
Standard Method of Test for

**Evaluation of Superpave Gyratory
Compactor (SGC) Internal Angle of
Gyrations Using Simulated Loading**

AASHTO Designation: TP 71-09¹

ASTM Designation: D 7115-05



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1. SCOPE

- 1.1. This practice covers the procedure for the evaluation of the Superpave Gyratory Compactor (SGC) internal angle of gyration using an instrument capable of simulating loading conditions similar to those created by a hot mix asphalt (HMA) specimen.
- 1.2. *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. *AASHTO Standard:*
- T 312, Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor

3. TERMINOLOGY

- 3.1. *external angle*—the angle formed between the external mold diameter and a stationary reference/axis of the machine frame.
- 3.2. *internal angle*—the angle formed between the internal mold diameter and a mold end plate as a mold is gyrated in an SGC.
- 3.3. *top internal angle*—the angle formed between the internal mold diameter and the upper mold end plate as a mold is gyrated in an SGC.
- 3.4. *bottom internal angle*—the angle formed between the internal mold diameter and the lower mold end plate as a mold is gyrated in an SGC.
- 3.5. *effective internal angle*—the average of the top internal angle and the bottom internal angle.

- 3.6. *tilting moment*—a force (F) acting at one end of an SGC mold platen in a direction parallel to the axis of gyration, but acting at some distance (e) away from that axis. The tilting moment at one end of the mold platen is computed as the product of this distance (e) and force (F).
- 3.7. *total moment*—the sum total (M) of the tilting moment acting at the top of the mold and the tilting moment acting at the bottom of the mold.
- 3.8. *eccentricity*—the distance (e) away from the axis of gyration at which a force (F) is acting at one end of an SGC mold. This use of the term *eccentricity* is consistent with previous published reports describing the mechanics of gyratory compaction.²
- 3.9. *standard SGC volumetric specimen*—a standard-sized HMA specimen prepared using an SGC for purposes of volumetric mix design. Such a standard specimen, prepared in accordance with T 312, has a diameter of 150 mm and a final compacted height of 115 ± 5 mm.

4. SUMMARY OF PRACTICE

- 4.1. The internal angle of gyration of an SGC is measured dynamically with an instrument inserted into the SGC mold.
- 4.2. A load (moment) is induced on the SGC while the internal angle is simultaneously measured. The simulated loading conditions are similar to those created by compaction of a standard SGC volumetric specimen.
- 4.3. The internal angles at each end of the mold are measured and then averaged to obtain the effective internal angle of gyration.

5. SIGNIFICANCE AND USE

- 5.1. SGCs are used to produce hot mix asphalt (HMA) mixture specimens in the laboratory to assess and predict pavement performance. In the fabrication of an SGC specimen, loose HMA is placed inside a metal mold, which is then placed into an SGC. A constant consolidation pressure is applied to the sample while the mold gyrates at a nominally constant angle (referred to as the angle of gyration) and rate. Consistency in the density of the HMA specimens produced is very important to the validity of the tests performed. Specimens of a consistent density are produced when an SGC maintains a constant pressure and a known constant angle of gyration during the compaction process.
- 5.2. There are several manufacturers and models of SGC. Each model employs a unique method of setting, inducing, and maintaining the angle of gyration. Each model also employs a unique calibration system to measure the external angle of gyration. These existing calibration systems cannot be used universally on all of the different SGC models commercially available. Inconsistencies in HMA specimens produced on different SGC models have been attributed to variations in the angle of gyration.
- 5.3. This practice describes instruments and processes that can be used to independently measure the internal angle of gyration of any manufacturer's SGC model under simulated loading conditions. The external shape of the instrument chassis assures that the points of physical contact between the mold end plates and the instrument occur at a fixed and known distance away from the axis of gyration. As a result, the vertical load is applied at these fixed points, creating tilting moments at each end of the mold.