SECTION 610 - PIPE UNDERDRAIN AND PAVEMENT BASE DRAIN

610.1 DESCRIPTION - This work is construction of pipe underdrains, and pavement base drains, of the type and size indicated.

610.2 MATERIAL -

(a) Pipes. Section 601.2(a)1 and as follows:

1. General.

   1.a Type. Use the type indicated. If not indicated, use any one of the types listed below.

   1.b Size. For circular pipe, unless otherwise indicated, use pipe with a minimum inside diameter of 4 inches and sized in not less than 1-inch increments. For semi-circular pipe, unless otherwise indicated, use pipe with a smooth-walled bottom section and an average inside diameter of 4 5/8 inches.

   1.c Perforations. Perforate a pipe to provide a minimum water inlet area of 1.4 square inches per linear foot of pipe and, unless otherwise specified, as follows:

      • Cut perforations cleanly so as not to restrict the flow of water.

      • Provide either circular or slotted perforations, except do not use slotted perforations in smooth walled pipe.

      • For circular perforations, provide holes with a nominal diameter not less than 3/16-inch or greater than 3/8-inch. Also, provide similar rows of perforations on both sides of the pipe's vertical centerline, with the lower most rows separated by an arc of 60 degrees minimum.

      • For slotted perforations, provide slots not exceeding 1/8-inch wide and a length not more than 10% of the average inside circumference for 4-inch to 8-inch diameter pipe and not exceeding 2 1/2 inches for pipes larger than 8 inches. Additionally, center slots in the corrugation valleys and at maximum 120 degree intervals about the pipe circumference.

   1.d Strength Test. As specified, except for plastic pipe test using the parallel plate load test, according to ASTM D2412.

   1.e Infiltration Rate. For perforated or porous pipe, provide a minimum infiltration rate of 10 gallons/min./lin. ft. of pipe, as determined according to AASHTO M 176M.

   1.f Pipe Length. Flexible plastic pipe, 6 inches or less in diameter, may be supplied in specified coiled lengths or standard increments agreeable to the Commission. The use of long coils, 3,000 feet to 4,000 feet in length, is allowed, provided placement is by equipment recommended by the manufacturer and the pipe is not stretched or damaged during handling or placement. Furnish flexible plastic pipe, larger than 6 inches in diameter, and all sizes of rigid pipe in maximum lengths of 20 feet. Furnish lengths not less than 99% of the stated quantity. Measure with any suitable device accurate to 1/4-inch in 10 feet (0.2%) while the pipe is stress-free and at rest on a flat surface in a straight line.
1.g Plastic Pipe. Furnish extruded or molded plastic pipe made of high density flexible plastic. Furnish pipe that is permanently marked, stenciled, or labeled with manufacturer's name, pipe trade name or type, average size the specification designates, the plant designation code, and the date of manufacture all at intervals of no more than 10 feet.

2. Corrugated Polyethylene (PE) Pipe. AASHTO M 252 (pipes 4 inches through 10 inches) and AASHTO M 294 (pipes 12 inches through 15 inches), modified as follows:

- The Commission will determine lot size for acceptance.
- Minimum pipe stiffness for pipes 4 inches through 10 inches to be 30 psi at 10% deflection, when tested in accordance with ASTM D2412. Minimum pipe stiffness for pipes 12 inches through 15 inches to be 45 psi at 5% deflection and 40 psi at 10% deflection, when tested according to ASTM D2412.

3. Polyvinyl Chloride (PVC) Pipe. ASTM D3034, ASTM F758, Type PS46 or ASTM F949 modified as follows:

- Minimum pipe stiffness for pipes 4 inches through 10 inches, 35 psi at 5% deflection, when tested according to ASTM D2412. Minimum pipe stiffness for pipes 12 inches through 15 inches, 45 psi at 5% deflection, when tested according to ASTM D2412.
- Capable of being flattened to 40% of the original pipe O.D. without splitting, cracking, or breaking.

4. Acrylonitrile-Butadiene Styrene (ABS) Pipe. ASTM D2751, modified as follows:

- Minimum pipe stiffness for pipes 4 inches through 10 inches, 35 psi at 5% deflection, when tested according to ASTM D2412. Minimum pipe stiffness for 12-inch pipe, 45 psi at 5% deflection, when tested according to ASTM D2412.
- Capable of being flattened to 60% of the original pipe O.D. without splitting, cracking, or breaking.

5. Perforated Plastic Semicircular Pipe. AASHTO M 278 or ASTM D2680, modified as follows:

- Smooth or corrugated top and a smooth semicircular bottom.
- Minimum pipe stiffness (PS), 35 psi at 5% deflection, when tested according to ASTM D2412.
- Capable of being flattened to 40% of the original pipe outside-to-outside height for PVC or 60% for ABS without splitting, cracking, or breaking.

(b) Aggregates.

1. Coarse Aggregate. Type C or better, Section 703.2, except that the percentage of crushed fragments for gravel is not required. Use No. 57 for Pipe Underdrain, Type I backfill, use No. 8 for
pavement base drain and median base drain and use No. 57 and No. 8 for pavement base drain with slope drainage.

(c) **Caulking Compound.** Section 705.8(a)

(d) **Bituminous Binder Course.** Section 409.

(e) **Bituminous Material, Class PG 64-22 Asphalt.** Section 702.

610.3 CONSTRUCTION - As shown on the PennDOT Standard Drawings, the Commission’s Standard Drawings, the Contract Drawings and as follows:

(a) **General.** Place pipe underdrain after fine grading is completed. Use Type I backfill for all pipe underdrain installations.

Intercept all existing lateral underdrain and connect to new pavement base drain.

Join underdrain and pavement base drains to new or existing drainage structures or to subsurface drain outlets with satisfactory connections. Use fittings with deflection angles of 45-degrees or less.

After completing the trench and the lower 2 inches of compacted backfill, lay the pipe and make the joints according to the manufacturer’s recommendations. For perforated pipe, place the perforations down, unless otherwise directed. Lay semicircular pipe with the smooth, circular portion at the bottom.

Do not leave trenches open during periods of precipitation or overnight. Seal the upgrade end of the pipe underdrain or base drain to prevent entry of foreign material. Complete backfilling after having the pipe inspected by the Inspector-in-Charge.

For the installation of pavement base drain with slope drainage, locate the drain on the right edge of the shoulder in cut areas, excavate the trench and backfill as shown on the Commission’s Standard Drawings.

1. **Rehabilitation Projects.** Locate pavement base drain and median base drain as shown on the Commission’s Standard Drawings. Excavate for pavement base drain and median base drain to the width and depth indicated on the Commission’s Standard Drawings and/or Contract Drawings. Make the sides of the trench vertical. Blasting is not permitted. If rock is encountered, excavate to the proper elevation using such equipment as is satisfactory and approved for this type of work. Sawcut the trench a minimum of 4 inches through the existing shoulder. Excavate without damaging the existing adjacent roadway pavement or cross-pipes and to cause minimal disturbance to the existing shoulder and/or median. Restore the shoulder by backfilling the trench with Bituminous Binder Course to match the adjacent shoulder and to the depths shown on the Contract Drawings. Seal with PG 64-22 Asphalt.

When removing existing underdrains or pavement base drains, remove any direct connections from the existing drain to the existing drainage cross-pipe (normally reinforced cement concrete pipe having a diameter of at least 15 inches). Repair the drainage cross-pipe by applying caulking compound around the existing direct connection hole, placing a minimum 1 foot x 1 foot sheet of 20 gage, or thicker, galvanized steel over the hole, that is formed to the cross-pipe diameter and that completely covers the existing direct connection hole. Alternate methods may be used with the approval of the Representative. Make repairs after the excavation and removal of the existing drain and prior to the installation of the new pavement base drain.

2. **Reconstruction Projects.** Place pavement base drain as shown on the PennDOT Standard Drawings for Standard Subbase, except locate the drain as indicated on the contract drawings and eliminate the Class 1 Geotextile material, after the adjacent roadway pavement is constructed, except when it is placed under curb sections or other special locations. Excavate pavement base drain trench without disturbing subbase under the roadway pavement.
610.4 MEASUREMENT AND PAYMENT -

(a) **Pipe Underdrain, Type I Backfill.** Linear Foot
Includes all excavation, backfill, and connections required.

(b) **Pavement Base Drain.** Linear Foot
Includes all excavation, backfill, connections required, and repairs to existing drainage cross-pipes.

(c) **Pavement Base Drain, Including Shoulder Restoration.** Linear Foot
Includes all excavation, backfill, connections required, repairs to existing drainage cross-pipes, and restoration of shoulder with bituminous material and PG 64-22 Asphalt.

(d) **Pavement Base Drain with Slope Drainage, Type I.** Linear Foot
Includes all excavation, backfill, connections required, repairs to existing drainage cross-pipes.

(e) **Pavement Base Drain with Slope Drainage, Type I with Shoulder Restoration.** Linear Foot
Includes all excavation, backfill, connections required, repairs to existing drainage cross-pipes, and restoration of shoulder with bituminous material and PG 64-22 Asphalt.

(f) **Pavement Base Drain with Slope Drainage, Type II.** Linear Foot
Includes all excavation, backfill, and connections required.

(g) **Median Base Drain.** Linear Foot
Includes all excavation, backfill and connections required.

(h) **Class 4 Excavation.** Cubic Yard
For extra depth pipe underdrain and extra depth pavement base drain excavation in excess of that shown on the Standard Drawings.

(i) **Additional Coarse Aggregate for Extra Depth Pipe Underdrain.** Cubic Yard

(j) **Additional Coarse Aggregate for Extra Depth Pavement Base Drain.** Cubic Yard

(k) **Subsurface Drain Outlets.** Section 615.4