INTERNATIONAL

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Standard Practice for Rolling Wheel Load Tests to Evaluate the Structural Performance of Roadway Test Sections with Geosynthetics[1]

This standard is issued under the fixed designation D8598; 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 standard practice outlines the requirements associated with the construction and testing of full-scale unpaved and paved roadway cross sections, with and without geosynthetics, that are built in a controlled manner and trafficked using a rolling wheel load.

1.2 Test section performance from these tests is normally calculated as a function of life extension, but can also be determined based on structural improvement. Life extension is related to the number of traffic passes that can be accommodated by a particular configuration when compared to a similarly constructed control. Structural improvements are based on elemental or system-wide stiffness increases.

1.3 The rolling wheel load test is intended to be a performance test conducted as closely as possible to as-built unpaved and paved roadway cross sections. It has been used as a tool to compare the performance of different geosynthetics using the same traffic conditions for various conditions, such as soil types, material strengths, layer thicknesses, and construction procedures for a variety of pavement applications.

1.4 *Units*—The values stated in SI units are to be regarded as the standard. Values in parentheses are for information only.

1.5 *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.*

1.6 *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]

D4439 Terminology for Geosynthetics

2.2 *AASHTO Standards:*[3]

AASHTO R 50-09 Standard Practice for Geosynthetic Reinforcement of the Aggregate Base Course of Flexible Pavement Structures

3. Terminology

3.1 *Definitions*—For definitions of common geosynthetic terms used in this practice, refer to Terminology D4439.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *equivalent single-axle load (ESAL), n*—the total number of repetitions of a standard design load of 80 kN (18 kips) applied to a single axle having two sets of dual wheels.

3.2.2 *traffic benefit ratio (TBR), n*—the ratio of the number of load cycles of a pavement structure with geosynthetic to the number of load cycles for the same test section without geosynthetic to reach the same defined failure state.

4. Summary of Practice

4.1 This practice covers the major considerations associated with rolling wheel load tests conducted on constructed pavement test sections that are built in a controlled manner and trafficked using a rolling wheel load. Common configurations include paved and unpaved roads, taxiways, runways, and other load support applications that include geosynthetics.

4.2 Design and construction of individual test sections are intended to match as closely as possible the type and properties of those anticipated for use in the design situation of interest and be the same for tests that will be used to determine performance properties through direct comparisons to one another.

[1] This practice is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.01 on Mechanical Properties.

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

[3] Available from American Association of State Highway and Transportation Officials (AASHTO), 555 12th St., NW, Suite 1000, Washington, DC 20004, http://www.transportation.org.

4.3 Testing is performed by loading the surface of the pavement structure using a rolling wheel load to induce progressive vertical displacement of the surface (rut). Wheel loads should be commensurate with the application and relatable to an ESAL.

4.4 Benefit from the geosynthetic is determined by calculating the traffic benefit ratio (TBR).

4.5 Load applications can be applied either in the field using actual highway traffic, a test track, or in the laboratory using an automated mechanical device previously calibrated to full-scale field test results.

5. Significance and Use

5.1 The rolling wheel load test is primarily intended as a performance test to quantify the benefits of geosynthetics in pavement structures as recommended by AASHTO R 50-09. Performance is predominantly defined in terms of TBR.

5.2 This test is used to accelerate rutting in a roadway cross section using a rolling wheel. The results from similarly constructed rolling wheel load tests are useful to evaluate and compare the performance of various products or designs. The results from these tests are most relevant to roads having similar design characteristics (material strengths and thicknesses). The extrapolation of results to designs that deviate significantly from the parameters tested may not be accurate, and performance calculations made at significantly different traffic levels than the expected service life of an actual pavement may not provide an accurate estimate of the benefits actually realized.

5.3 The number of traffic passes applied by the trafficking system can be designed to correspond to the number of equivalent single-axle loads (ESALs) used in the AASHTO 1993 pavement design equation, provided it uses load, wheel sizes, and tire pressures associated with that design method.

5.4 The test method is applicable to geosynthetics and construction materials used in typical pavement applications.

5.5 This test method produces test data that can be used to compare geosynthetic products, construction methods, and cross section configurations used in the design of roads and other paved or unpaved structures.

5.6 This test can be used to characterize specific behaviors of the geosynthetic under the conditions tested by including sensors to measure stresses and strains within the pavement cross section or on the geosynthetic itself. Sensors should be appropriately sized and installed to minimize their influence on the test results.

5.7 The relationship between traffic passes and deformation is a function of the composite stiffness of the constructed system and the interdependence between the individual components of the design.

6. Containment Area

6.1 *Containment Area*—The containment area should be designed and constructed to encapsulate the constructed roadway test section without adversely affecting its response under trafficking, have sufficient strength and durability to withstand stresses from construction equipment and repeated traffic loading, and be wide enough to accommodate full-size construction equipment.

6.1.1 Placement of vertical boundaries should be more than 1 m (39.4 in.) from the edge of wheel path to minimize the influence of boundary walls on the test results. The distance from the applied wheel load to rigid boundaries beneath the test sections should be at least twice the width of the applied wheel load, and the thickness of the subgrade shall be no less than 90 cm (35.5 in.) to minimize the influence of rigid boundaries beneath the test sections.

6.1.2 The height of the containment area should be large enough to accommodate the minimum height for a roadway cross section subjected to typical axle loads and the minimum subgrade thickness as defined in 6.1.1.

7. Materials

7.1 Construction materials (for example, subgrade soil, geosynthetic, subbase and base aggregates, and asphalt) should match as closely as possible the type and properties of those anticipated for use in the design situation of interest and be the same for tests that will be used to determine performance properties through direct comparisons to one another. Given the difficulty of matching material properties and characteristics for situations where test section materials have a different source, allowances are provided for adjusting asphalt concrete and aggregate base and subbase thicknesses for materials of somewhat different material properties.

7.1.1 At a minimum, the particle size distribution, Atterberg limits, classification, and moisture/density relationship shall be measured and documented for the subgrade, subbase, and base course materials. Other soil properties that may be documented include stiffness, resilient modulus, density, shear strength, bearing strength, moisture susceptibility, and permeability.

7.1.2 At a minimum, the gradation, asphalt content, air void content, and Rice specific gravity shall be measured and documented for the asphalt as appropriate. The stiffness-temperature relationship of the asphalt may also be measured and documented.

7.1.3 At a minimum, the 2 %, 5 %, and ultimate tensile strength in the principal strength directions, nominal opening size, mass per unit area, polymer type, coating type, manufacturing process, and geosynthetic type shall be measured and documented (as applicable) for the geosynthetic material for identification purposes. Other geosynthetic material properties may be used to augment this information to ensure clear identification.

8. Construction

8.1 Preparation and construction of soil, aggregate, and asphalt materials should be done as closely as possible to actual construction to ensure that they are uniform and resemble design or field conditions. The size and energy of the construction equipment should be optimized as much as possible to achieve the most realistic result. Small handheld equipment should not be used to compact fill soil, aggregate, and asphalt.

8.2 Densification of soil, aggregate, and asphalt layers can be achieved using vibrating rollers (most appropriate for