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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 D 3387; 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 employs two separate modes of operation of the Gyratory Testing Machine (GTM), namely: (*a*) GTM fixed roller mode; and (*b*) GTM oil-filled roller mode. The fixed roller mode of operation is employed in testing for compaction and strain indices only, while the oil-filled roller mode of operation is employed in testing for strength properties as well as compaction and strain indices. This test method is for use with mixtures containing asphalt cement, asphalt cut-back, asphalt emulsion, or tar and aggregate up to 1 in. (25.4 mm) maximum size in the 4-in. (101.6-mm) diameter specimen and 1.5 in. (38.1 mm) maximum size in the 6-in. (152.4-mm) diameter specimen.

1.2 *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:*

C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates[2]

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials[2]

3. Terminology

3.1 *Definitions:*

3.1.1 *gyrograph*—a recording of shear strain experienced by the bituminous mixture during the compaction test (see Fig. 1).

3.1.2 *gyratory angle*—a measure of the magnitude of the gyratory strain. Three pertinent angles are defined as follows:

3.1.2.1 Initial gyratory angle or shear strain (machine setting) θ_o(see Fig. 1),

3.1.2.2 Minimum gyratory angle or shear strain (minimum gyrograph band width) θ_i(see Fig. 1), and

3.1.2.3 Maximum gyratory angle or shear strain (maximum gyrograph band width) θ_{max} (see Fig. 1).

3.1.3 *gyratory stability index* (GSI)—the ratio of the maximum gyratory angle to the minimum gyratory angle (see Fig. 1).

3.1.4 *gyratory compactibility index* (GCI)—the ratio of the unit mass (total mix) at 30 revolutions of the GTM to the unit mass (total mix) at 60 revolutions of the GTM.

3.1.5 *gyratory shear strength* (S_G)—the shear resistance of the specimen which is, among other things, a function of the imposed vertical pressure and degree of strain (see Annex A1).

3.1.6 *gyratory shear factor* (GSF)—the ratio of the measured gyratory shear strength to the approximate theoretical maximum induced shear stress, that is, a factor of safety type index with regard to failure in simple shear for the defined loading conditions.

4. Significance and Use

4.1 Either mode of operation (fixed roller or oil-filled roller) is intended to be used for guidance in selection of the optimum bitumen content and establishing unit mass requirements; additionally the oil-filled roller mode of operation is intended for use in arriving at a shear strength factor (referred to as gyratory strength factor, GSF) with regard to shear under the load and strain conditions selected for the test. The procedure described here is for one selected degree of shear strain (in this case an initial gyratory angle of 1°) and some selected vertical pressure (in this case the anticipated tire contact pressure). Attention is called to the fact that the gyratory angle selected should relate to the anticipated pavement deflection. The 1° angle selected here should have wide application but should the pavement engineer select a different shear angle (such as a degree of shear strain), it should be so indicated in the report. It is essential that the vertical pressure correspond to the maximum anticipated tire contact pressure, since the theoretical stress for compaction and maximum induced shear used in determining the compaction requirements and the gyratory strength factor (GSF) is based on the concept of employing realistic loads for the test.

[1] This test method is under the jurisdiction of ASTM Committee D-4 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.26 on Fundamental/Mechanistic Tests.

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[2] *Annual Book of ASTM Standards*, Vol 04.02.

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