

**INDIANA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS MANAGEMENT**

**BULK SPECIFIC GRAVITY of AGGREGATE BLENDS
IN HMA MIXTURES
ITM No. 584-16T**

1.0 SCOPE.

- 1.1** This test method covers the procedure to determine the bulk specific gravity (Gsb) of a combined aggregate blend used in the HMA mixture.
- 1.2** This ITM may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. The user of the ITM is responsible for establishing appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

2.0 REFERENCED DOCUMENTS.

2.1 AASHTO Standards.

- R 35 Superpave Volumetric Design for Hot Mix Asphalt
T 84 Specific Gravity and Absorption of Fine Aggregates
T 85 Specific Gravity and Absorption of Coarse Aggregate
T 209 Maximum Specific Gravity of Bituminous Paving Mixtures

2.2 ITM Standards.

- 207 Sampling Stockpiled Aggregates
586 Binder Content by Ignition
571 Quantitative Extraction of Asphalt and Gradation of Extracted Aggregate from Asphalt Paving Mixture.

2.3 Other References.

- SP-2 Superpave Mix Design by Asphalt Institute

3.0 TERMINOLOGY. Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specifications, Section 101.

4.0 SIGNIFICANCE AND USE.

- 4.1** This ITM is used to determine the bulk specific gravity of a combined aggregate blend with recycled aggregate used in HMA mixture.
- 4.2** The bulk specific gravity (G_{sb}) of a combined aggregate blend is calculated using an estimate of the bulk specific gravity of the aggregate in the reclaimed asphalt pavement and the actual bulk specific gravity of the other aggregates.
- 4.3** The bulk specific gravity of an aggregate blend is used to perform a volumetric analysis on compacted HMA in accordance with AASHTO R 35.

5.0 APPARATUS. The apparatus shall be as stated in the referenced test methods.

6.0 SAMPLING. Sampling shall be as stated in the referenced test methods.

7.0 PROCEDURE.

- 7.1** Identify the coarse aggregate(s), fine aggregate(s) and reclaimed asphalt pavement selected for use in the mix design
- 7.2** Identify and record the actual percentages for each of the aggregate components used in the combined aggregate blend of the mix design
- 7.3** Obtain a representative sample of the recycled materials in accordance with ITM 207
- 7.4** Record the bulk specific gravity of each of the coarse aggregate(s) from the Department HMA Bulk Specific Gravities list
- 7.5** Record the bulk specific gravity of each of the fine aggregate(s) from the Department HMA Bulk Specific Gravities list
- 7.6** Record the bulk specific gravity of reclaimed asphalt shingles as 2.500
- 7.7** Record the bulk specific gravity of mineral filler(s) or baghouse fines as 2.800
- 7.8** Determine and record the maximum specific gravity of the reclaimed asphalt pavement in accordance with the supplemental procedure for mixtures containing porous aggregate in AASHTO T 209
- 7.9** Determine and record the asphalt content of the reclaimed asphalt pavement in accordance with ITM 571

- 7.10** Calculate and record the effective specific gravity of the recycled aggregate as follows:

$$(G_{se})_{RAP} = \frac{100 - P_b}{\frac{100}{G_{mm}} - \frac{P_b}{1.03}}$$

where:

$(G_{se})_{RAP}$ = effective specific gravity of the recycled aggregate

P_b = percent binder of the reclaimed asphalt pavement

G_{mm} = maximum specific gravity of the reclaimed asphalt pavement

- 7.11** Calculate and record the bulk specific gravity of the recycled aggregate as follows:

$$(G_{sb})_{RAP} = [0.9397 \times (G_{se})_{RAP}] + 0.0795$$

where:

$(G_{sb})_{RAP}$ = bulk specific gravity of the recycled aggregate

$(G_{se})_{RAP}$ = effective specific gravity of the recycled aggregate

- 7.11** If the $(G_{sb})_{RAP}$ of the recycled aggregate is equal to or greater than 2.600 or equal to or less than 2.680, use 2.640 as the $(G_{sb})_{RAP}$. If the $(G_{sb})_{RAP}$ is less than 2.600 or greater than 2.680, the Department will obtain a sample of the reclaimed asphalt pavement and determine the $(G_{sb})_{RAP}$.

- 7.12** Calculate and record the bulk specific gravity of the combined aggregate blend as follows:

$$(G_{sb})_{TOTAL} = \frac{P_1 + P_2 + \dots + P_N + P_{RAP} + P_{RAS} + P_{BH} + P_{MF}}{\frac{P_1}{G_1} + \frac{P_2}{G_2} + \dots + \frac{P_N}{G_N} + \frac{P_{RAP}}{(G_{sb})_{RAP}} + \frac{P_{RAS}}{2.500} + \frac{P_{BH}}{2.800} + \frac{P_{MF}}{2.800}}$$

where:

- $(G_{sb})_{TOTAL}$ = bulk specific gravity of the combined aggregate blend
- $P_1, P_2 \dots P_N$ = percentages by weight of aggregates 1, 2...N
- $P_{RAP}, P_{RAS}, P_{BH}, P_{MF}$ = percentages by weight of RAP, RAS, Baghouse Fines and Mineral Filler
- $G_1, G_2 \dots G_N$ = bulk specific gravities of aggregates 1, 2...N
- $(G_{sb})_{RAP}$ = bulk specific gravity of recycled aggregate
- $P_1 + P_2 + \dots + P_N + P_{RAP} + P_{RAS} + P_{BH} + P_{MF} = 100.0\%$

- 8.0 REPORT.** The G_{sb} of the combined aggregate blend is reported to the nearest 0.001.