

**Standard Method of Test for
Field Determination of Target Density for Plant Produced
Asphalt Mix by Use of the Control Strip Technique**
SCDOT Designation: SC-T-65 (01/20)

1. SCOPE

- 1.1 This test method is a guide of how to properly construct a control strip during the placement of plant produced asphalt pavement. Control strips are necessary to determine an optimum roller pattern and to establish a proper target density.

2. REFERENCED DOCUMENTS

- 2.1 SC Test Methods
SC-T-101
- 2.2 Forms
SCDOT Electronic Forms
400.02
400.11

3. SUMMARY OF TEST METHOD

- 3.1 This test method is a guide to help determine the number of passes for each phase of rolling to achieve contract density requirements. Use the average of 10 random density readings to determine the compaction effort necessary to achieve the target density of asphalt mixtures.

4. SIGNIFICANCE AND USE

- 4.1 To determine the target density of plant produced asphalt that will be used to monitor the compaction effort throughout the construction of plant produced asphalt pavements. As work progresses, construct additional control strips if there are changes to any of the following: underlying support, type of asphalt mix, the thickness of the mat, the paving or rolling equipment, any other elements that might affect the final density achieved, or when density requirements are not being met.

5. APPARATUS

- 5.1 The Contractor selects the equipment for rolling the plant produced asphalt in the control strip so long as proper density and a smooth riding pavement are obtained. The density gauge should be capable of measuring the density of asphalt concrete materials and is to be operated by a trained and certified operator. If an electronic impedance type gauge is used, ensure that it is approved by the Asphalt Materials Engineer (AME). Lumber crayon or similar to mark gauge locations and document measured readings.

6. TEST SPECIMEN

- 6.1 Minimum of 900 ft. of freshly paved asphalt roadway.

7. PROCEDURE

7.1 General

- 7.1.1 Ensure that the control strip is at least 900 feet in length, one paving width wide, and the same thickness as required in the construction documents. This 900 ft section is divided further into three sections. The first 300 ft allows the equipment to level out, the second section from 300-600 ft establishes the roller pattern, and the third section is required to determine target densities. Requirements for each of these sections is described below
- 7.1.2 Ensure that the material used for construction of the control strip is representative of the plant produced asphalt in the subsequent paving operation. Ensure that the delivery temperature is suitable and consistent with the expected temperature for the remainder of the work. Temperature is required to meet subsection 401.4.17 of the Standard Specifications.
- 7.1.3 Construct the control strip using the same paving and rolling equipment that will be used for the subsequent paving operation.

7.2 Optimum Roller Pattern

- 7.2.1 Use the optimum roller pattern described below as a guide to achieve consistent compaction. The contractor has the authority to vary the roller pattern as the paving operation progresses in order to achieve density requirements. If the roller pattern varies more than two passes per phase from the original roller pattern, the contractor must establish a new roller pattern.
- 7.2.2 The first 300 ft. section is intended to let the asphalt plant level out at the beginning of production to ensure that subsequent target densities determined are representative of the entire project. The Contractor is required to roll a 3-3-3 roller pattern in this section and monitor densities. The densities are for informational purposes only with the intent they only be used to determine if the road in question has the necessary sub-structure to resist subsequent compaction efforts.
- 7.2.3 In the second 300 foot section, break the 300 foot section into three sections approximately 100 feet each for each phase of rolling. Place the gauge on the freshly compacted mat and mark around the gauge with a lumber crayon. Mark two more additional locations approximately 10 feet apart within the 100 foot section for the breakdown roller. Ensure that the readings are at least 3 feet from the pavement edge. *If more than three rollers are used, use 100 feet additional in the 300 foot section, if less than three rollers are used, use 100 feet less in the 300 foot section to establish roller pattern.*
- 7.2.4 Take density gauge readings for the 3 selected locations and record them on SCDOT Form 400.02.

Note – Note the current offset to cores or use a zero offset on the gauge when obtaining control strip density readings. All gauge offsets must be noted on the Form 400.02.

7.3 Target Density

7.3.1 After all rolling of the control strip has been completed, make 12 random density gauge readings in the control strip area in the last 300 foot section. Discard the highest and lowest. Average these readings and use this average control strip density as the target density for subsequent paving operation. On projects where a density is used for final mixture acceptance, SCDOT will calculate core and gauge locations using SC-T-101 from the end of the target strip. The initial 900 feet of paving will not be used for calculating core locations or gauge shots used for final mixture acceptance. In the event that less than 900 feet is paved, then use 3-3-3 pattern or a previously accepted roller pattern per SC-M-400.

7.3.2 The Contractor is responsible for achieving density requirements in the contract documents. All measurements taken for acceptance should be documented on the road by using a lumber crayon or similar to mark around the perimeter of the gauge where the shot was taken along with the measured density written on the roadway surface. The Contractor will inform the **RCE** and the **AME** when the final density measurement continues to fail to meet density requirements. The **RCE** will investigate along with the **AME** to determine if there is not enough sub-structure support to achieve compaction efforts. The contractor must provide documentation that suitable equipment has been used and proper roller pattern procedures were followed in an attempt to achieve the maximum attainable density. The **RCE** and the **AME** will notify and give recommendations to the **DCE** based on their observations. The **DCE** will review this documentation and determine whether the density of the mix cannot be met under the current contract specifications. The use of a lower specification limit in the contract specifications for determining density of roadway cores or a density gauge may be used for final mixture acceptance.

8. CALCULATIONS

8.1 Example 1:

Roller # Passes	Site # 1 @ 340	Site # 2 @ 350	Site # 3 @ 360	Average	Remarks
Vibratory Steel Pass 1	133.0	133.6	134.0	133.5	
Vibratory Steel Pass 2	133.3	135.1	135.0	134.5	Use
Vibratory Steel Pass 3	132.9	135.0	135.0	134.3	Broke
Roller # Passes	Site # 1 @ 440	Site # 2 @ 450	Site # 3 @ 460	Average	Remarks
Pneumatic Pass 1	135.3	135.3	136.1	135.6	
Pneumatic Pass 2	135.5	135.2	136.4	135.7	
Pneumatic Pass 3	134.9	136.3	136.8	136.0	Use
Pneumatic Pass 4	136.0	136.1	135.6	135.9	Broke*
Roller # Passes	Site # 1 @ 540	Site # 2 @ 550	Site # 3 @ 560	Average	Remarks
Static Steel Pass 1	138.0	139.0	138.1	138.4	
Static Steel Pass 2	138.1	140.0	139.8	139.3	Use

Static Steel Pass 3	137.7	139.9	139.6	139.1	Broke
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*When a pneumatic roller is utilized, it is up to the contractor to use the determined number of passes or more passes in order to achieve density and keep tires on pneumatic roller warm.

Established Roller Pattern in Example 1: 2-3-2

SCDOT Form No. 400.02 must be used to document Contractor's roller pattern

8.2 Example 2: Target Density

Final 600-900 foot section (12 random readings)					
139.3	138.5	140.1	139.2	138.3	137.9
138.5	139.4	138.2	135.9	135.2	138.2

Discard the highest and the lowest readings: 140.1 & 135.2

Established target density (average of remaining 10 gauge readings above) = 138.3 psy

Average Daily Random Readings (SC-T-101) = 137.6 psy

Percentage of Target Density (% Compaction) = $137.6/138.3 * 100 = 99.4\%$

9. REPORT

9.1 Record roller patterns and densities on SCDOT Form 400.02 (Target Density) and 400.11 (In-place Density – for acceptance).

10. PAYMENT

10.1 The 900 foot control strip section described above will be paid at the average pay for the daily LPF for this day. Determine the payment using the contract specifications to calculate Lot Pay Factor for in-place density.