Designation: D7208 − 23

Standard Test Method for Determination of Temporary Ditch Check Performance in Protecting Earthen Channels from Stormwater-Induced Erosion[1]

This standard is issued under the fixed designation D7208; 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 covers the guidelines, requirements, and procedures for evaluating the ability of temporary ditch check systems to protect earthen channels from stormwater-induced erosion. Critical elements of this protection are the ability of the temporary ditch check to:

1.1.1 Slow or pond runoff, or both, to encourage sedimentation, thereby reducing soil particle transport downstream;

1.1.2 Trap soil particles up stream of structure; and

1.1.3 Decrease soil erosion.

1.2 This test method utilizes full-scale testing procedures, rather than reduced-scale (bench-scale) simulation, and is patterned after conditions typically found on construction sites at the conclusion of earthwork operations, but prior to the start of revegetation work. Therefore this test method considers only unvegetated conditions.

1.3 This test method provides a comparative evaluation of a temporary ditch check to baseline bare soil conditions under controlled and documented conditions.

1.4 *Units*—The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound units, which are provided for information only and are not considered standard.

1.5 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026 unless superseded by this standard.

1.5.1 The procedures used to specify how data are collected/recorded and calculated in this standard are regarded as the industry standard. In addition, they are representative of the significant digits that should generally be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to commensurate with these considerations. It is beyond the scope of this standard to consider significant digits used in analysis methods for engineering design.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

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]

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

D2937 Test Method for Density of Soil in Place by the Drive-Cylinder Method

D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D6026 Practice for Using Significant Digits and Data Records in Geotechnical Data

D6460 Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Earthen Channels from Stormwater-Induced Erosion

[1] This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.25 on Erosion and Sediment Control Technology.

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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. Terminology

3.1 *Definitions*—For definitions of common technical terms used in this standard, refer to Terminology D653.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *temporary ditch check (in erosion control), n*—a non-permanent barrier consisting of rocks, straw bales, excelsior logs, wattles, lumber, rock bags, interlocking pre-cast concrete blocks, or other materials installed or constructed across a drainage way, swale, or other ephemeral waterway to reduce flow velocity, decrease erosion, and promote soil retention.

3.2.2 *trapezoidal test channel, n*—an earthen channel used to test erosion control products shaped such that the bottom is flat with sides greater than 90° angle in relation to the bottom of the channel.

4. Summary of Test Method

4.1 This test method assesses the performance of a temporary ditch check in reducing stormwater-induced erosion when subjected to simulated concentrated stormwater flow in a trapezoidal channel.

4.2 This test method utilizes full-scale testing procedures, and is patterned after conditions typically found on construction sites prior to revegetation. Further, procedures for evaluation of baseline conditions are provided. Thus, test preparation, test execution, data collection, data analysis and reporting procedures herein are intended to be suitable for testing of bare soil only and bare soil plus installed ditch checks.

5. Significance and Use

5.1 This test method evaluates a system of temporary ditch checks and their means of installation to:

5.1.1 Reduce soil loss and sediment concentrations in stormwater runoff under conditions of varying channel conditions and soil type; and

5.1.2 Improve water quality exiting the area disturbed by earthwork activity by reducing suspended solids.

5.2 This test method models and examines conditions typically found on construction sites involving earthwork activities, including: highways and roads; airports; residential, commercial and industrial developments; pipelines, mines, and landfills; golf courses; etc.

5.3 This test method is a performance test. It is a comparative tool for evaluating the erosion control characteristics of different temporary ditch checks. Take caution when comparing results from different laboratories because information about between-laboratory precision is incomplete and slight differences in soil and other environmental and geotechnical conditions may affect.

NOTE 1—The quality of the result produced by this standard is dependent on the competence of the personnel performing it, and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D3740 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with Practice D3740 does not in itself assure reliable results. Reliable results depend on many factors; Practice D3740 provides a means of evaluating some of those factors.

6. Apparatus

6.1 *Test Channel*—The earthen trapezoidal test channel shall be a minimum of 18 m (60.0 ft) in length. The channel shall be constructed to a 5 ± 0.5 % slope. The channel shall be constructed to a 0.6 m to 1.2 m (2.0 – 4.0 ft) bottom width with sloped side walls no steeper than 2H:1V prior to testing. The geometry of the channel cross section shall be explicitly stated in the report. The test channel shall have a way of measuring water discharging in to the channel. A weir is suitable this purpose.

6.2 *Water Delivery System*—The water delivery system shall include pump(s), piping, channels, and water control structures, as necessary, to achieve the desired hydraulic conditions. The water control structures shall regulate the flow and to direct it into the desired test channel. The water delivery system shall be constructed such that turbulence at the entrance to the test channel is minimized. Use of flow straighteners (for example, tube racks or vanes) will reduce turbulence and achieve flow better aligned in one direction, though head loss should be expected through these devices. Flow introduction systems can use either flow diversion from natural waterways or mechanical diversion (such as mechanical pumps) to introduce water to the test channel. All flow systems must be able to meter and measure flow that is introduced to the system in order to verify that the desired or required flow rates are achieved. The water delivery system in Fig. 1 shows an example of a closed-loop water delivery system.

6.3 *Survey Apparatus*—Channel gradient must be measured in a three-dimensional coordinate system with respect to a fixed benchmark. A total station apparatus or survey level is required to determine elevations within the test reach. The total station system is a standard surveying instrument capable of measuring distance simultaneously with vertical and horizontal angles to determine the coordinates of a location (that is, *X*, *Y* and *Z* axis) within a defined coordinate system and store the data electronically in a data logger. In lieu of a total station system, manual surveying equipment may be used. Precision and bias of either instrument must be known. Soil loss may be recorded using survey apparatus referenced to a known bench mark or by calibrated point gauge assembly referenced to relative locations within the facility.

6.4 *Velocity Probe*—A velocity probe capable of measuring point velocities to an accuracy of ±0.025 m/s (±0.10 ft/s) shall be used to identify flow conditions during test operation. Acceptable types of probes include electromagnetic, spinning cup, propeller, and static tube devices. Users should be conscious of the potential for velocity probe readings to be adversely affected by debris in the flow. Periodic (at least annual) calibration and certification of this equipment shall be performed.

6.5 *Miscellaneous*—Other miscellaneous equipment includes: meteorological equipment (wind speed, temperature, precipitation), and cameras or video recorders.

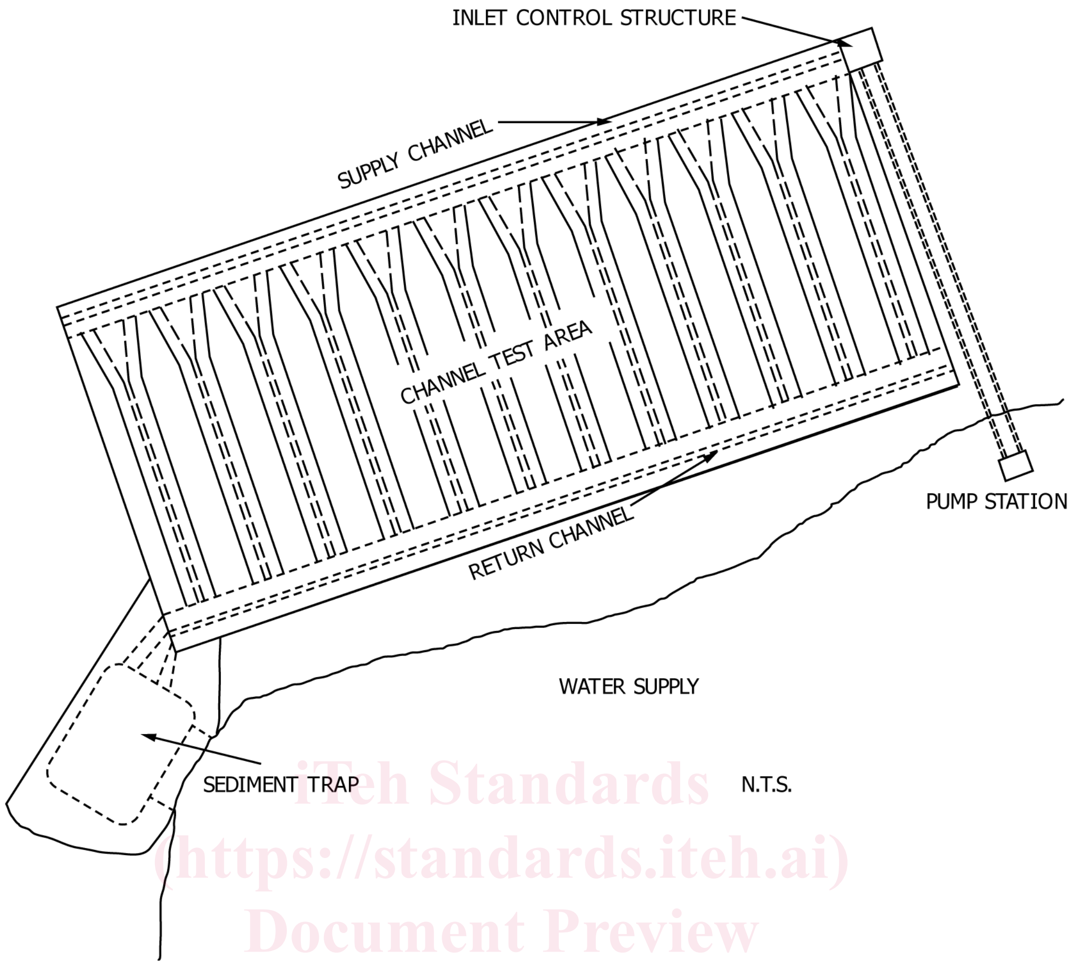

FIG. 1 Typical Water Delivery System

7. Test Water

7.1 *Water Source*—Any water source shall be suitable for testing provided that it is not sediment laden or contains deleterious materials that could impair the operation of the pumps.

8. Calibrations

8.1 *Water Control Structure / Total Discharge Determination*—The total discharge, Q_t, shall be determined independently of the measurements being made in the test section. Suitable determinations can be made by funneling the flow through a calibrated water control structure, such as a Parshall flume or a sharp-crested weir, either before the water enters or after the water exits the test section, and only once steady state flow is achieved.

8.2 For open-channel water delivery systems, measure the depth of water flowing into the test channel. Measure the velocity in the supply channel using a velocity probe in the measurement location shown in Fig. 2.

9. Procedure

9.1 *Trapezoidal Test Channel Preparation:*

9.1.1 Construct earthen test channels using conventional earthwork placement techniques similar to procedures outlined in Test Method D6460 for trapezoidal channels. Perform compaction of channel bed material to create a stable subgrade.

9.1.2 Plate the channel surface with a minimum 30-cm (12-in.) thick veneer of soil. General soil types to be used for testing shall be loam, clay, and sand. Target grain sizes and plasticity indices are included in Table 1. Place the veneer in 15 cm (6 in.) lifts and compact to 90 ± 3 % of standard Proctor density in accordance with Test Method D698 or D2937.

9.1.3 Excavate the channels to a trapezoidal cross-section with a 60 to 120 ± 2 cm (2.0 to 4.0 ± 0.07 ft) bottom width and maximum 2H:1V side slopes. The test channels shall be a minimum of 18 m (60.0 ft) in length to allow sufficient distance between temporary ditch check structures during testing. Bed slope shall be 5.0 ± 0.5 %. Fig. 3 shows a typical channel profile and Fig. 2 shows a typical channel cross-section.

9.1.4 Begin the test reach far enough below the inlet to the channel to ensure flow is uniform and extend 12.0 ± 0.1 m to (40 ± 0.3 ft) downstream from that point. Establish benchmarks on either side of the channel at each end of the test reach and at 1.5 ± 0.1 m (5.0 ± 0.3 ft) intermediate intervals (nine cross-sections total).

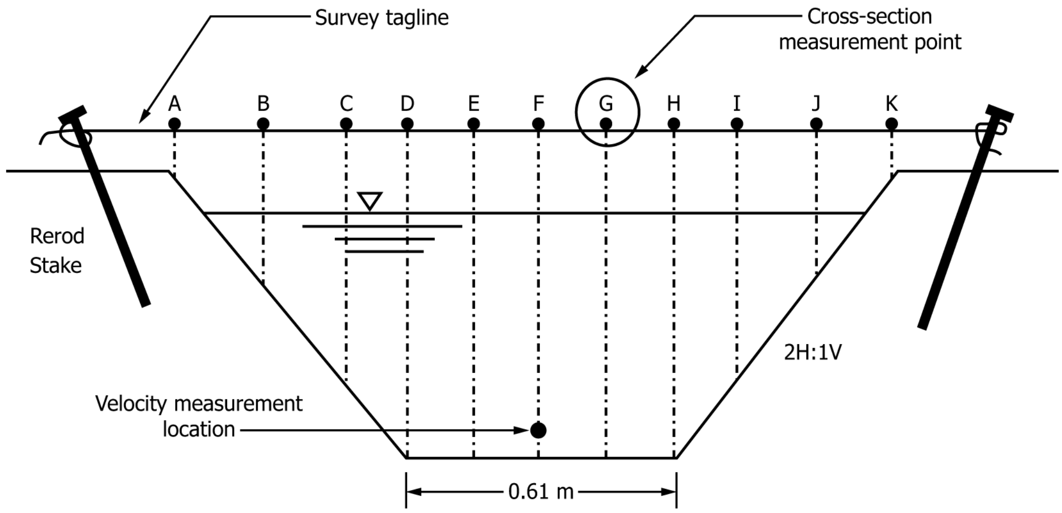

FIG. 2 Typical Channel Cross-Section

TABLE 1 Target Grain Sizes and Plasticity Indices

Particle Size (mm)	Sand	Loam	Clay
D_{100}	$25 > D_{100} > 3.0$	$10 > D_{100} > 0.3$	$3.0 > D_{100} > 0.02$
D_{85}	$4.0 > D_{85} > 0.8$	$0.8 > D_{85} > 0.08$	$0.08 > D_{85} > 0.003$
D_{50}	$0.9 > D_{50} > 0.2$	$0.15 > D_{50} > 0.015$	$0.015 > D_{50} > 0.0008$
D_{15}	$0.3 > D_{15} > 0.01$	$0.03 > D_{15} > 0.001$	$D_{15} < 0.002$
Plasticity Index	N/A (nonplastic)	2 < PI < 8	10 < PI

9.1.5 Loosen the soil veneer in the test reach and 1.5 ± 0.1 m (5.0 ± 0.3 ft) upstream and downstream of the test reach to a depth of approximately 10 ± 2 cm (4.0 ± 0.8 in.) using a tiller or other appropriate tools. Rake the tilled channel smooth with a steel hand rake and compact. Repair depressions, voids, soft or uncompacted areas before testing can commence. Also, free the channel from obstruction or protrusions, such as roots, large stones or other foreign material.

9.1.6 If the channel has been used previously for a test series, discard the soil carried out of the channel, and obliterate any rills and gullies. Spread new soil of the same type across the channel and blend (rake or tilled) into the surface.

9.2 *Pre-Test Documentation:*

9.2.1 Maintain a test folder for each test cycle, including information on:

9.2.1.1 Site conditions;

9.2.1.2 Geotechnical and soil conditions;

9.2.1.3 Meteorological data;

9.2.1.4 Temporary ditch check product type, description, and installation procedure; and

9.2.1.5 Photo documentation.

9.2.2 Include the following subjective site information: general visual conditions of the channel to be tested; general meteorological information; channel treatment; photographs or videotape, or both, and any supplemental information that is not included in the following sections, but is thought to be of significance to the test.

9.2.3 Include the following geotechnical and soils information: soil classification [Unified Soil Classification System (USCS) or USDA classification system, or both]; Standard Proctor moisture-density relationship; "K" factor; and gradation (including hydrometer test for the P_{200} fraction).

9.2.4 Include the following meteorological information: all data from the on-site weather station at the time of the test (that is, ambient air temperature, wind speed and precipitation).

9.2.5 Include the following product type and description information: manufacturer name; product name; description; specifications; size, and; a sample of the material, if practical.

9.3 *Test Set-Up:*

9.3.1 Install the maximum number of temporary ditch check(s) in the 12.0 ± 0.1 m (40.0 ± 0.3 ft) test reach after calibration has been completed and the test channel has been prepared. Document the installation methodology for the temporary ditch check(s) including: orientation on the bed and side slopes (longitudinal or lateral); placement (which side faces up); termination details; joint details; spacing between temporary ditch checks if more than one is to be tested, and; anchor type and installation pattern. Place the temporary ditch check(s) across the channel bottom perpendicular to the flow direction (or as otherwise directed to intercept flow) and extend it up the side slopes far enough so ponded water cannot erode around the temporary ditch check. If more than one temporary ditch check is to be tested, spacing shall follow manufacturer recommendations or ditch check spacing equation (see Section 10).

9.3.2 Measure the elevation of the channel surface with the surveying equipment using the reference benchmarks and a stringline between opposing benchmarks. Take elevation measurements for each test cross-section (nine total) at multiple locations such as shown in Fig. 2. Elevation measurements for additional cross-sections directly in front and behind each temporary ditch check may also be taken to measure deposition and/or scour directly adjacent to ditch check structure. To allow measurement of the channel surface, a steel tip extension ("stinger") may need to be attached to the base of the surveyor's rod. Perform rod placement from an above channel platform, so that the rodman does not walk on the test channel.