Colorado Procedure 56-09

Standard Practice for

Guidelines for Using Maximum Specific Gravity (Rice) of Project-Produced HMA to Change the Target Specific Gravity for Compaction Compliance

1. SCOPE

1.1   During the production of Hot Mix Asphalt, changes may occur in the maximum specific gravity of the mix. This change may be detected, and target specific gravity corrected, by measuring the maximum specific gravity (CP 51) of the project-produced material.

2. REFERENCED DOCUMENTS

2.1   *AASHTO Standards*:
   T 84   Specific Gravity and Absorption of Fine Aggregate
   T 85   Specific Gravity and Absorption of Coarse Aggregate
   T 164   Quantitative Extraction of Asphalt Binder from Hot-Mix Asphalt (HMA) by the Ignition Method
   T 308   Determining the Asphalt Binder Content of Hot-Mix Asphalt (HMA) by the Ignition Method

2.2   *Colorado Procedures*:
   CP 55   Reducing Field Samples of Hot Mix Asphalt to Testing Size
   CP 85   Asphalt Cement Content of Asphalt Mixtures by the Nuclear Method
   CP-L 5120   Determination of the Asphalt Binder Content of Bituminous Mixtures by the Ignition Method

3. APPARATUS

3.1   For the determination of the maximum specific gravity, the equipment shall be in accordance with CP 51.

3.2   For the determination of the asphalt cement content, the equipment shall be in accordance with AASHTO T 164, AASHTO T 308, CP-L 5120 or CP 85.

4. SAMPLING

4.1   A portion of the sample from CP 85, or a split sample, shall be used for determining the maximum specific gravity (CP 51). Reduction to test size shall be in accordance with CP 55.

4.2   Measure and record the maximum specific gravity in accordance with CP 51.

4.3   Measure and record the asphalt cement content in accordance with AASHTO T 164, AASHTO T 308, CP-L 5120 or CP 85.

5. PROCEDURE

5.1   A test for maximum specific gravity may be run for information during nuclear asphalt content gauge correlation, and compared to the maximum specific gravity reported on the Form #43. This optional test yields information that compares the maximum specific gravity of materials on the project with materials used in the design.

5.2   The tests for maximum specific gravity should be performed as early during production as possible. The best time to start is during the compaction test section.

5.2.1   Average the results of three maximum specific gravity tests (6 values) from known asphalt cement contents from the field-produced material.

5.2.2   Average the results of three asphalt cement content tests from the field-produced material.

NOTE 1: If all the design criteria are within specification, and the plot of the point determined in Subsections 5.2.1 and 5.2.2 differs by more than 0.010 from the graph sent with the mix design of the asphalt cement content versus maximum specific gravity, then the target maximum specific gravity for compaction shall be changed on the Form #43, as follows.

NOTE 2: If the maximum specific gravity is adjusted, it is possible that the aggregate specific

gravity has changed. The Contractor or the Engineer may request that the individual aggregates be re-sampled and retested to determine a new aggregate specific gravity (AASHTO T 84 & T 85). The re-sampled individual aggregates will be split and the Contractor will keep one split for testing while the other split will be immediately given to the Engineer for possible testing. The new aggregate specific gravity will be entered on the new Form #43 and a new VMA target will be calculated. If the new VMA target does not meet the minimum requirements specified in the Revision of 403, work shall be suspended and the Contractor shall complete and submit a new mix design meeting all of the requirements at no additional cost to the Department.

6. CALCULATIONS

6.1   Determine the effective specific gravity of the aggregate, as follows:

$$G_{se} = \frac{100 - P_{ba}}{\dfrac{100}{G_{mm}} - \dfrac{P_{ba}}{1.03}}$$

Where:

G_{se}	=	Effective specific gravity of the aggregate,
G_{mm}	=	Average maximum specific gravity (from Subsection 5.2.1),
P_{ba}	=	Average percent asphalt cement (from Subsection 5.2.2).

6.2   Determine the new target maximum specific gravity at optimum asphalt cement content, as follows:

(Note: Optimum asphalt cement content is from Form #43.)

$$G_{max} = \frac{100}{\dfrac{P_s}{G_{se}} + \dfrac{P_{bo}}{1.03}}$$
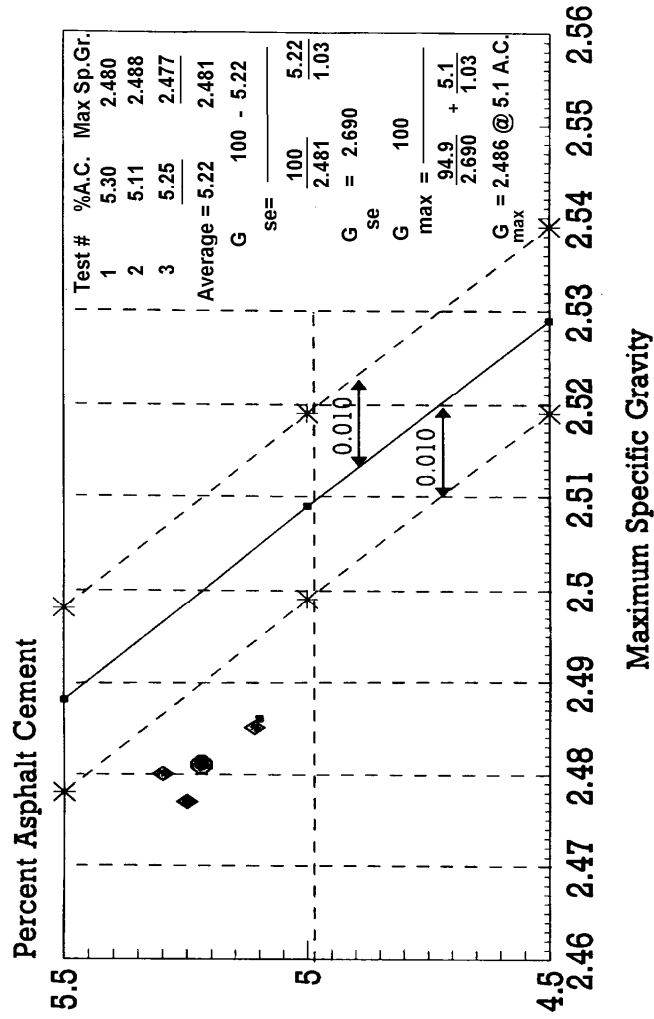
Where:

G_{max}	=	New target maximum specific gravity at optimum asphalt cement content,
P_s	=	Percent of aggregate at optimum asphalt cement content (100 minus optimum asphalt cement content),
P_{bo}	=	Optimum asphalt cement content,
G_{se}	=	Effective specific gravity (from Subsection 6.1).

6.3   The new target maximum specific gravity shall be reported on the Form #43. The Form #43 shall be dated when the contractor is notified of the new target. The Form #43 shall be signed by all of the involved parties.

NOTE 3: Following establishment of the new target maximum specific gravity, a new tolerance band of $\pm$ 0.01 shall be made and all further Rice values should be inside the tolerance band. If two consecutive maximum specific gravity values fall outside the 0.01 tolerance band, the next sample shall be taken immediately and a maximum specific gravity test performed. A new target maximum specific gravity based on three consecutive tests shall be specified on the Form #43, provided that all the design criteria are within specification. Aggregate specific gravity will again be determined in accordance with Note 2.

Example

Design = 5.1% A.C. and 2.507 Max. Sp. Gr.

Test #	%A.C.	Max Sp.Gr.
1	5.30	2.480
2	5.11	2.488
3	5.25	2.477
Average = 5.22		2.481

$$G \quad 100 - 5.22$$

$$se = \frac{100}{2.481} - \frac{5.22}{1.03}$$

$$G_{se} = 2.690$$

$$G_{max} = \frac{100}{\frac{94.9}{2.690} + \frac{5.1}{1.03}}$$

$$G_{max} = 2.486 \text{ @ 5.1 A.C.}$$

Percent Asphalt Cement

Maximum Specific Gravity

0.010

0.010

- ■- CDOT Design   ◆ Field Results   ✳ Minimum Spec.

✳ Maximum Spec.   ● Ave. Field Results   · New Max. Sp. Gr.

Field Sheet #

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