SECTION 822

UNDERDRAINS

822.1 DESCRIPTION

Construct the designated type of underdrain as shown in the Contract Documents.

BID ITEMS	UNITS
*Pipe Underdrains (**)	Linear Foot
Aggregate for Blanket Underdrains	Ton/Cubic Yard
*Size, Diameter	
**Type	

822.2 MATERIALS

Provide materials that comply with the applicable requirements.

Concrete and Grout	**SECTIONS 401 & 402**
Aggregates for Concrete Not On Grade	**SECTION 1102**
Aggregates for Blanket Underdrains and Backfill	**DIVISION 1100**

Underdrain Pipe

Type Designation		
F	Perforated Corrugated Metal Pipe	**DIVISION 1900**
H	Polyvinyl Chloride Pipe	**DIVISION 1900**
T	High-Density Polyethylene Pipe	**DIVISION 1900**

Underdrain Outlet Pipe

G	Corrugated Metal Pipe	**DIVISION 1900**
K	Polyvinyl Chloride Pipe	**DIVISION 1900**
S	High-Density Polyethylene Pipe	**DIVISION 1900**

If the type is not indicated in the Contract Documents, any of the types listed above are permitted. Provide underdrain pipes with a nominal minimum inside diameter of 6 inches, unless shown otherwise in the Contract Documents. Provide perforated and corrugated underdrain pipe with the same type of outlet pipe.

822.3 CONSTRUCTION REQUIREMENTS

a. Excavation for Pipe Underdrains. Excavate trenches for all lateral and longitudinal interceptor drains as shown in the Contract Documents. In case of conflict, where actual elevation of the strata or stratum to be intercepted is found to vary from designated elevation, the stratigraphy shall govern. When necessary, shore or sheet the trench to provide safe construction and backfilling. Construct trench bottoms for perforated pipe in firm material to permit the placing of aggregate for pipe underdrains underneath the pipe.

If unstable material is encountered in the bottom of the trench, place the drain pipe on an insulating course of aggregate for pipe underdrains of sufficient thickness (maximum 3 inches) to provide 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 are only permitted under perforated pipe. 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, lower the drain into the impermeable material.

The minimum trench width is 8 inches plus the exterior diameter of the underdrain pipe, unless shown otherwise in the Contract Documents. The basedrains shall be placed a minimum of 18 inches below the base of the pavement.

b. Excavation for Blanket Underdrains. Perform excavation according to the Contract Documents. Rest the blanket drain upon the bedrock or other suitable material as shown in the Contract Documents. Shape irregularities on the bedrock surface so undrained pockets are not formed. In suitable material, roll and shape the embankment surface to proper crown. Prior to placing aggregate for blanket underdrains, construct pipe underdrains built in connection with the blanket underdrains, as shown in the Contract Documents.

c. Laying Underdrain Pipe. Lay all pipes on a minimum grade of 1%, unless otherwise shown in the Contract Documents. Close all dead ends of pipe underdrains with a concrete cap.

Join metal pipe by means of approved coupling bands provided by the pipe manufacturer. Make all junctions and turns with wyes, tees and bends. When field cutting is required, cold or flame cut metal pipe as approved by the Engineer. Paint cut surfaces with an approved zinc-rich paint.

Lay perforations down, unless shown otherwise in the Contract Documents.

d. Laying Outlet Pipe. Lay outlet pipe only on stable material with minimum of 1% grade, unless otherwise shown in the Contract Documents. Place metal outlet pipe with ends abutting and join with manufacturer's coupling bands to provide a watertight joint.

e. Backfilling Pipe Underdrains. Do not begin backfill without approval of the Engineer. Place backfill to prevent large cavities in the backfill and walls of the trench. Backfill overbreakage due to blasting of rock in trench excavation and widening due to caving of trench walls or overbreakage at construction outcrops with aggregate for underdrains.

Where a portion of the trench above the underdrain backfill aggregate is to be filled with soil, use a compactable material. Place the material in layers and compact to a density equal to or greater than that required for the adjacent material, with a minimum of 90% of standard compaction of the soil used.

f. Constructing and Backfilling Blanket Underdrains. Construct the blanket underdrain with a minimum thickness of 12 inches.

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

Do not begin backfill without approval of the Engineer. Backfill all irregularities of the bedrock surface with aggregate for blanket underdrains.

Backfill the lateral drain trench under the blanket underdrain and round to an elevation of approximately 6 inches above the top of the trench. Maintain 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, spray the aggregate with water during the process of spreading and rolling. Perform the spraying so the force of the water will not wash the finer material to the bottom of the lift.

When concrete pavement or soil backfill material is to be placed over the blanket underdrain, use fine aggregate (complying with **DIVISION 1100**) in the top 4 inches of the underdrain, or other approved granular aggregate provided these fine aggregates do not have more than 2% passing the No. 200 sieve (wash).

g. Pipe Underdrain Outlets. Use a concrete flume or other approved type of flume, constructed at the outlet end of pipe underdrains as shown in the Contract Documents. Use Grade 3.0 concrete to construct the outlet flume so that the flume is flush with the finished shoulder slope.

h. Underdrain Markers. Erect 1 guidepost to mark each outlet flume for pipe underdrains, at the location shown in the Contract Documents. Use either a 6-inch diameter treated wood post or a 3-pound per foot galvanized or baked on enamel metal channel post. Set guideposts according to **SECTION 827**.

(1) Wood Guideposts. Apply 2 coats of aluminum paint to the upper 18 inches of the wooden post. Apply a third coat of International orange, enamel paint to the upper 12 inches of the wooden post.

(2) Metal Guideposts. Apply 1 coat of International orange, enamel paint to the upper 12 inches of the galvanized or baked-on enamel metal channel post.

i. Video Inspection. When specified in the Contract Documents, inspect completed underdrains according to **subsection 845.3c**. The video inspection of the completed underdrains will be subsidiary to the underdrain.

For the video inspection, provide a video camera complying with the following requirements:

- high resolution, high sensitivity, waterproof and color;
- ability to pan and tilt to a 90° angle with the axis of the pipe and rotate 360°;
- capable of negotiating the various angle fittings used in the edge drain system;
- with sufficient lighting to provide a true color picture of the entire periphery of the diameter of the pipe; and
- with attachments that will maintain the camera's position in the center of the pipe.

Provide a portable control unit of the video camera complying with the following requirements:

- capable of adjusting the iris, focus, and light level intensity;
- has a color monitor (8 inch minimum) with a minimum standard resolution of 720 x 480 pixels to track the camera's progress through the inspections;
- have 2 video input/output jacks for video recording, as well as digital playback verification through the built-in monitor; and
- have audio input to allow for dubbing of the video to incorporate comments as necessary.

Provide a video camera system complying with the following requirements:

- has sufficient cable/push rod to conduct inspections to a length of 500 feet, and a distance counter to monitor the length of the inspection; and
- have a color video printer that will produce color prints of any observations of interest during the course of the inspection;
- include a digital video recorder (minimum quality 4-head industrial grade VHS type) with audio dubbing still frame and slow speed capabilities; and
- has software capable of generating a report that shows each defect, along with its location measured from the inspection entrance, and a still frame image of the fault.

Provide an experienced video technician to operate the video camera system.

822.4 MEASUREMENT AND PAYMENT

The Engineer will measure pipe underdrains by the linear foot.

When aggregate for blanket underdrains is shown in the Contract Documents by the cubic yard, the Engineer will measure the cubic yards of aggregate in the vehicle at the time and place of unloading.

When aggregate for blanket underdrains is shown in the Contract Documents by the ton, the Engineer will measure the tons of aggregate in the vehicle at the time and place of unloading. Deductions will be made for all moisture in the material when measured by the ton. Determine the moisture content according to **DIVISION 2500**.

The Engineer will measure and pay for guideposts used for underdrain markers according to **SECTION 827**, and the quantities will be included in the quantity of guideposts shown in the Contract Documents.

Payment for "Pipe Underdrains" and "Aggregate for Blanket Underdrains" at the contract unit prices is full compensation for the specified work.