STANDARD SPECIFICATIONS

FOR STATE ROAD AND BRIDGE CONSTRUCTION

METRIC VERSION

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Kansas Department
of
Transportation

Edition 1990

DIVISION 800

INCIDENTAL CONSTRUCTION

SECTION 801

ELECTRIC LIGHTING AND TRAFFIC SIGNALS

801.01 DESCRIPTION.

This work shall consist of furnishing and installing all necessary equipment and materials to complete a highway lighting system or a traffic signal installation in accordance with these Specifications and as shown on the Plans or established by the Engineer.

BID ITEMS

Concrete Base for Light Standard.
Concrete Base for Light Tower (*).
Electric Lighting System.
*Electric Conduit (**).
Removal of Concrete Base.
Electric Service Box.
Traffic Signal Installation.
*Size.
**"Metallic" denotes metal material.
"Nonmetallic" denotes nonmetallic material.
No entry denotes that either metallic or nonmetallic may be furnished.

801.02 MATERIALS.

All materials shall conform to the requirements provided in the Materials Division. All materials shall be as specified in the schedule of quantities on Plan sheet.

801.03 REGULATIONS AND CODE.

All electrical work shall be performed in accordance with the National Electric Code and National Electrical Safety Code, Regulations of the National Board of Fire Underwriters, local ordinances and "Special Details for Electric Lighting System or Traffic Signal Installation" which will be a part of the Contract for each project.

801.04 CONSTRUCTION REQUIREMENTS.

(a) Preliminary Schedule of Equipment and Material.

Before commencement of installation of the roadway lighting system or traffic signal installation, a complete schedule of ma-

terials and equipment proposed for installation shall be submitted for the approval of the Engineer. The schedule shall be submitted as soon as practicable and shall include seven copies of catalog cuts, diagrams, drawings and other such descriptive data as may be required by the Engineer. In the event any items of material or equipment contained in the schedule fail to comply with specification requirements, such items may be rejected.

(b) Excavation and Backfilling.

The excavation required for the installation of conduit, foundations, and other appliances shall be performed in such a manner as to cause the least possible injury to the highway pavement, shoulders and roadside improvement areas. Trenches shall not be excavated wider than necessary for the proper installation of the electrical appliances and foundations. Excavation shall not be performed until immediately before installation of conduit, bases, or other appliances. The material from the excavation shall be placed in a position where the least damage and obstruction to vehicles and pedestrian traffic and the least interference with the surface drainage will occur.

All surplus excavated material shall be removed and disposed of on sites obtained by the Contractor and approved by the Engineer. The excavations shall be backfilled in conformance with the requirements of subsection 207.03 (c) (1).

All areas disturbed by the Contractor shall be reseeded as directed by the Engineer. Hand seeding methods may be used. The seed shall be raked or harrowed into the seedbed.

At the end of each day's work and at all other times when construction operations are suspended, all equipment and other obstructions shall be removed from that portion of the roadway open for use by public traffic.

(c) Replacing Damaged Improvements.

Improvements such as sidewalks, curbs, gutters, Portland cement concrete and asphaltic concrete pavement, bituminous surfacing base material and any other improvements removed, broken or damaged by the Contractor shall be replaced or reconstructed with the same kind of materials as found on the work or with materials of equal quality. The new work shall be left in a serviceable condition satisfactory to the Engineer. Excavations after backfilling, shall be kept well filled and maintained in a smooth and well-drained condition, until per-

manent repairs are made. Whenever a part of a square or slab of existing concrete sidewalk, driveway or pavement is broken or damaged, the entire square or slab shall be removed and the concrete reconstructed as specified above.

(d) Foundations.

(1) General.

Unless otherwise noted, foundation standards shall be Class A concrete, conforming to applicable requirements of Division 400 except as herein provided.

The concrete shall be cured with an approved moisture barrier such as wet burlap, polyethylene, etc., for a period of 72 hours. Cold weather curing shall be such that the concrete temperature shall be maintained above freezing for the entire curing period.

The bottom of the concrete foundations shall rest on firm ground. Foundations shall be poured monolithic where practicable. The exposed portions shall be formed to present a neat appearance. Forms shall be true to line and grade. Top of footing for standards, except special foundations, shall be finished to the curb or sidewalk grade or as directed by the Engineer. Forms shall be rigid and securely braced in place. Conduit ends and anchor bolts shall be placed in proper position, to proper heights, and held in place by means of a template until the concrete sets.

Anchor bolts shall be provided with two hex-head nuts and washers each. Both forms and ground which will contact the concrete shall be thoroughly moistened before placing concrete. Forms shall be oiled and shall not be removed until the concrete has thoroughly set.

Where obstructions prevent construction of planned foundations, the Contractor shall construct a foundation satisfactory to the Engineer.

(2) Removal of Concrete Bases.

(2.1) Concrete and anchor bolts shall be removed to the depth indicated on the Plans. Broken concrete shall be disposed of as directed by the Engineer.

Pieces of anchor bolts removed under this item shall become the property of the Contractor and shall be removed from the project.

(2.2) The base shall be backfilled and compacted as shown in subsection 207.03 (c) (1).

(e) General.

(1) All incidental parts which are not shown on the Plans or in the Specifications and which are necessary to complete the

electrical system or traffic signal and/or modify existing systems shall be furnished and installed as though such parts are shown on the Plans or specified herein. All systems shall be complete and in operation to the satisfaction of the Engineer at the time of acceptance of the work.

(2) All welds shall be continuous and shall develop the full strength of the member.

(3) All welds shall be performed by the submerged arc process.

(4) All exposed welds shall be ground flush with the base metal.

(5) All exposed edges of the plates which make up the base assembly shall be finished smooth and all exposed corners of such plates shall be neatly rounded to three millimeter radius.

(f) Conduit.

(1) All conductors shall be run between standard locations either in duct or conduit. Conduit, when used, shall be of a rigid type conforming to the provisions specified in the Materials Division and on the Plans. Installation shall conform to the appropriate articles of the National Electric Safety Code. The size of the conduit used shall be as shown on the Plans.

The Contractor may at his own expense, use larger size conduit if desired, and where larger size conduit is used, it shall be for the entire length of the run from outlet to outlet. No reducing couplings will be permitted.

The ends of all conduit shall be well reamed to remove burrs and rough edges. Field cuts shall be made square and true so that the ends will butt or come together for the full diameter thereof. Slip joints or running threads will not be permitted for coupling conduit. When a standard coupling cannot be used, an approved threaded union conduit shall be used. The threads on all conduit shall be painted with a good quality of lead or rust preventative paint, before couplings are made up. All couplings shall be fitted and tightened until the end of the conduits are brought together. Where coating on conduit has been injured in handling or installation, such injured places shall be thoroughly painted with rust preventative paint.

All conduit ends shall be threaded and capped with standard pipe caps until wiring is started. When caps are removed, the threaded ends shall be provided with approved conduit bushings.

The location of ends of all conduit for future electrical circuits in structures shall be marked by a "Y" at least 75 millimeters

high cut into the face of curb, gutter, or wall, directly above the conduit.

Conduit bends, except factory bends, shall have a radius of not less than six times the inside diameter of the conduit. Where factory bends are not used, conduit bends shall be made without crimping or flattening, using the longest radius practicable.

(2) Conduit Entrenched. On electric lighting projects where possible and on surfacing projects when called for on the Plans, the electrical conduit shall be installed by the trench method. Electrical conduit shall be installed on straight lines and shall be covered with thoroughly compacted earth.

Conduit shall be placed at the location shown on the Plans or directed by the Engineer and at an elevation of not less than 600 millimeters below the finished surface of the roadway.

(3) Conduit Jacked. Conduit shall be jacked under pavement sections at a depth not less than 600 millimeters below the top of pavement and where laid in trenches on shoulders and in park areas, it shall be laid to a depth of not less than 600 millimeters below natural ground level. Conduit shall be laid to a depth of not less than 600 millimeters below the finished surface in street areas, except that conduit may be laid on top of and secured to the existing pavement in curbed dividing strips. Conduit under railroad tracks shall be not less than one meter below top of tie.

Conduit shall be placed under existing pavement by approved jacking or drilling methods. Pavement shall not be disturbed without the written permission of the Engineer and then only in the event insurmountable obstructions are encountered. Jacking or drilling pits shall be kept 600 millimeters clear of the edge of any type of pavement wherever possible. Excessive use of water such that pavement might be undermined, or subgrade softened, will not be permitted.

(4) Conduit set in standard bases shall extend approximately 75 millimeters above the foundation vertically or shall be sloped towards the base opening where transformer bases are used. Conduit entering through the bottom of a pull box shall be located near the ends to leave the major portion of the box clear. Conduit entering concrete pull boxes shall terminate 50 millimeters inside the box wall and not less than 50 millimeters above the bottom and shall be sloped to facilitate pulling of cable. At all outlets, conduit shall enter from the direction of the run.

Conduit carried through existing culverts or bridge structures shall pick up the trenched cable for one meter in the ground

and run up the face of the culvert head wall to the nearest upper corner, or top, through the culvert, and down the opposite head wall and into the ground for one meter. Conduit shall be fastened to concrete surfaces by means of proper clamps and fasteners approved for such use.

Existing underground conduit to be incorporated into a new system shall be cleaned with a mandrel and blown out with compressed air.

Conduit runs shown on the Plans are for bidding purposes only, and may be changed with permission of the Engineer to avoid underground obstructions.

(g) Electric Service Box.

Electric service boxes shall be installed in reasonably close conformity to the locations, lines, grades and details shown on the Plans or as directed by the Engineer.

(h) Pull Boxes.

Pull boxes shall be installed at the locations shown on the Plans. The Contractor may install, at his own expense, such additional pull boxes as may be desired to facilitate the work. Pull boxes shall be precast reinforced concrete boxes of the sizes and details as shown on the Plans. Reinforcement shall be 20 millimeter mesh, 0.88 millimeter diameter hardware cloth. For lighting systems, reinforced concrete covers shall be inscribed "Department of Transportation-High Voltage." Pull boxes shall be installed so that the covers are level with curb or sidewalk grade, or level with the surrounding ground when no grade is established.

The bottom of the box shall be bedded in concrete or crushed rock as shown on the Plans or as directed by the Engineer.

Pull boxes for structure installations shall conform to the dimensions and locations shown on the Plans. Boxes or vaults formed in the concrete shall have metal frames and covers, with wording inscribed on the covers as shown on the Plans. All metal parts shall be hot-dipped galvanized after fabrication. Gasket surfaces shall form a true plane. Gaskets shall be of one piece rubber, three millimeters thick, and shall cover the contact surface between the frame and cover.

(i) Expansion Fittings.

Expansion fittings, as detailed on the bridge structure plans, shall be installed where conduit crosses an expansion joint in the structure. Each expansion fitting shall be provided with a

bonding jumper of 4.1 millimeters diameter solid copper wire, or equal.

(j) Wiring.

Wiring shall conform to the appropriate articles of the National Electric Code or subsequent revisions. Wiring within junction boxes, transformer bases, and on standards, etc., shall be neatly arranged and laced up.

No splices of cable will be permitted in conduit, or outside of pull boxes, splice boxes or standards, unless otherwise specified in the Contract or on the Plans for an overhead wiring system. Approved conductor cable when not fastened to existing structures or carried through conduit, shall be laid to a depth of 600 millimeters below ground level in trenches.

Powdered soapstone, talc or other approved lubricant shall be used when inserting conductors in conduit.

Conductors shall be spliced by the use of an approved connector. Conductor insulation shall be well penciled, trimmed to conical shape, and roughened before applying splice insulation.

When conductors and cables are pulled into the conduit, all ends shall be taped to exclude moisture, and shall be so kept until the splices are made or terminal appliances attached. Ends of spare conductors shall be taped.

(k) Bonding and Grounding.

Metallic cable sheaths, conduit, and metal standards shall be bonded to form a continuous system, and effectively grounded when a closed system, enclosed in conduit is used. When an open system such as an overhead wiring or direct burial underground is used, only standards and service points are to be effectively grounded, except where conduit runs used under pavement crosses a water system.

Bonding jumpers shall be 4.1 millimeter copper wire, or equal connected by approved clamps. Grounding of conduit and neutral at service point shall be accomplished as required by the National Electric Safety Code, except that bonding jumpers shall be four millimeter diameter, or equal. At each multiple service point, a ground electrode shall be installed. Each ground electrode shall be a one piece copper rod not less than 12 millimeters in diameter and 2.5 meters in length, unless otherwise noted on the Plans and driven to a depth so the top is below the surface of the ground. The service equipment shall be bonded to the driven ground rod by a 4.1 millimeters diameter solid copper wire.

Each steel standard on structures shall be grounded as specified above except that a common ground will be permitted provided not more than three standards are included and the ground rod is not less than 20 millimeters in diameter and three meters in length and driven to a depth where the top of the rod is 150 millimeters below the ground surface.

(l) Painting.

When steel standards or traffic pedestals are specified, they shall be cleaned of all rust, scale, grease and dirt, prior to applying the priming coat. If a prime coat has been applied by the manufacturer and it is in good condition, an application of primer by the Contractor, other than repairs, will not be required. Base plates, steel standards and mast-arms shall receive a shop coat, both inside and outside (the manufacturer's shop paint may be accepted for the shop coat). All exposed surfaces of bases, steel standards, mast-arms and exposed fittings above the ground shall be given one field coat of tinted aluminum paint, followed by a second coat of aluminum paint.

All paint coats may be applied either by hand brushing or by approved spraying machines in the hands of skilled operators. The work shall be done in a neat and workmanlike manner. The Department reserves the right to require the use of brushes for application of paint, should the work be done by the paint spraying machine prove unsatisfactory in the opinion of the Engineer.

801.05 SAFETY PRECAUTIONS.

Before starting work on existing street lighting circuits, the Contractor shall obtain daily safety circuit clearance from the serving company. Cut-out plugs shall be pulled and appropriate warning signs posted at cut-out boxes before any work is done.

801.06 INSTRUCTIONS FOR OPERATIONS.

The Contractor shall furnish to the Engineer all operating instructions and advice as to its proper control operation.

801.07 STANDARD FABRICATION.

The standards shall be straight with a permissible variation not to exceed 25 millimeters at the mid-point of 9 to 14 meter standards and not to exceed 20 millimeters at the mid-point of

6 to 8.0 meter standards. A maximum static deflection of 100 millimeters, without wind load, will be permitted for poles not over nine meters in height, and 115 millimeters for poles 10.5 meters in height. Static deflection shall be measured with mast arms and with luminaries in place.

The design of the standard, mast arm and the method of attaching the mast arm to the standard shall be approved by the Engineer. Pole top and hand hole modification shall be as detailed on the Plans. The standard fabrication shall be as shown on the Plans or as approved by the Engineer.

801.08 METHOD OF MEASUREMENT.

(a) Electric lighting system shall be measured by the lump sum complete in place.

(b) Electrical conduit when shown in the Contract as a bid item shall be measured per meter from outside edge to outside edge of service boxes, junction boxes or traffic light footings. No measurement will be made of excavation, backfilling or for Class A concrete, but shall be considered subsidiary to the item of electrical conduit.

(c) Concrete base for light standards and removal of concrete bases shall be measured per each.

(d) Concrete base for light tower shall be measured per meter.

(e) Electric Service Boxes shall be measured per each complete in place. No measurement will be made of the various items that constitute the work.

(f) Traffic signal installation shall be measured by the lump sum complete in place.

801.09 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above shall be paid for at the Contract lump sum price for "Electric Lighting System" and for "Traffic Signal Installation", per meter for "Electrical Conduit" and for "Concrete Base For Light Tower" which prices shall be full compensation for furnishing all materials, for all labor, equipment, tools, and incidentals necessary to complete the work.

The amount of completed and accepted work, measured as provided above shall be paid for at the Contract unit price per each for "Concrete Base for Light Standard", which price shall include all excavation, regardless of the type of material encountered, furnishing and placing concrete, forming, reinforce-

ment and anchor bolts, backfilling and all labor, tools, equipment and incidentals necessary to complete the work.

The amount of completed and accepted work, measured as provided above shall be paid for at the Contract unit price per each regardless of size for "Removal of Concrete Bases", which price shall include removing concrete and anchor bolts, backfilling with earth, disposal of all concrete and anchor bolts and all labor, tools, equipment and incidentals necessary to complete the work.

The amount of completed and accepted work measured as provided above shall be paid for at the Contract unit price per each for "Electric Service Box", which price shall include all excavation, regardless of the type of material encountered, furnishing and placing concrete, forming, reinforcing, frames and covers, backfilling and all labor, tools, equipment and incidentals necessary to complete the work.

SECTION 802

EROSION PIPE

802.01 DESCRIPTION.

This work shall consist of the construction of erosion pipe in accordance with these Specifications and as shown on the Plans or established by the Engineer.

BID ITEMS

*Erosion Pipe (**-***).

Concrete Headwalls.

*Size, diameter or "Bid Designation" minimum Sq. M waterway.

** "BC" denotes bituminous-coated. No entry denotes without bituminous-coating.

*** "CMP" denotes round corrugated metal pipe.
"CSP" denotes round corrugated steel pipe.
"CAP" denotes round corrugated aluminum pipe.
"CMMAC" denotes corrugated metal-metal arch culvert.
"CSMAC" denotes corrugated steel-metal arch culvert.
"CAMAC" denotes corrugated aluminum-metal arch culvert.
"CMP" and "CMMAC" designations for pipe denotes that either steel or aluminum pipe may be furnished.

See Section 712 for "Bid Designations" for corrugated metal-metal arch culverts.

802.02 MATERIALS.

Materials shall conform to the requirements specified in the Materials Division.

Corrugated Metal Pipe	Section 1900
Bituminous-Coated Corrugated Metal Pipe	Section 1900
Portland Cement	Section 2000
Water	Section 2400
Coarse Aggregate	Section 1100
Fine Aggregate	Section 1100
Mixed Aggregate	Section 1100
Reinforcing Steel	Section 1600

802.03 CONSTRUCTION REQUIREMENTS.

(a) Excavation.

The trench for erosion pipe shall be excavated to sufficient width to permit compaction of the backfill around the pipe. The lower part of the trench shall be shaped to give full support to the lower portion of the pipe to a depth equal to 1/4 of the external diameter of the pipe. Soft unstable materials encountered in the trench shall be removed and replaced with suitable material.

(b) Joining Sections of Pipe.

Bends and angles in erosion pipe shall be made in the shop by welding prior to the bituminous coating. Connections between straight sections of pipe shall be made with the manufacturer's connecting bands.

(c) Concrete Headwalls.

Headwalls for erosion pipe shall be constructed of Class A Concrete. The formwork, placing, curing and protection of the concrete shall conform to the requirements of Section 701. Reinforcing steel shall be placed as indicated on the Plans.

(d) Backfilling.

The area excavated for the pipe and headwalls shall be backfilled with suitable material and the material shall be compacted in accordance with the provisions of subsection 207.03(c)(1).

(e) Compacted Earth Cover.

An earth cover of the width and thickness shown on the Plans shall be placed over the pipe. The cover shall be placed in lifts not to exceed 200 millimeters loose measurement and each lift shall be compacted to the requirements of Type "A" compaction. On projects where Type "B" compaction is required on the adjacent roadway, the compaction for erosion pipe shall meet the requirements of Type "B" compaction as provided in Section 210.04.

Compaction shall be accomplished by hand or mechanical tampers. Rollers may be used provided there is no damage to the pipe.

802.04 METHOD OF MEASUREMENT.

Erosion pipe shall be measured by the meter along the center line of the pipe. Concrete headwalls shall be measured per each complete in place.

No measurement shall be made for excavation for erosion pipe or for headwalls. This work shall be considered as subsidiary work pertaining to the items of "Erosion Pipe" and "Concrete Headwalls."

If the surplus material from the excavation for erosion pipe is insufficient to provide the material to construct the earth cover for the pipe, the additional quantity of excavation shall be included in the quantity of roadway excavation in the Contract.

The compaction of the earth cover shall be included in the quantity of compaction of embankment in the Contract.

802.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per meter for "Erosion Pipe", and per each for "Concrete Headwalls", which prices shall be full compensation for furnishing and placing all materials, for excavation and backfilling for the pipe and headwalls, and for all labor, tools, equipment, and incidentals necessary to complete the work.

SECTION 803

RIPRAP

803.01 DESCRIPTION.

This work shall consist of the construction of riprap composed of approved stone, grouted stone, or reinforced concrete, in accordance with these Specifications and as shown on the Plans or established by the Engineer.

BID ITEMS
Riprap (Light Stone).
Riprap (Grouted Light Stone).
Riprap (Heavy Stone).
Riprap (Grouted Heavy Stone).
Riprap (*) (Reinforced Concrete).

* Thickness.

803.02 MATERIALS.

Materials shall conform to the requirements provided in the Materials Division.

Stone for Riprap	Section 1100
Portland Cement	Section 2000
Water	Section 2400
Fine Aggregate	Section 1100
Coarse Aggregate	Section 1100
Mixed Aggregate	Section 1100
Reinforcing Steel	Section 1600

803.03 CONSTRUCTION REQUIREMENTS.

(a) Excavation.

The area upon which the riprap is to be placed shall be excavated to the required grades and lines and the surface shall be smoothed and compacted. Sheeting shall be used for forming the toe wall for concrete riprap, if necessary, in order for the concrete to be placed in the dry.

(b) Reinforced Concrete Riprap.

Reinforced concrete riprap shall be of Class A concrete. Sufficient temporary headers and strike-offs shall be used to construct the riprap to the dimensions and grades indicated and to obtain a smooth, even surface. The surface shall be finished

with a wooden float and lightly broomed to obtain a more desirable finish.

Reinforcement shall be placed as indicated on the Plans. Unless otherwise noted on the Plans, the reinforcement shall extend through construction joints.

Contraction joints shall be spaced as indicated on the Plans and shall be constructed by inserting a metal plate in the fresh concrete or by cutting the fresh concrete with a trowel or other suitable tool. The indentations shall extend to the reinforcement and be perpendicular to the surface of the riprap. Guide plates shall be used in making the indentations to insure straight joints.

(c) Curing for Concrete Riprap.

The curing of concrete riprap shall conform to the requirements specified in Section 701. Workers may work from the membrane covered concrete before the completion of the curing period, if approved by the Engineer. This approval will be given only to complete the riprap. The damaged curing compound shall be repaired as directed and as soon as directed.

Cold weather curing shall be in accordance with Section 701.

(d) Stone Riprap.

The stones for the riprap shall be laid on edge with the bedding plane at right angles to the slope with the ends and sides abutting. The larger spaces between stones shall be filled with spalls of suitable size and all spalls shall be rammed thoroughly in place. The entire surface shall be rammed and compacted to obtain a tight surface. The finished surface shall present an even surface conforming to the lines, grades, and sections given.

When grouted stone riprap is indicated, the spaces between stones of grouted riprap shall be filled with grout consisting of one part Portland cement and three parts of fine aggregate with sufficient water to form a plastic mix. The grout shall be poured and broomed into the spaces until they are completely filled.

The grout shall be cured in the manner provided above for concrete riprap.

803.04 METHOD OF MEASUREMENT.

This work shall be measured by the square meter of riprap complete in place as measured along the finished surface.

803.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per square meter for "Riprap" of the type designated complete in place, which prices shall be full compensation for furnishing, transporting, delivering and placing all materials, for all excavation, and for all labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 804

ROCK EMBANKMENT

804.01 DESCRIPTION.

This work shall consist of the furnishing and placing of rock embankment to protect fill slopes and channel slopes, constructed at the locations in accordance with the Specifications, as shown on the Plans or directed by the Engineer.

BID ITEM
Rock Embankment.

804.02 MATERIALS.

Rock for this construction shall have a soundness ratio of not less than 0.80 after 25 cycles of freeze and thaw test and shall be free from injurious amounts of clay and soapstone. If the rock is to be furnished from a source not previously approved, the soundness tests shall be run on representative ledge samples.

Unless otherwise shown on the Plans, the rock shall be quarry run (shot rock) with no more than ten percent larger than 3.5 meters in circumference measured in any direction and not more than ten percent passing the 25 millimeter sieve as determined by visual inspection. The maximum size of rock placed will be limited by the thickness of rock embankment as shown on the Plans.

804.03 CONSTRUCTION REQUIREMENTS.

The rock embankment shall be placed in such manner as to produce a reasonably well-graded mass of rock with the minimum practicable percentage of voids, and shall be constructed within the specified tolerance to the lines and grades shown on the Plans or staked in the field. A tolerance of plus 150 millimeters from the slope lines and grades shown on the Plans will be allowed in the finished surface. It shall be placed to its full course thickness in one operation and the larger rocks shall be well-distributed. The finished embankment shall be free from objectionable pockets or small rocks and clusters of larger rocks. Placing rock by dumping into chutes or by similar methods likely to cause segregation of the various sizes will not be permitted. Spreading of rocks shall not be permitted by heavy equipment working upon the rock embankment unless

approved by the Engineer. The desired distribution of the various sizes of rock throughout the mass shall be obtained by selective loading of the material at the quarry or other source, by controlled dumping of successive loads during final placing, or by other methods of placement which will produce the specified results. Rearranging of individual rocks by mechanical equipment or by hand will be required to the extent necessary to obtain a reasonably well graded distribution of rock sizes. Oversize rocks shall not be placed on the fill, and if placed, shall be removed. The Contractor shall maintain the rock embankment protection until accepted and any material displaced by any cause shall be replaced at his expense to the lines and grades shown on the Plans.

804.04 METHOD OF MEASUREMENT.

Rock embankment shall be measured either by the metric ton in the vehicle at the location designated by the Engineer or by the cubic meter acceptably placed as computed from the neat lines and grades indicated on the Plans. No measurement will be made of any excavation or backfill necessary to complete the work. This work shall be considered as subsidiary to the item of Rock Embankment.

804.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per metric ton or cubic meter for "Rock Embankment", which price shall be full compensation for excavation, furnishing, hauling, placing and maintaining the materials as specified, for all labor, tools, equipment and incidentals necessary to complete the work.

No payment will be made for excess thickness nor for material required to replace embankment material lost by rain, wash, wind, erosion, or otherwise, except for additional material ordered in writing by the Engineer.

SECTION 805

FIELD OFFICE AND LABORATORY

805.01 DESCRIPTION.

This item shall consist of the furnishing and placing of a field office and laboratory of the type specified on the Plans or in the Contract. The building shall be built, equipped and maintained in accordance with these Specifications and in reasonably close conformity with the dimensions as shown herein unless approved otherwise by the Engineer.

BID ITEM
Field Office (Special).
Field Office and Laboratory (Type-*).

* Denotes type to be furnished.

805.02 REQUIREMENTS.

(a) General.

The building shall be for the exclusive use of the Engineer and inspectors for conducting tests of materials, making reports, and for proper storage of field equipment, testing apparatus, and records. The location of the building will be as directed and shall be relocated by the Contractor as the work progresses, if so directed. The Contractor shall place and secure the building in such a manner that it is solidly supported to eliminate vibration. The Engineer will have full control of and access to the building during the progress of the work. The outside doors shall have suitable locks and all outside doorways shall have screen doors in conjunction with the doors. Each office shall be equipped with an adequate fire extinguisher.

The field office and laboratory or field office (special) shall be placed at the location that is designated by the Engineer as soon as is directed by the Engineer. The field office and laboratory or field office (special) may be removed from the project when released by the Engineer.

On projects tied by the State, the price bid for the Field Office and Laboratory (of Type Specified) as shown on the Plans and Contract for one of the state tied projects, shall be full compensation for furnishing the Field Office and Laboratory (of Type Specified) for use on all of the state tied projects although

only one of the State tied projects includes the bid item of Field Office and Laboratory (of Type Specified).

Type A Field Office and Laboratory may be substituted and paid for as Type B or Type C Field Office and Laboratory. Type B Field Office and Laboratory may be substituted and paid for as a Type C Field Office and Laboratory.

A Type "A" or Type "B" Field Office and Laboratory may be substituted and paid for as Field Office (Special) provided they meet all of the requirements stipulated for Field Office (Special).

(b) Types of Field Offices and Laboratories.

(1) Type A Field Office and Laboratory.

On projects which require major testing, the Contractor shall provide a building which meets the following requirements.

The minimum floor area shall be 21 square meters, minimum inside width of 2.7 meters, completely insulated and weather tight, and a minimum ceiling height of 2.1 meters.

The building shall be partitioned to provide a main laboratory area and a drying room with an outside door in each room. The drying room shall be approximately 6.5 square meters in size, have approximately 2.1 meters of workbench as described later, at least one window as described later, and a suitable exhaust fan that is capable of changing the air in the room every minute. This room may be a separate adjacent building to the main laboratory as described above. The Contractor shall provide the necessary stoves, with gas or electric power, capable of drying samples.

There shall be a minimum of six sliding or swinging screened windows in the building with a minimum area of 0.4 square meters each. They shall be placed on two or more sides of the building.

The Contractor shall furnish a satisfactory and dependable source of electricity for power and lights (110 Volts A. C.). There shall be a minimum of six electrical outlets spaced throughout the building and three light fixtures that are so spaced that they will uniformly light the entire interior.

The Contractor shall furnish a constant water supply that has a minimum pressure of 34 kilopascals or a minimum head of 3.7 meters, if a gravity tank is used. A faucet and sink shall be provided in the main laboratory area. The sink shall have as minimum dimensions the following: length 750 millimeters, width 600 millimeters, depth 150 millimeters. The faucet shall be the type that a hose connection may be made with ease.

The building shall be equipped with solid workbenches and two chairs or stools suitable for use at the workbench. The workbenches shall have a minimum width of 750 millimeters, minimum total length of nine meters, and a height of from one meter to 1.1 meter. The building shall have a table or desk that is suitable for writing and a chair. The table or desk shall be approximately 1.5 meters by 750 millimeters and 750 millimeters high.

The building shall be equipped with a suitable heating system that is capable of maintaining a minimum temperature of 20° C. with a draft diverter on the flue or vent for natural gas or propane furnaces to prevent wind from blowing out the pilot light. The main part of the building shall be equipped with an air conditioner that can maintain a temperature below 30°C.

When deemed necessary by the Engineer the Contractor shall furnish and install telephone service in Type A Laboratories. The telephone service shall be a private line service. The telephone service shall be provided as soon as the laboratory has been placed on the project site and shall continue in service until released by the Engineer. If more than one laboratory is specified for the project, the telephone service shall be provided in the one designated by the Engineer.

(2) Type B Field Office and Laboratory.

On projects that require testing to a lesser degree than is determined by the Engineer as major testing, this type laboratory will be required, and shall be furnished by the Contractor.

The minimum floor area shall be 15 sqaure meters, minimum inside width of 2.1 meters, and minimum ceiling height of 2.1 meters.

There shall be a minimum of four sliding or swinging screened windows in the building with a minimum area of 0.4 square meters each, located on at least two sides of the building.

The Contractor shall furnish a satisfactory and dependable source of electricity for power and lights (110 Volts A. C.). There shall be a minimum of six electrical outlets spaced throughout the building and two light fixtures that are so spaced that they will uniformly light the entire interior.

The Contractor shall furnish a constant water supply that has a minimum pressure of 34 kilopascals or a minimum head of 3.7 meters, if a gravity tank is used. A faucet and sink shall be provided in the workbench area. The sink shall have as minimum dimensions the following: length 750 millimeters,

width 600 millimeters, depth 150 millimeters. The faucet shall be the type that a hose connection may be made with ease.

The building shall be equipped with solid workbenches and two chairs or stools suitable for use at the workbench. The workbenches shall have a minimum width of 750 millimeters, minimum total length of six meters and a height of from one meter to 1.1 meters. There shall be a suitable table for writing and a chair.

The building shall be equipped with a suitable heating system that is capable of maintaining a minimum temperature of 20° C. with a draft diverter on the flue or vent for gas or propane furnaces to prevent wind from blowing out the pilot light and an exhaust fan that is capable of changing the air in the building every three minutes.

The Contractor shall provide the necessary gas for the drying of samples.

(3) Type C Field Office and Laboratory.

On projects that require very little testing such as simple sieve analysis or compaction tests, this type laboratory shall be required and furnished by the Contractor.

The minimum floor area shall be 11 square meters, minimum inside width of 2.1 meters, and a minimum ceiling height of 2.1 meters.

There shall be a minimum of four sliding or swinging screened windows in the building with a minimum area of 0.4 square meters each, located on at least two sides of the building.

The building shall be equipped with a solid workbench and two chairs or stools suitable for use at the workbench. The workbench shall have a minimum width of 750 millimeters, minimum total length of three meters and a height of from one meter to 1.1 meter. There shall be a suitable table for writing and a chair.

The building shall be equipped with a suitable heating system that is capable of maintaining a minimum temperature of 20° C with a draft diverter on the flue or vent for gas or propane furnaces to prevent wind from blowing out the pilot light.

On projects requiring water for testing, the Contractor shall furnish an adequate water supply and the necessary gas for the drying of samples.

(4) Type D Field Office and Laboratory.

On projects requiring field extraction testing of bituminous mixtures, this type laboratory and laboratory equipment shall be furnished by the Contractor.

The laboratory shall meet or exceed the requirements of a Type B Laboratory. In addition, the laboratory shall be equipped with the items listed below.

The building shall be equipped with an air conditioner that can maintain a temperature below 30° C.

The building shall be equipped with an extraction apparatus consisting of the items listed in Section 151. The venting requirements listed below for the microwave oven and enclosed cabinet are in addition to any venting requirements for a Type B Laboratory.

(1) The microwave oven shall be placed in a hood or similar enclosure with a through-the-wall exhaust fan rated at 8.5 cubic meters per minute or greater. The electrical switch for the exhaust fan will be located outside the hood.

(2) The enclosed cabinet shall be vented through intake and exhaust ports to the exterior of the building. The size of the ports shall not be less than 125 millimeters in diameter or smaller than the ducting which will be attached thereto. Ports through the wall shall be spaced at least two meters apart. Alternately, ports may be provided through the ceiling and floor. If floor-ceiling ports are provided, exhaust shall be through the floor into the atmosphere. Floor ducting is not permitted into any enclosed space. Any configuration which induces positive pressure into the cabinet is prohibited. Care shall be taken in locating exhaust ports to provide maximum separation from any fresh air intake such as for air conditioning or furnaces.

The Type D Field Office and Laboratory will be installed, inspected, and a certificate of approval issued prior to actual use on the project. Vacuum extractor calibration shall be completed before any material is delivered to the road.

The solvent to be used for extraction testing shall be as specified in Section 603.

(5) Field Office (Special).

On projects that require room for bookkeeping and storage, this type of Field Office shall be required and furnished by the Contractor.

The minimum floor area shall be 15 square meters, minimum inside width of 2.1 meters and minimum ceiling height of 2.1 meters.

There shall be a minimum of four sliding or swinging screened windows in the building with a minimum area of 0.4 square meters each, located on at least 2 sides of the building.

The Contractor shall furnish a satisfactory and dependable source of electricity for power and lights (110 volts A.C.). There

shall be a minimum of six electrical outlets spaced throughout the office and two light fixtures that are so spaced that they will uniformly light the entire interior.

The office shall be equipped with solid workbenches and two chairs or stools suitable for use at the workbenches. The workbenches shall have a minimum width of 750 millimeters, minimum total length of six meters and a height of from one meter to 1.1 meters. The office shall have a table or desk that is suitable for writing and a chair.

The office shall be equipped with a suitable heating system that is capable of maintaining a minimum temperature of 20° C. with a draft diverter on the flue or vent for gas or propane furnaces to prevent winds from blowing out the pilot light. The office shall also be equipped with an air conditioner that can maintain a temperature below 30° C.

The Contractor shall furnish and install a private line telephone service for the office. The telephone service shall be provided as soon as the office has been placed on the project site and shall continue in service until released by the Engineer.

805.03 METHOD OF MEASUREMENT.

Field office and laboratory and field office (special) will be measured per each as required by the Contract and as directed by the Engineer.

805.04 BASIS OF PAYMENT.

The accepted "Field Office (Special)" or "Field Office and Laboratory" of the type designated, shall be paid for at the Contract unit price per each, which price shall be full compensation for the furnishing of the building, equipment, services, water, when required and electricity necessary until the building is released by the Engineer.

The building shall remain the property of the Contractor after it is released.

If due to the nature of the work, more than one field office and laboratory is required, the Contract unit price per each will govern regardless of the number required. If the Engineer decides, prior to the beginning of work that a field office and laboratory is not required, the item will be underrun and no payment will be made to the Contractor.

Partial payments for the Field Office and Laboratory and Field Office (Special) will be made as follows:

40 percent of the Contract unit price will be paid on the first estimate after it is furnished and acceptable for State use;

70 percent of the Contract unit price will be paid three months later; and

100 percent of the Contract unit price will be paid when it is released to the Contractor.

The Field Office and Laboratory/Field Office (Special) shall be placed at the location on the project designated by the Engineer for each Contract. If, after its initial location, the Engineer requests the unit be relocated at another site on the project for use on the same Contract, the Contractor shall be allowed $300.00 for Type A, B & D laboratories and $150.00 for Type C laboratories and Field Office (Special) for each relocation required. The relocation fee allowed will include the costs of utility hook-ups required, etc.

When the telephone service is deemed necessary, and a private line service is not feasible, the Engineer may accept a party line service with a deduct of five percent from the unit price bid for "Field Office and Laboratory (Type A)" and "Field Office (Special)".

When the telephone service is deemed unnecessary, as determined by the Engineer, the bid item "Field Office and Laboratory (Type A)" or "Field Office (Special)" shall be reduced by ten percent from the unit price bid.

Reductions shall be made by reducing unit price by the specified amount on a Change in Plans, Form 226.

SECTION 806

FENCING

806.01 DESCRIPTION.

This work shall consist of the construction of fence and gates in accordance with these Specifications, as shown on the Plans or established by the Engineer.

BID ITEMS

Fence (Woven Wire)(*).
Fence (Chain Link).
Fence (Barbed Wire).
Fence (Removal and Resetting Wire).
Fence (Removal and Resetting Chain Link).
Fence (Removal of Existing).
Fence (Single Wire Cable).
Gates (**).
Posts (Corner) (***).
Posts (End) (***).
Posts (Pull) (***).
Floodgates.

* "Type A or B" denotes either Type A or Type B is permissible.
"Type A" denotes only Type A is permissible.
"Type B" denotes only Type B is permissible.
** Size.
*** Type of fence, woven wire or chain link.

806.02 MATERIALS.

Materials shall conform to the requirements provided in the Materials Division.

Woven Wire Fence Fabric	Section 1600
Chain Link Fence Fabric	Section 1600
Barbed Wire	Section 1600
Steel Posts and Braces	Section 1600
Wood Posts	Section 2300
Gates	Section 1600
Tension Wire	Section 1600
Fittings	Section 1600
Wire Cable and Fittings for Highway Fence	Section 1600
Preservative Treatment for Timber	Section 2300
Floodgates	Section 1600

Osage orange (hedge) posts, untreated, when designated on the Plans or permitted by provision on the Plans shall be reasonably straight and free from splits.

Metal "T" section commercial grade posts for barbed wire fence, when designated on the Plans or permitted by provision on the Plans shall be galvanized, shall weigh not less than two kilograms per meter after galvanizing and shall be of the length shown on the Plans.

806.03 CONSTRUCTION REQUIREMENTS.

(a) General.

The Contractor's activities and operations shall be confined to the area immediately adjacent to the right-of-way lines and within the highway right-of-way. The Contractor shall be responsible for satisfactory arrangements for permits as required by him from adjacent property owners, in performing the work required.

The fencing shall be completed in such a timely manner as to prevent livestock from entering the project right-of-way, easements and/or adjoining properties. At certain locations such as structure terminals or at such other locations where it is impossible or impractical to complete the fencing and other appurtenant installations, the Contractor shall provide temporary fencing and appurtenances to prohibit livestock from entering the right-of-way.

The Contractor that creates the need for temporary fence on a project will be responsible for furnishing and installing the necessary temporary fence until such time that the permanent fence is in place.

The temporary fence will be removed by the Contractor that installed it unless other arrangements are made by the same. Temporary fence will be subsidiary to other bid items in the contract.

All temporary fencing and appurtenances shall be located to provide the above requirements and shall meet the approval of the Engineer.

(1) Clearing. Any additional clearing which may be required by the Contractor to complete the permanent fencing installations shown on the Plans shall not be paid for directly but shall be considered as subsidiary work pertaining to the other items in the Contract.

(2) Trench Excavation. When necessary in areas of irregular ground to secure clearance between the ground line and the bottom of the fence fabric, or to obtain the established grade, or to permit placing steel fence wire below the bottom of the fence fabric at stream crossings, a trench shall be excavated

to the grade and line established or designated by the Engineer. In areas where rock is encountered, the rock shall be excavated as may be necessary, in the opinion of the Engineer, to the required grade and line. Any excavation of rock below the required grade shall be backfilled with suitable materials as directed by the Engineer. Trenches shall be so constructed as to insure proper drainage. In general, the bottom of the fence will follow the contour of the ground in accordance with usual practice in constructing fence of the types specified and it is not anticipated that a great amount of shallow trench excavation will be required. Trench excavation shall not be paid for directly but shall be considered as subsidiary work pertaining to the other items in the Contract.

Material secured from such excavations shall be used, if directed by the Engineer, in the formation of embankments to secure the required grade for the fence. Such embankments shall be constructed to the grade and line established or designated by the Engineer. Material shall be placed in horizontal layers not to exceed 200 millimeters loose measurement and compacted. Hand tampers or rollers may be used for this purpose. All materials excavated to form trenches and not used for embankment shall be spread evenly over the adjacent area inside the right-of-way or otherwise disposed of by the Contractor to the satisfaction of the Engineer.

(b) Concrete Footings.

Footings where required shall be constructed of cast-in-place commercial grade concrete in accordance with the details shown on the Plans.

Volumetric proportioning and hand mixing of concrete will be permitted for cast-in-place concrete footings where small quantities are to be mixed and when done to the satisfaction of the Engineer.

The top of the footing shall extend slightly above the ground line and shall be steel troweled to a smooth finish with a slope to drain away from the post. Posts, braces and other units shall be approximately centered in their footings. The posts and braces shall be set sufficiently in advance of placing the fence to allow the concrete time to obtain its strength.

All excess excavation from footings shall be disposed of in a manner satisfactory to the Engineer.

(c) Posts Set in Rock.

Where rock occurs within the required depth to which fence posts are to be erected, a hole of a diameter slightly larger

than the largest dimension of the post shall be drilled in the rock and the posts grouted in. The concrete footing, where required as shown on the Plans, shall then be cast in place as specified above, between the top of rock and the required grade. At line posts, where top of rock is 200 millimeters or less below the required grade, the anchor plate shall be removed. At all line posts, the excavation above the top of rock shall be backfilled with excavation materials placed in 100 to 150 millimeter layers, each layer thoroughly tamped in place. No separate payment will be made for drilling holes in rock or for any excavation or backfilling in connection therewith or for grouting posts in place, but all costs thereof shall be included in the prices bid for the various fence items in the Contract.

(d) Structure Terminals.

Structure terminal assemblies shall be placed at all stock passes, cross road underpasses or overpasses and major drainage structures as shown on the Plans for the type of fence designated.

(e) Floodgates and Channel Crossings.

Floodgates and channel crossings of the type designated shall be constructed at the locations shown on the Plans. Floodgates and channel crossings shall be constructed to conform to the measurements shown on the Plans for the type designated.

(f) Line Posts.

Each post shall be erected plumb and all posts between horizontal angle points shall line up horizontally with no perceptible variation. Line post spacing shall be as uniform as practicable under local conditions and shall be not greater than the maximum spacing shown on the Plans with a tolerance of minus 600 millimeters.

(g) Pull Posts.

Pull post assemblies shall be placed to the approximately spacing shown in straight runs and at each vertical angle point as shown on the Plans or as directed. Pull post assemblies shall be constructed to conform to the measurements shown on the Plans for the type of fence designated.

(h) Corner Posts.

Corner post assemblies shall be placed at all horizontal angle points and shall be erected to conform to the measurements shown on the Plans for the type of fence designated.

(i) End Posts.

End post assemblies shall be placed in the line of the fence at all terminal points other than those mentioned in this section. End post assemblies shall be constructed to conform to the measurements shown on the Plans for the type of fence designated.

(j) Gate Posts.

Gate post assemblies shall be erected in the same manner as end posts in this Section.

(k) Identification Signs.

Identification signs shall be furnished and placed in accordance with the Plan details and notes.

(l) Erection of Gates.

The pedestrian and vehicular gate installation shall include gate frames, tie rods, stretcher bars, filler fabric, latches, stops, locking device, padlocks, hinges, gate posts with braces, turnbuckles, caps, and all fittings and hardware for gates and gate posts, all as specified and as shown on the Plans and as required to make a complete installation.

All gates shall be carefully aligned with posts vertical. Where clamps are used for attaching hardware, they shall be assembled tight. The bottom of each gate shall be not less than 75 nor more than 125 millimeters above the ground when closed and shall clear the ground by at least 75 millimeters at all points in its swing. The Contractor shall modify the existing grade within the area of swing, if necessary, to meet this requirement when directed by the Engineer. Direction of swing of gates will be as indicated on the Plans or as directed by the Engineer. Stops with latches, or other approved means for holding the gates open, shall be provided for all gates and so placed as to prevent damage to the gate or fence by overswing. Unless otherwise instructed by the Engineer, stops shall be provided also to arrest the swing of a closed gate at the centerline of the fence.

All gate stops for six meter vehicular gates shall be of the type shown on the Plans or an alternate as approved by the Engineer and shall be set in concrete as shown on the Plans.

(m) Removal of Existing Fence.

The existing fence shall be removed and stored at the locations as directed by the Engineer. The existing fence to be

removed and reset will be reset at the locations shown on the Plans in accordance with the notes and details on the Plans or as directed by the Engineer.

The resetting of the existing fence shall be according to the requirements detailed elsewhere in this Section.

All new materials necessary for resetting the chain link fence shall be furnished by the Contractor.

(n) Erection of Woven Fence.

Unless otherwise designated on the Plans or in the Contract either type of woven wire fence shown on the Plans may be furnished but only one type may be used on a project. The fence shall be erected adjacent to the right of way line or to a line of fence as shown on the Plans or established by the Engineer.

The bottom of the fabric of woven wire fence shall be placed a nominal distance of 75 millimeters above the ground line, however, over irregular ground a minimum clearance of 25 millimeters and a maximum clearance of 150 millimeters will be permitted for a distance not to exceed 2.4 meters. Any necessary excavation and backfilling required, in order to comply with these provisions, shall be made as previously specified herein.

All metal end, corner, pull posts, brace posts, and all braces shall be set in concrete footings as called for on the Plans. The dimensions of the footings may be varied as permitted by the Engineer but shall provide an equal volume of concrete. Except where rock is encountered, intermediate or line posts shall be set or driven into the ground and metal posts shall be furnished with an approved plate or other satisfactory anchor device to hold the post in proper alignment and plumb. The plate or anchor shall be satisfactorily welded or riveted (not less than two rivets) to the post. Wood posts may be driven or set in pre-bored holes. Any posts damaged by driving will be rejected.

Posts shall be permanently positioned and concrete footings fully set before fabric is placed. The fabric shall be placed by securing or fastening one end and applying sufficient tension to remove all slack before making permanent attachments elsewhere. The lateral wires shall be fastened to end, corner, and pull posts by wrapping the wires around the posts and tying the wire back on itself with not less than five twists tightly wrapped. Such tying shall be done by use of tools designed for the purpose in accordance with the fence manufacturer's recommendation.

The tension for stretching the fence shall be applied by use of mechanical fence stretchers and with single wire stretchers

designed and manufactured for that purpose, and in accordance with the fence manufacturer's recommendations.

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

Fence fabric shall be fastened to steel intermediate or line posts with ties or clamps and to wood posts with staples at the bottom and top two wires and other alternate intermediate lateral wires. Where the design of the line post incorporates satisfactory provision for supporting and securing the fabric wire to the post, the Engineer will approve the use of such means in place of the tie wires or clamps.

(o) Erection of Chain Link Fence.

The posts shall be set sufficiently in advance of the placing of the fabric to allow the concrete time to obtain its design strength. The bottom of the fabric shall be set 75 millimeters above the finished ground line or as shown on the Plans. The fabric shall be fastened to the tension wires as shown on the Plans.

(1) Post Spacing and Setting. All posts shall have a maximum spacing of three meters and shall be set a minimum of 750 millimeters below the finished surface of the ground in concrete footings in accordance with the details shown on the Plans. The concrete footings shall be of a proper size and shape so as to furnish a foundation and support sufficient to withstand any strain or shock ordinarily brought to bear on a fence of this character.

(2) Fabric bands with fasteners. Fabric shall be fastened to line posts with fabric bands spaced approximately 350 millimeters apart. Fabric bands shall be aluminum or galvanized. The fabric shall be securely fastened to the end posts by approved type metal fasteners.

(p) Erection of Barbed Wire Fence.

The fence shall be erected at the location shown on the Plans and as designated by the Engineer.

Either wood posts or metal posts of the type designated on the Plans may be used for intermediate posts.

Holes for wooden posts shall be on line and excavated to the depth indicated on the Plans. The holes shall be of sufficient size to permit adequate compaction of the backfill around the post.

The corner posts and support posts shall be set and securely braced and wired prior to setting the intermediate posts. The intermediate posts shall then be spaced equal distances apart but at a distance not greater than four meters apart, unless shown otherwise on the Plans. The posts shall be set plumb, firm and true to the lines established. The backfill around the posts, if not concrete, shall be placed in thin layers and thoroughly compacted.

If metal posts are used for the intermediate posts, they shall be driven with an approved mechanical device. They shall be driven to the depth as shown on the Plans.

The brace wire shall consist of two complete loops of 3.75 millimeter diameter smooth, galvanized wire, unless shown otherwise on the Plans. These loops shall be twisted both above and below the brace post until tight.

Barbed wire shall be drawn taut with an approved mechanical device and securely fastened to each post with at least one fence staple or approved wire clip. The wire shall be looped around the end and corner posts and fastened with sufficient staples to anchor the wire securely.

(q) Erection of Single Wire Cable Fence.

The single wire cable fence shall be constructed in accordance with the Plan notes and details and the applicable requirements of this Section.

806.04 ELECTRICAL GROUNDS.

All fence shall be grounded by a galvanized or copper coated rod 2.4 meters long and a minimum of 15 millimeters in diameter driven vertically until the top is approximately 150 millimeters below the top of ground. A 4.1 millimeter diameter copper conductor shall be brazed or attached by an approved clamp to the rod and to the fence in such manner that each element of the fence is grounded as shown on the plans, and immediately below where a power line passes over the fence. The ground rod shall be installed immediately below the point of crossing.

No special payment will be made for electrical grounds and the cost thereof shall be included in the prices bid for the various items in the Contract.

806.05 METHOD OF MEASUREMENT.

Fence of the various types shall be measured by the meter complete in place center to center of terminal posts of the various sections along the fence.

Fence of the various types for removal, and for removal and resetting, shall be measured by the meter removed, for fence to be removed only, and by the meter complete in place, for fence to be removed and reset, from center to center of terminal posts of the various sections. The measurement shall not include any length for gates. Gates of each type shall be measured per each complete in place.

Single wire cable fence shall be measured in accordance with this subsection, except that no measurement will be made for corner posts and end posts for this type of fence.

Corner posts, end posts, floodgates, and pull posts of each type shall be measured per each complete in place. Gate posts shall be measured and paid for as End Posts. Pull post assemblies as shown on the Plans for woven wire fence type A and barbed wire fencing using wood posts shall be measured and paid for as one Pull post. No measurement will be made for structure terminals, channel crossing, or line posts.

The furnishing and erection of any necessary temporary fencing and appurtenances shall not be measured and paid for separately but shall be considered as subsidiary to the other bid items in the Contract.

806.06 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per meter for "Fence" of the various types, per meter for "Fence (Removal and Resetting Chain Link)", per meter for "Fence (Removal of Existing)", per each for "Gates", "Floodgates" and "Posts" of the various types, which prices shall be full compensation for furnishing and erecting all materials, for all clearing, excavation, embankment, for all concrete footings and grouting, identification signs, and for all labor, tools, equipment and incidentals necessary to complete the work.

Structure terminals, channel crossings, temporary fencing and line posts will not be paid for directly but will be considered subsidiary to the item of various types of fence.

SECTION 807

FLAPGATES

807.01 DESCRIPTION.

This work shall consist of the construction of flapgates in accordance with these Specifications and as shown on the Plans or as directed by the Engineer.

BID ITEMS
(*) Flapgates.
* Size.

807.02 MATERIALS.

Materials shall conform to the requirements provided in the Materials Division.

Cast Iron	Section 1600
Structural Steel	Section 1600

807.03 CONSTRUCTION REQUIREMENTS.

Flapgates shall be placed at the locations and in the manner indicated on the Plans. The installation shall be made in a workmanlike manner so that when completed, the flapgates will operate satisfactorily. Shop drawings shall be required as specified in Section 702.03.

807.04 METHOD OF MEASUREMENT.

Flapgates shall be measured by the units of various sizes complete in place.

807.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per each for "Flapgates" of the several sizes, which price shall be full compensation for furnishing, transporting, and installing all materials, for all labor, tools, equipment, and incidentals necessary to complete the work.

SECTION 808

GUARD FENCE AND GUIDEPOSTS

808.01 DESCRIPTION.

This work shall consist of the construction of guard fence, the setting of guideposts, and the removal and resetting of guard fence or guideposts in accordance with these Specifications and as shown on the Plans or as directed by the Engineer.

BID ITEMS
- Guard Fence, Steel Plate.
- Guard Fence, Cable
- Guard Fence, Removal of Steel Plate.
- Guard Fence, Removal of Cable.
- Guard Fence, Removal of Timber.
- Guard Fence, Reconstruction of Steel Plate.
- Guard Fence, Reconstruction of Cable.
- Guard Fence, Removal and Reconstruction of Steel Plate.
- Guard Fence, Removal and Reconstruction of Cable.
- Guideposts.
- Guideposts, Removal of.
- Guideposts, Resetting of.
- Guideposts, Removal and Resetting of.
- Guard Fence Posts.

808.02 MATERIALS.

Materials shall conform to the requirements provided in the Materials Division.

Posts	Section 2300
Preservative Treatment for Timber	Section 2300
Wire Cable and Fittings	Section 1600
Metal for Guard Fence and Fittings	Section 1600
Paint	Section 1800

808.03 CONSTRUCTION REQUIREMENTS.

(a) General.

When steel plate guard fence is required by the Plans and Contract, any one of the types of steel plate guard fence included in the Plans may be furnished but only one type may be used on a project.

(b) Erection of Guard Fence and Guideposts.

Holes for guard fence posts and guideposts shall be excavated to the required depth. The holes shall be of sufficient size to permit adequate compaction of the backfill around the posts.

Guard fence posts and guideposts may be set by driving. Post caps that are designed to protect the post from detrimental crushing shall be used during driving operations. If in the opinion of the Engineer, the post or shoulder is being damaged, or unacceptable line and grade is obtained, the Contractor shall excavate for the erection of the posts.

The posts shall be set plumb, firm, and true to the lines and grades established. The backfill around the posts shall be placed in thin layers and thoroughly compacted. The top of the backfill shall be of the same material that is used in the construction of the shoulders and the thickness shall be at least equal to the thickness of the shoulder at that point unless otherwise specified by the Engineer. The cost of all excavation and backfill material shall be considered as subsidiary to other items of the Contract.

The guard fence cables, plates, shapes, and fittings shall be placed and fastened in accordance with the details shown on the Plans.

Guard fence which is removed and is reused on the project shall be thoroughly cleaned of all asphalt material, paint, mud, dirt, etc., prior to erection. The guard fence shall be punched or drilled so as to accommodate the revised post spacing as indicated on the Plans. When guard fence is required to be cut, the cut shall be made by sawing. All such holes and cuts shall be treated with zinc dust paint so as to prevent rusting. The required treated wood blocks shall be subsidiary to the item of reconstruction of steel plate guard fence.

(c) Removal of Guard Fence or Guideposts.

Guard fence shall be carefully disassembled and guard fence posts and guideposts shall be dug out or pulled in a manner that will prevent undue injury to the fence, fittings, and posts. The material shall be stored in neat piles, in accordance with Section 808.04, at an accessible location on the project, approved by the Engineer and shall remain the property of the owners.

(d) Reconstruction of Guard Fence and Resetting of Guideposts.

Guard fence and accessories to be reconstructed or guideposts to be reset will be furnished by the owners from a storage

site on or near the project or at locations indicated on the Plans. The reconstruction of guard fence and resetting of guideposts shall conform to the methods described above for the construction of new guard fence and setting new guideposts. All guideposts, all posts and knee braces for cable guard fence and all steel plates and fittings for steel plate guard fence required to be reset or reconstructed shall be given two coats of field paint after resetting or reconstruction, unless otherwise designated on the Plans or in the Specifications. The posts and knee braces shall be painted with aluminum paint and the steel plates and fittings shall be painted with white paint, the first coat tinted, the second untinted. Any surfaces which will be inaccessible to painting after erection shall be field painted before erection.

(e) Removal and Reconstruction of Guard Fence and Removal and Resetting of Guideposts.

The removal and reconstruction of guard fence and the removal and resetting of guideposts shall conform to the requirements of subsections 808.03 (c) and (d) except that the Contractor shall be responsible for all materials and shall replace at his own expense any material lost or damaged during the removal, storage or reconstruction.

808.04 STORING OF GALVANIZED GUARD FENCE.

All galvanized rail elements, end sections and accessories shall be stored in a manner to prevent galvanic action. While in storage the material shall not be in direct contact with the soil and there shall be a minimum of 150 millimeters of space between the lowermost element and the ground surface. The material may be stored in the open providing it is properly separated, stacked and drained.

Galvanized surfaces which have been abraded so that the base metal is exposed, threaded portions of all fittings and fasteners and cut ends of bolts shall be protected in a manner as may be specified or directed.

The Contractor shall be responsible for the condition of the material in storage. Any material which, in the opinion of the Engineer, shows detrimental galvanic action may be rejected at the time of erection.

808.05 METHOD OF MEASUREMENT.

The construction, removal, reconstruction, or removal and reconstruction of guard fence shall be measured by the meter.

Each separate run of fence shall be measured from center of end post to center of end post along the rail or may be determined by recording the number of standard length panels actually installed.

Guideposts shall be measured according to the number of guideposts to be set, removed, reset or removed and reset. Guard fence posts shall be measured according to the number of new posts to be furnished and set.

808.06 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per meter for "Guard Fence, Steel Plate", "Guard Fence, Cable", "Guard Fence, Removal of Steel Plate", "Guard Fence, Removal of Cable", "Guard Fence, Removal of Timber", "Guard Fence, Reconstruction of Steel Plate", "Guard Fence, Reconstruction of Cable", "Guard Fence, Removal and Reconstruction of Steel Plate", "Guard Fence, Removal and Reconstruction of Cable", per each for "Guard Fence Posts", "Guideposts", "Guideposts, Removal of", "Guideposts, Resetting of", and "Guideposts, Removal and Resetting of", which prices shall be full compensation for furnishing all required materials, for placing all materials, and for all labor, tools, equipment, and incidentals necessary to complete the work.

SECTION 809

MISCELLANEOUS DRAINAGE

809.01 ADJUSTING MANHOLES, CATCH BASINS AND CURB INLETS.

(a) Description.

This work shall consist of the adjustment of existing manholes, catch basins or curb inlets, in accordance with these Specifications and as shown on the Plans or established by the Engineer.

BID ITEMS
Adjustment of Catch Basins.
Adjustment of Curb Inlets.
Adjustment of Manholes.
Structural Steel.
Cast Steel.
Cast Iron.

(b) Materials.

Materials shall conform to the requirements provided in the Materials Division.

Portland Cement	Section 2000
Water	Section 2400
Coarse Aggregate	Section 1100
Fine Aggregate	Section 1100
Mixed Aggregate	Section 1100
Reinforcing Steel	Section 1600
Gray Iron Castings	Section 1600
Steel Castings	Section 1600
Structural Steel	Section 1600
Brick	Section 1300

(c) Construction Requirements.

Existing manholes, catch basins and curb inlets shall be adjusted to the elevation, grade, or dimensions shown on the Plans or as ordered by the Engineer. Structural steel or cast fixtures shall be carefully removed and reinstalled or stored by the Contractor for future use by the owners as indicated. If the height of brick walls is to be increased the addition may be of brick, concrete blocks or Class A Concrete unless shown otherwise on the Plans. If brick, satisfactory to the Engineer, can be salvaged from the project, they may be used in increasing the height of the walls. If there are no satisfactory brick

obtainable from the project, new brick or concrete blocks shall be furnished by the Contractor. The placing of the masonry, concrete and castings shall conform to the requirements of Section 810.

(d) Method of Measurement.

Measurement quantities for this work shall be as a unit for the adjustment of a single structure and no measurement of the separate items such as excavation, concrete and cast iron will be made except that if the Contractor is required to furnish new structural steel or cast fixtures, these items shall be measured by the kilogram as provided in Section 702.

(e) Basis of Payment.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per unit for "Adjustment of Catch Basins", "Adjustment of Manholes", or "Adjustment of Curb Inlets", as the case may be, which prices shall be full payment for furnishing all materials except new structural steel or castings, for all excavation, backfilling, and for all labor, equipment, tools, and incidentals necessary to complete the work. New structural steel or cast fittings furnished by the Contractor shall be paid for at the Contract unit prices per kilogram for "Structural Steel", "Cast Steel", or "Cast Iron".

809.02 WASH CHECKS.

(a) Description.

This work shall consist of the construction of wash checks, in accordance with these Specifications, of materials designated, and as shown on the Plans or established by the Engineer.

BID ITEM
Wash Checks.

(b) Materials.

Materials shall conform to the requirements provided in the Materials Division.

Stone for Wash Checks	Section 1100
Metal Sheeting	Section 1600
Portland Cement	Section 2000
Water	Section 2400
Fine Aggregate	Section 1100

Mixed Aggregate	Section 1100
Coarse Aggregate	Section 1100

(c) Construction Requirements.

Unless otherwise designated on the Plans or in the Contract, any one of the types of wash checks shown on the Plans may be used. Unless otherwise permitted in writing by the Engineer, only one type may be used on a project.

The curing and protection of concrete wash checks shall conform to the requirements specified in Section 701.

The trenches shall be excavated to the proper width and depth for the satisfactory installation of the wash checks. After the construction of the wash checks the trench shall be backfilled and the backfill material compacted to a density equal to or greater than the surrounding area as determined by visual inspection.

The stone in all stone wash checks shall be laid in a mortar bed and the spaces between stones shall be filled with mortar. The mortar shall consist of one part Portland cement and three parts fine aggregate mixed with sufficient water to produce a plastic mix. The mortar shall be cured in the manner provided above for curing concrete.

(1) Stone Wash Checks (Type I-A). The stones for Type I-A wash checks shall be laid to form a structure of the approximate dimensions shown on the Plans. The sides and ends of the stones shall be in contact as much as the sizes and shapes of the stones will permit. Spalls shall be rammed into the large spaces between stones to form a solid wall. Joints between stones in one row shall break with joints between stones in the adjacent rows.

(2) Stone Wash Checks (Type I-B). Type I-B stone wash checks shall be constructed in accordance with the above requirements except that smaller sizes of stone will be permitted.

Wash checks constructed of commercial grade concrete may be substituted for Type I-B wash checks at the option of the Contractor.

(3) Stone Wash Checks (Type II). The stones for Type II wash checks shall be laid with sides abutting and with broken joints to form a wash check of the approximate dimensions as indicated on the detail Plans.

(4) Wash Checks (Metal Sheeting). The length of sheeting shall be as shown on the Plans. Any excavation required in order to drive the metal sheeting and the necessary backfill as directed, shall be made by the Contractor.

The metal sheeting may be driven with a light hammer, of such weight and so operated that it will not damage the sheeting or by methods approved by the Engineer. An approved fabricated or cast driving head, made for the type sheeting being used, shall be used in driving the sheeting.

The metal sheeting shall be set and held in the proper position by the use of frames, guides, or templates and shall be driven vertically. Any sheeting that is driven out of line shall be pulled and redriven as directed.

The metal sheeting shall be driven to the penetration shown on the Plans unless the Engineer decides it is impractical to get the penetration shown without injury to the sheeting in which case the Contractor will be required to cut the sheeting off at the elevation shown on the Plans or as ordered by the Engineer.

(5) Other Types of Wash Checks. Other types of wash checks may be permitted or required by the Plans in which case all materials shall meet the requirements of the Materials Division. They shall be constructed of the materials and to the dimensions shown on the Plans or established by the Engineer.

(d) Method of Measurement.

All types of wash checks shall be measured according to the meters of wash checks complete in place. Measurement shall be made along the top surface and at the upstream edge of each wash check.

(e) Basis of Payment.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per meter for "Wash Checks", which price shall be full compensation for all excavation, backfilling, for all materials, for all labor, equipment, tools and incidentals necessary to complete the work.

SECTION 810

CATCH BASINS, INLETS, OUTLETS, MANHOLES, JUNCTION BOXES AND PAVED DRAINAGE

810.01 DESCRIPTION.

This work shall consist of constructing catch basins, inlets, outlets, manholes, junction boxes and paved drainages in accordance with the Specifications and as shown on the Plans or established in the field by the Engineer.

BID ITEMS
Catch Basin (*).
Inlet (*).
Outlet (*).
Manhole (*).
Junction Box.
* Type

810.02 MATERIALS.

Materials shall conform to the requirements provided in the Materials Division.

Portland Cement	Section 2000
Water	Section 2400
Fine Aggregate	Section 1100
Coarse Aggregate	Section 1100
Mixed Aggregate	Section 1100
Reinforcing Steel	Section 1600
Gray Iron Castings	Section 1600
Steel Castings	Section 1600
Structural Steel	Section 1600
Brick	Section 1300
Manholes Steps	Section 1700

810.03 CONSTRUCTION REQUIREMENTS.

(a) Excavation.

The method of excavation shall conform to the requirements of "Excavation for Structures", in Section 207.

(b) Concrete.

The form work for, and the placing, curing, and protection of the concrete shall conform to the requirements of Section 701.

Class A Concrete shall be used unless otherwise shown on the Plans.

(c) Masonry.

When so indicated on the Plans, brick masonry or concrete masonry units may be used in lieu of concrete for the walls of catch basins, manholes, or curb inlets. Masonry manholes may be constructed circular, with an inside diameter equal to the greater of the inside dimensions indicated on the Plans for the concrete manhole.

When masonry is used in lieu of concrete for square or rectangular structures, the inside dimensions of the structure shall be of the dimensions shown on the Plans unless ordered otherwise by the Engineer.

The mortar for masonry shall be as specified in Section 402. The brick or concrete masonry units shall be laid with full mortared joints and with sufficient header courses to tie the masonry together properly.

(d) Reinforcement.

The method of reinforcing shall conform to the requirements of Section 703.

(e) Placing Castings.

Castings shall be set in full mortar beds or otherwise secured as shown on the Plans. Mortar for setting castings shall be mixed as specified in Section 402. Castings shall be set accurately to correct elevation so that no subsequent adjustment will be necessary.

(f) Backfilling.

Backfilling shall conform to the requirements of Section 207, "Excavation for Structures".

(g) Cleaning.

All catch basins, manholes, inlets and outlets shall be thoroughly cleaned of any accumulations of silt, debris or foreign matter of any kind, and shall be free from such accumulations at the time of final inspection.

(h) Painting.

Structural steel cover plates shall be painted with one shop coat of an approved primer, one field coat of aluminum paint (tinted) and one field coat of aluminum paint. Painting shall be in accordance with the requirements provided in Section 702

"Structural Steel Construction". Painting of castings will not be required unless specified on the Plans.

(i) Pre-Cast Units.

Pre-Cast Units may be used when shown on the Plans.

If the Plans do not contain fabrication details for precast units, the Contractor shall, before any fabrication is begun, submit to the Engineer six prints of shop drawings (maximum size 560 mm × 915 mm) for approval.

810.04 METHOD OF MEASUREMENT.

Catch basins, inlets, outlets, manholes and junction boxes shall be measured by the number of completed units in place.

Masonry and pre-cast units shall not be measured or paid for as a separate item but shall be paid for as the completed unit as provided above.

810.05 BASIS OF PAYMENT.

The amount of completed and accepted work measured as provided above, shall be paid for at the Contract unit price per each for "Catch Basins", "Inlets", "Outlets", "Manholes" and "Junction Boxes", however, the unit bid price of these items will be adjusted in accordance with the table listed below for increases or decreases in the height indicated on the Plans.

Adjustment of payment for increases and decreases in height will be as follows:

Change in Height	Increment of Increases or Decreases in Unit Bid Price	Total Increase or Decrease
0 to 149 mm	None	None
150 to 300 mm	7.5%	7.5%
301 to 600 mm	10.0%	17.5%
601 to 900 mm	12.5%	30.0%

For change in height of more than 900 millimeters the increment of increase or decrease shall be 15% for each 300 millimeters or fraction over 900 millimeters.

The Occupational Safety and Health Act (OSHA) requires different construction procedures and safety requirements when excavated depths reach 1.5 meters or greater. In consideration of this, if a plan height of less than 1.5 meters is adjusted to a height of 1.5 meters or greater, or a plan height of 1.5 meters or greater is adjusted to a height of less than 1.5 meters, an additional 25% of the unit price shall be added or deducted

from the bid price. This is in addition to normal correction applied from the table above.

This price shall be full compensation for furnishing and placing all materials, including structural steel, cast steel, cast iron, concrete, reinforcing steel, excavation, all labor, backfill, painting, equipment, forms, tools and incidentals necessary to complete the work.

810.06 CURBS AND GUTTERS.

(a) Description.

This work shall consist of the construction of curb, gutter or combination curb and gutter in accordance with the Specifications and as shown on the Plans or established by the Engineer.

BID ITEMS

Curb, Edge (*)(**).
Curb, Header (**).
Curb and Gutter, Combined (**).
Gutters (**).
Curb, Protection (*)(**).
Curbs, Asphaltic Concrete.
Gutters, Asphaltic Concrete.
Curb and Gutters, Asphaltic Concrete.

* size, height or special.
** "AE" denotes air entrained.
No entry denotes without air.

(b) Materials.

Materials shall conform to the requirements provided in the Materials Division.

Portland Cement	Section 2000
Water	Section 2400
Fine Aggregate	Section 1100
Coarse Aggregate	Section 1100
Mixed Aggregate	Section 1100
Reinforcing Steel	Section 1600
Structural Steel	Section 1600
Expansion Joint Filler	Section 1500
Joint Sealing Compound	Section 1500
Bituminous Materials	Section 1200
Aggregates for Bituminous Mixtures	Section 1100

NOTE: Unless otherwise indicated on the Plans the aggregate to be used for asphaltic curbs, gutters, curb and gutters and slope drains shall be BM-2 or BM-3. The maximum sizes and gradation of the aggregate and the asphalt content of the mixture shall be adjusted to produce a dense workable mix capable of being molded and pressed through the slip form without tearing or pulling

and which will produce a dense section with smooth and uniform surfaces free from segregated areas and with clear-cut corners and edges.

Mechanical Finishers: Mechanical finishers shall be capable of molding and satisfactorily compacting asphaltic and concrete mixtures to form a section, true to line, grade and cross section. The machine shall be self-powered and compaction may be obtained by an extrusion process. It shall be equipped with adequate steering devices, guide lines or rails to insure straight, neat lines.

(c) Construction Requirements.

(1) Concrete.

(1.1) Composition, Consistency, Proportioning, Mixing. Unless otherwise indicated on the Plans, edge curb, header curb, combined curb and gutter, gutters and protection curb adjacent to concrete pavement shall be constructed of the class of concrete specified for the pavement. The composition, consistency, proportioning, batching, mixing and curing of concrete shall conform to the requirements of Section 402, or Section 502, as applicable.

(1.2) Subgrade. The subgrade for combined curb and gutter, gutters and protection curb shall be excavated to the grades and sections shown on the Plans. If the section is not indicated, the width to be excavated shall be 300 millimeters each side of the outside edges of the curb or gutter. The subgrade shall be of uniform density. Rock, shale, or soft and yielding material shall be excavated 150 millimeters below subgrade elevation and replaced with suitable backfill material. The backfill material shall be compacted to meet the requirements of Type A Compaction as specified in Section 210.04. All subgrade shall be rolled or compacted to provide a smooth surface.

(1.3) Forms. Forms for edge curb or header curb constructed monolithic with concrete pavement shall be of steel. Forms for all other types of curb and gutter shall preferably be of steel but with the permission of the Engineer, may be of wood for curb or gutter of unusual section or when small quantities are involved. All forms shall be sufficiently strong and rigid and securely staked and braced to obtain a finished product correct to the dimensions, line and grade required. Forms shall be cleaned and oiled before each use.

Slip form equipment may be approved by the Engineer and used on a satisfactory performance basis.

(1.4) Reinforcement. All reinforcement shall be held in the position indicated on the Plans, by pins, bar chairs, or other approved devices.

(1.5) Expansion. Contraction and construction joints for curbs and/or gutters shall be constructed at the intervals and places shown on the Plans. All joints and materials shall be of the type and conform to the dimensions shown on the Plans.

Planes of weakness in curbs and/or gutters may be constructed by sawing through the curb to a depth of not less than 31 millimeters below the surface of the gutter and to a width not to exceed nine millimeters or they may be formed by inserting a removable metal template in the fresh concrete, or by other methods approved by the Engineer. Sealing of joints is not required.

(1.6) Placing Concrete. Edge curb and header curb shall be constructed monolithic with concrete pavement. The areas to be covered with the curb shall be cleaned of all laitance and roughened immediately after finishing. The concrete shall be placed and consolidated and then shaped with a steel tool to the section shown on the Plans. Concrete for other types of curbs and gutters shall be placed upon the previously prepared and moistened subgrade. The concrete shall be consolidated with an approved internal type vibrator or by hand spudding and tamping. The surface shall be shaped by use of a steel tool shaped to produce the cross section shown on the Plans. The edges shall be rounded with edgers to form the radii indicated.

(1.7) Finish. Unless the Plans specifically require a steel trowel or rubbed finish, the surfaces of curbs and gutters shall be finished with a wood float. Light brushing may be required by the Engineer.

(1.8) Curbs and/or gutters that are monolithic with concrete pavement shall be cured in the same manner as specified for the pavement.

All other curbs, gutters, and combined curb and gutters shall be cured immediately after the concrete is finished and hardened sufficiently to prevent detrimental marring, as set out in Section 701.

(2) Asphalt. The bituminous mixture shall be prepared in accordance with the requirements provided in Section 603. The mixed material shall be delivered to the mechanical finisher in vehicles meeting the requirements provided in Division 150.

The surface on which the curbs, gutters, and curb and gutters are to be constructed shall be thoroughly cleaned of all foreign material and shall receive a bituminous tack coat at the rate designated by the Engineer when placed on a bituminous surface. When these sections are not placed on a bituminous surface the subgrade shall be smooth and well compacted.

The sections shall be formed and compacted only with the use of an automatic mechanical placing machine except where its use is impracticable due to extremely short radii or through inaccessible areas. When hand placement methods are necessary the sections shall be formed and compacted with hand tools and back forms shall be used.

The maximum temperature of the asphaltic mixture, at time of placing, shall not exceed 168°C. The minimum temperature shall be sufficient to allow the material to be placed and compacted, if required, to the specified density and surface tolerance requirements.

In cool weather, if necessary to obtain an adequate bond between the curb and the surface course, the upper portion of the surface course shall be heated by methods which will not harm the mixture in the surface course.

Operations shall be suspended at any time that adequate bonding of the section to the surface is not being accomplished and the conditions causing deficient bonding shall be corrected.

On gutter sections a surface treatment of asphaltic cement in the amount to waterproof the section shall be applied.

(3) Backfilling. The area adjacent to curbs and/or gutters shall be backfilled with approved material to the top edges of the curbs and/or gutters or to the elevation shown on the Plans. The backfill shall be placed and compacted in accordance with the requirements of Section 207, except the compaction requirements shall be waived unless the backfill area falls within the shoulder area which is to be compacted. If the curb and/or gutter backfill falls within a shoulder or other area which is designated by the Plans or Specifications to be compacted, the curb and gutter backfill shall be compacted in accordance with the compaction provisions for the adjacent material.

On surfacing projects where there is median curb, the filler material or earth fill, as designated on the Plans, necessary to bring the grade up to within 100 millimeters from top of curb shall be subsidiary to other bid items on the Contract.

(d) Method of Measurement.

Excavation for the various types of curbs and gutters shall not be measured separately for payment but shall be considered as subsidiary work, except when such excavation is a part of, and is measured in conjunction with, the roadway excavation. In such instances the excavation shall be measured and

included in the quantity of roadway excavation computed as a pay item of the Contract as provided in Division 200.

The various types of curbs will be measured by the meter along the front face of the section. The combination curb and gutter will be measured by the meter along the face of the curb. Type I and II of combined curb and gutter will not be measured separately but shall be measured together as meters of combined curb and gutter. Gutter will be measured by the meter along the flowline.

No measurement will be made of the bituminous material or aggregate required to construct the work.

(e) Basis of Payment.

The amount of curbs and gutters, completed and accepted, and measured as provided above, shall be paid for at the Contract unit prices per meter for "Curb, Edge", "Curb, Header", "Curb and Gutter, Combined", "Gutters", "Curb Protection", "Curb, Asphaltic Concrete", "Gutters, Asphaltic Concrete" or "Curb and Gutters, Asphaltic Concrete", which prices shall be full compensation for furnishing and placing all materials, including reinforcement and joints, for excavation except as provided above, and for all labor, equipment, forms, tools and incidentals necessary to complete the work.

810.07 DITCH LINING.

(a) Description.

This work shall consist of the construction of stone or concrete ditch lining, in accordance with these Specifications and as shown on the Plans or established by the Engineer.

BID ITEMS

Ditch Lining, Concrete.
Ditch Lining (Backslope), Concrete.
Ditch Lining, Grouted Stone.
Ditch Lining (Backslope), Grouted Stone.

(b) Materials.

Materials shall conform to the requirements provided in the Materials Division.

Stone for Ditch Lining	Section 1100
Portland Cement	Section 2000
Water	Section 2400
Coarse Aggregate	Section 1100
Fine Aggregate	Section 1100

Mixed Aggregate	Section 1100
Reinforcing Steel	Section 1600

(c) Construction Requirements.

(1) Excavation. The subgrade for the ditch lining shall be excavated to a smooth surface parallel to the proposed finished surface and to a depth sufficient for the full thickness of the lining. Soft, unstable subgrade material shall be removed and replaced with suitable materials. The subgrade shall be firm and well-compacted.

(2) Concrete Ditch Lining. Concrete ditch lining shall be constructed of Class A concrete. The concrete shall be placed beginning at the lower end of the portion of the ditch to be lined and progressing toward the upper end.

If required on the Plans the concrete shall be reinforced with the type of reinforcement and in the manner indicated.

Contraction or construction joints shall be spaced and formed as indicated on the Plans.

The surface shall be finished with a wooden float. A light brooming may be required for a more acceptable finish. Bridges shall be used to avoid walking in the freshly laid concrete.

Immediately after the finishing operations are completed the concrete shall be protected and cured in conformance with the requirements specified in Section 701.

(3) Stone Ditch Lining. The stones shall be placed in rows transversely to the centerline of the ditch in the manner indicated on the Plans. The stones shall be placed with ends and sides abutting and the joints between stones in each row breaking with the joints in the preceding row. The larger spaces between stones shall be filled with spalls. The stones shall be rammed or compacted to give them firm bearing and stability.

After the surface has been inspected and approved, the spaces between stones shall be completely filled with a grout composed of one part of Portland cement and three parts of fine aggregate mixed with sufficient water to produce a plastic mortar. The grout shall be brushed or broomed into the spaces to insure proper filling.

The grout shall be cured in the manner provided above for concrete ditch lining.

(d) Method of Measurement.

Ditch lining shall be measured by the square meter complete in place as measured along the finished surface.

(e) Basis of Payment.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per square meter for "Ditch Lining, Concrete", "Ditch Lining, (Backslope), Concrete", "Ditch Lining, Grouted Stone", or "Ditch Lining, (Backslope) Grouted Stone", which prices shall be full compensation for furnishing, transporting and placing all materials, including reinforcement if required, for all excavation and for all labor, tools, equipment and incidentals necessary to complete the work.

810.08 FLUME INLETS AND SLOPE DRAINS.

(a) Description.

This work shall consist of the construction of flume inlets and slope drains in accordance with these Specifications and as shown on the Plans or established by the Engineer.

BID ITEMS

Inlets, Flume (*).
Drains, Slope (*).
Drains, Slope, Asphaltic Concrete.

* "AE" denotes air entrained.
No entry denotes without air.

(b) Materials.

All materials shall conform to the requirements provided in the Materials Division.

Portland Cement	Section 2000
Water	Section 2400
Coarse Aggregate	Section 1100
Fine Aggregate	Section 1100
Mixed Aggregate	Section 1100
Reinforcing Steel	Section 1600
Stone	Section 1100
Asphaltic Materials	Section 1200
Aggregate for Bituminous Mixtures	Section 1100

NOTE: Unless otherwise indicated on the Plans the aggregate to be used for asphaltic slope drains shall be BM-2 or BM-3. The maximum sizes and gradation of the aggregate and the asphalt content of the mixture shall be adjusted to produce a dense workable mix which will produce a dense section with smooth and uniform surfaces free from segregated areas and with well-filled, clean-cut corners and edges.

(c) Construction Requirements.

(1) Concrete. Flume inlets and slope drains shall be constructed of the type and materials indicated on the Plans and at the locations shown on the Plans or ordered by the Engineer.

The excavation for concrete-type inlets and drains shall be of sufficient width for the proper construction of forms and of sufficient depth to obtain full Plan thickness of the inlets and drains at proper elevations and grades.

Unless otherwise indicated on the Plans, concrete flume inlets and slope drains shall be constructed of Class A Concrete. The curing and protection of the concrete shall conform to the requirements provided in Section 701.

Reinforcement for concrete inlets and drains shall be placed in the positions indicated on the Plans prior to the placement of the concrete and shall be supported on bar chairs.

Stone inlets and slope drains shall be plain or grouted as indicated on the Plans and shall be of the approximate dimensions as shown. Grout shall be composed of one part Portland cement and three parts of fine aggregate. The stones shall be laid with ends and sides abutting and spalls shall be used to fill larger spaces between stones. Joints between stones in each row shall break with joints in the preceding row. The grout shall be poured and broomed into spaces between stones until the spaces are completely filled. Immediately after the grout is placed, it shall be cured the same as is required for the concrete.

Backfill material shall be placed along the sides of the inlets and slope drains to the top of the outside edges. The backfill shall be compacted to a density of 90 percent of the standard compaction of the material used. The backfill on projects where Type "B" compaction is required on the adjacent roadway, the compaction for flume inlets and slope drains shall meet the requirements of Type "C" compaction as provided in Section 210.04.

Excess excavation shall be disposed of as directed by the Engineer and the entire area shall be left in a neat and presentable condition.

(2) Asphalt. The bituminous mixture shall be prepared in accordance with the requirements provided in Section 603. The mixed material shall be delivered in vehicles meeting the requirements provided in Division 150.

The surface on which the slope drains is to be constructed shall be thoroughly cleaned of all foreign material and shall receive a bituminous tack coat at the rate designated by the Engineer when placed on a bituminous surface. When these sections are not placed on a bituminous surface the subgrade shall be smooth and well compacted.

The sections shall be formed and compacted only with the use of an automatic mechanical placing machine except where

its use is impracticable due to extremely short radii or through inaccessible areas. When hand placement methods are necessary the sections shall be formed and compacted with hand tools and back forms shall be used.

The maximum temperature of the bituminous mixture, at time of placing, shall not exceed 168°C. The minimum temperature shall be sufficient to allow the material to be placed and compacted, to the specified density and surface tolerance requirements.

On asphaltic slope drain sections a surface treatment of asphaltic cement in the amount to waterproof the section shall be applied.

(d) Method of Measurement.

Flume inlets shall be measured by the unit complete in place. Slope drains shall be measured by the meter along the flowline.

No measurement will be made of the bituminous material or aggregate required to construct the work.

(e) Basis of Payment.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per each of the "Inlets, Flume" of the various types and per meter for "Drains, Slope" of the various types, which prices shall be full compensation for furnishing and placing all materials, including reinforcing steel, for all excavation, backfill, compaction of backfill, and for all labor, tools, equipment and incidentals necessary to complete the work.

SECTION 811

PAVEMENT WIDENING

811.01 DESCRIPTION.

This work shall consist of the widening of the existing pavement or base course and the shouldering and finishing of the completed work in accordance with these Specifications, and as shown on the Plans or established by the Engineer.

BID ITEMS

Pavement Widening.
Water.
Removal of Edge Curb.
Aggregate for Bituminous Surface Course (*).
Aggregate for Bituminous Base Course (*).
Cutback Asphalt (*).
Emulsified Asphalt (*).
Asphalt Cement (*).
Portland Cement Concrete Pavement (**).

* Designated Type and Grade.
** Thickness.

811.02 MATERIALS.

All materials shall conform to the requirements provided in the Materials Division.

(a) Plant Mix Bituminous Base Course and Plant Mix Bituminous Pavement:

Bituminous Material	Section 1200
Aggregate for Bituminous Construction	Section 1100

(b) Portland Cement Concrete:

Water	Section 2400
Portland Cement	Section 2000
Fly Ash	Section 2000
Fine Aggregate	Section 1100
Coarse Aggregate	Section 1100
Mixed Aggregate	Section 1100
Hot Poured Joint Sealing Compound	Section 1500
Cold Poured Joint Sealing Compound	Section 1500
Reinforcing Steel	Section 1600
Concrete Curing Materials	Section 1400
Expansion Joint Filler	Section 1500

811.03 CONSTRUCTION REQUIREMENTS.

(a) Trenching.

The Contractor shall excavate along the edge of the existing pavement for the full depth and width as shown on the Plans. The bottom of the trench shall be compacted with rollers and/or tampers to the type of compaction shown on the Plans. If the Plans do not call for a specific type of compaction, the subgrade shall be compacted by rolling with an approved type trench roller until the entire surface is smooth, firm and at the specified elevation.

Adequate provisions shall be made for drainage of the trench to prevent damage to the subgrade.

Before placing any widening material, the trench shall be cleaned of all loose material. The edge of the existing pavement shall be thoroughly cleaned.

(b) Removal of Edge Curb.

When specified on the Plans or directed by the Engineer, the Contractor shall remove the concrete integral curb by methods that will not damage the pavement. After removal of the curb, the resulting surface shall not be more than 13 millimeters above the proper elevation of the existing pavement.

(c) Placing Bituminous Mixture.

Prior to placing any material, the edge of the existing pavement or base course shall be painted or sprayed with a thin coat of bituminous material of the type and grade used in the mixture, cutback asphalt or emulsified asphalt.

The bituminous mixture shall be prepared as set out in Section 603. The material shall be placed in the prepared trench in two or more layers as shown on the Plans. This material may be placed either by approved machine methods or by hand methods. If placed by hand methods, the material shall be thoroughly raked with asphalt rakes prior to being compacted.

After being spread, each lift shall be thoroughly compacted with approved trench rollers. The initial rolling shall be at the time the mixture is at such temperature that it will compact without any undue displacement under the roller. Rolling shall continue until the mixture is satisfactorily compacted. Delays in rolling of the freshly placed material will not be permitted.

(d) Placing Concrete Widening.

The type of concrete used for pavement widening shall conform to the requirements for concrete for pavement as designated on the Plans.

Concrete for pavement widening shall be prepared as set out in Section 402.

Pavement widening shall be placed in accordance with the applicable requirements of Section 502.

Wood forms or approved slip forms may be used in lieu of steel forms. When used, wood forms shall be not less than three meters in length and shall have a depth equal to the edge thickness of the pavement widening. Slip forms may be of metal or wood and shall be so designed, constructed, and propelled that the true cross section, crown, and grade of the widening are maintained at all times. They shall be equipped with auxiliary screeds or shoes that will move a sufficient quantity of earth against the edge of the widening to prevent excessive slumping of the concrete. A vibratory screed shall be provided to consolidate the concrete. When the Contract includes surfacing of the widening, a reasonably true surface obtained with the slip forms or normal finishing and made slightly granular with a broom drag will be acceptable. When the Contract does not provide for surfacing over the widening the concrete shall be finished to a true, smooth surface in the same plane as the existing pavement and shall be further finished with a burlap drag.

(e) Shoulders.

After the surface courses have been completed, the shoulders shall be constructed to the section shown on the Plans. The material used for constructing the shoulders shall be obtained from the widening trench, the ditches, and the backslopes. The removal of earth from ditches and backslopes shall be performed in a manner that will provide adequate and satisfactory drainage without pockets that will impound water; with reasonably uniform ditch widths and depths; and with reasonably uniform backslopes. In order to construct the shoulders to the minimum section indicated on the Plans, it may be necessary to haul material from locations within the right of way where a surplus exists to locations where a deficiency exists, in order to construct the shoulders to the minimum section indicated on the Plans or as approved by the Engineer. Any surplus material from the widening trench shall be disposed of at locations furnished by the Contractor and approved by the Engineer.

During the operations of constructing the shoulders, extreme care shall be exercised to prevent injury to the previously constructed surfaces.

The shoulders shall be watered during shaping and rolling as required by the Engineer. After the material has been shaped and bladed, the shoulders shall be compacted with a roller weighing not less than seven metric tons.

No additional compensation shall be paid for this work and it shall be considered as subsidiary work pertaining to the item of "Pavement Widening."

(f) Maintenance of Traffic.

Maintenance of traffic shall be in accordance with Section 821 and the following.

Widening operations shall be permitted on only one side of the pavement at a time and excavation of trenches shall be permitted only sufficiently in advance of other operations to insure a continuity of the operations of excavating, placing widening material, and rolling.

Approved barricades shall be placed along open trenches day and night. Approved warning lights shall be placed at each barricade at night. The barricades shall be placed at intervals in accordance with the requirements shown on the Plans.

The Contractor shall make adequate provisions to enable traffic to cross open trenches at intersecting roads, streets and private entrances.

Partial shouldering shall be performed immediately after completion of widening of portions of the work, in order to eliminate the hazard of the open trench.

811.04 METHOD OF MEASUREMENT.

(a) Plan Quantity Measurement.

The quantities for Pavement Widening and Portland Cement Concrete Pavement for which payment will be made shall be the quantities shown on the Plans for the various items, provided the project is constructed essentially to details shown on the Plans.

When the Plans have been altered or when disagreement exists between Contractor and Engineer as to the accuracy of Plan quantities in any location or the entire project, either party shall have the right to request and cause the quantities in-

volved to be measured in accordance with the provisions of subsection 811.04 (b).

(b) Measured Quantities.

The pavement widening shall be measured by the unit of one kilometer, as measured on each side of the roadway and shall include all excavation, trimming, compacting and all other work necessary for the preparation of the trench. It shall also include all work to be done on the shoulders and shoulder slopes.

Water, ordered by the Engineer or added with the consent of the Engineer, which is necessary to obtain satisfactory compaction of the foundation treatment or of the shoulders shall be measured by the cubic meter by means of calibrated tanks, or distributors or by accurate water meters. Deductions shall be made for the cubic meters of water considered to be in excess of the quantity required and for the number of gallons lost due to waste or other avoidable losses.

Removal of Edge Curb shall be measured by the meter of edge curb actually removed.

Aggregate for Bituminous Surface Course, and Aggregate for Bituminous Base Course shall be measured by the metric ton as provided for in Section 603.

Bituminous material shall be measured by the metric ton as provided in Division 100.

Portland Cement Concrete Pavement shall be measured by the square meter complete in place. Measurements shall be horizontal.

811.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per kilometer for "Pavement Widening", per cubic meter for "Water", per meter for "Removal of Edge Curb", per metric ton for "Aggregate for Bituminous Surface Course", per metric ton for "Aggregate for Bituminous Base Course", per square meter for "Portland Cement Concrete Pavement", per metric ton for the various grades and types of bituminous materials, which prices shall be full compensation for furnishing all materials, for all labor, equipment, tools, supplies, and incidentals necessary to complete the work.

When the quantity of water furnished overruns or underruns the Contract quantities, the Contract unit price shall govern regardless of the total quantity furnished.

SECTION 812

PAVEMENT PATCHING

812.01 DESCRIPTION.

This work shall consist of patching concrete pavement and asphaltic concrete pavement in accordance with the Specifications and as shown on the Plans, in the Contract or established by the Engineer.

BID ITEMS

Aggregate for Bituminous Base Course (*) Patching.
Aggregate for Bituminous Surface Course (*) Patching.
Cutback Asphalt (*).
Emulsified Asphalt (*).
Asphalt Cement (*).
Portland Cement Concrete Pavement (**) Patching (***).
Extra Work Saw Cuts.

* Designated Type and Grade.
** Thickness.
*** Denotes sound or unsound.

812.02 MATERIALS.

Materials for the construction of pavement patching shall conform to the requirements specified in the Materials Division.

(a) Asphaltic Concrete Pavement:

Bituminous Material	Section 1200
Emulsified Asphalt	Section 1200
Aggregate for Bituminous Construction	Section 1100

(b) Concrete Pavement:

Water	Section 2400
Reinforcing Bars	Section 1600
Mesh Reinforcing Steel	Section 1600
Fine Aggregate	Section 1100
Coarse Aggregate	Section 1100
Mixed Aggregate	Section 1100
Portland Cement	Section 2000
Calcium Chloride	Section 1700
Concrete Curing Materials	Section 1400

812.03 CONSTRUCTION REQUIREMENTS.

(a) General.

The type of patching shall be that type shown on the Plans or in the Contract.

Detouring of highway traffic for this work will not be provided for or permitted. Unless otherwise provided for, operations shall be restricted to one traffic lane at all times in order to permit the unrestricted use of the other lane(s) for traffic and all operations shall be conducted in a manner to cause the least possible inconvenience to traffic.

When work is started at one location the construction procedure of removing the existing pavement, preparing the subgrade and placing and finishing the concrete or bituminous mixture shall so progress that no excavated areas shall remain unfilled overnight. In case of unavoidable delays which make it impossible to place the concrete or bituminous mixture on the same day that the excavation is completed, the Contractor shall fill such excavations with temporary bituminous mixture and shall thoroughly compact the backfill material before nightfall. Temporary bituminous mixture shall not be paid for but will be subsidiary to other items of the Contract.

The old pavement and previously placed patching material shall be removed to the limits designated on the Plans, in the Contract or by the Engineer. The waste material shall be removed from the area of the roadway the same day of removal and disposed of by the Contractor in the manner indicated on the Plans, in the Contract or approved by the Engineer.

The subgrade shall be adjusted to grade to permit the thickness of pavement indicated on the Plans or in the Contract. The subgrade shall be thoroughly and uniformly recompacted by hand tamping or rolling.

(b) Asphaltic Concrete Patching.

The bituminous mixture shall be prepared in accordance with applicable requirements specified in Section 603.

If the Plans or Contract call for the existing pavement to be sawed prior to the removal of the old pavement, it shall be sawed full depth or as indicated on the Plans or in the Contract.

Prior to placing the bituminous mixture in the area to be patched, the exposed edges of the existing pavement shall be cleaned of dirt and other foreign matter and shall be painted or sprayed with a thin coat of bituminous material (of the type designated in the Contract). These sections shall then be repaved with bituminous mixture of the type designated on the Plans or in the Contract. The bituminous mixture shall be deposited in uniformly spread layers not to exceed 75 millimeters in thickness and each layer shall be thoroughly compacted. Care shall be taken to protect the various layers and any dirt shall be removed before the next layer of material is added.

(c) Concrete Patching.

The type and size of patch will be shown on the Plans or Contract and meet the applicable following requirements:

The handling of material, mixing, placing and finishing concrete will conform to the requirements of Section 402 and Section 502 except for the following:

Any aggregate permitted in Section 1102 for concrete pavement may be used in patching sound and unsound concrete pavement. Crushed limestone or dolomite for use in unsound pavement need not meet the requirements for durable Class I or Class VI aggregates. The Plans and/or Contract will designate whether the pavement is sound or unsound. The maximum slump of the concrete at the time of depositing will be 62 millimeters.

All concrete in pavement patching will be air-entrained.

The type and amount of cement used shall be as shown in subsection 812.03 (c) (3) and (4).

The concrete in the patch will be thoroughly consolidated, struck off, finished with wooden floats or other approved methods.

(1) Full depth Patches.

All full depth concrete patches will be sawed full depth with a diamond or carborundum saw making sure not to damage the subgrade. Removal of slabs in one piece is recommended provided damage to remaining concrete does not occur. If PCCP is to be overlayed the same construction season a rock saw may be used. Sawing ahead in preparation of patching shall not be more than three working days ahead of the normal patching operation.

Tie bars and dowel bars shall be fixed in place with an epoxy or Portland cement grout in accordance with Section 830. The size, number and spacing shall be designated on the Plans or in the Contract.

Edges of all patches not receiving an overlay shall be sawed or formed to form a groove and sealed as shown on the Plans. Prior to sealing, the joint faces shall be cleaned by high pressure sand blasting followed by high pressure air cleaning free of contaminates. A 13 millimeter backer rod of paper rope or denver foam will be inserted in the groove to form a joint shape factor designated in the Plans and then sealed with a sealing compound meeting the requirements of Section 1501 or 1502.

Patches shall be a minimum of two meters measured in longitudinal direction by full lane width wide.

If the concrete remaining at an individual joint shows deterioration after slab removal as directed by the Engineer, the repair area may be extended to include the deterioration and additional saw cuts shall be paid for at the set price as shown in the Contract under "Extra Work Saw Cuts".

At the time of depositing concrete, the subgrade and exposed surface of existing pavement will be sufficiently moist so that it will not absorb moisture from the concrete, but not to the extent that the subgrade will be muddy or have free water standing thereon.

All edges not abutting remaining concrete pavement shall be formed for the full depth of the patch.

(2) Partial Depth Patches.

The limits of the area to be patched shall be delineated at least 25 millimeters outside the area to be patched by a saw and shall be sawed to a minimum depth of 50 millimeters or as indicated on the Plans. The connecting edges below the sawed portion shall be cut out and chipped to as nearly true lines with vertical faces as practicable. If the depth of repair of an area designated for partial depth repair exceeds 100 millimeters, the entire area shall be removed and replaced as a full depth patch when directed by the Engineer.

Sufficient old pavement shall be removed at each individual location to provide that a patched area shall contain not less than 0.1 square meter for partial depth patches. All of the old pavement and old patching material shall be disposed of by the Contractor. A Portland cement grout consisting of a 1:1 by mass mixture of Portland cement and Mortar Sand (FA-M) with a water/cement ratio of 0.60 by mass shall be applied in the area to be patched immediately prior to placing new concrete.

Edges of partial depth patches will not be sealed, however, where a side abuts an existing joint a compressible material nine millimeters wide extending the full depth of the patch shall be installed prior to pouring the patch.

(3) Normal Cure.

In areas where pavement repair and patching can be cured a minimum of 24 hours, the following shall apply:

A minimum of eight sacks (340 kilograms) of either Type I or Type II cement will be used.

The minimum length of time after placement of the concrete patches before opening the pavement to traffic will be 24 hours when the minimum temperature in that period is 15°C or above.

If the temperature falls below 15°C during the cure period a Schmidt rebound hammer will be used to determine when the

patch can be opened to traffic. The patch may be opened to traffic when the results of the rebound hammer test equals or exceeds results obtained on material previously cured under this Specification or 60 percent of the rebound on adjoining pavement.

(4) Accelerated Cure.

When conditions are such that an accelerated cure is necessary, the following shall apply:

A minimum of seven sacks (298 kilograms) of Type III cement will be used.

An amount of calcium chloride consisting of one to two percent by dry weight of the cement will be required to obtain desired minimum compressive strength of the concrete patching material before opening the pavement to traffic. The calcium chloride shall be type II or equivalent as approved by the Engineer and will be added by solution. The solution is considered part of the mixing water. The calcium chloride used shall be subsidiary to other items of the Contract.

The minimum length of time after placement of the concrete patches before opening the pavement to traffic will be as follows:

With one percent calcium chloride, the minimum length of time after placement of the concrete patch before opening to traffic will be six hours at 15°C or above; or

With two percent calcium chloride, the minimum length of time after placement of the concrete patch before opening to traffic will be four hours at 15°C or above.

If the temperature falls below 15°C during the cure period a Schmidt rebound hammer will be used to determine when the patch can be opened to traffic. The patch may be opened to traffic when the results of the rebound hammer test equals or exceeds results obtained on material previously cured under this specification or 60 percent of the rebound on adjoining pavement.

(d) Curing of Concrete Patches.

Extra precaution or time will be required if the ambient air temperature, after placement of the concrete, falls below 15°C. Hot weather precautions should be observed if the ambient air temperature reaches 32°C before placement of concrete.

The concrete will be cured with a curing membrane in the same manner as specified for concrete pavement in Section 502.03 or with Emulsified Asphalt (SS-1H) whichever is designated by the Engineer. If emulsified asphalt is used it will be

applied at a rate to obtain adequate coverage as determined by the Engineer. In most cases where there are plans to overlay the concrete pavement in the near future the Emulsified Asphalt (SS-1H) will be used for curing.

No patching will be performed when the ambient air temperature is below 4°C.

812.04 METHOD OF MEASUREMENT.

Portland Cement Concrete Pavement (Patching) shall be measured by the square meter, complete in place, of the type shown in the Contract documents.

The aggregate for bituminous patching shall be measured in accordance with Section 603.08. This item shall include the furnishing of materials, the drying and screening of the aggregate; the mixing of the bituminous material with the aggregate, and the placing, finishing and compaction of the mixed material.

Bituminous material shall be measured by the metric ton as provided in Division 100.

Extra work saw cuts will be the actual meters of additional saw cut required to extend the limits of the plan patch for removal of deteriorated concrete.

All excavation required for pavement patching shall be subsidiary to the item of "Concrete Pavement (Patching)" or "Aggregate for Bituminous Base or Surface Course".

812.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per square meter for "Portland Cement Concrete Pavement Patching", per metric ton for the various types and grades of bituminous material and per metric ton for "Aggregate for Bituminous Surface Course", and "Aggregate for Bituminous Base Course", and at the set price per meter for "Extra Work Saw Cut", which prices shall be full compensation for furnishing all materials, (including dowel bars, tie bars, reinforcing mesh and underpinning) whichever applicable, for all labor, equipment, tools, supplies, and incidentals necessary to complete the work.

The removal and disposal of excavated materials, replacing and compacting subgrade material will be subsidiary to the appropriate bid item for patching.

SECTION 813

SANITARY SEWERS

813.01 DESCRIPTION.

(a) This work shall consist of the construction of sanitary sewer in accordance with these Specifications and as shown on the Plans or established by the Engineer.

BID ITEMS

* Sanitary Sewer (**).
Sewer Excavation (Common).
Sewer Excavation (Rock).

* Size, Diameter.
** Type when specified.
"CIPP" denotes Cast Iron Pressure Pipe.
"CISP" denotes Cast Iron Soil Pipe.
"PVCP" denotes Polyvinyl Chloride Pipe.
No entry denotes vitrified clay.

(b) Classification of Sewer Excavation.

Excavation for sanitary sewers shall not be measured but shall be subsidiary to the item of "Sanitary Sewer" unless shown as a bid item on the Plans. When shown as a bid item, excavation for sewers shall be classified as either "Sewer Excavation (Common)" or "Sewer Excavation (Rock)". The classification will be made in the same manner as described in Section 204.02.

813.02 MATERIALS.

Materials shall conform to the requirements provided in the Materials Division.

Portland Cement	Section 2000
Fine Aggregate	Section 1100
Water	Section 2400
Clay Sewer Pipe *	Section 1900
Cast Iron Pressure Pipe	Section 1900
Materials for Sealing Joints in Pipes	Section 1500
Factory Molded Joints	Section 1500
Plastic Joint Compound	Section 1500
Cast Iron Soil Pipe and Fittings	Section 1900
Polyvinyl Chloride Pipe	Section 1900

* Unless otherwise called for on the Plans or in the Contract standard strength clay sewer pipe shall be furnished. Cast iron pipe shall be of the bell and spigot type. Clay pipe may be either the bell and spigot type or plain-end pipe.

813.03 CONSTRUCTION REQUIREMENTS.

The methods of construction shall conform to the following requirements:

(a) Excavation.

The trench shall be excavated beginning at the outlet end and proceeding toward the upper end, true to line and grade as shown on the Plans or established by the Engineer. The width of the trench shall be sufficient to lay and backfill the pipe satisfactorily but in no case shall be less than the external diameter of the pipe plus 150 millimeters on each side. When necessary, the trench shall be adequately shored or sheeted to insure safe and satisfactory construction and backfilling. If tunneling under a railroad or existing street or highway is required, it shall be done by methods approved by the Engineer, which will insure that the railroad, street or highway is undisturbed during and after the construction. If it is necessary to remove the existing street or highway surface in constructing the sewer, an equivalent surface shall be placed at the expense of the Contractor unless provision for the removal and reconstruction is otherwise provided on the Plans.

The foundation in the trench shall be so formed as to prevent subsequent settlement. If the foundation is in rock, an equalizing bed of well-compacted sand or similar material shall be placed upon the rock. If the foundation is in good firm earth, the earth shall be pared or molded to give full support to each pipe for a depth at least equal to 1/4 the external diameter of the pipe, notches being cut to receive the bell. The Contractor shall have the option to undercut the trench and backfill, at his expense, with well compacted sand or other suitable material to insure proper, uniform bearing of the sanitary sewer pipe.

When indicated on the Plans, or if ordered in writing by the Engineer, in order to provide a suitable foundation for the pipe, a concrete cradle or encasement shall be placed under or around the pipe. The dimensions and class of the concrete shall be as indicated on the Plans or ordered by the Engineer.

(b) Laying.

The laying of pipes in finished trenches shall be started at the outlet end so that the spigot ends point to the direction of flow. All pipes shall be laid with ends abutting and true to line and grade. They shall be laid in the beds so that the lower portion of each pipe is supported for its entire length to a depth

at least equal to 1/4 the external diameter of the pipe. They shall be fitted and matched so that when laid in the trench, they will form a sewer with a smooth, uniform invert. Bell ends shall be carefully cleaned before pipes are lowered into the trenches. Pipes shall be so lowered as to avoid unnecessary handling in the trench.

(c) Vitrified Clay Pipe Joints.

(1) Cement Mortar Joints. The ends of the pipe shall be cleaned with a wet brush. The joint shall be formed by tamping into the bell or hub a gasket of hemp or oakum which has been saturated in cement mortar. The annular opening remaining shall be completely filled with cement mortar composed of one part Portland cement and two parts fine aggregate, mixed with sufficient water to form a plastic mortar. The mortar shall be leveled off to an angle of 45 degrees with the outside of the pipe. The inside of the joint shall be filled with mortar, finished smooth and wiped clean.

(2) Hot Poured Joints. The ends of the pipe shall be clean and dry when the joints are made. The joint shall be formed by tamping into the bell or hub a gasket of hemp or oakum in sufficient quantity to seal the joint without unnecessarily filling the annular space. The remaining annular opening shall then be filled with hot poured asphalt jointing material.

(3) Plastic Compound Joints. Plastic compound used for filling joints shall be prepared and applied in a manner recommended by the manufacturer.

(4) Compression Coupling Joint. The compression coupling as used with plain-end pipe having factory molded joints shall be installed in accordance with the manufacturer's recommendations.

(d) Cast Iron Pressure Pipe.

(1) Handling. Pipe and accessories shall be handled in such manner as to insure delivery on the work in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. No other pipe or material of any kind shall be placed inside of a pipe or fitting after the coating has been applied.

(2) Cutting. Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise authorized by the Engineer, cutting shall be done by means of an approved type of mechanical cutters. Wheel cutters shall be used when practicable.

(3) Placing and Laying. While suspended in the sling and before lowering into the trench, the pipe shall be inspected for

defects and tapped with a light hammer to detect cracks. Defective, damaged, or unsound pipe will be rejected. The pipe shall be carefully bedded with bell holes excavated to insure that each pipe shall rest firmly upon its bed for its full length, and shall be laid true to the lines and grades shown on the drawings. After placing a length of pipe in the trench, the packing material for the joint shall be held around the bottom of the spigot so that the packing shall enter the bell as the pipe is pushed into position. The spigot shall be centered in the bell and the pipe pushed into position and brought into the required alignment. Except where necessary in making connections with other lines, or as authorized by the Engineer, pipe shall be laid with the bells facing the direction of laying. Except at closures, not less than two lengths of pipe shall be in position ahead of each joint, with packing installed and earth fill tamped alongside the pipe, before the joint is poured.

(4) Joints. Before jointing bell and spigot pipe, all lumps, blisters, and excess coating materials shall be removed from the bell and spigot ends of the pipe. All oil and grease shall be removed. The outside of the spigot and the inside of the bell shall be wire brushed and wiped clean and dry. The packing shall be carefully placed and tightly calked to a uniform thickness. No loose or frayed ends of fiber shall protrude into the space to be filled with joint filler. Each joint shall be carefully inspected and checked for proper depth before the joint runner is attached. The depth of load in lead filled joints shall be not less than 56 millimeters back of the face of the bell. Lead shall be heated in a melting pot kept near the joint to be poured, brought to proper temperature, so that when stirred the surface will show a rapid change in color, and when poured into the joint space, will insure a perfect joint. Before pouring lead, all scum shall be removed. The outside of the pipe shall be dammed with clay at the pouring gate, to assure filling the joint even with the top of the bell. Each joint shall be made with one pour completely filling the joint space. The calking shall be done by competent mechanics, in such manner as to secure tight joints without overstraining the bells. The calking shall progress toward the joint gate. If the packing has been insufficiently caulked, permitting the lead to be driven, during calking, to a depth more than six millimeters from the face of the bell at any point, the lead shall be removed and joint remade.

(e) Backfilling.

Backfilling shall be performed in accordance with the requirements provided in Section 207. When approved by the En-

gineer an approved granular material may be used for backfill purposes. The material shall be of satisfactory moisture content and adequately rolled or tamped in place. The granular material shall be placed in uniform layers not exceeding 300 millimeters in thickness. When deemed necessary by the Engineer the granular backfill material shall be terminated a minimum of 200 millimeters below the subgrade or ground level and a suitable soil used to backfill the remaining portion.

813.04 METHOD OF MEASUREMENT.

This item shall be measured by the meter of the various sizes of sanitary sewers. Measurement shall be along the centerline of the pipe complete in place from the end of pipe to the inside face of walls of manholes.

Concrete used for cradling or encasement of sewers shall be measured by the cubic meter complete in place of the several classes of concrete involved. Measurement shall be on the neat lines of the cradle or encasement as shown on the Plans or as ordered by the Engineer.

When shown as a bid item, Sewer Excavation (Common) will be measured by the cubic meter actually removed except that no measurement will be made of material outside of a volume bounded by vertical planes 150 millimeters outside the external diameter of the pipe and a plane at right angles to the theoretical sides of the excavation through the flow line of the sewer.

When shown as a bid item, Sewer Excavation (Rock) will be measured by the cubic meter actually removed except that no measurement will be made of material removed outside of a volume bounded by vertical planes 150 millimeters outside the external diameter of the pipe and a plane at right angles to the theoretical sides of the excavation and a distance below the flow line of the sewer equal to the thickness of the wall of the pipe plus 150 millimeters.

The Engineer may elect to use the quantities shown on the Plans for basis of payment for excavation. When the Plans have been altered or when disagreement exists between the Contractor and Engineer as to the accuracy of Plan quantities in any location or the entire project, either party shall have the right to request and use the quantities involved to be measured.

813.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided, shall be paid for at the Contract unit price per meter

of "Sanitary Sewer" of the various sizes, per cubic meter for the classes of concrete involved, per cubic meter for "Sewer Excavation (Common)" and "Sewer Excavation (Rock)" which prices shall be full compensation for furnishing and placing all materials, for all labor, excavation, backfilling, compaction of backfill, if required, the disposal of excess material, for all equipment, tools, and incidentals necessary to complete the work.

No payment will be made for cement mortar for grouting joints or for other materials used in caulking joints.

If the item of "Sewer Excavation (Common)" is the only sewer excavation item shown in the Contract and rock is encountered in the excavation for the sewer, "Sewer Excavation (Rock)", shall be added and paid for in accordance with the provisions of Division 100.

SECTION 814

STORM SEWERS

814.01 DESCRIPTION.

This work shall consist of the construction of storm sewers for the removal of water from collection points, in accordance with these Specifications and as shown on the Plans or established by the Engineer.

BID ITEMS

* Storm Sewer (**-***).
* End Sections (**-****).
Sewer Excavation (Common).
Sewer Excavation (Rock).
Class _____ Concrete.
Class _____ Concrete (AE).
Reinforcing Steel.

* Size, diameter or "Bid Designation" minimum Square Meters waterway.
** "BC" denotes bituminous-coated. No entry denotes without bituminous-coating.
*** Denotes type of pipe.
**** Denotes type of end section.

PIPES

"RCP" denotes round reinforced concrete pipe.
"RCPA" denotes reinforced concrete pipe arch.
"RCPHE" denotes reinforced concrete pipe horizontal elliptical.
"CMP" denotes round corrugated metal pipe.
"CSP" denotes round corrugated steel pipe.
"CAP" denotes round corrugated aluminum pipe.
"CMMAC" denotes corrugated metal-metal arch culvert.
"CSMAC" denotes corrugated steel-metal arch culvert.
"CAMAC" denotes corrugated aluminum-metal arch culvert.
"CP-ES" denotes clay pipe (extra strength).
"CP" denotes clay pipe (standard strength).
"CIP" denotes cast iron pipe.
"CPP" denotes corrugated polyethylene pipe.
"PVCP" denotes polyvinyl chloride pipe.
"SP" denotes steel pipe.
"BCCMP-FP" denotes bituminous-coated corrugated metal pipe (fully paved).
"BCCSP-FP" denotes bituminous-coated corrugated steel pipe (fully paved).

"BCCAP-FP" denotes bituminous-coated corrugated aluminum pipe (fully paved).

END SECTIONS

"RC" denotes round reinforced concrete end section.
"RCA" denotes reinforced concrete arch.
"RCHE" denotes reinforced concrete horizontal elliptical end section.
'CM" denotes round corrugated metal end section.
"CS" denotes round corrugated steel end section.
"CA" denotes round corrugated aluminum end section.
"CMMA" denotes corrugated metal-metal arch end section.
"CSMA" denotes corrugated steel-metal arch end section.
"CAMA" denotes corrugated aluminum-metal arch end section.

No entry denotes that any of the types of pipes permitted by the provisions of Table 1 of Section 1900 may be furnished.

"CMP" and "CMMAC" designations for pipe denotes that either steel or aluminum pipe may be furnished.

See Table 1, Section 712 for Plan and Bid Designations for Corrugated Metal-Metal Arch Culverts, Reinforced Concrete Pipe Horizontal Elliptical and Reinforced Concrete Pipe Arch.

(a) Types of Pipe for Storm Sewers.

Pipe may be furnished for storm sewers as permitted by the provisions of Table I, Section 1900, unless otherwise shown on the Plans or in the Contract. Corrugated metal, metal arch, vitrified clay (standard clay), or bituminous coated corrugated metal pipe may be furnished if specifically called for on the Plans or in the Contract. The same type of pipe base metal (steel or aluminum) shall be used throughout any individual run or installation of pipe or for pipe extension.

(b) Reinforced Concrete Box Storm Sewer.

Reinforced concrete box storm sewer shall be constructed in place to conform to the location and dimensions shown on the Plans and in accordance with the requirements specified in Sections 402 and 701.

(c) Classification of Sewer Excavation.

Excavation for storm sewers shall not be measured but shall be subsidiary to the item of "Storm Sewer" unless shown as a bid item on the Plans. When shown as a bid item, excavation

for sewers shall be classified as either "Sewer Excavation (Common)" or "Sewer Excavation (Rock)". The classification shall be made in the same manner as described in Section 204.02.

814.02 MATERIALS.

Materials shall conform to the requirements provided in the Materials Division.

Pipe (Table 1)	Section 1900
Steel Encasement Pipe	Section 1600
Portland Cement	Section 2000
Water	Section 2400
Fine Aggregate	Section 1100
Coarse Aggregate	Section 1100
Mixed Aggregate	Section 1100
Reinforcing Steel	Section 1600
Plastic Joint Compound	Section 1500

814.03 CONSTRUCTION REQUIREMENTS.

(a) Pipe Storm Sewer Requirements.

(1) Excavation. The trench shall be excavated beginning at the outlet end and proceeding toward the upper end, true to line and grade shown on the Plans or as established by the Engineer. The width of the trench shall be sufficient to lay and backfill the pipe satisfactorily but in no case shall be less than the external diameter of the pipe plus 150 millimeters on each side. When necessary, the trench shall be adequately shored or sheeted to insure safe and satisfactory construction and backfilling. If tunneling under a railroad or existing street or highway is required, it shall be done by methods which will insure that the railroad, street, or highway is undisturbed during and after the construction and such methods shall be approved by the Engineer before work is begun. If it is necessary to remove an existing street or highway surface in constructing the sewer, an equivalent surface shall be placed at the expense of the Contractor unless provision for the removal and reconstruction is otherwise provided on the Plans.

The foundation in the trench shall be so formed as to prevent subsequent settlement. If the foundation is in rock, an equalizing bed of well-compacted sand or similar material at least 150 millimeters in thickness shall be placed upon the rock. If the foundation is in good firm earth, the earth shall be pared or molded to give full support to each pipe for a depth at least

equal to 1/4 the external diameter of the pipe, notches being cut to receive the bell (when bell and spigot pipe is used). The Contractor shall have the option to undercut the trench and backfill, at his expense, with well compacted sand or other suitable material to insure proper, uniform bearing of the storm sewer pipe.

When indicated on the Plans, or if ordered in writing by the Engineer, in order to provide a suitable foundation for the pipe, a concrete cradle or encasement shall be placed under or around the pipe. The dimensions and class of the concrete shall be as indicated on the Plans or ordered by the Engineer.

(2) Laying. The laying of pipes in finished trenches shall be started at the outlet end so that the spigot ends (when bell and spigot pipe is used) point to the direction of flow. All pipes shall be laid with ends abutting and true to line and grade. They shall be laid in the beds so that the lower portion of each pipe is supported for its entire length to a depth at least equal to 1/4 the external diameter of the pipe. They shall be fitted and matched so that when laid in the trench, they will form a sewer with a smooth, uniform invert. Bell ends (when bell and spigot pipe is used) shall be carefully cleaned before pipes are lowered into the trenches. Pipes shall be so lowered as to avoid unnecessary handling in the trench.

Sections of corrugated metal pipe shall be placed with the ends abutting and joined with the manufacturer's coupling bands. Sections of clay pipe may be joined using factory molded joints with plain end compression coupling (slip type collar) or bell and spigot type. Joints of all other types of pipe, over 600 millimeters in diameter, shall be cemented with a cement mortar or plastic joint compound. The cement mortar shall be composed of one part Portland cement and three parts of fine aggregate mixed with sufficient water to form a plastic mortar. As each section of pipe is laid, the bell or hub of the preceding pipe shall be cleaned and the bottom portion filled with the mortar. After the pipe is placed, the remaining portion of the joint shall be filled. The inside of the joint shall be finished smooth and wiped clean. The mortar on the outside shall, after its initial set, be protected from the sun with earth or other covering. Plastic joint compound shall be prepared and applied in accordance with the manufacturer's recommendations.

On 600 millimeter and smaller RCP's, plastic joint compound shall be used to join the sections.

Plastic joint compound may be used in lieu of the Portland cement mortar. If plastic joint compound is used, it shall be

prepared and applied in accordance with the manufacturer's recommendations.

(3) Backfilling. All trenches and excavation shall be backfilled with suitable material in a manner that will not disturb the pipe.

The trenches for all sewers that lie within the roadbed, or beneath entrances, side roads, sidewalks, and other intersecting traveled ways, or which are so designated on the Plans, shall be backfilled to the required grade in layers not to exceed 150 millimeters in compacted thickness and each layer shall be compacted to Type A compaction as defined in Section 210.04.

On all sewers to which the requirements of the preceding paragraph do not apply, the material shall be carefully deposited and satisfactorily tamped in uniform layers not greater than 150 millimeters in thickness until the backfill reaches the top of the pipe. The remainder of the trench shall be backfilled, either in uniform layers not exceeding 300 millimeters in thickness and satisfactorily tamped, or by completely filling the trench and settling by satisfactory methods of jetting or flushing. The operations shall continue until the backfill remains slightly above the ground level.

When approved by the Engineer, an approved granular material may be used for backfill purposes. The material shall be of satisfactory moisture content and adequately rolled or tamped in place. The granular material shall be placed in uniform layers not exceeding 300 millimeters in thickness. When deemed necessary by the Engineer, the granular backfill material shall be terminated a minimum of 200 millimeters below the subgrade or ground level and a suitable soil used to backfill the remaining portion.

Excess material shall be disposed of and the area involved shall be left in a neat and presentable condition.

(b) Reinforced Concrete Box Storm Sewer.

Reinforced concrete box storm sewer shall be constructed of the class of concrete designated on the Plans and the work shall conform to the requirements specified in Sections 402 and 701.

Backfilling of reinforced concrete box storm sewer shall conform to the requirements specified in Section 207.

814.04 METHOD OF MEASUREMENT.

(a) Pipe Storm Sewer.

Pipe storm sewer shall be measured by the meter of the various sizes and types of storm sewers and per each for the various classes and sizes of end sections. Measurements shall be along the centerline of the pipe complete in place from end of pipe to the inside face of walls of catch basins, manholes, inlets, sumps, or from inside face to inside face of walls of such structures, as the case may be.

Concrete used for cradling or encasement of sewers shall be measured by the cubic meter complete in place of the several classes of concrete involved. Measurement shall be on the neat lines of the cradle or encasement as shown on the Plans or as ordered by the Engineer.

Excavation for storm sewers shall not be measured but shall be subsidiary to the item of "Storm Sewers" unless shown as a bid item on the Plans. When shown as a bid item "Sewer Excavation (Common)" for pipe storm sewer will be measured by the cubic meter actually removed except that no measurement will be made of material removed outside of a volume bounded by vertical planes 150 millimeters outside the external diameter of the pipe and a plane at right angles to the theoretical sides of the excavation through the flow line of the sewer.

When shown as a bid item "Sewer Excavation (Rock)" for pipe storm sewer will be measured by the cubic meter actually removed except that no measurement will be made of material removed outside of a volume bounded by vertical planes 150 millimeters outside the external diameter of the pipe and a plane at right angles to the theoretical sides of the excavation and a distance below the flow line of the sewer equal to the thickness of the wall of the pipe plus 150 millimeters.

The Engineer may elect to use the quantities shown on the Plans for basis of payment for excavation. When the Plans have been altered or when disagreement exists between the Contractor and Engineer as to the accuracy of Plan quantities in any location or the entire project, either party shall have the right to request and use the quantities involved to be measured.

(b) Reinforced Concrete Box Storm Sewer.

The quantities of the various items that constitute the completed and accepted structure shall be measured for payment.

Only accepted work will be included and the dimensions will be those shown on the Plans or ordered in writing.

Concrete and reinforcing steel shall be measured as provided in Division 700.

When shown as a bid item "Sewer Excavation (Common)" and "Sewer Excavation (Rock)" for reinforced concrete box storm sewer shall be measured by the cubic meter actually removed except that no measurement will be made of material outside of a volume bounded by vertical planes 300 millimeters outside the footing.

814.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per meter for pipe "Storm Sewer" of the various sizes and types, per each for "End Sections" of the various size and types, per cubic meter for the classes of "Concrete", per cubic meter for "Sewer Excavation (Common)" when shown as a bid item, for "Sewer Excavation (Rock)" when shown as a bid item and per kilogram for "Reinforcing Steel", which prices shall be full compensation for furnishing and placing all materials, for all labor, equipment, tools, and incidentals necessary to complete the work.

No payment will be made for cement mortar or plastic joint compound for grouting joints.

If the item of "Sewer Excavation (Common)" is the only sewer excavation item shown in the Contract and rock is encountered in the excavation for the sewer, "Sewer Excavation (Rock)", shall be added and paid for in accordance with the provisions of Division 100.

SECTION 815

SIDEWALKS AND STEPS

815.01 DESCRIPTION.

This work shall consist of the construction of concrete sidewalks, and steps, in accordance with these Specifications and as shown on the Plans or established by the Engineer.

BID ITEMS
Sidewalk Construction (*) (**).
Class A Concrete (Misc.).
Reinforcing Steel.

* Thickness.
** "AE" denotes air-entrained concrete.
No entry denotes concrete without air.

815.02 MATERIALS.

Materials shall conform to the requirements provided in the Materials Division.

Portland Cement	Section 2000
Fly Ash	Section 2000
Water	Section 2400
Coarse Aggregate	Section 1100
Fine Aggregate	Section 1100
Mixed Aggregate	Section 1100
Reinforcing Steel	Section 1600
Preformed Joints Type B	Section 1500
Joint Sealing Compound	Section 1500

815.03 CONSTRUCTION REQUIREMENTS.

(1) Excavation. Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the forms. The foundation shall be shaped and compacted to a firm even surface conforming to the section shown on the Plans. All soft and yielding material shall be removed and replaced with acceptable material.

(2) Forms. Forms shall extend for the full depth of the concrete. All forms shall be straight, free from warp and of sufficient strength to resist the pressure of the concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.

Slipform equipment may be approved by the Engineer and used on a satisfactory performance basis.

(3) Mixing and Placing Concrete. Unless otherwise specified on the Plans, concrete sidewalks and steps shall be constructed in a single course of Class A Concrete. The foundation shall be thoroughly moistened immediately prior to the placing of the concrete. The proportioning, mixing and placing of the concrete shall be in accordance with the requirements for the class of concrete specified.

The surface shall be finished with a wooden float or as otherwise directed by the Engineer. No plastering of the surface will be permitted.

All outside edges of the slab and all joints shall be edged with a six millimeter radius edging tool.

(4) Reinforcement. Reinforcing steel for steps or sidewalks shall be placed as indicated on the Plans. Bars shall be supported on metal bar chairs and shall be securely wired to prevent displacement during the placing of the concrete.

(5) Curing. Sidewalks and steps shall be cured immediately after the finishing operations in accordance with the requirements for Section 701.

(6) Contraction, Construction, and Expansion Joints. Contraction joints shall be formed at intervals shown on the Plans or if not shown, they shall be at intervals designated by the Engineer. The contraction joints shall be formed by placing a metal template having a minimum thickness of three millimeters into the concrete for at least 1/3 of the depth of the concrete or by cutting entirely through the fresh concrete with a trowel.

Expansion joints shall be constructed at the locations, of the dimensions, and of the materials shown on the Plans or as directed.

Construction joints shall be formed around all appurtenances such as manholes, utility poles, etc., extending into and through the sidewalk and six millimeter Type B preformed joint filler shall be installed in these joints. Expansion joint filler of the thickness indicated shall be installed between concrete sidewalks and any fixed structure such as a building or bridge. This joint filler or expansion joint material shall extend for the full depth of the walk.

The edges of contraction, construction, and expansion joints shall be rounded with a six millimeter radius edging tool.

(7) Backfilling. The area adjacent to new sidewalks or steps shall be backfilled and satisfactorily compacted with suitable material. Adequate precautions shall be observed to prevent injury to the sidewalks or steps during the compacting operations.

Excess excavated material, remaining after the backfilling has been completed, shall be disposed of as indicated on the Plans or as directed by the Engineer, and the entire area shall be left in a neat and presentable condition.

815.04 METHOD OF MEASUREMENT.

Excavation for the construction of sidewalks and steps shall not be measured separately for payment but shall be considered as subsidiary work except when such excavation can be considered as a part of, and can be measured in conjunction with, the roadway excavation. In such instances the excavation shall be included in the quantity of roadway excavation computed as a pay item of the Contract.

New sidewalk shall be measured by the square meter of the various thickness indicated.

Steps shall be measured by the cubic meter of Class A Concrete (Misc.).

Reinforcement shall be measured by the kilogram as provided in Section 703.

815.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per square meter for "Sidewalk Construction" and "Sidewalk Construction (AE)" of the various thickness indicated, or per cubic meter for "Class A Concrete (Misc.)" and per kilogram for "Reinforcing Steel" for steps, which prices shall be full compensation for furnishing and placing all materials, for excavation except as provided above, and for all labor, tools, equipment and incidentals necessary to complete the work.

SECTION 816

TEMPORARY SURFACING

816.01 DESCRIPTION.

This work shall consist of the placing and spreading of aggregate on areas designated by the Engineer to be temporary crossings and temporary routes of ingress and egress to residences and places of business adjacent to or near the project.

BID ITEM
Temporary Surfacing Material.

816.02 MATERIAL.

Temporary surfacing material will have no requirements as to standard methods of testing of aggregates except that it shall be approved by the Engineer and of such quality that when spread will allow vehicular travel during wet and rainy periods.

816.03 CONSTRUCTION REQUIREMENTS.

Temporary surfacing is to be performed in conjunction with the requirements of Section 107 and does not relieve the Contractor of his responsibility to the traveling public.

Cross roads, side roads, approach roads, culvert or bridge detours and temporary roads to residences or places of business when ordered by the Engineer shall be shaped to a reasonable cross section to prevent ponding of water. The surface shall be smoothed by blading and temporary surfacing material uniformly spread on locations ordered by the Engineer in the amount and at the time that will allow vehicular travel during wet and rainy weather.

816.04 METHOD OF MEASUREMENT.

This item shall be measured by the cubic meter of temporary surfacing material in the vehicle at the time and place of unloading.

The Engineer may accept commercial scale tickets for this item with a conversion factor to be used as specified in Section 109. The use of commercial scale tickets as a source document will be at the option of the Engineer.

816.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price set per cubic meter for "Temporary Surfacing Material", which price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 817

RAILROAD SIGNING

817.01 DESCRIPTION.

This work shall consist of furnishing and installing all necessary equipment and materials to complete reflectorized advance-warning and/or railroad crossing signs in accordance with these Specifications and as shown on the Plans or established by the Engineer.

BID ITEMS
Reflectorized Railroad Crossing Signs.
Reflectorized Advance-Warning Signs.

817.02 MATERIALS.

Materials shall conform to the requirements provided in the Materials Division.

Post	Section 2300
Preservative Treatment for Timber	Section 2300
Metal Sheets	Section 1600
Reflective Sheeting	Section 2200
Center Mount Reflectors	Section 2200

817.03 CONSTRUCTION REQUIREMENTS.

Unless noted otherwise on the Plans all parts of the signs and posts shall be furnished and erected by the Contractor. The signs shall be of the size, shape, and dimensions and shall be processed and marked as designated on the Plans.

The types and grades of materials shown on the Plans or provided in this Specification shall be manufactured and installed in accordance with best standard practice and shall show evidence of first-class workmanship.

The signs shall be fabricated, processed and assembled as completely as practicable in the factory prior to shipping to the project. In any event, all silk screening shall be done and the process color allowed to dry in a protected location unexposed to weather or dust.

The posts shall be set to the required depth in the ground and the backfill firmly tamped in place. The post shall be carefully plumbed and set so that the face of the sign, when attached to the post shall face slightly away from the road at an

angle of approximately 93 degrees to the centerline of the highway.

Advance-warning signs shall be placed at the location shown on the Plans or designated by the Engineer. In urban areas, warning signs shall be erected 75 meters in advance of the railroad, while in a residential or business district they shall be placed 30 meters to 75 meters in advance of the railroad, and in rural areas 230 meters to 300 meters in advance, subject to adjustment to local conditions.

Railroad-crossing signs shall be placed at the location shown on the Plans or as designated by the Engineer.

817.04 METHOD OF MEASUREMENT.

Reflectorized advance-warning signs and reflectorized railroad- crossing signs shall be measured by the number of signs complete in place.

817.05 BASIS OF PAYMENT.

The completed and accepted work, measured as provided above, shall be paid for at the contract unit price per each for "Reflectorized Railroad-Crossing Signs" or "Reflectorized Advance-Warning Signs", which price shall be full compensation for furnishing, installing and screening, for all labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 818
UNDERDRAINS

818.01 DESCRIPTION.

This work shall consist of constructing underdrains using pipe and granular filter material, underdrain pipe outlets, and blanket drains using granular material in accordance with these Specifications, and as shown on the Plans or established by the Engineer.

BID ITEMS

* Pipe Underdrains (Type **).

Aggregate for Blanket Underdrains.

* Size, Diameter.

** Type.

818.02 MATERIALS.

Materials shall conform to the requirements provided in the Materials Division.

	Aggregate	
Aggregate for Underdrains		Section 1100

Type Designation	Underdrain Pipe	
B	Perforated Clay Pipe	Section 1900
F	Perforated Corrugated Metal Pipe	Section 1900
H	Polyvinyl Chloride Pipe	Section 1900
L	Corrugated Polyethylene Tubing	Section 1900
	Underdrain Outlet Pipe	
A	Clay Pipe	Section 1900
E	Corrugated Polyethylene Tubing	Section 1900
G	Corrugated Metal Pipe	Section 1900
K	Polyvinyl Chloride Pipe	Section 1900
Special	Clay Drain Tile	Section 1900

The Plans will indicate the type or types of pipe and aggregate permitted. If the type is not indicated on the Plans any of the types listed above will be permitted. All underdrain pipes shall have a nominal minimum inside diameter of 150 millimeters unless shown otherwise on the Plans.

818.03 CONSTRUCTION REQUIREMENTS.

The exact location and layout of underdrains as shown on the Plans shall be subject to revision by the Engineer as de-

termined during construction. Materials for underdrains shall not be ordered until quantities, based on field investigation, are furnished by the Engineer.

(a) Excavation for Pipe Underdrains.

Trenches for all lateral and longitudinal interceptor drains shall be excavated to the dimensions, depths and elevations, in relation to the stratigraphy, as shown on the Plans or ordered by the Engineer. In case of a conflict, where the actual elevation of the strata or stratum to be intercepted is found to vary from Plan elevation, the stratigraphy shall govern in the installation of underdrains. When necessary, the trench shall be adequately shored or sheeted to insure safe and satisfactory construction and backfilling. Trench bottoms for perforated pipe in firm material (no mucky or soupy condition existing) shall be constructed to permit the placing of 25 millimeters of aggregate for pipe underdrains underneath the pipe. When Type B pipe is used the bells shall be bedded into the backfill material to provide uniform grade and support under the pipe.

If unstable material is encountered in the bottom of the trench, the drain pipe shall be placed upon an insulating course of aggregate for pipe underdrains of sufficient thickness (maximum of 75 millimeters) to insure proper movement of water without danger of sealing or mudding off the underdrain and to maintain proper alignment and grade of the pipe. Insulating courses of aggregate will be permitted under perforated pipe only. If the unstable material is also permeable to the extent that water is lost through the bottom of the trench as determined by the Engineer, the drain shall be lowered into impermeable material.

Minimum width of trench shall be 200 millimeters plus the exterior diameter of the underdrain pipe unless otherwise shown on the Plans.

Surplus excavated material shall be disposed of by the Contractor at locations approved by the Engineer.

(b) Excavation for Blanket Underdrains.

Excavation shall be in accordance with the location, lines, grade and elevations as indicated on the Plans or as ordered by the Engineer. The blanket drain shall rest upon the bedrock or other suitable material as indicated on the Plans or as determined by the Engineer. Irregularities on the bedrock surface shall be so shaped that undrained pockets are not formed. In suitable material the roadbed surface to receive the blanket

drain shall be rolled and shaped to the proper crown. Pipe underdrains constructed in connection with the blanket underdrains shall be constructed to the lines, grades and elevations shown on the Plans or in accordance with field conditions as ordered by the Engineer prior to placing the aggregate for blanket underdrains.

(c) Laying Underdrain Pipe.

All underdrain pipe shall be laid carefully to line and grade. All pipe shall be laid on a minimum grade of one percent unless otherwise shown on the Plans. Type B pipe shall be laid with bell ends upgrade and with the spigots fully extended into the bells. The upper 1/2 of the joints shall be grouted in accordance with the provisions of Section 814. All dead ends of pipe underdrains shall be completely closed with a concrete cap.

Metal pipe shall be joined by means of approved coupling bands furnished by the pipe manufacturer. All junctions and turns shall be made with wyes, tees, and bends. Cold and flame cutting of metal pipe in the field is permissible by direction of the Engineer. Cut surfaces shall be painted with an approved zinc rich paint.

Perforations shall be laid down unless otherwise indicated on the Plans.

(d) Laying Outlet Pipe.

All outlet pipe shall be laid on a minimum of one percent grade unless otherwise shown on the Plans. Metal outlet pipe shall be placed with ends abutting and joined with manufacturer's coupling bands and shall be made watertight. Joints of Type A pipe shall be grouted in accordance with the provisions of Section 814 and shall be watertight. Outlet pipe shall be laid only on stable impermeable material.

(e) Backfilling Pipe Underdrains.

Backfilling the trenches of lateral and longitudinal underdrains shall not be started until approved by the Engineer. The trenches shall be backfilled to the elevations shown on the Plans with aggregate for pipe underdrains. The backfill material shall be placed in such a manner as to prevent formation of large cavities in the backfill and walls of the trench. Overbreakage due to blasting of rock in trench excavation and widening due to caving of trench walls or overbreakage at construction outcrops shall be backfilled with aggregate for underdrains.

Where a portion of the trench above the underdrain backfill aggregate is to be filled with earth it shall be filled with material that will compact satisfactorily. This material shall be placed in layers and compacted to a density equal to or greater than that required for the adjacent material with a minimum of 90 percent of standard compaction of the soil used.

(f) Backfilling of Blanket Underdrains.

Backfilling of blanket underdrains shall not be started until the pipe underdrain installation and the foundation for the blanket underdrain are approved by the Engineer. The blanket shall be backfilled to elevations shown on the Plans with aggregate for blanket underdrains or with the type of aggregate specified in the Plans. All irregularities of the bedrock surface shall be backfilled with aggregate for blanket underdrains. At no point shall the blanket underdrain be less than 300 millimeters thick.

When blanket underdrains are constructed over lateral or longitudinal underdrains all earth, mud, etc., that may have collected in the top portion of the pipe underdrain backfill shall be removed so that the aggregate of the blanket underdrain will be in direct contact with the aggregate backfill of the lateral or longitudinal underdrains.

The lateral drain trench under the blanket underdrain shall be backfilled and rounded to an elevation of approximately 150 millimeters above the top of the trench and shall be maintained at the rounded elevation free from mud or other objectionable material until the aggregate for the blanket underdrains is placed thereon.

If necessary, in order to form a stable layer or course, the aggregate shall be sprinkled with water during the process of spreading and rolling. The sprinkling shall be performed in such a manner that the force of the water will not wash the finer material to the bottom of the lift.

When concrete pavement or earth backfill material is to be placed over the blanket underdrain, the top 100 millimeters of the underdrain shall be composed of fine aggregate meeting the requirements of Section 1100, or other approved granular aggregate provided these fine aggregates do not have more than two percent passing the 75 micrometer sieve (wash).

(g) Pipe Underdrain Outlets.

Outlets shall have a concrete flume or other approved type of flume and shall be constructed at the outlet end of pipe un-

derdrains as indicated on the Plans. The outlet flume shall be so constructed and adjusted that the flume is flush with the finished shoulder slope. Concrete outlet flumes shall be constructed of Class A Concrete.

(h) Underdrain Markers.

One guidepost shall be erected, to mark each outlet flume for pipe underdrains, at the location shown on the Plans or directed by the Engineer. Guideposts may be either a 150 millimeter diameter treated wood post or a 4.5 kilogram per meter galvanized or baked on enamel metal channel post.

(1) Wood Guideposts. Guideposts for this work shall be set in accordance with Section 808. The upper 450 millimeters of the wooden post shall receive two coats of aluminum paint, the upper 300 millimeters of each wooden post shall receive a third coat of international orange enamel paint.

(2) Metal Guideposts. The upper 300 millimeters of galvanized or baked on enamel metal channel posts shall receive one coat of International orange enamel paint. Guideposts used for this work shall be measured and paid for in accordance with Section 808, and the quantities shall be included in the quantity of guideposts shown in the Contract.

818.04 METHOD OF MEASUREMENT.

Pipe underdrains shall be measured by the meter along the centerline of the underdrains from the end of the pipe to the end or the center of junctions. No measurement shall be made for excavation, disposal of surplus excavated materials, aggregate for underdrains required to fill the trenches, concrete outlet flumes or other types of outlets designated on the Plans to be constructed at the outlet ends of the underdrains. Such work shall be considered as subsidiary work pertaining to the item of pipe underdrains.

Aggregate for blanket underdrains shall be measured by the metric ton or the cubic meter of aggregate as shown in the Contract. When bids are shown in the Contract to be taken by the cubic meter, this item shall be measured in cubic meters in the vehicle at the time and place of unloading. When bids are shown in the Contract to be taken by the metric ton this item shall be measured in metric tons in the vehicle at the time and place of unloading or at such other points as may be designated by the Engineer. Deductions will be made for all moisture in the material when measured by the metric ton. Moisture determination shall be in accordance with Section 2500 of the Materials Division.

The excavation for blanket underdrains shall be measured by the cubic meter and shall be included in the quantity of the various classes of "Excavation for Highway."

818.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price or at an adjusted unit price determined as hereinafter described, per meter for the various sizes and several types of "Pipe Underdrains", and per metric ton or per cubic meter for "Aggregate for Blanket Underdrains", which prices shall be full compensation for furnishing, transporting, delivering, and placing all materials, for all excavations and backfilling of pipe underdrains and for all labor, equipment, tools and incidentals necessary to complete the work.

In event that construction conditions warrant the construction of underdrains at elevations lower than shown on the Plans an adjusted unit price shall be determined as follows: For the determination of an adjusted unit price the underdrain shall be considered in sections of three meters in length, beginning at one end of the underdrain. If the average bottom of excavation elevation of a three meter section is not greater than 300 millimeters below the elevation shown on the Plans, no adjustment will be made in the unit price and the Contract unit price shall apply.

If, upon written order of the Engineer, a three meter section must be excavated to an average elevation of more than 300 millimeters but not more than 600 millimeters below the elevation shown on the Plans, the unit price per foot for that section shall be 125 percent of the Contract unit price. When the average bottom of excavation elevation of a section is more than 600 millimeters but not more than one meter below the elevation shown on the Plans, the adjusted unit price shall be 150 percent of the Contract unit price. If the bottom of excavation is more than one meter below the elevation shown on the Plans, the adjusted unit price per foot shall be 150 percent of the Contract unit price plus 25 percent of the Contract unit price for each 300 millimeter increment or fraction thereof below the one meter depth.

In event that construction conditions warrant the construction of the blanket underdrain at elevations lower than shown on the Plans, the additional excavation shall be paid for by the cubic meter at the unit price bid for the various classes of "Excavation for Highway" and no adjusted price shall apply.

SECTION 819

CONTRACTOR CONSTRUCTION STAKING

819.01 DESCRIPTION.

Contractor Construction Staking shall consist of establishing or re-establishing the project centerline; referencing or rereferencing all necessary control points; running a level circuit to check or reestablish plan bench marks; set other bench marks as needed; take any original cross sections needed that are not incorporated in the plans; stake right-of-way or re-stake right-of-way where needed if it has been previously staked and perform all construction layout and reference staking necessary for the proper control and satisfactory completion of all structures, grading, paving, drainage and all other appurtenances required for the completion of the construction work and acceptance of the project.

BID ITEM

Contractor Construction Staking.

819.02 CONSTRUCTION REQUIREMENTS.

The Contractor personnel performing the construction staking shall work under the direct supervision of qualified engineering or surveying personnel who are trained and experienced in construction layout and staking of the type and kind required in the Contract and who are acceptable to the Engineer.

All stakes, references, line, grades and batter boards which may be required for the construction operations shall be furnished, set and properly referenced by the Contractor in a manner consistent with standard engineering practices and in accordance with the Department's standard prescribed procedures or alternate procedures approved by the Engineer. The Contractor shall be solely and completely responsible for the accuracy of the line and grade of all features of the work. Any errors or apparent discrepancies found in previous surveys, plans, specifications or special provisions shall be called to the attention of the Engineer by the Contractor for correction or interpretation prior to proceeding with the work.

Field notes shall be kept in standard, bound field note books in a clear, orderly and neat manner consistent with standard engineering practices and in accordance with the Department's note book procedures. The Contractor shall provide the note

books which shall become the property of the Department of Transportation upon completion of the project. The field note books shall be subject to inspection by State project personnel at any time.

The Contractor shall be responsible for the placement and preservation of adequate ties and references to all control points, whether established by him or found on the project, necessary for the accurate re-establishment of all base lines or centerlines shown on the Plans. All land ties (i.e. section corners, fractional section corners, etc.) that may be lost or destroyed during construction shall be carefully referenced and replaced in accordance with KSA 58-2011. A copy of the completed survey and references to the corner or accessory shall be filed with the Secretary of State and with the County Surveyor for the county or counties in which the survey corner exists within 30 days of the date the activity is completed.

On road projects, the level circuit to check the plan bench marks shall be run the full length of the project. At important bridge sites the circuit shall include four bench marks, if possible, two on each end of the structure.

The Engineer will make all necessary final checks, measurements and surveys that involve the determination of final pay quantities. He may check the accuracy and control of the work, as established by the Contractors construction staking, at any time as the work progresses. These checks made by the Engineer in no way relieves the Contractor of his responsibility for the accuracy of the engineering layout or the final result of construction accuracy.

The supervision of the Contractor's construction engineering personnel shall be the responsibility of the Contractor; and, any deficient engineering layout or construction work which may be the result of inaccuracies in his staking operations or of his failure to report inaccuracies found in work previously done by the Department shall be corrected at the expense of the Contractor and at no additional cost to the Department.

In order to expedite the commencement of construction operations, the staking operation may commence prior to the issuance of the Notice to Proceed. The Contractor shall obtain approval of the Engineer prior to commencing the staking.

819.03 BASIS OF PAYMENT.

(a) Contractor Construction Staking as specified herein shall be paid for on a lump sum basis which shall include furnishing all necessary personnel, engineering equipment and supplies,

materials, filing fees, transportation and work incidental to the accurate and satisfactory completion of the work. Partial payment will be made as follows:

(1) On the first estimate after some survey work has been done, 25% of the amount bid for Contractor Construction Staking may be paid.

(2) When work amounting to 5% of the original contract amount has been completed, 40% of the amount bid for Contractor Construction Staking may be paid.

(3) When work amounting to 25% of the original contract amount has been completed, 60% of the amount bid for Contractor Construction Staking may be paid.

(4) When work amounting to 50% of the original contract amount has been completed, 80% of the amount bid for Contractor Construction Staking may be paid.

(5) When work amounting to 70% of the original contract amount has been completed, 95% of the amount bid for Contractor Construction Staking may be paid.

(6) When all field books and records have been furnished to the Engineer, 100% of the original contract amount bid for Contractor Construction Staking will be paid.

No adjustment will be made in the Lump Sum Bid Price because of overruns or underruns in original contract items developed in the process of construction.

(b) The term "Original Contract Amount" used in this Specification shall be construed to mean the total dollar value of the original contract, including all bid items shown in the contract.

SECTION 820

MOBILIZATION

820.01 DESCRIPTION.

This item shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to the project site; for the establishment of all offices, buildings and other facilities necessary for work on the project, and for all other work and operations which must be performed or costs incurred prior to beginning work on the various items on the project site.

BID ITEM
Mobilization.

820.02 BASIS OF PAYMENT.

(a) Partial Payments.

Partial payments may be made as follows:

(1) When work amounting to 5 percent of the original contract amount has been completed, 25 percent of the Contract amount for the item of mobilization or 2.5 percent of the original Contract amount whichever is lesser, will be paid.

(2) When work amounting to 10 percent of the original Contract amount has been completed, 50 percent of the Contract amount for the item of mobilization or 5.0 percent of the original Contract amount whichever is lesser, will be paid.

(3) When work amounting to 25 percent of the original Contract amount has been completed, 60 percent of the Contract amount for the item of mobilization or 7.5 percent of the original Contract amount whichever is lesser, will be paid.

(4) When work amounting to 50 percent of the original Contract amount has been completed, 100 percent of the Contract amount for the item of mobilization or 10 percent of the original Contract amount whichever is lesser, will be paid.

(5) Upon acceptance of the Contract, payment of any amount in excess of 10 percent of the original Contract amount will be paid.

(b) The term "Original Contract Amount" used shall be construed to mean the total dollar value of the Original Contract, including all bid items shown in the Contract.

When computing the percentage of the original Contract amount completed, do not include monies earned for Mobili-

zation, materials stored, Traffic Control (when bid as lump sum) and Contractor Construction Staking.

SECTION 821

TRAFFIC CONTROL

821.01 DESCRIPTION.

This work shall consist of furnishing, erecting, moving, cleaning, replacing, maintaining and removing signs, barricades, lights and other traffic control devices as shown on the Plans, Traffic Control Plan, or as required by the Engineer or as proposed by the Contractor and approved by the Engineer.

BID ITEM

	Pay Unit
Construction Signs (0 to 0.85 Sq. m)	Each Per Day
Construction Signs (0.86 to 1.45 Sq. m)	Each Per Day
Construction Signs (1.46 Sq. m and over)	Each Per Day
Construction Barricades (Type I or II)	Each Per Day
Construction Barricades (Type III—1.2 to 2.4 Lin. m)	Each Per Day
Construction Barricades (Type III—2.7 to 4.2 Lin. m)	Each Per Day
Construction Warning Light (Type "B" High Intensity)	Each Per Day
Reflectorized Drum	Each Per Day
Advance Warning Flashing or Sequencing Arrow Panels	Each Per Day
Temporary Traffic Signals	Lump Sum
Temporary Pavement Marking, Reflectorized	
100 mm Broken Lane Marking (*)	Per Km./Line
100 mm Solid Lane Marking (*)	Per Km./Line
Temporary Striping	Per Km/Line
Object Markers	Each Per Day
Vertical Panels (Single Type)	Each Per Day
Vertical Panels (Back to Back Type)	Each Per Day
Tubular Markers	Each Per Day
Traffic Control	Lump Sum

* Denotes Type

821.02 MATERIALS.

Materials shall conform to the requirements specified in the Materials Division.

Reflective Sheeting	Section 2200
Construction Warning Lights	Section 1700
Nonmetallic Drums	Section 1700
Reflective Temporary Pavement Marking	Section 2200

821.03 CONSTRUCTION REQUIREMENTS.

The Contractor shall provide, erect, remove, relocate, clean, replace and maintain at all times during the progress or tem-

porary suspension of the work, suitable signs, barricades, fences or other necessary traffic control devices in accordance with details shown on the Plans, the Traffic Control Plan, or as directed by the Engineer.

The Contractor may develop an alternate Traffic Control Plan to be submitted to the Engineer for approval prior to its use.

The safe and satisfactory movement of traffic through the project is of paramount importance and shall be the responsibility of the Contractor.

When the Plans specifically provide that traffic be carried through construction, no detour will be provided for traffic during the construction of the project and the Contractor shall not route traffic on a detour without the written permission of the Engineer.

The Contractor shall furnish all necessary posts, skids, easels and supports as may be required for proper installation of traffic control devices. The size, shape, color and placement of all signs, barricades, mountings and devices shall comply with the details shown on the Plans, and/or the Traffic Control Plan, or the current edition of the M.U.T.C.D. The size and layout of the message on the signs shall comply with the latest edition of "Standard Highway Signs and Standard Alphabets for Highway Signs" as approved by the A.A.S.T.H.O. and the F.H.W.A., U.S.D.O.T.

Supports used for mounting signs or devices for temporary conditions shall be constructed to yield upon impact to minimize hazards to the motorists. Additional supports may be placed on the back side of signs in the form of bracing for resisting wind currents. Guy wires and tie-downs will not be allowed.

All signs, barricades, drums and markers shall be reflectorized with high performance sheeting. The message and border shall be opaque color as required for day time use unless shown otherwise on the Plans or Traffic Control Plan.

All detours signed by the Contractor will utilize high performance sheeting unless otherwise shown on the Plans.

Traffic cones and tubular markers shall be a minimum of 450 millimeters in height with a broadened base and may be constructed of polyethylene or other material to withstand impact without damage to themselves or to vehicles. 700 millimeters shall be the minimum height of cones and tubular markers used on freeways and other high-speed roadways. Orange shall be the predominant color on the cones and tubular markers. The Contractor shall keep them clean and bright for max-

imum target value. For nighttime use, tubular markers shall be reflectorized with high performance sheeting or equipped with lighting devices for maximum visibility. High performance sheeting shall have a smooth, sealed outer surface which will display the same approximate color day and night.

Reflectorization on tubular markers shall be a minimum of two 75 millimeter wide bands placed a maximum of 50 millimeters from the top with a maximum of 150 millimeters between the bands. Tubular markers shall have a 56 millimeter minimum diameter and constructed in such a manner as to yield on impact and return to its original position.

Traffic cones should be used only during temporary activities where portability is advantageous and where there is adequate surveillance to see that they remain in place. Traffic cones shall not be used for nighttime operation.

All signs, barricades and traffic control devices shall comply with the current edition of the M.U.T.C.D. and shall be approved by the Engineer prior to erection on the project. They shall be furnished by the Contractor and shall remain the property of the Contractor upon completion of the project. No signs and/or traffic control devices are to be furnished or sold to the Contractor by the Secretary.

All Type III barricades placed across a roadway shall be suitably distributed across the roadway and protected at night by approved yellow flashing lights unless noted otherwise on the Plans or Traffic Control Plan. The lights shall be kept burning from sunset to sunrise. Other barricades and signs shall be protected by approved yellow steady burn or flashing lights and drums, used singly, shall be protected by flashing lights all in accordance with the details shown on the Plans or as directed by the Engineer. In case no details are shown, the M.U.T.C.D. shall govern.

Type I or II barricades left in place at night shall be equipped with Type A or C warning lights as directed by the Engineer unless noted otherwise on the Plans or Traffic Control Plan.

When it is necessary for residents living along the road to use the road which is closed to through traffic, suitable means (including the use of temporary surfacing material) shall be provided for their entrance or exit, but the general traveling public shall be excluded.

The Contractor's responsibility for the maintenance of traffic control devices on any individual item of work included in the Contract shall cease when released in writing by the Engineer.

The Engineer shall use every precaution possible to safeguard the persons and property of the traveling public on roads

on which construction work is in progress, but the failure of the Engineer to notify the Contractor to maintain barriers, lights, signals or watchpersons shall not relieve the Contractor from his responsibility.

On surfacing projects where the material is to be placed in a windrow on the roadbed, the Contractor shall provide, erect and maintain restricted traffic control signs, lights and devices as noted on the Plans or Traffic Control Plan.

Speed zones and corresponding speed limits will be as shown on the Plans or as determined by the Engineer. Restricted speed zones, when provided, shall be confined to the immediate vicinity of the work and shall be maintained over only the minimum length of the project which is practicable for the proper protection of traffic and the satisfactory prosecution of the work.

In order to eliminate all unnecessary inconvenience for the traveling public and to increase the effectiveness of signs and traffic control devices, they shall be moved ahead as the work progresses. Devices which are necessary only when work is actually being performed shall be removed from the road or completely covered with an opaque weatherproof material during periods when no work is in progress.

The signing of the project shall conform to the details included in the Plans and/or the Traffic Control Plan. The Contractor may be permitted to erect additional informative signs, provided the signs are not contrary to standard procedure.

The legend "Travel at Your Own Risk" on any sign is prohibited.

The Contractor shall designate someone from his work force at the project level who will have the responsibility for signing and traffic control on the project, which person shall be available 24 hours a day to repair, replace, remove, relocate, clean and maintain any traffic control device required or as directed by the Engineer. The Engineer will be advised of the name, local address and local telephone number of the person given this responsibility.

The Engineer shall designate a trained, qualified person at the project level who will have the responsibility and sufficient authority for assuring that the Traffic Control Plan and other safety aspects of the Contract are effectively administered.

Two-way traffic on a normal two-way roadway shall be provided whenever practicable and all operations shall be conducted in a sequence that will reduce the necessity for one-way traffic to a minimum.

When necessary to permit only one-way traffic, the Contractor shall provide courteous, competent flaggers to direct traffic and to provide for the satisfactory operation of one-way traffic. Flaggers shall be equipped with hand signaling signs mounted on suitable staffs (1.5 meters as measured from the bottom of the sign) and must wear distinctive uniforms while directing or flagging through construction upon the highways. Every flagger while on duty shall wear an orange vest and headgear of the same color. For night time conditions similar outside garments shall be reflectorized. Flaggers' hand signaling signs shall be as specified in the latest edition of the M.U.T.C.D. A Contractor may use uniformed enforcement officers as flaggers in lieu of the above uniformed flaggers. An enforcement officer when used as a flagger by Contractors shall wear his official uniform with badge. All flaggers shall know and observe all regulations prescribed for flaggers. The latest edition of the instructions shall apply and copies may be obtained from the Engineer. The flaggers' uniforms and hand signal signs shall be provided by the Contractor.

When necessary to permit one-way traffic, temporary traffic signals may be used in lieu of flaggers for controlling traffic when approved by the Engineer. Continued use will be based upon satisfactory performance of the system to effectively move traffic through the area. When flaggers are required and used, they shall not be paid for separately but shall be considered as subsidiary to other bid items. If the Contractor is permitted to use temporary traffic signals in lieu of flaggers, they shall not be paid for separately but shall be considered subsidiary to other items of the Contract. If temporary traffic signals are shown as a bid item in the Plans and part of the Traffic Control Plan they shall be paid for as temporary traffic signals.

Flaggers may not be required if a satisfactory system of lights, warning signs and barricades, meeting the approval of the Engineer, are provided. The lighting system shall include automatic flashing lights placed in such a position as to adequately warn traffic of the restricted traffic zone ahead.

Pilot cars when used shall be light "pickup" trucks or other approved vehicles, preferably carrying the Contractor's monogram or company insignia, equipped with signs reading "Pilot Car-Follow Me". Two signs shall be mounted on the vehicle so as to be clearly visible from both directions. The bottom of the signs shall be mounted a minimum of one foot above the top of the vehicle.

The pilot car while on duty shall be used exclusively to lead and assist traffic and shall not be used for other purposes.

While on duty the pilot car shall be kept in continuous operation causing no delay to traffic for reasons such as refueling, lunch, etc. The work shall be so coordinated that the pilot car shall make a round trip in 15 minutes or less unless designated otherwise by the Engineer.

Where specified, the Contractor shall furnish, install and maintain an advance warning flashing or sequencing arrow panel. It shall be mounted on a portable chassis and shall be operated continuously when necessary to divert traffic. Operational ability of the advance warning flashing or sequencing arrow panels shall comply with the M.U.T.C.D. The lamp intensity for the advance warning flashing or sequencing arrow panel shall be adjusted to prevent an unnecessary blinding effect and to compensate for daytime and nighttime light conditions so that the arrow panel message is legible for a minimum distance of one kilometer. The lamp intensity, for flashing or sequencing arrow panels, shall be controlled by an automatic solar cell switch, backed by a manual switch, capable of dimming 50 percent from the rated lamp voltage for nighttime operation. The flashing rate of the lamps shall not be less than 25 nor more than 40 flashes per minute. Minimum lamp "on time" shall be 50 percent for the flashing arrow and 25 percent for the sequential chevron. The arrow panel lamps or lenses shall be recess mounted or, alternately equipped with an upper hood of not less than 180 degrees, and the color of the light emitted shall be yellow.

Unless approved otherwise, all work shall be performed during daylight hours. Whenever practical, all vehicle equipment, tools, and materials, except necessary barricades and lights, shall be parked and/or stored off the right-of-way or far enough from the edge of pavement to provide clearance of at least nine meters.

Fully reflectorized non-metallic drums used for channelizing traffic, lane closures and marking of specific projects shall meet the requirements of the M.U.T.C.D., and the drums shall be of the following general specifications:

Configuration. The drums shall be approximately one meter in height and a minimum of 450 millimeters in diameter;

Reflective Stripes. The exterior vertical surface of the drums shall have three orange and two white alternating circumferential stripes. Each stripe shall be 150 millimeters wide and shall be reflectorized. If there are non-reflectorized spaces between the horizontal orange and white stripe, they shall be no more than 50 millimeters wide. Reflective stripes shall be high

performance reflective sheeting meeting the requirements of Section 2200.

Warning Lights for Drums. Type A warning lights shall be installed on drums used singly as required and directed by the Engineer, unless noted otherwise on the Plans or Traffic Control Plan.

Type A and C warning lights used on traffic control devices shall be kept lighted from sunset to sunrise and when conditions exist, as determined by the Engineer, which tend to obscure vision. Type B (high intensity) lights shall be kept lighted 24 hours per day and shall be used on the devices shown on the Plans and/or the Traffic Control Plan. All warning lights shall be used and installed in accordance with details shown on the Plans, Traffic Control Plan, or in accordance with the M.U.T.C.D.

The Contractor shall move any sign, barricade or traffic control device from one location and re-erect it at another location as directed by the Engineer.

On bituminous base course and/or surface course projects, the Contractor shall furnish temporary striping by placing a nominal 100 millimeter wide by approximately 1.2 meters long retroreflectorized stripe on the centerline of the roadway or lane line of multi-lane roads at approximately 15 meter centers, or, in the case of severe curvature, approximately 600 millimeters long at approximately 7.5 meter centers after each lift of bituminous material has been placed unless noted otherwise on the Plans and/or Traffic Control Plan. A solid temporary stripe may also be used on the edge of pavement and on the outside edge of widening areas and ramps when deemed necessary by the Engineer. The Contractor shall maintain this striping until covered with the next lift or the project is accepted. Placement of striping will be as soon as practical after each lift is placed or as directed by the Engineer. The color of the striping used shall be in accordance with the current edition of the M.U.T.C.D. Striping may be composed of reflective paint, tape or other material approved by the Engineer. It shall be easily visible in the daylight and dark. Tape used for temporary striping shall meet the requirements of Section 2205. Paint used for temporary striping shall be a high quality commercial grade paint manufactured for that purpose with glass beads immediately applied to the paint as approved by the Engineer. Paint shall be applied at a rate to provide approximately a 0.3 millimeter wet film thickness and the glass beads at a rate of 700 grams per liter of paint. No-passing zones

should be marked with temporary signs erected and maintained by the Department unless otherwise shown on the Plans.

On other types of construction, temporary pavement markings shall be placed and maintained when shown on the Plans, in the Traffic Control Plan or as directed by the Engineer. The markings shall consist of an approved weather resistant, retroreflectorized tape, approximately 100 millimeters wide if placed on pavement that is to remain in place. The striping used will be a retroreflectorized striping meeting the requirements of Section 2205. It shall be easily visible in the daylight and dark. Temporary marking and striping tape shall be applied mechanically or manually. To assure bonding of the tape to the pavement, a truck or automobile shall be driven twice over the tape, slowly (3 - 5 KPH), in such a manner that at least one tire rides on the tape so that the tape becomes tightly adhered. A special tamping cart may be used in lieu of the vehicle provided it has a minimum load of 90 kilograms and the roller has either a deep, soft rubber surface or fiber bristles. The road surface shall be clean and dry and the surface and air temperature shall be at least 4° C and rising for Type I temporary tape and 10° C and rising for Type II temporary tape. The markings may be painted on pavement that is to be removed, abandoned or covered with another layer of pavement. Paint used shall be a commercial grade high quality paint manufactured for that purpose with glass beads immediately applied to the paint as approved by the Engineer. Paint shall be applied at a rate to provide an approximate 0.3 millimeter wet film thickness and the glass beads at a rate of 700 grams per liter of paint. Lane lines shall be solid white stripes and centerlines shall be yellow stripes approximately four meters in length, placed at approximately 11.5 meter intervals unless shown otherwise on the Plans or directed otherwise by the Engineer. No passing lines shall be double yellow stripes placed continuously for the length specified or directed. The markings shall be maintained by the Contractor until directed to be removed by the Engineer.

Where temporary pavement markings are to be placed on a surface which has existing lines or markings, the incorrect lines or markings shall be removed in accordance with Section 822.

During periods of inclement weather, or during periods of unusually heavy traffic, the Engineer may require all operations to cease in order to adequately handle the traffic. The Engineer reserves the right to require the suspension or delay

of certain operations, or the speeding up of other operations to insure a proper sequence of operations and thus aid the satisfactory movement of traffic.

The Engineer may require additional barricades, lights, flaggers, watchpersons or other traffic control devices at any time or at any place that, in his opinion, are necessary for proper protection of traffic and workers, however, approval by the Engineer of the Contractor's method of operation shall not relieve the Contractor of the responsibility of protecting the traffic.

Periodic checks of traffic control devices will be made at night by the Contractor and Department personnel in accordance with requirements determined by the Engineer.

821.04 METHOD OF MEASUREMENT.

Traffic Control will be measured by the following methods:

1. When Traffic Control is shown on the Plans and Contract as a "Lump Sum" item it shall be measured as such.

2. When bid items are shown in the Plans and Contract for individual traffic control devices used in traffic control, each sign, barricade, advance warning flashing or sequencing arrow panel, drum, object marker, tubular marker, vertical panel, and type "B" high intensity warning lights shall be measured by the unit, complete in place, each calendar day the device is required and is in place in an acceptable condition and position to meet all of the above requirements. Drums used to support vertical panels or barricades will not be measured as a pay item. A Type III barricade used at any location shall be in the length bracket shown on the Plans for that location. The actual length used within the designated length bracket shall be approved by the Engineer. Multiple Type III barricade units (minimum length of one meter each) may be used to meet the length required for any given location, and when used in such manner they shall be measured as one Type III barricade of the length bracket designated.

Measurement for payment of signs and other traffic control devices will begin on the day they are installed in place for traffic control and direction. When signs and devices are not needed for traffic control, they shall be removed or covered and will not be measured.

During non-working periods such as holidays, Sunday, etc., the list of devices in place in satisfactory condition and measured for payment on the day following such downtime will be used to determine the devices to be paid for. During these non-working periods the Contractor shall conduct a minimum of

one check per day to see that the devices are in place and in satisfactory condition. During suspended periods measurement of the devices used will be based on periodic checks conducted by the Engineer. The frequency of these checks will be as determined by the Engineer.

Units that may be used for only a portion of a day shall be paid for one full day's use regardless of the length of time they are used during that day and/or the number of times the unit may be moved or re-erected. The number of units for pay on any one day cannot exceed the maximum number of units in simultaneous use during that day.

When, in the opinion of the Engineer, any traffic control device has been damaged or becomes deteriorated to the extent it is no longer effective due to dirt, grime, scarring or discoloration, it shall be replaced or cleaned as required, as soon as possible. Payment will not be made for any traffic control devices that remain in an unacceptable condition, for an unreasonable length of time after the Contractor has been advised they are not acceptable as determined by the Engineer.

Temporary striping used on bituminous lifts will be measured per line of striping per lift, per roadway kilometer to the nearest 0.1 kilometer with an odometer. When a double yellow centerline marking is required, it shall be paid for as two lines of striping. The temporary striping for widening and decelerating lanes, accelerating lanes and ramp areas will not be paid for directly but will be considered subsidiary.

Temporary pavement marking, reflectorized, on other types of construction will be measured per kilometer per line. Words and/or symbols, when required, will be subsidiary to other bid items.

Traffic cones, when used, shall not be measured but will be subsidiary to other bid items.

Uniformed flaggers shall be subsidiary to other items unless shown as a bid item. Pilot cars, will not be measured for payment but shall be subsidiary to other bid items. Temporary traffic signals when used in lieu of flaggers will not be paid for but shall be subsidiary to other items of the Contract. Temporary traffic signals, when shown on the Plans as a bid item or as part of the Traffic Control Plan, shall be measured per unit.

Type A and C construction warning lights shall be subsidiary to other bid items.

Delineators, when shown on the Plans or Traffic Control Plan will not be measured but shall be subsidiary to other items of the Contract.

Signs and other traffic control devices will not be measured for payment for the remainder of the project once the Contractor has used all the contract working days plus any additions or deletions resulting from change orders. This in no way relieves the Contractor from his responsibility for providing all necessary signing on the project until it has been completed and accepted. Such signs will be at the Contractors own expense.

821.05 BASIS OF PAYMENT.

Signs and other traffic control devices, measured as provided above, will be paid for at the Contract unit price, which payment shall be full compensation for furnishing, installing, moving, cleaning, replacing, maintaining and removing the various items, (including all temporary striping and/or pavement marking required to be removed as a result of construction activities) and for equipment, labor and incidentals necessary to complete the work as specified.

Quantities shown on the Plans are for estimating purposes only. No adjustment in the Contract unit price will be made regardless of the amount of underruns or overruns.

(a) Partial Payments.

When Traffic Control is measured as a "Lump Sum" item then payment will be made as follows:

(1) When work amounting to 10 percent of the original Contract amount is completed, 50 percent of the amount bid for traffic control or five percent of the original Contract amount, whichever is lesser, may be paid.

(2) When work amounting to 80 percent of the original Contract amount is completed, 100 percent of the amount bid for traffic control or ten percent of the original Contract amount, whichever is lesser, may be paid.

(3) Upon completion of all work on the project, 100 percent of the amount bid for traffic control will be paid.

(b) The term "Original Contract Amount" used shall be construed to mean the total dollar value of the original Contract, including all items shown in the Contract.

When computing the percentage of the original Contract amount completed, do not include monies earned for mobilization, materials stored, traffic control (when bid as Lump Sum) and contractor construction staking.

(c) Partial payments for traffic signal installation (temporary) will be made as follows:

(1) Seventy-five (75) percent of the contract unit price for traffic signal installation (temporary) will be made after the traffic signals are initially installed and operable as approved by the Engineer.

(2) One hundred (100) percent will be paid after the traffic signals are no longer needed for the movement of traffic and have been removed and/or stockpiled on the right of way as specified in the Plans.

The price bid for "Traffic Signal Installation (Temporary)" shall be full compensation for furnishing all material, installing, relocating, electricity, electric hook-ups, operating and maintaining, removing and stockpiling of signals and for all labor, equipment, tools and incidentals necessary to complete the work as specified in the Plans.

SECTION 822

REMOVAL OF PAVEMENT MARKINGS

822.01 DESCRIPTION.

This item of work shall consist of the removal of any existing pavement markings shown to be removed on the Plans or as designated by the Engineer. This does not include traffic markings installed by the Contractor as a result of construction activities.

BID ITEM
Pavement Marking Removal (Meter).

822.02 CONSTRUCTION REQUIREMENTS.

Pavement markings shall be removed to the fullest extent possible without damage to the pavement surface. Equipment used for the removal of the markings shall be any type that will not appreciably damage the surface or texture of the pavement. All material deposited on the pavement as a result of the removal operation shall be removed as the work progresses. Where blast cleaning is used for the removal of pavement markings and such removal operation is being performed within three meters of the traveling public, the residue including dust, shall be removed immediately by methods approved by the Engineer.

Any appreciable damage or different appearance from the surrounding surface shall be repaired by the Contractor, at his expense, by methods approved by the Engineer. The Contractor shall treat, at his expense, the affected areas with any permanent or lasting material to blend in and match as well as practical, the appearance of the surrounding area. This specification in no way relieves the Contractor from his responsibilities as set forth in Section 107.

822.03 METHOD OF MEASUREMENT.

Individual pavement marking removal shall be measured by the meter removed. Any pavement marking arrows, words, or symbols shall be subsidiary to the bid item of Pavement Marking Removal.

822.04 BASIS OF PAYMENT.

Unless otherwise specified in the Plans, removal of pavement markings, as measured above, shall be paid for at the Contract unit price for Pavement Marking Removal.

SECTION 823

TERRACES AND OUTLET DITCHES

823.01 DESCRIPTION.

This work shall consist of the construction of a series of ridges and channels to form terraces across the slope at suitable spacings and with accepted grades to reduce erosion damage by intercepting surface runoff and channeling it to a suitable outlet at a nonerosive velocity. The terraces and outlet ditches shall be constructed in accordance with these Specifications and as shown on the Plans or established by the Engineer.

BID ITEMS
Terraces.
Outlet Ditches.

823.02 CONSTRUCTION REQUIREMENTS.

Terraces shall be constructed on such borrow areas or portions of areas and at other locations as designated by the Engineer. The terraces shall be constructed to an approximately uniform section at the spacings and dimensions as shown on the Plans or as directed by the Engineer to fit field conditions. Compaction of the ridges of the terraces will not be required, however, they shall be constructed by methods to provide uniform settlement. The ridge height shall include a reasonable factor for settlement.

Outlet ditches shall be constructed to the section and in accordance with the notes on the Plans at the locations as designated by the Engineer to fit field conditions.

The borrow areas shall be shaped and finished in order that final cross-sections may be taken for earthwork quantities prior to the construction of the terraces and outlet ditches, unless otherwise directed by the Engineer.

823.03 METHOD OF MEASUREMENT.

This work shall be measured by the kilometer measured on the ground surface along the centerline of the terrace or outlet ditch.

823.04 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit prices per kilometer for "Terraces" and per kilometer for "Outlet Ditch", which prices shall be full compensation for furnishing all materials, equipment, tools, labor, and incidentals necessary to complete the work. Provided, that when the quantity of Terraces or Outlet Ditches overruns or underruns the Contract quantities, the Contract unit prices shall govern regardless of the total quantity of these items performed.

SECTION 824

PERMANENT BARRICADE

824.01 DESCRIPTION.

This item of work consists of furnishing and erecting a fixed barricade at the locations as shown on the Plans.

BID ITEM
Type III Barricade (Fixed).

824.02 MATERIALS.

The materials for "Type III Barricade (Fixed)" shall conform to the specifications listed on the Plans.

824.03 CONSTRUCTION REQUIREMENTS.

The fixed barricades shall be constructed in accordance with the details shown on the Plans or established by the Engineer.

824.04 METHOD OF MEASUREMENT.

This item of work shall be measured per each installation at each location.

824.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per each installation for "Type III Barricade (Fixed)", which price shall be full compensation for furnishing all required materials, for placing all materials and for all labor, tools, equipment and incidentals necessary to complete the work.

SECTION 825

HIGHWAY SIGNING AND DELINEATION

825.01 DESCRIPTION.

Highway Signing and Delineation shall consist of furnishing and installing highway signs and delineators as shown on the Plans. The work shall be in accordance with the Plans, the M.U.T.C.D. (latest edition) and these Specifications.

BID ITEMS

* Aluminum I Beam.
Removable Legend Signs (High Performance).
Removable Legend Signs (Regular Performance).
Removable Legend Sign Overlays (High Performance).
Removable Legend Sign Overlays (Regular Performance).
Direct Screen Process Signs (High Performance).
Direct Screen Process Signs (Regular Performance).
Direct Screen Process Sign Overlays (High Performance).
Direct Screen Process Sign Overlays (Regular Performance).
Reverse Screen Process Signs (High Performance).
Reverse Screen Process Signs (Regular Performance).
Reverse Screen Process Sign Overlays (High Performance).
Reverse Screen Process Sign Overlays (Regular Performance).
** Wood Posts (***).
3 Kilograms Per Meter "U" Steel Beam Posts.
* Steel Beam Posts.
* Steel Beam Stub Post with Breakaway Base Plate.
** Breakaway Base Plates.
** Dia. Concrete Footings (#).
Type ## Delineators (### Post).

* Size and Mass.
** Size.
*** Designate for Flat Signs or for Structural Panel Signs.
# Designate for Wood Post or for Steel Post.
Designate Type.
Designate Post Length.

825.02 MATERIALS REQUIREMENTS.

Materials shall conform to the requirements specified in the Materials Division.

Aluminum I Beam	Section 1600
Fasteners	Section 1600
Steel Sign Posts	Section 1600
Reflective Sheeting	Section 2200

Zinc Rich Paint	Section 1800
Delineators	Section 2200
Delineator Posts	Section 1600
Aluminum Sheets	Section 1600

825.03 SHOP FABRICATION OF SIGNS.

(a) Description.

The signs to be furnished shall be of three types: flat sheets, structural panels and delineators. The type or types to be erected at each location shall be as shown on the Plans.

(b) Fabrication of Steel Sign Posts.

The number and size of posts have been determined from theoretical sections and are to be shown on the Plans. Before ordering, the Contractor shall determine the length of each post necessary for the sign or the assembly to provide horizontal and vertical clearance required by the Plans. Order length of post will be furnished by the Engineer.

(c) Fabrication of Sign Panels.

(1) Structural Extruded Panels. The panels for each sign shall be of the length and width specified on the Plans. The width of the top, intermediate and bottom panels shall be in the sequence shown on the Plans for each sign. In addition to the above requirements, the following shall apply:

(1.1) The ends of all panels in any one sign shall be perpendicular and the ends shall be free from cockles and burrs.

(1.2) The length tolerance of each sheet shall be three millimeters from the length shown on the Plans.

(1.3) The mismatch between the edge of a sheet and the extrusion to which it is fastened shall not exceed 800 micrometers.

(1.4) All mounting holes shall be as shown on the Plans.

(2) Flat Sheet Signs. Flat sheet signs shall be cut to the size and shape shown on the Plans. They shall be free from buckles, warp, dents, cockles, burrs and other defects caused by fabrication. Signs shall be attached to posts as shown on the Plans.

(d) Sign Legend Details.

Capital letters and numbers shall conform to the standard rounded capital letter alphabets contained in the latest edition of "Standard Alphabets for Highway Signs", as approved by A.A.S.H.T.O. and U.S.D.O.T., F.H.W.A. Letters and numbers shall be of the series as shown on the Plans.

Where lower case and initial capital letters are shown on the Plans they shall conform to the following: All initial capital letters shall be 1 1/3 times the "loop" height of the lower case letters and they shall be from a modified series "E" alphabet in which the stroke width is increased to approximately 1/5 of the height of the letter or number.

The lower case letters shall conform to the design in the latest edition of "Standard Lower Case Alphabet for Highway Signs", U.S.D.O.T., F.H.W.A.

The sign border shall be of the width specified on the Plans. The border on all signs with removable cutout legend shall be an enclosed lens, white pressure sensitive adhesive coated reflective sheeting applied directly to the sign face.

The border on all signs with a direct screen processed or a reverse screen processed legend shall be processed on the sign face. The border shall be an inset or outset border and of the color as shown on the Plans.

(e) Application of Reflective Sheeting and Black Lettering Film.

(1) Preparation of Metal. All letters, numerals, symbols and sheeting shall be cut to the required shape and dimension and holes formed at locations shown on the drawings for removable legend. The edges of holes and sheets shall be free of burrs, cockles, warp, dents and other defects.

Following fabrication, the metal to which the sheeting is to be applied shall be prepared with a class 2 chromate conversion coating as outlined in ASTM B449, "Standard Recommended Practice for Chromate Treatments on Aluminum".

The metal shall not be handled except by a mechanical device or with clean canvas gloves between the cleaning and etching operation and the application of reflective sheeting. There shall be no opportunity for metal to come in contact with greases, oils, or other contaminants prior to the application of sheeting or film.

(2) Application of Sheeting. Reflective sheeting shall not be applied when the ambient air temperature, the temperature of the metal and the sheeting is below 18° C.

(2.1) Sheets and Structural Extruded Panels. Reflective sheeting shall be applied to the treated base panels mechanically with the equipment and in a manner specified by the manufacturer of the sheeting or by a method which will produce an equivalent result.

Sign faces that comprise two or more pieces of reflective sheeting shall be carefully matched for color during fabrication

to provide uniform appearance and brilliance under both day and night illumination. Alternate, successive width sections of sheeting or panels must be reversed and consecutive to insure that corresponding edges of sheeting lie adjacent on the finished sign. Failure to comply with this requirement may result in nonuniform shading and an unacceptable contrast between adjacent widths of applied sheeting, a condition that will be cause for rejection of the sign.

At splices, pressure sensitive sheeting shall be overlapped not less than five millimeters. Heat activated sheeting may be spliced with an overlap not less than five millimeters or butted, in which case the gap between adjacent sheets shall not exceed 800 micrometers.

Only splices vertical to the edge of the structural extruded panel shall be permitted. Such splices shall be a minimum of 1.2 meters apart.

For signs fabricated from flat sheet aluminum, one butt splice or one lap splice is permitted except that splicing shall be prohibited when the sign face is to be reverse silkscreened. Splices may be either vertical or horizontal, but horizontal lap splices shall be made in such a manner that the uppermost piece overlaps the lower piece.

After aging 48 hours at 24° C the adhesion of reflective sheeting to the sign surface shall be strong enough to resist stripping from the panel when tested with a stiff putty knife.

(2.2) Detachable Numerals, Letters and Symbols. The sheeting and lettering film shall be applied to the cutout letters, numerals and symbols in a manner specified by the manufacturer of the sheeting and lettering film or by a method which will produce an equivalent result.

(f) Screen Processed Legend and Border.

Direct screen processing shall consist of processing the legend and border color on the face of the sign by the screen process method. The process color material to be used and the dry film thickness to be obtained shall be as recommended by the manufacturer of the reflective sheeting. The color of the sign face, the legend and border shall be as shown on the Plans.

Reverse screen processing shall consist of processing a transparent color over the sign face to form the legend and border. The transparent process color material to be used and the dry film thickness to be obtained shall be as recommended by the manufacturer of the reflective sheeting. The color of the sign face, legend and border shall be as shown on the Plans.

(g) Sign Identification.

The sign fabricator shall stencil or paint on the rear exposed portion of the lower right hand corner of all shield, triangular or rectangular shaped signs and in the right corner of all diamond shaped signs the following legend with black exterior grade paint.

Sign No ..... (Filled in by Sign Fabricator)
Erection Date .....(Filled in by Sign Erector)

In lieu of the stencil or paint, a reflective pressure sensitive orange sheeting with black legend may be used to form the identification.

On all signs that are less than 1.5 square meters in area the height of the legend shall be 13 millimeters.

On all signs that are 1.5 square meters or more in area the height of the legend shall be 25 millimeters.

(h) Delineators.

Delineators shall consist of the following types:

(1) Type "A" White Delineator
  (1) One 75 mm × 200 mm rectangular white reflector
  (2) One 81 mm white center mount reflector
  (3) Flexible Delineator (Type I Anchor)
  (4) Flexible Delineator (Type II Anchor)
  (5) Flexible Delineator (Type III Anchor)
(2) Type "A" Yellow Delineator
  (1) One 125 mm × 125 mm diamond yellow reflector
  (2) One 81 mm yellow center mount reflector
  (3) Flexible Delineator (Type I Anchor)
  (4) Flexible Delineator (Type II Anchor)
  (5) Flexible Delineator (Type III Anchor)
(3) Type "B" White Delineator
  (1) Two 75 mm × 200 mm rectangular white reflectors
  (2) Two 81 mm white center mount reflectors
  (3) Flexible Delineator (Type I Anchor)
  (4) Flexible Delineator (Type II Anchor)
  (5) Flexible Delineator (Type III Anchor)
(4) Type "B" Yellow Delineator
  (1) Two 125 mm × 125 mm diamond yellow reflectors
  (2) Two 81 mm yellow center mount reflectors
  (3) Flexible Delineator (Type I Anchor)
  (4) Flexible Delineator (Type II Anchor)
  (5) Flexible Delineator (Type III Anchor
(5) Type "C" Yellow Delineator
  (1) Three 125 mm × 125 mm diamond yellow reflectors
  (2) Three 81 mm yellow center mount reflectors

The 75 mm × 200 mm and 125 mm × 125 delineators should be made from aluminum sheets 1.6 millimeter thick complying

with the applicable requirements of Section 1626, and shall be covered with high performance reflective sheeting.

The 81 millimeter center mount reflectors shall comply with Section 2203 of the Materials Division.

(i) Welding.

(1) Aluminum. Aluminum shall be spot welded using equipment, methods and machine settings that are in accordance with good industrial practice.

(2) Steel. All welding of steel shall be performed in accordance with the applicable requirements of the Kansas Department of Transportation.

(j) High Performance Overlays of Existing Signs.

(1) Description: This work shall consist of applying aluminum backed sign faces to existing signs.

(2) General Requirements. The sign face shall consist of (a) a high performance reflective sheeting applied to a thin aluminum sheet. The back side of the aluminum shall have a coating of an aggressive adhesive which shall be protected by a removable liner, or (b) a high performance reflective sheeting applied to an aluminum sheet which is to be fastened to the original sign with pop rivets as shown on the Plans.

(3) Application Details: Application details for both high performance and regular performance shall be shown on the Plans.

825.04 CONSTRUCTION REQUIREMENTS.

(a) General.

The Contractor shall be responsible for the protection of, and where necessary, the relocation of existing underground electrical conduits and cables within the vicinity of footing locations. All such conduits and cables damaged by the Contractor during the progress of the work shall be repaired at his expense. At the Contractor's request, the Engineer will furnish the Contractor with the best information available regarding the locations of all underground electrical installations that occur in the vicinity of the footing areas.

Existing temporary signs that will interfere with the erection of the permanent signs that are included in the Contract shall be removed and reset by the Contractor at locations designated by the Engineer. This shall be subsidiary to other items of the Contract.

(b) Traffic Signs.

(1) Locations. All signs shall be located and staked out by the Engineer in conformance with the Plans and Specifications. The Engineer shall furnish the Contractor with the vertical measurements from the top of the pavement edge to the top of each footing at each sign location.

When Contractor Construction Staking is included in the Contract, the Contractor shall be responsible for the locating and staking of signs. Information to determine the length of each post necessary shall be furnished the Engineer by the Contractor.

The total length of posts shown on the Plans have been estimated. The Contractor shall determine the length of each post necessary for the sign or the assembly to provide the traffic clearance required by the Plans. Order length of post will be furnished by the Engineer. The Contractor may order wood posts in stock length and cut to required length in the field and holes for sign attachments drilled on the site. All field cuts and drill holes shall be treated in accordance with Section 2304.

(2) Excavation for Footings. Footing holes shall be carefully dug or drilled to the required size at the proper location. All excavation shall be disposed of within the right of way in such a manner as to blend uniformly with the existing surface and as approved by the Engineer. Immediately before placing any concrete, the Contractor shall remove all loose and uncompacted material from the bottom of the hole. Inasmuch as some of the holes are located in the bottom of the drainage ditches, it will be necessary for the Contractor to conduct this construction operation in such a manner that water will not enter any excavated holes.

The right-of-way areas on which the Contractor has performed work or used as an assembling area shall be restored to its original condition. All debris deposited by the Contractor such as packaging or waste materials shall be disposed of off the right of way.

(3) Compaction of Backfill Soil. All soil used for the backfilling of footing excavation shall be thoroughly compacted as it is placed. The backfill shall be brought up to the original ground line adjacent to footings.

(4) Concrete Footings. All ground sign footings shall be a true circle in shape. The depth of each footing shall be as shown on the Plans. The top 300 millimeters of the footing where steel posts are used shall be formed.

The footing shall be cast in place Class A Concrete conforming to the requirements of Section 402. All concrete for footings shall be rodded and vibrated in place to fill all voids.

Stub posts and metal sleeves shall be placed to the proper depth, properly aligned and secured in place as shown on the plans, prior to pouring concrete.

(5) Attachment to Stub Posts. After completion of the curing period, the post with plate shall be placed on the footing and the sign or signs mounted. After all signs have been mounted and the sign post plumbed, the bolt nuts shall be tightened to final position.

(6) Sign Positioning. Signs shall be positioned to eliminate or minimize specular reflection by positioning the vertical axis truly vertical and the horizontal axis at 93 degrees away from the center of the lane which the sign serves and from the direction of travel. Where lanes divide or on curves, sign faces shall be oriented as shown on the Plans so as to be most effective both day and night and to avoid the possibility of specular reflection.

(7) Painting Damaged Galvanized Areas. All areas where the galvanizing has been removed or damaged shall be cleaned and painted with an approved zinc rich paint.

(c) Kilometer Sign Posts and Delineator Posts.

Kilometer sign and delineator posts shall be erected at locations shown on the Plans and set at elevations such that the kilometer signs and delineator reflectors will be at the required height above the ground surfaces.

The posts shall be erected by driving, either by hand or with mechanical devices. The method of driving shall not substantially alter the cross-sectional dimensions of the posts or materially damage the coating. Battered tops will not be permitted. Posts which are bent or otherwise damaged during or after erection shall be removed from the site and replaced at the Contractor's expense. After driving, the portion of the posts above ground shall be plumb and the posts shall be firm in the ground.

(d) Construction Sequence.

In order to expedite the completion of the project and the opening of the highway, the signing Contractor may be required to prosecute his work and/or move onto the project at several different periods of time.

At the discretion of the Engineer, if the grading and surfacing work has progressed sufficiently, the Notice to Proceed for the

signing Contract may be issued and the Contractor will be expected to start the work in the areas directed by the Engineer.

After all feasible work has been accomplished, the Contractor may be issued a "Temporary Suspension of Work" in accordance with Section 108, until such time as the surfacing or other construction work has been completed or the signing Contractor is ordered to resume work. The Contractor will then be expected to complete all feasible work at that time or the balance of the signing Contract, whichever may apply.

825.05 INSPECTION, SAMPLING AND TESTING.

All signs fabricated outside the borders of Kansas will be inspected at destination. Signs manufactured in Kansas shall be inspected at the site of manufacture. The Contractor shall be responsible for and bear all costs of the alteration or replacement of all signs that are found to be defective when inspected at destination, regardless of the point of fabrication.

825.06 METHOD OF MEASUREMENT AND BASIS OF PAYMENT.

(a) Removable Legend Signs.

Payment for removable legend signs shall be made at the Contract unit price per square meter, to the nearest 0.001 square meter, of the sign face.

The unit price shall be full compensation for the signs as completely assembled and attached to the sign post or posts, which shall be full compensation for the furnishing of all materials and the performance of the following fabrication and erection work:

(1) Assembly of structural extruded panels.

(2) Application of reflectorized sheeting for background.

(3) Application of reflectorized sheeting for borders.

(4) The fabrication of all removable cutout legend, and its attachment to the sign faces shall include cutout legend reflectorized with reflective sheeting.

(5) All other work and materials necessary for the assembly and fabrication of the sign and its attachment to the post or posts.

(b) Direct Screen Process Signs.

Payment for signs assembled from structural extruded panels or sign sheeting reflectorized with reflective sheeting as shown on the Plans and with the legend and border applied

by the direct screen process as specified herein, and attaching sign or sign assemblies to sign post or posts, shall be made at the Contract unit price per square meter to the nearest 0.001 square meter of the sign face. The unit price shall be full compensation for furnishing, fabricating and attaching the sign or sign assemblies to the sign post or posts as shown on the Plans, and specified herein, including the furnishing of the structural extruded panel, sign sheet, all connections and attachments for same, furnishing and applying the reflective sheeting to the sign face, process material and screens for direct screen processing the legend and border on the reflectorized sign face and furnishing all bolts, nuts, washers, post clips and attachments and attaching sign or sign assemblies to sign post or posts, and all labor required.

(c) Reverse Screen Process Signs.

Payment for signs assembled from structural extruded panels or sign sheeting reflectorized with reflective sheeting as shown on the Plans and with the legend and border formed by reverse screen process as specified herein, and attaching sign or sign assemblies to sign post or posts shall be made at the Contract unit price per square meter to the nearest 0.001 square meter of sign face. The unit price shall be full compensation for furnishing, fabricating and attaching the sign or sign assemblies to the sign post or posts as shown on the Plans, and specified herein, including the furnishing of the structural extruded panel, sign sheet, all connections and attachments for same, furnishing and applying the reflective sheeting to the sign face, process materials and screens for reverse screen processing the legend and border on the reflectorized sign face and furnishing all bolts, nuts, washers, post clips and attachments and attaching sign or sign assemblies to sign post or posts and all labor required.

(d) Overlays of existing signs.

Overlays of existing signs shall be measured to the nearest 0.001 square meter of the sign face and paid for under the applicable bid item.

(e) Wood Posts.

Payment for wood posts for flat signs or for structural extruded panel signs shall be made at the Contract unit price per meter of each size of post in place, which price shall include the wood post, the section of 4.5 kilogram per meter flanged channel posts and fasteners for attaching structural

extruded panels to wood posts when required, the drilling of all holes and all labor, tools and equipment for placing the post.

(f) Three Kilogram Per Meter "U" Steel Beam Posts.

Payment for three kilogram per meter "U" steel beam posts shall be made at the Contract unit price per meter of posts in place, which price shall include the steel in the post, punching of the holes, protective coating and driving the post at the proper location as shown on the Plans.

(g) Steel Beam Posts and Steel Beam Stub Posts with Breakaway Base Plate.

Payment for steel beam posts and steel beam stub posts with breakaway base plate shall be made by the unit as shown on the Plans for each size and mass of post in place, which price shall include the steel beam post, the drilling of all holes, welding and hot-dipped galvanizing and all labor for placing the posts and stub posts with breakaway base plate. The breakaway base plates are not measured as a part of the linear post length.

(h) Breakaway Base Plates.

Payment for breakaway base plates shall be made at the Contract unit price per each of the various sizes, which price shall include all plates, nuts, bolts, washers and shims, welding breakaway plate, hot-dipped galvanizing and all labor, tools and equipment for the complete assembly.

(i) Concrete Footings.

Payment for concrete footings shall be made at the Contract unit price per meter of the various diameter footing for wood posts or steel posts, which price shall include all excavation, regardless of type of material encountered, for furnishing and placing concrete, for forming where required, for reinforcement and metal sleeves when required, backfilling, for all other details necessary to provide a complete footing, and for all labor, tools and equipment for the complete footing.

(j) Delineators.

Delineators shall be measured by the units of various types complete in place. Payment for delineators shall be made at the Contract unit price per each of the various types of "Delineators", which price shall be full compensation for furnishing and erecting the delineators, complete as shown on the

Plans and as specified herein, including the post, all necessary fittings and attachments and all labor necessary to complete the work.

(k) Aluminum I Beam.

Payment for Aluminum I Beams shall be made at the Contract unit price per meter for each size and mass of beam, which price shall be full compensation for furnishing and erecting all materials and for all labor, tools, equipment and incidentals necessary to complete the work.

SECTION 826

INERTIAL BARRIER SYSTEM

826.01 DESCRIPTION.

This item of work shall consist of furnishing and installing an inertial barrier system in accordance with the Plans or as directed by the Engineer and the furnishing of additional modules to be stockpiled as directed by the Engineer.

BID ITEMS
Inertial Barrier System.
Modules (*).
* Series

826.02 MATERIALS.

The unit shall consist of an Inertial Barrier System as shown on the Plans and all hardware for attachments.

All materials for the modules shall conform to the manufacturers recommendations.

826.03 CONSTRUCTION REQUIREMENTS.

The inertial barrier system shall be installed according to the manufacturers recommendation.

The mixture for the modules shall consist of 95 percent sand by mass, meeting the requirements of Type UD-1 (Sand-Gravel) in Section 1108, "Aggregates for Underdrain and other Permeable Backfills" and five percent by mass of Sodium Chloride (Rock Salt).

The moisture content of the sand shall not exceed three percent by mass and at no time shall free moisture be visible. The moisture determination shall be as provided in Section 2500.

The Contractor shall furnish and deliver the modules to the project at the locations as directed by the Engineer.

826.04 METHOD OF MEASUREMENT.

Inertial Barrier System shall be measured per each by the number of units complete in place. The modules shall be measured per each for the various series of modules furnished.

826.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per

each for "Inertial Barrier System" and per each for the various series of "Modules", which price shall be full compensation for furnishing all materials, erecting all necessary hardware for attachments, for the sand-salt mixture added to the modules, and for all labor, tools, equipment and incidentals necessary to complete the work.

SECTION 827

PLOWABLE PAVEMENT MARKERS

827.01 DESCRIPTION.

This specification covers a type of plowable, raised, prismatic, reflective pavement marker for lane marking and delineation for night time visibility.

BID ITEM
Plowable Pavement Marker (*) (**).
* Type
** Color

827.02 MATERIALS.

Materials shall conform to the requirements specified in the Materials Division.

Nodular Iron Holder	Section 2200
Reflective Marker	Section 2200

827.03 CONSTRUCTION REQUIREMENTS.

Markers shall be stored indoors and protected from any source of moisture both during shipment to the job and at the jobsite. The markers shall be maintained at a high enough temperature to prevent moisture condensation. At the time of placement both the markers and their containers shall be dry.

Before beginning pavement marker application, the Contractor shall accurately and adequately layout, by reference points, the location of all pavement markers to ensure their proper placement. Pavement markers shall not be placed on pavement surfaces that show visible evidence of cracking, checking, spalling, or failures of underlying base material. If during the pre-installation layout operation, it is determined that a marker would be placed at a point with one of the aforementioned pavement surface defects or at a pavement construction joint or within the intersection of a driveway or public street as a result of typical marker spacing, the affected marker should be relocated longitudinally a sufficient distance to a point approved by the Engineer. The distance the marker may be relocated should not exceed ten percent of the typical marker spacing. When it would be necessary to relocate the marker a distance greater than ten percent of the typical marker spacing, the affected marker should be deleted. The

reflective face of the marker shall be perpendicular to a line parallel to the roadway centerline.

At the time of installation, the pavement marker holder shall be free of dirt, dust, oil, grease, rust, moisture, or any foreign matter that will impair adhesion to the pavement. It will be the Contractor's responsibility to clean each contaminated holder by sand blasting or other acceptable procedure to remove all such foreign matter prior to installation.

The pavement shall be machined to match the bottom contour of the marker holder. The holders shall be installed the same day the slots are cut into the pavement. The adhesive shall be an epoxy adhesive complying with the requirements of AASTHO M237, Type IV.

The epoxy adhesive shall be mixed by combining component A and B in a ratio of 1:1 by volume. The epoxy adhesive requires that the mixing operation and placing of the pavement markers be done rapidly. Any mixed batch that becomes so viscous that it cannot be readily extruded from under the holder under light pressure shall not be used. The adhesive shall be maintained between 15° and 27° C before mixing. Any heating of the epoxy should be by the application of indirect heat. The adhesive shall not be heated above 50° C.

Before installing the markers, the recesses or grooves shall be blown clean of loose material and be dry. Sufficient epoxy shall be placed in the recess to ensure that all voids beneath and around the holder are filled so as to create a watertight seal around the holder. The holder shall be hand placed into the recess in such a manner as to ensure that the tips of the holder's snowplow deflecting surface(s) are below the pavement surface.

Markers shall not be placed under the following conditions:

When either the pavement or the ambient air temperature is 10° C or less;

If the relative humidity of the air is greater than 80 percent;

If the pavement is not surface dry; or

On new asphalt concrete surfacing until the surface has been opened to public traffic for a period of not less than 14 days.

827.04 TRAFFIC CONTROL.

Normal directional traffic shall be maintained on the roadway at all times during the construction period, as approved by the Engineer.

The Contractor shall provide, place and subsequently remove all necessary signs and channelizing devices to keep traffic off newly installed pavement markers for the minimum period specified in the following table.

Ambient Air Temperature (degrees C)	Minimum Period (Minutes) Protected from Traffic
38	15
32	20
27	25
21	30
15	35
10 (No Application below 10° C)	45

At the completion of each working day, all warning signs and channelizing devices shall be removed from the roadway and the roadway opened to the normal flow of traffic.

827.05 METHOD OF MEASUREMENT.

The Plowable Pavement Marker will be measured per each, per type, per color installed. Surface preparation or any other incidentals will be subsidiary.

827.06 BASIS OF PAYMENT.

The amount of completed and accepted work measured as provided above shall be paid for at the Contract unit prices per "Plowable Pavement Marker", per type, and per color which will be full compensation for the furnishing and placing of all material and for labor, equipment, tools and incidentals necessary to complete the work.

Section 828

CONCRETE SAFETY BARRIER

828.01 DESCRIPTION.

This work shall consist of the construction of concrete safety barrier in accordance with this Specification and as indicated on the Plans or as directed by the Engineer.

BID ITEM:

Concrete Safety Barrier (*).

* Type as specified on the Plans.

828.02 MATERIALS.

Materials shall conform to the requirements shown on the Plans and the Materials Division.

828.03 BASIS OF ACCEPTANCE.

Concrete Safety Barrier intended for use in permanent locations shall be inspected for acceptance at the point of manufacture. Temporary concrete safety barrier, whether new or used, shall be accepted upon receipt and approval of a certification prepared by the Contractor. The certification shall state that the barrier complies with all applicable requirements of the Plans and Specifications. The Engineer will visually inspect all barrier at the project site prior to making final acceptance.

828.04 CONSTRUCTION REQUIREMENTS.

The concrete safety barrier shall be constructed in accordance with the details, the lines, grades and dimensions shown on the Plans or established by the Engineer.

828.05 METHOD OF MEASUREMENT.

Concrete Safety Barrier shall be measured by the meter, along the centerline of the top of the barrier regardless of cross section dimension of barrier.

828.06 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above shall be paid for at the Contract unit price per

meter for "Concrete Safety Barrier" of the various types designated on the Plans, which price shall be full compensation for furnishing and placing all materials, for moving of temporary barrier to alternate locations for various phases of construction when required, and for all labor, equipment, tools and incidentals necessary to complete the work.

The amount of Concrete Safety Barrier to be paid for will be the maximum amount required to be in place at any one time.

SECTION 829

OBJECT MARKERS

829.01 DESCRIPTION.

This work shall consist of the furnishing and installation of object markers in accordance with this Specification and as shown on the Plans or as directed by the Engineer.

BID ITEM

Object Marker (*).

* Type

829.02 MATERIALS REQUIREMENTS.

Materials shall conform to the requirements specified in the Materials Division.

Steel Sign Blanks	Section 1600
Aluminum Sign Blanks	Section 1600
Steel Posts	Section 1600
Fasteners	Section 1600
Reflective Sheeting	Section 2200

829.03 CONSTRUCTION REQUIREMENTS.

The object markers shall be installed in accordance with the details shown on the Plans and to the lines, grades and dimensions shown on the Plans or established by the Engineer.

The posts shall be erected by driving, either by hand or with mechanical devices. The method of driving shall not substantially alter the cross sectional dimensions of the posts or materially damage the spelter coating. Battered tops will not be permitted. Posts which are bent or otherwise damaged during or after erection shall be removed from the site and replaced at the Contractors expense. After driving, the portion of the posts above ground shall be plumb and the posts shall be firm in the ground.

829.04 METHOD OF MEASUREMENT.

Object markers shall be measured by the number complete in place.

829.05 BASIS OF PAYMENT.

The number of object markers complete in place shall be paid for at the Contract unit price per each for "Object Mark-

ers", which price shall be full compensation for furnishing and installing all materials and for all labor, tools, equipment and incidentals necessary to complete the work.

SECTION 830

GROUTING

830.01 DESCRIPTION.

This item shall consist of the grouting of anchor bolts, dowel bars, tie bars and reinforcing steel into previously poured concrete at the locations and to the dimensions shown on the Plans or determined by the Engineer.

830.02 CONSTRUCTION REQUIREMENTS.

The holes, drilled at the locations shown on the Plans, shall be drilled six millimeters +/- two millimeters inch larger than the diameter of the anchor bolts, dowel bars, tie bars or reinforcing steel to be grouted into the concrete and in such a manner that the adjacent concrete will not be injured. The hole shall be drilled to maintain both vertical and horizontal alignment. After the hole is drilled, it shall be thoroughly cleaned while dry and then scrubbed with a fiber brush and clear water to remove all traces of loose material.

Immediately prior to placing the anchor bolts and reinforcing steel, the concrete shall be dried of all surface moisture.

After placing the anchor bolts, dowel bars or tie bars and reinforcing steel, the hole shall be completely filled with an approved epoxy grout or an approved non-shrink grout. The grout shall be mixed, applied, and cured according to the manufacturer's recommendations or as directed by the Engineer.

The grout shall be applied so that the holes are completely filled and no voids exist between the anchor bolt, dowel bars or tie bars or reinforcing steel, and the concrete.

830.03 METHOD OF MEASUREMENT AND BASIS OF PAYMENT.

The drilling of the holes and the mixing and placing of the epoxy grout or non-shrink grout shall not be measured and paid for directly but shall be considered subsidiary to the other items of the Contract.

SECTION 831

MAILBOX ADJUSTMENTS

831.01 DESCRIPTION.

The Contractor shall carefully remove and lay back on the owners' property all mailboxes remaining in place when work starts on a portion of the project in order to clear the site for construction operations.

831.02 METHOD OF MEASUREMENT AND BASIS OF PAYMENT.

This work shall not be paid for directly but shall be considered as subsidiary work pertaining to the other items of the Contract.

SECTION 832

MOWING

832.01 DESCRIPTION.

When the Contract includes the item of mowing, the Contractor shall perform the mowing one or more times, wherever and whenever the Engineer directs, either on the areas seeded or sodded under the Contract, or on other areas outside the construction limits, as may be directed.

BID ITEM

	Unit
Mowing	Per kilometer per side

832.02 EQUIPMENT.

Equipment used for the mowing operations shall be of such size as to perform the work satisfactorily.

832.03 CONSTRUCTION METHODS.

Mowing shall be done when the ground is sufficiently firm to prevent rutting.

Litter, debris and excessive amounts of grass clippings of sufficient magnitude to smother or retard grass growth shall be removed or disked a sufficient number of times to allow the growth of the new grass.

832.04 METHOD OF MEASUREMENT.

Mowing, when directed by the Engineer, shall be measured by odometer readings of the actual areas mowed, per kilometer per side to the nearest 0.1 kilometer. Measurement will be taken along each side and will include all areas from shoulder line to right of way line.

When mowing is required around bridge berms, on bridges less than 0.1 kilometer in length, no deduction will be made for the bridge.

Median mowing will not be measured but will be subsidiary.

When mowing of borrow pits adjacent to right of way is required, this mowing shall be subsidiary.

832.05 BASIS OF PAYMENT.

The amount of completed and accepted work measured, for each mowing as provided above, will be paid for at the Con-

tract unit price per kilometer per side for "Mowing", which price will be full compensation for all labor, tools, equipment and incidentals necessary to complete the work. No adjustment in unit price will be made in case of overruns or underruns.

SECTION 833

RESTORATION AND MAINTENANCE OF HAUL ROADS

833.01 DESCRIPTION.

This work shall consist of the restoration and maintenance of public roads which are used as haul roads for construction materials. All work shall be done in accordance with these specifications and as directed by the Engineer.

For the purpose of this specification a haul road shall be defined as follows: Any public road in Kansas, excluding state highways, over which 5,000 metric tons or more of material is hauled pertinent to the construction of this project. Such material shall include both commercial delivery and Contractor production.

BID ITEM
Restoration and Maintenance of Haul Roads.

833.02 MATERIALS.

Materials used for restoration and maintenance of haul roads shall be of the type necessary to restore the road to its existing condition and shall be visually inspected and approved by the Engineer.

833.03 CONSTRUCTION REQUIREMENTS.

The Contractor shall be responsible to be aware of any local conditions as stipulated in Section 107.01 which may affect his haul road selection.

The Contractor shall designate in writing, to the Field Engineer the exact location of all haul roads. Designation shall be made prior to use and in sufficient time to allow an inspection to be made to determine the existing condition of the roadway, surfacing, drainage structures and other appurtenances. The inspection shall be made jointly by the Contractor and the Field Engineer. The local government agency shall be given the opportunity to accompany the inspection team, and any deficiencies or special conditions shall be documented by the Engineer as to the adequacy of the existing road and/or structures.

During hauling operations, the Contractor shall use only the designated haul roads, perform either preventative mainte-

nance or repair maintenance to minimize damage which may result from hauling operations and maintain the road in as nearly as possible the same condition as existed prior to commencement of the hauling operations. This specification shall not be interpreted to allow other than legal weight or speed limits unless special permits have been granted in accordance with applicable laws and regulations. Upon completion of hauling operations, damaged haul roads will be restored to a state approximately equal to their condition as when initially inspected. When determining the extent of damage, consideration shall be given to any hauling which may have been accomplished by other parties on the designated haul roads. A final review should be made by the Field Engineer, a representative of the Contractor and, when possible, a representative of the local government. The final determination of the extent of restoration will be made by the Field Engineer.

833.04 METHOD OF MEASUREMENT.

The item of "Restoration and Maintenance of Haul Road" shall be measured by lump sum.

833.05 BASIS OF PAYMENT.

(a) If any haul roads are used as defined in this Specification, payment for the item of "Restoration and Maintenance of Haul Roads" will be made in the amount of money set forth in the Contract as a "Lump Sum". The "Lump Sum" shall be considered full compensation for any and all labor and equipment provided, materials supplied and incidentals necessary to accomplish the work. No overrun will be allowed. Payment will be made regardless of whether or not any maintenance and restoration proves necessary, provided the Contractor has designated the haul roads as described in Section 833.03.

(b) If no haul roads are used as defined in this Specification, no payment will be made and the entire amount of money set forth in the Contract as a "Lump Sum" for "Restoration and Maintenance of Haul Roads" shall be underrun.

(c) Use of roads other than the designated haul roads shall result in the forfeiture of payment for the Contract item "Restoration and Maintenance of Haul Roads" and the Contractor shall be required to repair any and all roads used for the performance of the Contract to the approximate condition as existed prior to commencement of the hauling operation as determined by the Engineer.

(d) If the item "Restoration and Maintenance of Haul Roads" is not included as a bid item in the Contract and more than 5,000 metric tons of materials are required to complete the project, haul roads, as defined herein, shall be repaired by the Contractor to the approximate condition as existed prior to commencement of the hauling operations as determined by the Engineer.

When not shown as a bid item "Restoration and Maintenance of Haul Roads" will be subsidiary to other items of the Contract.

SECTION 834

COLD PLASTIC PAVEMENT MARKING

834.01 DESCRIPTION.

This work shall cover the furnishing and applying of a reflective, prefabricated, conformable tape of specified type and width, which shall be capable of being bonded to bituminous or Portland cement concrete pavement by means of a precoated or applied adhesive and pressure as herein specified.

BID ITEMS:

Cold Plastic Marking (*) (+).

* Class A
* Class B
+ Width (When bid per meter)

834.02 MATERIALS.

Materials shall conform to the requirements specified in the Materials Division.

Cold Plastic Pavement Marking ..... Section 2204

834.03 CONSTRUCTION REQUIREMENTS.

The pavement to be striped shall be broomed and cleaned prior to application as deemed necessary by the Engineer.

Except for turn arrows, letters, cross bars, stop bars, etc., the marking material shall be supplied complete with a precoated, factory applied adhesive, for immediate application to the pavement without use of heat, solvent or other type of adhesive primer, unless recommended otherwise by the manufacturer due to climatic or pavement conditions. When the adhesive backing is supplemented by a solvent or other type of adhesive or primer, the material used and application shall be in accordance with the manufacturers recommendation. Turn arrows, letters, stop bars, cross bars, etc., shall be applied utilizing an adhesive recommended and supplied by the manufacturer of the pavement marking material.

When applied to freshly laid hot mix bituminous surfaces, application shall be made by positioning the marking material on the pavement followed by embedment by a steel roller during the final rolling.

When applied to Portland cement concrete surfaces, sand or shot blast shall be required to remove the curing compound, laitance, debris, and any other foreign matter. Application of

primer and pavement markings shall closely follow the cleaning procedure.

Except when rolled into a hot bituminous surface a minimum of three passes with a tamping cart shall be used to assure bond of the marking material to the pavement. The tamping cart shall weigh a minimum of 90 kilograms and have a roller with either a deep soft rubber surface or fiber bristles. Tamping with the tires of an automobile or truck in lieu of the tamping cart shall not be permitted.

When applied to Portland cement or cold bituminous surfaces the pavement temperature shall be not less than 21° C, and the ambient air temperature shall not be less than 15° C, and rising.

834.04 METHOD OF MEASUREMENT.

The Cold Plastic Marking will be measured either by the lump sum or meter and per each for signs, letters or symbols, whichever is called for on the Plans or in the Contract. When measured per meter, it will be measured by the meter for each length of the various widths and classes complete in place.

834.05 BASIS OF PAYMENT.

The amount of completed and accepted work measured as provided above will be paid for at the Contract lump sum or unit prices per meter or unit prices per each of the various widths and classes of "Cold Plastic Marking", which price will be full compensation for all layouts required, furnishing and placing all materials and for all labor, equipment, tools and incidentals necessary to complete the work.

SECTION 835

DURABLE PAVEMENT MARKING TAPE

835.01 DESCRIPTION.

This work shall cover the furnishing and applying of a reflective, prefabricated, conformable tape of specified type and width, which shall be capable of being bonded to bituminous or Portland cement concrete pavement by means of a precoated adhesive and pressure as herein specified.

BID ITEMS:

Durable Pavement Marking Tape (*) (+).

* Class A
* Class B
+ Width (When bid per meter)

835.02 MATERIALS.

Materials shall conform to the requirements specified in the Materials Division.

Durable Pavement Marking Tape ..... Section 2206

835.03 CONSTRUCTION REQUIREMENTS.

The pavement to be striped shall be broomed and cleaned prior to application as deemed necessary by the Engineer.

The marking material shall be supplied complete with a precoated, factory applied adhesive for immediate application to the pavement without use of heat, solvent or other type of adhesive primer, unless recommended otherwise by the manufacturer due to climatic or pavement conditions. When the adhesive backing is supplemented by a solvent or other type of adhesive or primer, the material used and application shall be in accordance with the manufacturer's recommendation.

When applied to freshly laid hot mix bituminous surfaces, application shall be made by positioning the marking material on the pavement after the final rolling, within the same day, and followed by embedment by a tamping cart.

When applied to Portland cement concrete surfaces, sand or shot blast shall be required to remove the curing compound, laitance, debris, and any other foreign matter. Application of primer and pavement markings shall closely follow the cleaning procedure.

For all surface types, a minimum of three passes with a tamping cart shall be used to assure bond of the marking ma-

terial to the pavement. The tamping cart shall weigh a minimum of 90 kilograms and have a roller with either a deep soft rubber surface or fiber bristles. Tamping with the tires of an automobile or truck in lieu of the tamping cart shall not be permitted.

When applied to Portland cement or cold bituminous surfaces the pavement temperature shall be not less than 21° C, and the ambient air temperature shall not be less than 15° C, and rising.

835.04 METHOD OF MEASUREMENT.

The Durable Pavement Marking Tape will be measured either by the lump sum or meter, whichever is called for on the Plans or in the Contract. When measured per meter, it will be measured by the meter for each length of the various widths and classes complete in place.

835.05 BASIS OF PAYMENT.

The amount of completed and accepted work measured as provided above will be paid for at the Contract lump sum or unit prices per meter or unit prices per each of the various widths and classes of "Durable Pavement Marking Tape", which price will be full compensation for all layouts required, furnishing and placing all materials and for all labor, equipment, tools and incidentals necessary to complete the work.

SECTION 836

GABIONS

836.01 DESCRIPTION.

This work shall consist of construction of gabions in accordance with this Specification, as shown on the Plans or directed by the Engineer.

BID ITEM.
Gabions.

836.02 MATERIALS.

Materials shall conform to the requirements provided in the Materials Division.

Baskets	Section 1700
Geotextile Fabric	Section 1700

Stone for filling the gabions shall comply with the quality and process control requirements of Stone for Riprap shown in Section 1116. The size shall comply with the requirements shown on the Plans.

836.03 CONSTRUCTION REQUIREMENTS.

(a) General.

Gabions shall be assembled and wired together. Each gabion unit shall be assembled by tying all untied edges, including diaphragms, with lacing wire or fastener clips. The lacing procedure consists of cutting a length of lacing wire approximately 1½ times the distance to be laced (not to exceed 1.5 meters), securing one end of the wire at the corner by looping and twisting lacing with single and double loops at approximately 125 millimeter intervals, and securing the other end of the wire to selvedges by looping and twisting.

Gabions shall be placed on a prepared subgrade that has been graded to a tolerance of 25 millimeters and to the lines and grades shown on the plans. They shall be securely tied to each adjoining gabion with lacing wire or fastener clips along the perimeter of all vertical contact surfaces in the same manner as described above for assembly. Gabions on other gabions shall be laced to the lower gabion with lacing wire along the front, back, and ends.

(b) Filling and Installing Requirements.

The filling of gabions, including installed connecting wires, shall be performed as follows:

(1) Each empty cell shall be first filled to a depth of 300 millimeters for one meter deep gabions, 225 millimeters for 450 millimeter deep gabions, and completely for 300 millimeter or less deep gabions.

(2) Two parallel connecting wires shall be uniformly spaced and securely fastened to each outer face of each cell, at a height of 300 millimeters above the base for one meter deep gabions, and 225 millimeters for 450 millimeter deep gabions. Inner tie wires in the interior of the structure where all sides of each cell will be supported by the rock fill in the adjacent cell, will not be required.

(3) Cells shall be filled to a further depth of 300 millimeters (completely for a 450 millimeter deep gabion), and connecting wires shall be similarly tied at this level in the one meter deep gabions and to each outer face of each cell as in (2).

(4) If a given group of gabions must be completed prior to the completion of the structure, they will constitute a temporary perimeter and must have the inner tie wires installed. The cells around the perimeter, when half full, shall have inner tie wires installed to prevent bulging of the unsupported outer faces.

(5) Each filling, incremental or otherwise, shall contain stone of such size that not less than two layers of stone are required to complete the filling.

All connecting wires shall be looped around two mesh openings and the ends of the wires shall be securely twisted to prevent their loosening and all loose edges and projecting ends of wires shall be turned into the gabion.

Cells in the row shall be filled in stages such that the depth of rock fill in any cell does not exceed the depth in an adjoining cell by more than 300 millimeters. Rock shall be placed in gabions by mechanical equipment or by hand, except that along all visible faces of the completed structure the stone shall be carefully placed and packed by hand for a depth of approximately 200 to 250 millimeters to ensure proper alignment and a neat, compact, square appearance. Sides of gabion cells bent or smashed down shall be restored to their original dimension before filling.

When the gabion has been overfilled (approximately 50 millimeters) to allow for future settlement of the rock, the lid shall be bent and stretched until it meets the perimeter edges of the front and end panels. The lid shall then be tightly laced with

lacing wire to the edges of the front and end panels and the top of diaphragms in the same manner as described above for assembling. To assist in closing and lacing, a pinch bar or special closing tool shall be used. Lacing adjacent lids to the vertical panels in one operation is acceptable. PVC coatings or other damage of the lids must be repaired as approved by the gabion manufacturer.

836.04 METHOD OF MEASUREMENT.

The quantity to be measured under this item will be the number of cubic meters of stone required to fill the gabions in accordance with the dimensions shown on the Plans.

836.05 BASIS OF PAYMENT.

The completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per cubic meter for "Gabions," which price shall be full compensation for all excavation, backfilling, for furnishing and placing all materials including filter fabric, for all labor, tools, equipment and incidentals necessary to complete the work.