shall be rubbed again until a uniform color is produced, using in place of water, a thin grout composed of 1 part of portland cement and 1 part of fine aggregate.

When completed the curb or combination curb and gutter shall be covered with suitable material and kept moist for a period of three days, or longer if necessary, and shall be protected in a satisfactory manner from the elements until thoroughly hardened.

After the concrete has set sufficiently, the spaces in front and back of the curb or combination curb and gutter shall be refilled to the required elevation with suitable material, which shall be tamped in layers of not more than 6 inches until firm and solid.

-4.1 Method of Measurement. The footage to be paid for shall be the number of linear feet of concrete curb of the several depths and of combination concrete curb and gutter, measured in place, completed and accepted. No deduction will be made where the curb is flattened for entrances.

-5.1 Basis of Payment. The footage measured as provided above shall be paid for at the contract unit price per linear foot bid for "Concrete Curb" of the several depths and for "Combination Concrete Curb and Gutter," as the case may be, which price and payment shall be full compensation for furnishing and placing all materials including reinforcing steel and expansion joint material, forms, drainage openings, excavation for curb and combination curb and gutter, subbase for combination curb and gutter, refilling, tamping and disposal of surplus materials, and for all labor, equipment, tools and incidentals necessary to complete the item.

310 PLANK FLOORS

310-1.1 Description. This item shall consist of a flooring of timber planks constructed in accordance with these specifications and in conformity with the lines, grade and cross section shown on the plans.

-2.1 Materials. Floor plank shall be treated or untreated timber, as called for in the Bid Schedule. Roadway and sidewalk floor plank, unless otherwise specified, shall be surfaced one side and one edge (S1S1E). The plank shall be of the grades required for decking and wearing surfaces under the specifications for "Treated and Untreated Timber."

-3.1 Construction Method. Single plank floors shall consist of a single thickness of plank supported by stringers or joists. The planks shall be laid heart side down, with 1/4 inch openings between them for seasoned material and with tight joints for unseasoned material. Each plank shall be spiked securely to each joist. The planks shall be graded carefully as to thickness and so laid that no two adjacent planks shall vary in thickness by more than 1/16 inch.

Two-ply timber floors shall consist of two layers of flooring supported on stringers or joists. The lower course shall be pressure-treated with creosote oil. The top course may be laid either diagonal or parallel to the center line of roadway, as specified and each floor piece shall be securely fastened to the lower course. Joints shall be staggered at least 3 feet. If the top flooring is placed parallel to the center line of the roadway, special care shall be taken to fasten the ends of the flooring securely. At each end of the bridge these planks shall be beveled.

-4.1 Method of Measurement. The footage of plank floor to be paid for shall be the number of thousand feet board measure of timber planking in the completed work.

-5.1 Basis of Payment. The footage of plank floor, determined as provided above, shall be paid for at the contract unit price per thousand feet board measure, bid for "Plank Floor", which price and payment shall constitute full compensation for furnishing, preparing and installing all material for the entire completion and furnishing of the flooring, and for all labor, equipment, tools and incidentals necessary to complete the item.

311 LAMINATED OR STRIP FLOORS

311-1.1 Description. This item shall consist of a laminated or strip flooring constructed in accordance with these specifications and in accordance with the lines, grade and typical cross section shown on the plans.

-2.1 Materials. Lumber used in this type of floor shall be treated or untreated timber, as called for in the Bid Schedule. The strips shall be of the grade required for decking and wearing surfaces under the specifications for "Treated and Untreated Timber," and shall be not more than 3 inches in thickness. They shall be surfaced to a uniform thickness (S1S) and, when specified, to a uniform width (S1E).

-3.1 Construction Method. The strips shall be placed on edge, at right angles to the center line of the roadway, and securely fastened to the adjacent strip. The spikes shall be of sufficient length to pass through two strips and at least half-way through a third. In addition, the strips shall be toe-nailed or otherwise fastened to the stringers.

-4.1 Method of Measurement. The footage of laminated or strip flooring to be paid for shall be the number of thousand feet board measure of flooring in the completed work.

-5.1 Basis of Payment. The footage of laminated or strip floors determined as provided above shall be paid for at the contract unit price per thousand feet board measure, bid for "Laminated or Strip Floors," which price and payment shall constitute full compensation for furnishing, preparing and installing all material for the entire completion and finishing of the flooring, and for all labor, equipment, tools and incidentals necessary to complete the item.

312 MINERAL SURFACED ASPHALT PLANK

312-1.1 Description. This item shall consist of a bridge floor wearing surface composed of a mineral surfaced asphalt and fibre material furnished in planks, constructed in one course on a prepared concrete or wood bridge subfloor, in accordance with these specifications and in conformity with the lines, grades and dimensions shown on the plans.

-2.1 Materials. The asphalt plank shall be composed of asphalt cement, organic or vegetable fibre and mineral filler in the following proportions:

	Percent
Asphalt cement	35 to 50
Organic or vegetable fibre. . .	13 to 18
Mineral filler (The mineral surfacing material is not included in the percentage of mineral filler). .	40 to 50

The constituent materials of the plank shall meet the following requirements: The asphalt cement shall have such characteristics that, when combined with the other ingredients, a plank of the required quality will result.

The fibre shall be free from lumps and be in a flocculent condition when used and shall be finely divided whole threads or shreds. The fibrous material shall be free from all foreign materials such as metal wool, leather, rubber, straw, wood, cornstalks or other deleterious materials.

The mineral filler shall be finely crushed slate, limestone, silica or other aggregate which has been proven suitable for use with asphalt cement in constructing pavement wearing surfaces.

The plank shall be formed by extrusion under sufficient pressure to expel the air and form a dense homogeneous mass. Into one surface of the freshly extruded hot plank shall be embedded under pressure not less than one pound per square foot of tough, hard, durable, crushed stone well graded from 1/4 to 3/4 inch. The stone shall be embedded to such a depth that none extends above the intended wearing surface but the top face of the stone shall not be covered with matrix of the plank proper.

The asphalt plank shall weigh not less than 85 pounds per cubic foot exclusive of the weight of mineral surfacing material. The planks shall be of the thickness and other dimensions shown on the plans with a tolerance in thickness of plus or minus 1/16 inch, in width plus or minus 1/8 inch and in length of plus or minus 1/4 inch. Planks of the various thicknesses shall meet the respective requirements set out in the table below.

Thickness Inches	Dimensions	Maximum Absorption Percent (A.A.S.H.O. T-42)	Min. Impact Value ft. lb.	Compression Shear 100 lb. per sq. in. at 51°C: Max.	Compression Shear 350 lb. per sq. in. at 51°C. Max.	Brittleness Test Percent	Brittleness Test Nail size
3/4	Shown on plans	1.0	20	0.080	0.280	80	12 d.
1	"	1.0	28	0.100	0.350	80	16 d.
1-1/4	"	1.0	35	0.120	0.420	80	20 d.
1-1/2	"	1.0	40	0.140	0.500	80	30 d.
2	"	1.0	50	0.180	0.650	80	30 d.

The individual planks shall be sound, free from cracks, fissures or other defects, cut square and true on ends and sides, and conform to the dimensions shown on the plans.

-2.2 Methods of Testing. The methods of making the tests for composition, weight of mineral surfacing, cold brittleness, absorption, impact value, and compression shear shall be as specified under A.A.S.H.O. Method T-77. The results of the tests shall comply with the requirements given under each test respectively, and with the requirements given above under "Materials."

-3.1 Construction Methods. Preparation of Concrete Subfloor. When the asphalt plank wearing surface is to be laid on concrete base the base shall be of slightly roughened texture or "floated" finish true to grade and free from all appreciable irregularities. It shall conform in general to the ordinary requirements of a good concrete base surface. The concrete shall be dry and free from dust, dirt, rubbish, etc. Surplus talc or other powder shall be removed from the asphalt by means of a stiff brush or broom.

A coat of approved asphalt primer shall be applied cold, well brushed out and allowed to dry. Approximately one gallon of asphalt primer is required for 100 square feet of surface.

-3.2 Application on Concrete Subfloor. The surface shall then be mopped with approved asphalt cement applied hot, into which the asphalt plank shall be imbedded. Approximately 50 pounds of asphalt cement is required for 100 square feet of surface. Only such an area shall be covered with asphalt cement at any time as will permit placing planks in the cement before the cement appreciably cools. The asphalt plank shall be laid in a neat, workmanlike manner, breaking joints, and each individual plank shall be crowded snugly against adjacent planks in such a manner that all seams and spaces between asphalt planks are completely filled with asphalt cement.

-3.3 Preparation of Wood Subfloor. When the asphalt plank wearing surface is to be laid on a wood floor, the floor shall be uniform in thickness, laid close together and securely spiked to every stringer. The surface elevation of adjacent planks shall not differ more than 1/8 inch. All nails, dirt, rubbish, etc., shall be swept off before laying asphalt plank.

-3.4 Application on Wood Subfloor. Asphalt plank shall be laid in a neat workmanlike manner, breaking joints, and each individual plank shall be crowded tightly against adjacent planks. Wedges, jacks, or bars may be employed for this purpose. A side and an end butt joint of each plank shall be given a heavy coat of asphalt cement before laying and after the planks have been placed, in such a manner that each side of each joint in place will have received a coating of asphalt. Any open joints remaining in the finished floor and the joint between the plank and the retaining strip on each side of the driveway shall be poured with hot asphalt cement.

The asphalt plank shall be secured in place with nails of size specified, spaced not over 12 inches apart, and staggered, at each end of each plank, at a distance of 1-1/4 inches from any edge. Nails shall be driven until their heads are 1/8 inch below the top surface of the plank.

Nails. Either wire or cut nails or spikes may be used. The size of nail used for any given thickness shall not be less than indicated in the following table:

Thickness of Asphalt Plank Inches	Nail Sizes
3/4 "	12 d.
1 "	16 d.
1-1/4 "	20 d.
1-1/2 "	30 d.
2 "	40 d.

-4.1 Method of Measurement. The yardage to be paid for shall be the number of square yards of mineral surfaced asphalt plank of the several thicknesses in place, completed and accepted.

-5.1 Basis of Payment. The yardage, determined as provided above, shall be paid for at the contract unit price per square yard bid for "Mineral Surfaced Asphalt Plank" of the several thicknesses, which price and payment shall be full compensation for furnishing and placing all materials including nails, asphalt for priming for mopping and for joints and for all labor, equipment, tools and incidentals necessary to complete the item.

313 PREPARATION OF SUBFLOOR
(For Bituminous Wearing Course)

313-1.1 Description. This item shall consist of the conditioning of an existing wood or concrete floor ready for the placing of the contemplated bituminous wearing course, in accordance with these specifications and as called for by the Bid Schedule.

-3.1 Construction Methods. Conditioning of Wood Subfloor. Before placing the wearing surface, all parts of the subfloor shall be securely fastened to prevent vibration and, unless otherwise specified, all sharp corners, projections or irregularities in the surface shall be removed. Wood which is worn or which contains defects which may be injurious to the bituminous carpet shall be removed and replaced with new material. Any openings in the floor shall be completely sealed by caulking with oakum, or by other suitable means. All dust, dirt, debris or foreign material on the surface to be treated shall be removed by sweeping with stiff brooms and if necessary the surface may be flushed with water. If water is used, the subfloor shall be allowed to become thoroughly dry and then swept with stiff brooms before applying the first coat.

-3.2 Conditioning of Concrete Subfloor. The requirements as to cleanliness, as specified above for wood subfloors, shall also apply to concrete subfloors. Irregularities in the surface such as might project into or injure the bituminous carpet, shall be removed. Immediately before applying the first coat the surface shall be swept clean and no traffic permitted thereon until the wearing course is placed.

-4.1 Compensation. The work and any necessary material prescribed under this item shall not be measured or paid for directly, but shall be considered as necessary and subsidiary parts of the work paid for under the contract unit price bid for the contemplated wearing course.

314 WATERPROOFING

314-1.1 Description. This item shall consist of waterproofing of concrete surfaces in accordance with the method prescribed for the several classes of waterproofing hereinafter designated as membrane waterproofing, membrane waterproofing with mortar protection and membrane waterproofing with asphalt plank protection, each to be prepared and applied in accordance with these specifications where shown on the plans or directed by the engineer.

-2.1 Materials. Asphalt for waterproofing shall conform to the requirements of Federal Specification SS-A-701. Asphalt for mop coat shall conform to requirements of Federal Specification SS-A-666, Type III.

-2.2 Waterproofing fabric shall conform to the requirements of Federal Specification HH-C-581a.

-2.3 Mortar shall be composed of 1 part of portland cement and 3 parts of sand. Cement, sand and water shall conform to the requirements for these materials hereinbefore given in the specifications for "Concrete." The sand and cement shall first be mixed in a tight box until the mixture assumes a uniform color, after which water shall be added as the mixing continues until the mortar attains a consistency such that it can be easily handled and spread with a trowel.

-2.4 Asphalt plank shall be composed of asphalt and fibre material. It shall be furnished in preformed, dense and homogeneous slabs, 1-1/4 inches in thickness and of the cross section designated as ship lap. Planks may be from 6 to 8 inches in width but all pieces for one structure shall be of the same width except for such "closers" as may be necessary. The lengths shall be such as to lay to the best advantage on the surface to be covered but shall not be less than 3 nor more than 8 feet. Individual planks shall be straight, uniform in cross section and dimension, free from cracks, fissures and other defects, and with ends cut square and true. A tolerance of not to exceed 1/16 inch over or under nominal thickness and 1/8 inch over or under nominal width shall be permissible.

-3.1 Construction Methods. Membrane Waterproofing. All surfaces shall be reasonably smooth without projections or holes, which might cause puncturing of the membrane. They shall be reasonably dry and be swept clean of dust and all loose material before the application of the waterproofing. No work shall be done in freezing weather without written authorization from the engineer.

The surface to be waterproofed shall be given one coat of a suitable primer of the same manufacture as the other waterproofing materials. The waterproofing shall then be started at the low point and the sheets so laid that the drainage will be over and not against or along the laps. Before the placing of each sheet of fabric the surface to be covered by the sheet shall be swabbed with hot asphalt, the fabric immediately placed and swabbed with hot asphalt until the sheet lies flat against the surface free from ridges and entrapped air. The fabric shall be "shingled" so that at all points there will be two thicknesses and all edge laps shall be at least 4 inches and all end laps at least 12 inches. Under no circumstances shall one ply of fabric touch another at any point or touch the surface of the concrete as there must be at least three complete and unbroken moppings of asphalt. All corners and angles shall be waterproofed without cutting or slitting the fabric. Flashing shall be carefully done around all openings and obstructions in a manner meeting the approval of the engineer. At curbs, spandrel walls, etc., the flashing shall be done with separate sheets lapping the main membrane not less than 12 inches. All expansion joints and cracks in the concrete surfaces shall be covered with specially designed flashing.

-3.2 Membrane Waterproofing with Mortar Protection. The waterproofing membrane shall be constructed in all particulars in accordance with the specifications for the materials and methods of construction given above for membrane waterproofing. Every part of the membrane, except on undercut surfaces, shall then be covered with a course of reinforced mortar. This course shall be 1-1/2 inches thick, reinforced with wire netting, 2-inch mesh, No. 18 gage, placed so as to lie midway between the top and bottom surface of the mortar. The top surface of the mortar course shall be trowelled to a smooth hard finish. On undercut surfaces (the under side of surfaces making an angle of less than 90° with a horizontal plane) the membrane shall be protected with a layer of three-ply roofing felt laid in hot asphalt in lieu of the mortar covering. The asphalt used for this purpose shall be the same as that used in building up the membrane. The mortar protection shall be cured by the use of burlap held in close surface contact and kept wet for 72 hours.

-3.3 Membrane Waterproofing with Asphalt Plank Protection. The waterproofing membrane shall be constructed, in all particulars, in accordance with the specifications for the materials and methods of construction given above for membrane waterproofing. Every part of the membrane shall be then covered with asphalt plank. The plank shall be laid in regular straight courses as indicated on the plans. Whole planks shall be used except as required to make closures and trim around openings and obstructions. Closing and trimming pieces shall be carefully cut to size. Before laying, all surplus talc or other powder shall be removed from the plank with a stiff brush or broom. Each piece shall be laid in a mopping of hot asphalt and the edge and end of pieces in place shall be coated with hot asphalt before the next piece is placed. Each individual piece shall be crowded tightly against the adjacent piece and the completed work shall have a uniform smooth surface without open cracks or spaces.

-3.4 Defective Work. Any waterproofing that is found to leak at any time prior to the final acceptance of the contract shall be repaired and remedied to the satisfaction of the engineer at the sole expense of the contractor.

-4.1 Method of Measurement. The yardage to be paid for shall be the number of square yards of waterproofing of the several kinds measured in place in the completed work and accepted.

-5.1 Basis of Payment. The yardage determined as provided above shall be paid for at the contract unit price per square yard bid for "Membrane Waterproofing," "Membrane Waterproofing with Mortar Protection," or "Membrane Waterproofing with Asphalt Plank Protection," as the case may be, which price and payment shall be full compensation for furnishing all the materials, including the mesh reinforcing for mortar protection, and for all labor, equipment, tools and incidentals necessary to complete the several items.

315 DAMP PROOFING

315-1.1 Description. This item shall consist of damp proofing concrete surfaces in accordance with these specifications at the location shown on the plans or directed by the engineer.

-2.1 Materials. Tar for absorptive treatment shall meet the requirements given in Table I for TW-1-X and shall be crude water gas tar, which may be treated for the removal of excess water if necessary to meet the detailed requirements of this specification.

Tar for seal application shall meet the requirements given in Table I for TR-1-25 and shall be prepared from the refined gas house coke oven and/or water gas tars fluxed with suitable distillates. The tar shall be homogeneous.

Tars

Designation	A.A.S.H.O.	TW-1-X		TR-1	
		Min.	Max.	Min.	Max.
Specific Gravity	T-43	1.03	1.10	1.09	1.19
Specific Viscosity 104°F	T-54		3	35	60
Bitumen CS_2	T-44	98%		80%	
Total Distillate by wt.	T-52				
to 338°F.				2%	8%
445°F.				10%	20%
518°F.				18%	30%
572°F.			50%		38%
Soft. pt. Res. °F.	T-53				149
Water	T-55		3%		2%
Temp. of Application °F.	-	-	-	75	100

-3.1 Construction Methods. After the concrete is cured in conformity with the requirements hereinbefore given in the specifications for "Concrete" the surfaces to be damp proofed shall be allowed to dry at least 10 days. They shall be then coated thoroughly with four coats of water-gas tar, Grade TW-1-X applied cold with a brush or spray gun and each coat shall be absorbed before the succeeding one is applied. After absorption of the final coat, a seal coat of refined tar, grade TR-1-25, shall be applied at a temperature of about 80°F., and thoroughly brushed into all surfaces. The seal coat shall harden before any water or earth is allowed to come against it. No coat shall be applied when the concrete or the preceding coat is damp or at any time when in the opinion of the engineer the weather is unsuitable.

-4.1 Method of Measurement. The yardage to be paid for shall be the actual number of square yards of surface damp proofed, measured in place in the completed structure and accepted.

-5.1 Basis of Payment. The yardage, determined as provided above, shall be paid for at the contract unit price per square yard bid for "Damp proofing," which price and payment shall be full compensation for furnishing all materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

316 BRONZE BEARING PLATES

316-1.1 Description. This item shall consist of furnishing and placing bronze bearing plates in accordance with these specifications and in conformity with the sizes, dimensions, design and locations shown on the plans.

-2.1 Materials. Bronze bearing plates may be cast or rolled and shall conform to standard specifications for bronze bearing metals for turntables and movable railroad bridges, A.S.T.M. B 22-21, Class B material. Bronze castings shall be free from inclusions of foreign material, casting faults, injurious blow holes or other defects rendering them unsuitable for the service intended.

-3.1 Construction Methods. Bearing plates shall be accurately set in correct position as shown on the plans and shall have uniform bearing over the total area. They shall be anchored securely to the concrete by ribs or bolts of the size and set in the concrete as shown on the plans. Sliding surfaces shall be planed parallel to the movement of the spans and polished and shall be coated thoroughly with graphite and grease just before being placed in position, and special care shall be taken to avoid placing concrete in such a manner as to interfere with their free action.

-4.1 Method of Measurement. The weight to be paid for shall be the actual scale weight of the bronze plates furnished and accepted.

-5.1 Basis of Payment. The weight, determined as provided above, shall be paid for at the contract unit price per pound bid for "Bronze Bearing Plates" complete in place, which price and payment shall be full compensation for furnishing materials, including bolts or set screws, and for all labor, equipment, tools and incidentals necessary to complete the item.

317 COPPER FLASHING

317-1.1 Description. This item shall consist of furnishing and placing sheet copper flashing in expansion and construction joints in accordance with these specifications at the locations shown on the plans or directed by the engineer.

-2.1 Materials. Copper for flashing shall be uniform in quality and temper, clean, sound, and smooth, commercially flat, and free from foreign material, pipes, slivers, laps, cracks, twists, seams, scale, damaged ends or edges, buckles, and other injurious defects. The sheets shall be rolled from virgin metals or from virgin metals and scrap of known and approved composition, and shall contain not less than 99.85 percent copper, silver being counted as copper. Unless otherwise shown or directed the thickness of the sheets shall be 0.032 inches, subject to the tolerances permitted by the following table.

Permissible Variations in Thickness of Sheets
(plus or minus)

Thickness, inch	Up to 6 inches wide inclusive	Over 6 to 9 inches wide, inclusive	Over 9 to 14 inches wide, inclusive	Over 14 to 20 inches wide, inclusive
.0320	.0020	.0021	.0023	.0024

-3.1 Construction Methods. Sheets for flashing shall be of the width and bent to the shapes shown or directed. The flashing in each joint shall be continuous, separate pieces being connected by thoroughly workmanlike soldered joints to form a complete watertight unit. The flashing shall be placed in the forms of the first member of the joint to be cast in a manner that will permit the specified width to be embedded in the concrete, as it is cast, while keeping the proper width free to be embedded in the other member of the joint when the concrete is cast therein. Forms shall be designed so that they can be removed without injurious bending of the flashing.

-4.1 Method of Measurement. The weight to be paid for shall be the number of pounds of copper flashing as computed from the square feet of copper sheets actually incorporated in the completed work in accordance with the plans or as directed by the engineer. One square foot of copper sheet of the thickness specified above shall be assumed to weigh 1.48 pounds.

-5.1 Basis of Payment. The weight of copper flashing, determined as provided above, shall be paid for at the contract unit price per pound bid for "Copper Flashing" complete in place, which price and payment shall be full compensation for furnishing and placing all material, and for all labor, equipment, tools and incidentals necessary to complete the item.

318 ASBESTOS BOARD BLAST SHIELDS

318-1.1 Description. This item shall consist of manufactured asbestos board blast shields, of the thickness and widths specified, for the protection of the superstructure of highway structures against the blasts of locomotives passing beneath, installed in accordance with these specifications at the locations and in the manner shown on the plans.

-2.1 Materials. Blast board material shall be fireproof and made up of asbestos fibre and portland cement which have been united under pressure into dense, rigid sheets, meeting the approval of the engineer.

The special cement for covering rivet and bolt heads shall be resistant to fire and locomotive blasts and fumes, shall be waterproof and durable under extremes of temperature and shall not set up to a brittle, hard texture, but shall retain a permanent slight degree of plasticity or pliability.

-3.1 Construction Methods. The method of fabrication and installation of the blast shields shall be as shown on the plans. Upon the completion of the placing of the blast shields, all rivets and bolt heads which are exposed on the under surface shall be covered with a hemisphere of special cement. This cement shall be mixed to a plastic consistency such that it can be pressed over the metal parts to be covered, concentrically with the dished washers with which the bolts are to be provided, with a special wooden or metal hand mold and such that a mechanical bond will be obtained between the special cement and the dished washers and also such that the molded material will adhere to the metal parts upon removal of the mold.

-4.1 Method of Measurement. The footage to be paid for shall be the number of square feet of blast shield in place, completed and accepted.

-5.1 Basis of Payment. The footage, determined as provided above, shall be paid for at the contract unit price per square foot bid for "Asbestos Board Blast Shield," which price and payment shall be full compensation for the furnishing and placing of all materials, including special cement and all appurtenances and for all labor, equipment, tools and incidentals necessary to complete the item.

319 RIGHT OF WAY MONUMENTS

319-1.1 Description. This item shall consist of concrete right of way monuments constructed in accordance with these specifications, placed at the locations, and in conformity with the design, dimensions and elevations shown on the plans. Type "A" monuments shall be used in all cases except that Type "B" monuments may be used where solid rock is encountered if the contractor so elects.

-2.1 Materials and -3.1 Construction Methods. Monuments shall be constructed of Class A concrete. Each monument shall be set accurately to the locations established and in such manner as to insure the monument being held firmly in place.

-4.1 Method of Measurement. The number of right of way monuments to be paid for shall be the actual number installed and accepted.

-5.1 Basis of Payment. The number of right of way monuments, determined as provided above, shall be paid for at the contract unit price each bid for "Right of Way Monuments Type A," or "Right of Way Monuments Type B" which price and payment shall be full compensation for furnishing and installing the monuments complete in place and accepted, including excavation, backfill and all materials, and for all labor, equipment, tools and incidentals necessary to complete the item.

320 CONCRETE MAINTENANCE POSTS

320-1.1 Description. This item shall consist of the furnishing and placing of concrete maintenance posts every ten stations, numbered consecutively for each station ending in 0, in accordance with the dimensions and design shown on the plans for concrete maintenance posts.

-2.1 Materials and -3.1 Construction Methods. The concrete shall be class "D" conforming to the specifications for concrete as elsewhere herein contained, except that an approved brand of white portland cement shall be used.

The numbers shall be of die cast metal and of the size as shown on the plans and they shall be held by anchors into the concrete. The metal shall be non-rusting and dark in color.

-4.1 Method of Measurement. The number of posts to be paid for shall be the actual number of posts installed and accepted.

-5.1 Basis of Payment. The number of posts, determined as provided above, shall be paid for at the contract unit price each bid for "Concrete Maintenance Posts," which price and payment shall be full compensation for the furnishing and placing of all materials including excavation and backfill, and for all labor, equipment, tools and incidentals necessary to complete the item.

321 CATTLE GUARDS

321-1.1 Description. This item shall consist of cattle guards and connecting fences and gates, constructed in accordance with these specifications and in conformity with the lines and grades shown on the plans or directed by the engineer.

-2.1 Materials and -3.1 Construction Methods. The materials used shall conform to the kinds and grades shown on the plans. Gates of the size and type shown, and connecting fences shall be constructed as shown on the plans.

-4.1 Method of Measurement. The number of cattle guards to be paid for shall be the actual number installed and accepted.

-5.1 Basis of Payment. This item shall be paid for at the contract unit price each bid for "Cattle Guards" of the various widths, completed and accepted, which price and payment shall be full compensation for all necessary excavation, backfilling, connecting fences, and gates, for the furnishing and placing of all materials and for all labor, equipment, tools and incidentals necessary to complete the item.

322 BARBED WIRE FENCE

322-1.1 Description. This item shall consist of barbed wire fence of the type shown on the plans constructed in accordance with these specifications and in conformity with the lines and grades shown on the plans or directed by the engineer.

-2.1 Materials and -3.1 Construction Methods. Materials shall be of the kinds and types shown on the plans. All old fencing which is replaced by new fencing or which is indicated for removal on the plans shall be dismantled, removed and disposed of as directed by the engineer.

Posts shall be set vertically to the depth shown on the plans and maintained in accurate alignment while the post holes are backfilled with suitable material thoroughly tamped in layers, or by other approved methods of installing posts. After the posts are properly set, the wires shall be set and fastened to the posts with approved fasteners. Wire stays shall be then placed as shown on the plans.

-4.1 Method of Measurement. The footage to be paid for under this item shall be the number of linear feet of barbed wire fence of the several types constructed in place, completed and accepted.

-5.1 Basis of Payment. The footage, determined as provided above, shall be paid for at the contract unit price per linear foot bid for "Barbed Wire Fence," which price and payment shall be full compensation for dismantling, removing and disposing of the old fence for excavation and backfill, for furnishing and placing all materials, and for all labor, equipment, tools and incidentals necessary to complete the item.

323 GATES

323-1.1 Description. This item shall consist of gates and fittings of the size and type as shown on the plans, constructed in accordance with these specifications and in conformity with the designs and dimensions shown on the plans or directed by the engineer.

-2.1 Materials and -3.1 Construction Methods. The materials shall conform to the kinds, grades and sizes as shown on the plans, and shall include the necessary fittings and posts. The posts shall be of the size indicated and of the same type as those in the existing fence, and shall be set in Class B concrete to the depth shown on the plans.

-4.1 Method of Measurement. The number of gates to be paid for shall be the actual number installed and accepted.

-5.1 Basis of Payment. The number of gates, determined as provided above, shall be paid for at the contract unit price each bid for "Gates" completed and accepted, which price and payment shall be full compensation for the furnishing and placing of all materials, including all excavation and backfill fittings and posts, and for all labor, equipment, tools and incidentals necessary to complete the item.

324 TRAFFIC STRIPE

324-1.1 Description. This item shall consist of furnishing and applying paint for a traffic stripe six inches in width, to be painted on the completed surface in accordance with these specifications at the locations shown on the plans or directed by the engineer.

-2.1 Materials. The paint shall meet the requirements of A.A.S.H.O. Specification M-34 or M-35, whichever is called for by the Bid Schedule.

-3.1 Construction Methods. All work is to be performed in a neat and workmanlike manner. The stripe can be placed on the road either by hand-labor methods or by an approved striping machine.

-4.1 Method of Measurement. The mileage to be paid for shall be the number of miles of traffic stripe, measured along the center line of the stripe, completed and accepted.

-5.1 Basis of Payment. The mileage, determined as provided above, shall be paid for at the contract unit price per mile bid for "Traffic Stripe," which price and payment shall be full compensation for furnishing and applying the paint and for all labor, equipment, tools, and incidentals necessary to complete the item.

325 HUB-HIGH WOOD GUARDRAILa

325-1.1 Description. This item shall consist of wood guardrail of either rustic,a or surfaced and painted timber, constructed where called for on the plans or directed by the engineer, in accordance with these specifications and in conformity with the detail plans for Hub-High Guardrail.

-2.1 Materials. The posts and railing shall be of the species of timber specifieda on the plans, or, if not specified thereon, as required by the engineer.a

-2.2 Rustic posts and rails shall be straight, sound and free from injurious defects and shall be cut from live trees not less than 30 days in advance of use, but not exceeding one year, and be allowed to season with the bark on. Immediately before use in the work, all bark shall be peeled and the logs trimmed smooth of all knots and projections. Slight curvature or "wind" to give a pleasing appearance to the structure will be permitted. Only one species shall be used in the construction of any one continuous length of guard rail.

-2.3 All posts and rails other than rustic shall conform to the requirements stipulated for rails and rail posts hereinbefore given under "Treated and Untreated Timber,"a and shall be Standard Stress-Grade as setaout in Table II thereof if andaas called for on the plans. Railing shall be of sufficient length to span two panels. It shall be surfaced four sides.

-2.4 The stain for the visible portion of rustic posts shall be Cabots Creosotea Stain No. 247 or an equivalent thereof. White paint for posts and rails other than rustic shall meet the requirements for "Paint for Rails and Rail Posts" stipulated under "Treated and Untreated Timber."

-2.5 Black paint shall consist of lampblack ground in oil and mixed to thea required consistency with pure raw linseed oil.

-2.6 Posts and rails shall be "treated" or "untreated" as called for in the Bida Schedule and, if treated, the preservative used shall be the particular preservative called for in the Bid Schedule.

-3.1 Construction Methods. The posts shall be set vertically to the depth shown on the plans. They shall be maintained in accurate alignment while the post holes are backfilled with suitable material and thoroughly tamped in layers. After backfilling, thea posts shall be sawed to exact grade and sloped or beveled as called for on the plans. Posts and railings shall be so shaped or notched that satisfactory contact surfaces will be obtained where rails are secured to the posts.

-3.2 Holes for bolts shall be bored with a bit of the same diameter as the bolt. Except for rustic guardrail all bolts shall be given two coats of red-lead shop paint as specified for structural steel.

-3.3 Sawed and surfaced guardrail shall be painted with three coats of white paint as hereinbefore specified above a point 8 inches above the ground line. All timbera to be painted must be seasoned and painting shall be done only when the timber is free from frost and the surface is dry and clean. No painting shall be done in wet or freezing weather. All paint shall be thoroughly dry before applying the succeeding coats. It shall be applied in heavy coats, completely covering every part of the surface and shall be worked well into the joints and open spaces; it shall be so thoroughly and evenly spread that no excessive paint will collect at any point. The visible portion of the lower ends of posts (except rustic posts) to a point 8 inches above the ground line shall be painted with two coats of the black paint hereinbefore specified.a

-3.4 Rustic guardrail, after completion of the erection, shall be stained witha two applications of the approved stain, covering the rails and the exposed portions ofa the posts. The wood shall be dry when stained. The first coat shall be thoroughly dry when the second is applied. Stain shall not be applied in damp weather.

-4.1 Method of Measurement. The footage to be paid for shall be the actuala number of linear feet of wood guardrail in place completed and accepted, measured from outside to outside of end posts. The measurement shall not include handrail erected on timber bridges.

-5.1 Basis of Payment. The footage of guardrail, determined as provided above, shall be paid for at the contract unit price per linear foot bid for "Hub-High Rustic Guardrail," "Hub-High Untreated Wood Guardrail" or "Hub-High Treated Wood Guardrail" of the particular preservative required, which prices and payment shall be full compensation for all posts and rails, all materials, including nails, bolts, driftbolts, paint, stain, all excavation and backfilling, and all labor, equipment, tools, and incidentals necessary to complete the item. Standing timber for rustic posts and rails, when so noted on plans, will be available for cutting under the same conditions stipulated for standing timber for log bridges.

350 REPLACING TOPSOIL

350-1.1 Description. This item shall consist of removing topsoil from designated storage piles and hauling, depositing and spreading it in accordance with these specifications on shoulders and slopes of the roadway or elsewhere within the highway and in conformity with the lines, grades and dimensions shown on the plans as directed by the engineer.

-3.1 Construction Methods. The plans indicate the locations of the storage piles from which topsoil is to be obtained and the areas where it is to be placed.

Topsoil shall not be placed until the whole roadway, including surfacing, has been completed and accepted unless otherwise directed by the engineer. In no case shall topsoil be placed in the final position until permission is given by the engineer in writing.

Topsoil shall be spread on the areas shown on the plans or designated by the engineer to a depth sufficiently greater than that required by the plans so that after natural settlement has taken place, the work will conform to the lines, grades and elevations shown on the plans.

The contractor shall take all reasonable precautions to avoid injury to existing or planted growth, and to structures or surfacing on the roadway.

During hauling operations the roadway surfacing shall be kept clean and any topsoil or other dirt which may be brought upon the surfacing shall be removed promptly and thoroughly before it becomes compacted by traffic. If necessary the wheels of all vehicles shall be cleaned frequently and kept clean as possible to avoid bringing any dirt upon the surfacing.

After the spreading of the topsoil all large stiff clods, hard lumps, large stones, brush, roots, stumps, litter or other foreign material shall be raked up and removed from the topsoiled area. Spreading shall be completed in such a manner that seeding, sodding or planting, if and as called for by the plans, can proceed after completion of this item without additional soil preparation of any nature.

-4.1 Method of Measurement. The yardage to be paid for shall be the number of cubic yards of topsoil, measured in position in the storage piles, complete in place and accepted.

The "overhauled" yardage of topsoil to be used in the computation of overhaul in this item shall be the yardage of topsoil hauled as ordered more than 1,000 feet. For material hauled 2,000 feet or less the "overhaul distance" shall be the distance expressed in feet from any stockpile to the center of gravity of the material as placed from that particular stockpile less 1,000 feet. For material hauled more than 2,000 feet the "overhaul distance" for station yard computation shall be 1,000 feet and the "cubic yard mile overhaul distance" for computation of the cubic yard mile overhaul of the same material shall be the distance expressed in miles from any stockpile to the center of gravity of the material as placed from that particular stockpile less 0.38 of a mile. The number of station yards to be paid for shall be the product of the volume of all the "overhauled material" by the "overhaul distance," as defined above, in feet divided by 100 and the number of cubic yard miles to be paid for shall be the product of the volume of that portion of the "overhaul material" hauled more than 0.38 of a mile by the "cubic yard mile overhaul distance." The material shall be measured in the vehicle at the point of delivery and the distance shall be measured along the shortest practicable route.

-5.1 Basis of Payment. The yardage, determined as provided above, shall be paid for at the contract unit price per cubic yard bid for "Replacing Topsoil" which price and payment shall be full compensation for loading, hauling, depositing and spreading the topsoil, and for all labor, equipment, tools and incidentals necessary to complete the item, except Overhaul. The station yard overhaul and the cubic yard mile overhaul, defined and determined as provided above, shall be paid for respectively at the contract unit prices bid for "Station Yard Overhaul, Topsoil Pile to Placement," or "Cubic Yard Mile Overhaul, Topsoil Pile to Placement," which price and payment shall constitute full compensation for overhauling under this item.

351 FURNISHING AND PLACING LOAMY TOPSOIL

351-1.1 Description. This item shall consist of furnishing, excavating, hauling, depositing and spreading loamy topsoil in accordance with these specifications on shoulders and slopes of the roadway or elsewhere within the highway and in conformity with the lines, grades and dimensions shown on the plans or directed by the engineer.

-2.1 Materials. The material shall consist of loamy topsoil defined as follows: A natural workable loamy topsoil without admixture of subsoil, refuse or any foreign materials and reasonably free from stumps, roots, hard dirt, stiff clay, stones larger than one inch in diameter, noxious weeds, brush or other litter. Acceptable loamy topsoil shall be such a mixture of sand, silt and clay particles as to exhibit sandy and clayey properties in about equal proportions. The material shall be classifiable as a loam, silt loam, clay loam, sandy loam or a combination thereof. Such loamy topsoil shall contain not less than 5 percent nor more than 20 percent organic matter as determined by loss on ignition of oven-dried samples. Acceptable loamy topsoil shall, prior to stripping, have demonstrated by the occurrence upon it of healthy crops, grass or other vegetative growth, that it is reasonably well drained and that it does not contain toxic amounts of either acid or alkaline elements. After inspection is approved by the engineer and prior to stripping, the contractor shall afford every opportunity for it to be examined and shall remove any grass, briers, stumps or roots by mowing, grubbing or other satisfactory means.

Ignition Test. The ignition test shall be performed on samples which have been thoroughly oven-dried to constant weight at a temperature of 221°F.

-3.1 Construction Methods. The loamy topsoil shall be furnished, hauled, deposited and spread on the areas shown on the plans or designated by the engineer, to a depth sufficiently greater than that required by the plans, so that after natural settlement has taken place the work will conform to the lines, grades and elevations shown on the plans.

The contractor shall take all reasonable precautions to avoid injury to existing or planted growth, and to structures or surfacing on the roadway.

During hauling operations the roadway surfacing shall be kept clean and any topsoil or other dirt which may be brought upon the surfacing shall be removed promptly and thoroughly before it becomes compacted by traffic. If necessary, the wheels of all vehicles shall be cleaned frequently and kept clean to avoid bringing any dirt upon the surfacing.

After the spreading of loamy topsoil, all large stiff clods, hard lumps, large stones, brush, roots, stumps, litter or other foreign material shall be raked up and removed from the topsoiled area. Spreading shall be completed in such a manner that seeding, sodding or planting, if and as called for on the plans, can proceed after completion of this item without additional soil preparation of any nature.

-4.1 Method of Measurement. The yardage to be paid for shall be the number of cubic yards of loamy topsoil, measured in the bodies of the trucks or other hauling equipment upon arrival at the place of spreading, complete in place and accepted.

-5.1 Basis of Payment. The yardage, determined as provided above, shall be paid for at the contract unit price per cubic yard bid for "Furnishing and Placing Loamy Topsoil," which price and payment shall be full compensation for furnishing, excavating, loading, hauling, depositing and spreading the topsoil, and for all labor, equipment, tools and incidentals necessary to complete the item.

352 CUTTING, LIFTING AND PLACING SOD

352-1.1 Description. This item shall consist of removing sod from areas indicated on the plans or ordered by the engineer; transporting and storing of it at points designated by the engineer, and/or placing and installing it where shown on the plans or directed by the engineer in accordance with these specifications.

-2.1 Materials. (Topsoil and seed.) Any loamy topsoil or seed, or both, which shall be applied as required under subsection -3.4 of this item shall meet the requirements as specified for these materials under the respective items "Furnishing and Placing Loamy Topsoil" and "Seed and Seeding."

-3.1 Construction Methods. The sod shall be cut into rectangular sections which may vary in length but shall be of equal width, to a depth equal to the growth of the roots, but in no case less than two inches. Sections or strips shall be of such size as to be lifted without breaking, longer sections being as a rule permitted in clay topsoils and shorter in soils containing a high percentage of sand. Sections shall be cut away below the root line with an acceptable sod cutter or sharp flat spade and shall be transported to storage piles without breaking, or carried to the point of installation and set in final place as shown on the plans or designated by the engineer. In no case shall temporary storage be permitted for more than 5 days and sod broken in transit or stored beyond this time limit may be rejected by the engineer in which case no payment shall be made for such rejected material and it shall be removed from the job by the contractor immediately. Sod must be lifted and loaded or unloaded by hand and no dumping from vehicles will be permitted.

-3.2 While in temporary storage, sod shall be placed grass to grass or roots to roots, the stacks or piled layers being sprinkled with water when and as directed by the engineer, and covered with moist burlap, straw or other acceptable material if required. Any sod permitted by the contractor to dry out may be rejected, whenever, in the judgment of the engineer, its survival after placing shall have been rendered doubtful. In such case no payment therefor shall be made.

-3.3 Before the sod is placed, soil preparation (or topsoiling) as required by the plans shall have been completed. The ground upon which sod is to be placed shall be then brought to an even surface satisfactory to the engineer.

-3.4 Sod shall be transported from the point of cutting or storage piles and shall be lifted from trucks and placed by hand. All gaps between sections of sod shall be avoided and openings at angles and the like, shall be plugged with sod. After setting the sections in place, acceptable loamy topsoil shall be used to fill the joints and to cover the sod in place to a depth of about 1/4 inch. An approved grass seed mixture at the rate of 1/2 pound per 1,000 square feet of sod in place, shall be mixed with clean, dry sand, dry sandy loam and sown upon the topsoil surface dressing. Following this seeding, the sod sections shall be tamped or rolled in place as directed by the engineer.

-3.5 Sod placed on slopes steeper than 2 on 1, and in ditch areas, shall be staked in place, stakes being driven flush after tamping or rolling has been completed. Stakes shall be not larger than 1 inch in cross section, shall be 8 inches or more in length, and shall be spaced as indicated on the plans or directed by the engineer.

-4.1 Method of Measurement. The footage to be paid for shall be the number of square feet of sod, complete in place, and accepted.

-5.1 Basis of Payment. The footage, determined as provided above, shall be paid for at the contract unit price per square foot bid for "Cutting, Lifting and Placing Sod," which price and payment shall be full compensation for cutting, lifting, hauling or moving to final position, any temporary storage, conditioning of surface to be sodded, placing, top dressing, seeding, tamping or rolling, and staking and for all labor, equipment, tools and incidentals necessary to complete the item.

353 SEED AND SEEDING

353-1.1 Description. This item shall consist of the furnishing and delivery of grass seeds and certain seeds other than those of the true grasses, the preparation of the ground for seeding, the sowing of seed and the raking, rolling and watering of the seed bed areas, in accordance with these specifications and at the locations shown on the plans or directed by the engineer.

-1.2 Where the "Bid Schedule" calls only for the furnishing and storing of extra seed, the seed furnished shall meet the requirements for seed as hereinbelow prescribed and shall be stored for the use of the government at the places and in the manner designated by the engineer. The storage space will be provided by the government.

-1.3 Topsoil where required as an addition to the seed bed shall be furnished and paid for as described under items "Furnishing and Placing of Loamy Topsoil" or under "Replacing Topsoil."

-2.1 Materials. Materials shall consist of various grass seeds, seeds other than grasses, and barnyard or stable manures or equivalent organic or inorganic fertilizers, separately or in mixtures, in accordance with the requirements shown on the plans or stated in the Special Provisions.

-2.2 Seed. All grass seeds and seeds of other than the true grasses, including but not limited to clover, vetch, rye, and lespedeza, shall be furnished and delivered separately, and mixed after delivery as directed by the engineer. All seed shall comply with the State and Federal seed laws, shall be reasonably free from noxious weeds. If required by the engineer one pint samples shall be furnished by the contractor for testing prior to delivery. All seed shall meet the requirements stated in the plans or in the Special Provisions as to minimum percentage of purity and germination, and maximum allowable weed content.

-2.3 Manures and Fertilizers. Barnyard or stable manures shall consist of animal droppings mixed with not more than 25 percent of straw or other bedding materials by volume, and to be free of materials toxic to plant growth. Manures shall be well rotted. One cubic yard samples shall be furnished by the contractor for approval prior to delivery.

Where acceptable barnyard or stable manure is difficult to procure, dried blood, tankage, fish scrap, or a mixture of such organic fertilizers or equivalent with each other or with commercial chemical fertilizers, shall be considered as equivalent to manure, provided that such mixed organic or organic and chemical fertilizers, shall contain the minimum percentage of available nitrogen, phosphorus and potassium stated in the plans or in the Special Provisions and Bid Schedule.

-3.1 Construction Methods. Seeding operations shall be performed as indicated on the plans or as described in the special provisions of the contract, and at the times and seasons therein stated.

The contractor shall notify the engineer at least 48 hours in advance of the time he intends to begin sowing seed and shall not proceed with such work until permission to do so has been granted in writing by the engineer.

-3.2 Advance Preparation of Seed Bed. Prior to the sowing of seed, topsoil, manure or equivalent as specified shall be distributed and spread over the seed bed. The surface of the seed bed shall be plowed, harrowed and raked until it has become loosened and pulverized and until added materials have become incorporated to a depth of not less than five inches. The seed bed shall be brought smoothly to the lines or grades indicated on the plans or designated by the engineer, all sticks, litter, stones larger than one inch in diameter, and other foreign materials being removed.

-3.3 Sowing. Grass or other seeds separately or in mixture shall be sown in the required amount per 1,000 square feet, preferably by rotary or other mechanical seeders. No seeding shall be done during windy weather or when the ground is frozen, wet or otherwise in a nontillable condition. Seeding shall be done in two directions at right angles to each other. The rates of seeding shall be as indicated on the plans or as provided in the Special Provisions.

Leguminous seeds such as clover, or vetch shall be inoculated before sowing unless otherwise specified, in accordance with the Special Provisions.

Grass seed mixtures shall be raked in lightly to a depth of approximately 1/4 inch. When only seeds other than those of the true grasses are specified, such heavy types of seeds shall be raked in after sowing to an approximate depth of 1/2 inch.

The seed bed shall be then rolled with a light roller of a weight acceptable to the engineer. In the case of clay soils rolling shall be done with extreme care and the rolling may be omitted where in the judgment of the engineer compaction of clay soils will tend to prevent seed germination.

-3.5 The contractor shall water, mow and otherwise properly maintain all grass areas to the satisfaction of the engineer until the acceptance of the contract.

-4.1 Method of Measurement. The area of "seed and seeding" to be paid for shall be the number of "seeding units" of area laid out as hereinbelow required, completed and accepted. Each "seeding unit" shall be a rectangle of ground 50 feet in length in direction parallel to the centerline of the road and 20 feet in width, measured horizontally; these units shall be laid out contiguously with corners at even stations or half stations, beginning at the near edge of the pavement and proceeding outward away from the road centerline to the boundary of "seeding" fixed by the engineer. In the case of centerline curvature the layout and the units shall be conformed thereto, but shall not otherwise be changed save that the lines at stations and half stations normal to the centerline shall be used as bounding lines between successive units, and units of greater or less than 1,000 square feet area thus created shall be treated and considered as normal units each payable at the contract unit price bid, provided however that any unit of less than 200 square feet actual area shall be disregarded so far as inclusion in payment quantity is concerned. The engineer will determine the boundary or boundaries of the area or areas to be seeded, and he will determine, station by station, the number of "seeding units" for which payment is to be made and total the number of units.

-4.2 Where the "Bid Schedule" calls for furnishing and storing extra seed, the quantity of seed to be paid for shall be the number of pounds of seed net weight, in standard bags furnished, tested, stored and accepted. Such bags, or containers, shall become the property of the Government.

-5.1 Basis of Payment. The number of "seeding units," determined as provided above, shall be paid for at the contract unit price per seeding unit bid for "Seed and Seeding," which price and payment shall constitute full compensation for furnishing seed in the kinds and amounts specified together with required manure or equivalent and for all labor, equipment, tools and incidentals necessary to complete the item.

The pounds of extra seed furnished, tested, stored and accepted as provided above, shall be paid for at the contract unit price per pound bid for each kind of seed.

354 TREE WELLS AND TREE ROOT PROTECTION

354-1.1 Description. This item shall consist of the protection of selected trees, shrubs or other woody plants by tree wells and/or by porous material placed to protect the root system in accordance with these specifications and as directed by the engineer. Tree wells shall be constructed of "dry rubble masonry" in accordance with the specifications therefor.

-2.1 Materials. The material for root protection shall be approved porous material ranging from 3/8 to five inches in size. The material may be any suitable porous material taken from the roadway excavation under the terms of article 4.8 and shall be broken to suitable size.

The materials for tree wells shall conform to the requirements of specifications for "Dry Rubble Masonry."

-3.1 Construction Methods. Tree wells shall be constructed in accordance with the dimensions and arrangement shown on the plans or as directed by the engineer. They shall be made of dry rubble masonry or of cement rubble masonry as shown on the plans or directed by the engineer provided, however, that dry rubble masonry, only, shall be used in any portion of the tree well extending below the level of the top of the contiguous broken stone root protection.

No backfill of any nature shall be placed by the contractor above the root spread of a tree or plant which it is desired to preserve until a fill of porous material not less than 3 inches in depth or as directed by the engineer has first been placed above its roots.

Where tree root protection is ordered the porous material shall be placed to a depth ranging from 3 to 12 inches (or to such other depths indicated on the plans) over the root spread of the tree or trees selected, about each of which a tree well is to be constructed, or other trees within or without the fill area, not to be welled but indicated for tree root protection by the engineer.

The area for tree root protection shall be first thoroughly cleaned of all vegetation and porous material shall be then spread loosely over the required area.

Following the spreading of the porous material for tree root protection a minimum of from 4 to 5 inches of topsoil shall be spread above the porous fill to bring the area to the finish grade lines designated by the engineer. Such topsoil shall be transported, handled and paid for under the items "Replacing Topsoil" or "Furnishing and Placing Loamy Topsoil," all as directed in writing by the engineer.

Sufficient care shall be taken so that trees or shrubs which are to be preserved in place are not scarred or damaged by the operations under this item. The root area to be protected shall be the area of ground surface lying within the periphery of the tree.

-4.1 Method of Measurement. The yardage of masonry to be paid for shall be the number of cubic yards of dry rubble masonry or of cement rubble masonry, as the case may be, measured complete in place and accepted.

The yardage of tree root protection to be paid for shall be the number of cubic yards of stone, gravel or slag placed in tree root protection, measured in vehicle at point of delivery, and accepted.

-5.1 Basis of Payment. The yardage of masonry, determined as provided above, shall be paid for at the contract unit price per cubic yard bid for "Dry Rubble Masonry" or "Cement Rubble Masonry" as the case may be. The yardage of porous material tree root protection, measured as provided above, shall be paid for at the contract unit price bid per cubic yard for "Porous Material for Tree Root Protection," which price and payment shall be full compensation for cleaning the ground surface, for placing the porous fill, for procuring and delivering all materials, and for all labor, equipment, tools and incidentals necessary to complete the item.