# Special Specification 4020
# Permeable Concrete Edge Drain

## 1. DESCRIPTION

Install permeable concrete edge drain.

## 2. MATERIALS

**2.1.** **Permeable concrete**. Furnish concrete in accordance with Item 421, "Hydraulic Cement Concrete." Meet the requirements of Table 1.

**Table 1**
**Specific Requirements for Permeable concrete**

| | |
|---|---|
| Max water/cement ratio | 0.38 |
| Coarse Aggregate Grade | Grade 4 or 5 |
| Cement | Type I or II |
| Minimum Cement Factor | 385 lb. cement per cy of permeable concrete |
| Fine Aggregate | None |
| Admixtures | None |
| Maximum Slump | Not Applicable |
| Design Strength | Not Applicable |
| Mix Design Options | Not Applicable |

**2.2.** **Pipe**. Furnish Type 5, 7, or 8 perforated pipe that meets the requirements of Article 556.2.1, "Pipe." Use only one type of pipe on a project.

**2.3.** **Filter Fabric**. Furnish filter fabric that meets the requirements of Article 556.2.3, "Filter Fabric."

## 3 CONSTRUCTION

**3.1** **Permeable Concrete Mix Design.** Submit proposed mix design for approval prior to production. Use only approved permeable concrete mix designs. Meet the unit weight requirements as determined in accordance with ASTM C-138. Do not change the mix design component materials without prior approval.

Provide one of the following with the mix design submittal:

- Evidence from three sets of production data, either from Department acceptance tests or independently verifiable commercial mixes that the permeable concrete produced in accordance with the proposed mix design meets the requirements of this specification.
- Test data from a single trial batch of 1 cy. minimum, which demonstrates that the permeable concrete produced using the proposed mix, designated ingredients, and designated water-cement ratio meets the requirements of this specification.

**3.1.1.** **Drainage Requirement**. Provide permeable concrete that is capable of draining at a rate of 6 oz./sec. Test in accordance with Section 4. Permeable concrete not meeting the drain rate requirement will be rejected. Remove and replace all rejected permeable concrete edge drain at the Contractor's expense.

**3.1.2.** **Batch Adjustment.** Meet the theoretical yield requirements of the approved mix design. Inform the Engineer of any adjustments to the approved mix design. Note any batch adjustments and record the actual quantities incorporated into the mix on the concrete Delivery Ticket.

**3.2.** **Installation.** If present, remove existing edge drain system including filter media, filter fabric, pipe, outfalls, and headwalls as shown on the plans or as approved.

Install permeable concrete edge drain in accordance with Article 556.3, "Construction" except as noted in this section or shown on the plans.

Construct trench at the depth and width as shown on the plans or as directed.

Place permeable concrete instead of filter material.

Place outfalls and pipe as shown on the plans or as directed.

Unless otherwise directed by the Engineer, cure permeable concrete edge drain for a minimum of twelve (12) hr., then backfill with materials as shown on the plans or as approved.

## 4. ACCEPTANCE OF PERMEABLE CONCRETE

Sample and test the fresh and hardened permeable concrete for acceptance. All testing will be witnessed by the Engineer. The test results will be reported to the Engineer and the permeable concrete supplier. Investigate the quality of the materials, the permeable concrete production operations, and other possible problem areas to determine the cause for any permeable concrete that fails to meet the required drain rate as outlined below. Take necessary actions to correct the problem including redesign of the permeable concrete mix. The Engineer may suspend all permeable concrete edge drain operations under the pertinent Items if the Contractor is unable to identify, document, and correct the cause of the low drainage in a timely manner. Resume permeable concrete edge drain operations only after obtaining approval for any proposed corrective actions. Permeable concrete failing to meet the required drain rate as outlined below will be removed and replaced at no cost.

Provide 6"x12" concrete cylinder molds for testing. Take random samples of the permeable concrete mixture at the point of placement as directed to determine the drain rate. Make two test cylinders per day as prescribed below:

- Place mold on level surface, free from vibrations or other disturbances
- Place a sample of permeable concrete in the mold in one 6-in. layer using a scoop, leaving a 6-in. void at the top of the test mold.
- Move the scoop around the top edge of the mold as the permeable concrete is discharged in order to ensure a symmetrical distribution
- Tamp the layer forcibly with 25 strokes of a 2 in. x 2 in. square wooden tamper approximately 24 in. long. Strike off and remove any excess material above the 6 inch level to ensure a flat, level surface
- Immediately cover the specimens with a durable, impervious plastic to prevent evaporation. Cure specimens a minimum of 24 hr. in the vertical upright position under the same ambient conditions that are in the field.
- Between 24 hr. and 7 days after molding the specimens, carefully remove the bottoms of the molds with an appropriate cutting tool such as a carpet knife with a sturdy blade. Remove the bottoms of the molds so they are approximately flush with the sides of the specimens leaving an approximately 1/8-in. lip around the bottom to prevent the sample from falling out.
- Place the molds, with the bottoms removed, vertically upright with the 6 in. cavity end facing upward and the exposed bottom of the specimens resting on two small blocks that have been leveled by eye. Place the molds in such manner as to impede as little of the flow through the permeable concrete as possible.
- Fill a container with 128 oz. of potable water.

- Carefully pour the water from the container into the upper opened end of the specimen taking care not to overfill the specimen mold. Begin the time reading when the water is poured into the specimen mold. End the time reading when the last of the water in the 6 in. cavity portion of the specimen mold clears the surface of the permeable concrete specimen. Record the total seconds for the water to clear the surface of the permeable concrete specimen.
- Calculate the drain rate by dividing the total volume of water by the time in seconds. Record the drain rate in ounces per second to the nearest tenth of a unit.
- Report the total ounces of water, seconds, and drain rate in ounces per second for each cylinder. Report the average drain rate for the two cylinders to the Engineer within two hours of completion of the test.

## 5. MEASUREMENT

This item will be measured by the foot along the top of the trench parallel to the pavement and along the top of the outfalls from the junction of the centerline of the trench to the outside edge of the headwall or intersection of the side slope when no headwall is placed.

## 6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Permeable Concrete Edge Drain." This price is full compensation for removal of existing underdrain system, furnishing, hauling, and mixing permeable concrete materials; furnishing and placing pipe, couplers, plugs, screens, and filter fabric; excavation and backfill; and equipment, labor, tools, and incidentals.

Protection methods for excavations deeper than 5 ft. will be measured and paid for in accordance with Item 402, "Trench Excavation Protection."