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Standard Test Method for Measurement of Suspended Sediment Removal Efficiency of Hydrodynamic Stormwater Separators and Underground Settling Devices[1]

This standard is issued under the fixed designation C1746/C1746M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method concerns measurement of the efficiency of hydrodynamic separators and underground settling devices in removing suspended sediment from simulated stormwater runoff under conditions defined herein. This test method is not intended for use in determining field removal efficiency.

1.2 Units tested shall be of a size commonly manufactured, not a scale model. This test method is not intended to address product scaling.

1.3 This test method is not for measuring the removal efficiency of filters or the scouring potential of hydrodynamic separators and underground settling devices.

1.4 In this test method, only gravity flow operation is addressed—performance of units operating under pressurized conditions is not addressed.

1.5 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

~~1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*~~

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1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D422 Test Method for Particle-Size Analysis of Soils (Withdrawn 2016)[3]

D854 Test Methods for Specific Gravity of Soil Solids by Water Pycnometer

D4959 Test Method for Determination of Water Content of Soil By Direct Heating

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *inlet (or outlet) rounding, n*—radius of fillet at inside pipe junction with separator structure.

[1] This test method is under the jurisdiction of ASTM Committee C27 on Precast Concrete Products and is the direct responsibility of Subcommittee C27.70 on Precast Concrete Products for Stormwater Management.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

4. Summary of Test Method

4.1 This test method describes procedures and equipment to measure the suspended sediment removal efficiency of hydrodynamic separators and underground settling devices used for treating stormwater runoff.

5. Significance and Use

5.1 Each device has unique flow patterns and turbulence characteristics and may exhibit a wide range of efficiencies as discharge, particle-size distribution, particle density, and flow viscosity (that is, water temperature) changes. The testing procedures described in Section 8 provide a method of measuring the removal efficiency of these devices under a given flow condition, flow viscosity (water temperature), and particle-size distribution and density. Therefore, the results of testing represent the flow, viscosity, and particle-size distribution tested.

6. Apparatus

6.1 The experimental setup includes an influent straight pipe (without bends or fittings) of minimum length equivalent to ten pipe diameters or 6 m [20 ft], whichever is less, upstream from the test unit and effluent pipe length equivalent to three pipe diameters with a free-fall condition at its downstream end. Pipe shall have a Manning's roughness coefficient not greater than 0.013.

6.2 The test unit shall be set up to reflect actual field installation parameters to the greatest degree possible, including inlet/outlet roundings as supplied or recommended by the manufacturer.

6.3 Influent and effluent pipe diameters shall be the minimum size recommended by the manufacturer and shall be documented in test results, as well as pipe orientation and pipe slopes (2 to 3 %). Pipe slopes shall not be negative.

6.4 The sediment injection point shall be at the crown of the influent pipe at a distance equal to 2 ± 0.1 pipe diameters along the centerline of the pipe upstream of the inlet to the treatment device to supply the sediments in the simulated stormwater runoff.

6.5 The sediment delivery system (feeder) shall be comprised of suitable means of sediment addition so as to provide consistent sediment feed rate of solids (including an auger, vibratory hopper, well-mixed slurry injection system, or other).

6.6 A flow meter shall be installed to measure the water flow rate through the test unit.

6.7 All components of the experimental setup shall be inspected immediately before any testing to confirm that no damage or obstruction is present and that there are no sediments or other deleterious materials therein. ~~No leakage~~ Leakage in system piping or from the unit ~~is allowed during the test.~~during the test is allowable as long as the leakage rate is less than 0.1 % of the measured flow rate.

7. Sampling

7.1 Sampling of the sediment delivery system is intended to quantify the average influent concentration. Six feed rate samples shall be taken from the feeder at of the injection point, at evenly spaced intervals over the total duration of the test. Each sample shall be collected in a ~~clean preweighed plastic 1-L [1.06-qt]~~ clean, preweighed container over an interval timed to the nearest 1 s.

7.2 Feed rate samples shall be a minimum 100 cm^3 [6.10 in^3] or collection interval shall not exceed 1 min, whichever comes first. Samples shall be dried, weighed to the nearest 1 g [0.002 lb] and recorded. The feed rate coefficient of variation (COV) shall not exceed 0.10.

7.3 The influent concentration of each sample shall be computed from Eq 1:

$$C_{inf} = \frac{W_{sample}}{\Delta t\ Q\ g} \tag{1}$$

$$C_{inf} = \frac{M_{sample}}{\Delta t\ Q} \tag{1}$$

where:

C_{inf} = influent concentration,
~~W_{sample}~~ = ~~dry weight of each sample,~~
M_{sample} = dry mass of each sample,
Q = measured flow rate,
~~Δt~~ = ~~sampling duration,~~
Δt = sampling duration.
~~g~~ = ~~gravitational acceleration.~~

8. Procedure

8.1 *Suspended Solids:*

8.1.1 The specific gravity of the particles shall be assessed before the test using Test Method D854. The particle-size distribution shall be determined according to Test Method D422 using standard sieves conforming to Specification E11.