

**METHODS OF SAMPLING AND TESTING**  
**MT 335-11**  
**LINEAR KNEADING COMPACTION OF BITUMINOUS MIXTURES**

**1 Scope:**

- 1.1 Use this test method for preparing compacted slabs of bituminous mixture for testing on Wheel-Track Devices.

**2 Reference Documents:****2.1 MT Manual:**

MT 303	Method of Sampling Bituminous Paving Mixtures
MT-309	Reducing Samples of Hot Mix Asphalt to Testing Size
MT 314	Bulk Specific Gravity of Compacted Bituminous Mixtures
MT 321	Maximum Specific Gravity of Bituminous Mixtures
MT 332	Gyratory Compaction of Bituminous Mixtures
MT 334	Hamburg Wheel-Track Testing of Compacted Bituminous Mixtures

**3 Apparatus:**

- 3.1 *Linear Kneading Compactor* - A slab of plant mix is compacted by applying pressure to the plant mix through a series of rectangular parallel plates. The sample is placed in an open top steel box with the desired dimensions. Closely fitting steel plates are placed in a vertical row across the plant mix. A steel roller travels back and forth on the row of plates and successively applies pressure to the plant mix through the plates. This compacting motion continues until the height of the sample of plant mix is reduced to the height calculated to yield the desired voids.

3.1.1 *Steel Wear Plate* - 10.125" wide, 12.6" long, .125" high

3.1.2 *Steel Compacting Plates* - 3.6" high

3.1.3 *Steel Compaction Carrier Box* - 10.25" wide, 12.625" long, 6" high

3.2 *Temperature Control System* - An oven which can maintain temperatures (250°F to 350°F).

3.3 *Rubber Mallet*

**4 Sample:**

- 4.1 *Field Samples* - The top lift or lifts of plant mix are tested. Samples for testing should have a thickness that is more than three times the nominal maximum aggregate size.

4.1.1 *Slabs* - The formula for the volume of a slab is as follows: length x width x thickness. The amount of material to batch for each slab with  $7 \pm 1\%$  air voids is determined by multiplying the sample length x width x thickness in cubic centimeters by the sample's maximum specific gravity (Gmm) x 0.93.

$$\text{Mass for sample} = 5283 \text{ cm}^3 \times 1 \text{ gm/cm}^3 \times \text{Gmm} \times 0.93$$

- 4.1.2 *Laboratory Produced Mix* - Before mixing bituminous mixtures for testing, all of the pans and implements should be "buttered". Heat materials to be mixed in a laboratory to the mixing temperature range in a forced draft or convection oven. Do not overheat the samples.

**5 Procedure:**

- 5.1 Make sure plant mix is up to compaction temperature, if not, place in the oven. Mix and quarter in accordance to MT-309 to approximate sample sizes.
- 5.2 Weigh out two each sample size slabs. Note that prepared lab samples are pre-made to sample size. Return second sample to the oven to maintain compaction temperature range.
- 5.3 Take preheated mold plate out of oven and place in compaction carrier box. Load sample into compaction carrier box and place the steel parallel plates vertically on top of the sample mixture. To level plates on the sample, use a rubber mallet if needed.
- 5.4 Close the Kneading Compactor door and press the power on and start buttons. This will move the sample under the compaction wheel.
- 5.5 Apply pressure with the hydraulic jack to a load which will compact the sample material to voids of  $7 \pm 1\%$ . Maintain a constant pressure until sample reaches proper voids.
- 5.6 Press the stop button to draw the sample back to the original starting point. Remove steel plates and side walls. Remove slab along with the bottom plate and cool to room temperature (to the touch).
- 5.7 Repeat the procedure for the second sample.
- 5.8 Determine bulk density using MT 314 Bulk Specific Gravity of Compacted Bituminous Mixtures.

**6 Report:**

- 6.1 Report the Bulk Specific Gravity of Compacted Bituminous Mixtures and calculate the voids in the mixture using MT-321- Maximum Specific Gravity of Bituminous Mixtures (Rice Gravity).

**7 Calibration / Equipment Verification Procedure:**

- 7.1 The inside form dimensions of the steel compaction carrier box is critical for this procedure.