



Standard Test Method for Compaction and Shear Properties of Bituminous Mixtures by Means of the U.S. Corps of Engineers Gyratory Testing Machine (GTM)¹

This standard is issued under the fixed designation D3387; 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 method employs a testing machine (Fig. 1) that generates a precisely controlled gyratory kneading process which is used to prepare and test specimens of bituminous paving mixtures. This method is intended for use in bituminous mixtures design and control testing as well as accelerated traffic simulation. The objective is to compact to the ultimate in place density under the anticipated vertical stress while monitoring the process in terms of unit mass, and shearing resistance including the plastic properties. Particular attention is given to the development of the plastic properties associated with the compaction phenomenon. The maximum permissible bitumen content is indicated directly by the first evidence of a progressive increase in shear strain (as indicated by a progressive increase in the gyratory angle) accompanied by a progressive reduction in shear strength (as indicated by a progressive reduction in roller pressure.) The procedures described here are for mix design and plant control as well as accelerated traffic simulation.

1.2 This test method covers two separate modes of operation of the Gyratory Testing Machine (GTM), namely: (1) GTM oil-filled roller mode; and (2) GTM air-filled roller mode. With the air filled roller, the GTM machine angle varies according to the resistance encountered during the gyratory kneading process. Thus the GTM using the air-filled roller is considered a better mechanical analog of the interaction between pneumatic tire and pavement structure.

1.3 This test method is for use with mixtures containing asphalt cement, asphalt binder cutback asphalt, asphalt emulsion. Test molds are available in 4-in. (101.6 mm), 6-in. (152.4 mm), and 8-in. (203.2 mm) diameters with corresponding height of 8-in. (203.2 mm), 10-in. (254.0 mm), and 12-in. (304.8 mm) respectively. These molds can accommodate maximum

particle sizes of 1 in. (25.4 mm) 1.5-in. (38.1 mm) and 2.0-in. (50.8 mm) respectively.

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

1.5 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.6 *This standard may involve hazardous materials, operations, and equipment. 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.*

2. Referenced Documents

2.1 *ASTM Standards*:²

D3666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
E1 Specification for ASTM Liquid-in-Glass Thermometers

3. Terminology

3.1 *Definitions*:

3.1.1 *Critical roller pressure, p'* —the roller pressure required for a Gyratory Shear Factor (GSF) equal to unity. That is, the roller pressure when $SG = \tau_{max}$. (See Annex A1.)

3.1.2 *Equilibrium density*—density when a rate of densification of 1 lb/ft³ (16 kg/m³) per 100 revolutions of the GTM roller carriage is reached. This rate of densification is intended to duplicate the ultimate in place density.

3.1.3 *Gyratory Angle*—measure of the magnitude of the gyratory strain θ . Four pertinent angles are defined as follows:

3.1.3.1 Machine angle (machine setting) θ_0 .

¹ This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.26 on Fundamental/Mechanistic Tests.

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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.