

SFPUC Modified ASTM D2434 Procedures for Use When Measuring Hydraulic Conductivity of Bioretention Soil Mixes

Adapted from Washington State Department of Ecology's 2012 Stormwater Management Manual for Western Washington (Amended December 2014). Procedures developed by the City of Seattle in cooperation with western Washington soils laboratories.

Introduction

These procedures are intended to modify and further standardize hydraulic conductivity measurement for bioretention soil mixes (BSM) to produce more consistent and comparable estimates of BSM hydraulic conductivity across the City and County of San Francisco.

Procedure

Proctor method ASTM D1557 Method C (6-inch mold) shall be used to determine maximum dry density values for compaction of bioretention soil sample. Sample preparation for the Proctor test shall be amended in the following ways:

1. Maximum grain size within the sample shall be no more than ½ inches in size.
2. Snip larger organic particles (if present) into ½ inch long pieces.
3. Prior to compacting the sample, allow the sample to pre-soak for at least 48 hours. This pre-soak ensures the organics have been full saturated at the time of the test.

ASTM D2434 shall be used and amended in the following ways:

1. Apparatus:
 - a. Use a 6-inch mold size.
 - b. If using porous stone disks, the permeability of the stone disk shall be measured before and after the soil tests to verify that no clogging or decreased permeability of the stone disks has occurred during testing.
 - c. Use the confined testing method with 5- to 10-pound force spring.
 - d. Use de-aired water.
2. Sample:
 - a. Maximum grain size within the sample shall not be more than ½ inch in size.
 - b. Snip larger organic particles (if present) into ½-inch long pieces.
 - c. Pre-soak the sample for at least 48 hours prior to loading the sample into the mold. During the pre-soak, the moisture content shall be higher than optimum moisture but less than full saturation (i.e., there shall be no free water). This pre-soak ensures the organics have been fully saturated at the time of the test.
3. Preparation of Sample:
 - a. Place soil in cylinder via a scoop.
 - b. Place soil in 1-inch lifts and compact using a 2-inch diameter round tamper. Pre-weigh the amount of soil necessary to fill a 1-inch lift at 85% of maximum dry density, then tamp to 1-inch thickness. Once mold is full, verify that density is at 85% of maximum dry density (+/- 0.5%). Apply a vacuum (20 inches Hg) for 15 minutes before inundation.
 - c. Inundate sample slowly (still under a vacuum of 20 inches Hg) over a period of 60 to 75 minutes.
 - d. Slowly remove vacuum (>15 seconds).

- e. Sample shall be soaked in the mold for 24 to 72 hours before starting test.
4. Procedure:
- a. The permeability test shall be conducted over a range of hydraulic gradients between 0.1 and 2.
 - b. Steady state flow rates shall be documented for four consecutive measurements before increasing the head.
 - c. The permeability test shall be completed within one day (one-day test duration).