Colorado Procedure 77-18

Standard Procedure for

Determination of Macro-Texture of a Pavement Surface

1.   SCOPE

1.1   This test method describes the means to evaluate the macro-texture of an HMA or PCCP pavement surface.

1.2   This CP may involve hazardous materials, operations, and equipment. This CP does not purport to address all of the safety problems associated with the CP's use. The CP user's responsibility is to establish appropriate safety and health practices and determine the applicability of regulatory limitations before use.

2.   REFERENCE

2.1   *AASHTO Standards:*
   - M 247-07, Type 1 Glass Beads Used In Traffic Paints

2.2   ASTM Standards:
   - E 1094-04 Pharmaceutical Glass or ISO Standard 6706 Plastic Laboratory Ware - Graduated Measuring Cylinders

2.3   *CP Standards:*
   - FMM Appendix L, Random Sampling

3.   TERMINOLOGY

3.1   Terms and abbreviations shall be as per the CDOT Standard Specifications and the Field Materials Manual.

Method A – Milled HMA Surface

4.   SIGNIFICANCE AND USE

4.1   This CP is used to evaluate the macro-texture of a milled HMA pavement surface.

5.   APPARATUS

5.1   *Filler:* Type 1 glass beads per AASHTO M 247-07.

5.2   *Spreader:* A flat, stiff, hard disk made from methyl methacrylate (Plexiglas) with a thickness of 0.5 ± 0.1 in., with a diameter of 8 ± 2 in. and a round handle affixed in the center used to spread the filler.

5.3   *Graduate:* A conical or cylindrical shape graduate, Type 1, Class B, or better, 250 ml capacity conforming to the volume and accuracy requirements of ASTM E 1094-04 or ISO Standard 6706 used to measure the volume of filler for the test.

5.4   *Brushes:* A stiff wire brush and a soft-bristle brush are used to clean the pavement.

5.5   *Container:* A small container with a secure and easily removable cover used to store at least 200 ml of filler.

5.6   *Screen:* A shield used to protect the test area from air turbulence created from wind or traffic.

6.   LABORATORY PREPARATION

6.1   Prepare one container for each sample location.

6.2   Fill the graduate with 200 ± 2 ml of filler.

6.3   Gently tap the side of the graduate to level the surface of the filler.

6.4   Place the measured volume of filler in the container.

6.5   Label the container with the type and quantity of filler.

7.   PROCEDURE

7.1   Randomly determine a sample location on the milled pavement surface following the CP 75 Random Sampling, to test the macro-texture.

7.2   Inspect the sample location and ensure it is a dry, homogeneous site, free of unique or localized features such as cracks, joints, stripping, and patching.

7.3   If localized features are present, move up-station at the same transverse offset until a a suitable site is found.

7.4   Gently clean an area of about 1 foot by 1 foot for the sample location using the stiff wire brush to remove any, residue, debris, or loosely bonded material. Be careful not to dislodge bonded material. After using the stiff wire brush, gently brush the sample location with the soft bristle brush to remove any remaining debris.

7.5   Place the screen on the milled pavement surface to protect the sample location from air turbulence.

7.6   Hold the container with filler above the pavement at the sample location at a height not greater than 4 in.

7.7   Pour the measured volume of filler from the container onto the milled pavement surface into a conical pile.

7.8   Place the spreader lightly on top of the conical pile of filler being careful not to compact the filler.

7.9   Move the spreader in a slow, circular motion to disperse the filler in a circular area and to create a defined crest around the perimeter. An alteration of the circular pattern is unacceptable and should be minimized.

7.10   Continue spreading the filler until it is well dispersed and the spreader rides on top of the high points, of the milled pavement surface.

7.11   Measure and record the diameter of the circular area four times, at intervals of 45º and to the nearest 0.1 in., as shown in Figure 1.
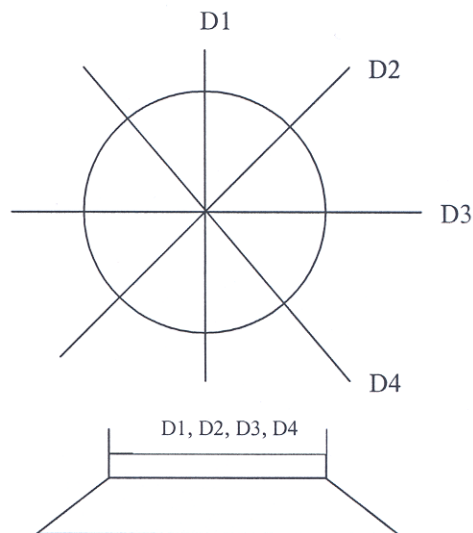

FIGURE 1: Typical Measuring Pattern

7.12   Measure the diameter of the circular area from the top (crest) of the slope on one side, through the center, and to the top (crest) of the slope on the other side of the circular area.

7.13   Calculate the average diameter of the circular area covered by the filler.

7.14   Determine the macro-texture thickness of the milled pavement surface by using the Cross-reference table on the bottom of the Macro-Texture Report forms for Method A. Report the result to three decimal places.

7.15   Remove the filler material from the location using the soft bristle brush and repeat Subsections 7.5 through 7.14.

7.16   Determine the average macro-texture thickness by adding the two results determined in Subsection 7.14 and dividing by 2. Report the result to three decimal places.

Method B – PCCP Surface

8. SIGNIFICANCE AND USE

8.1 This method is used to evaluate the macro-texture of a PCCP surface.

9. APPARATUS

9.1 *Filler:* Type 1 glass beads per AASHTO M 247-11.

9.2 *Spreader:* A flat, stiff hard disk with a thickness of 1.0 ± 0.5 in., with a diameter of 4 ± 2 in.

9.3 *Graduate:* A conical or cylindrical shape graduate, Type 1, Class B, or better, 250 ml capacity conforming to the volume and accuracy requirements of ASTM E 1094-04 or ISO Standard 6706 used to measure the volume of filler for the test.

9.4 *Brushes:* A stiff wire brush and a soft-bristle brush are used to clean the pavement.

9.5 *Container:* A small container with a secure and easily removable cover used to store at least 50 ml of filler.

9.6 *Screen:* A shield used to protect the test area from air turbulence created from wind or traffic.

10. LABORATORY PREPARATION

10.1 Prepare one container for each sample location.

10.2 Fill the graduate with 25 ± 2 ml of filler.

10.3 Gently tap the side of the graduate to level the surface of the filler.

10.4 Place the measured volume of filler in the container.

10.5 Label the container with the type and quantity of filler.

11. PROCEDURE

11.1 Randomly determine a sample location on the pavement surface per CP 75 Random Sampling procedure, to test the macro-texture.

11.2 Gently clean an area of about 1 foot by 1 foot for the sample location using the stiff wire brush to remove any, residue, debris, or loosely bonded material. Be careful not to dislodge bonded material. After using the stiff wire brush, gently brush the sample location with the soft bristle brush to remove any remaining debris.

11.3 Place the screen on the pavement surface to protect the sample location from air turbulence.

11.4 Hold the container with filler above the pavement at the sample location at a height not Greater, than 4 in.

11.5   Pour the measured volume of filler from the container onto the milled pavement surface into a conical pile.

11.6   Place the spreader lightly on top of the conical pile of filler being careful not to compact the filler.

11.7   Move the spreader in a slow, circular motion to disperse the filler in a circular area and to create a defined crest around the perimeter. An alteration of the circular pattern is unacceptable and should be minimized

11.8   Continue spreading the filler until it is well dispersed and the spreader rides on top of the high points of the pavement surface.

11.9   Measure and record the diameter of the circular area four times, at intervals of 45º and to the nearest 0.1 in., as shown in Figure 1.

11.10   Calculate the average diameter of the circular area covered by the filler.

11.11   Determine the macro-texture thickness of the pavement surface by using the cross-reference table on the bottom of the Macro-Texture Report Form for Method B. Report the result to three decimal places.

11.12   Repeat Subsections 11.2 through 11.11 two more times on areas within the selected PCCP panel.

11.13   Remove the filler material from the locations and properly dispose of the material.

12.   CALCULATIONS

12.1   Calculate the average diameter of the circular area covered by the filler.

$$Da = (D1 + D2 + D3 + D4) / 4$$

Where:
Da = Average diameter of the filler area, inches
D1, D2, D3, D4 = Diameters of the filler area, in.

$$\text{Area (in}^2) = \pi\, Da^2/4$$

Calculate the volume of filler in cubic inches (in.^{3})

$$V \text{ (in.}^3) = V \text{ (ml) } /16.387 \text{ ml/in.}^3$$

Calculate Macro-Texture Depth (inches):

Depth: Volume of the filler (in^3) divided by Area of the filler (in.^{2}).

Example:
Da = 8.0 inches

$$\text{Area} = \pi\, Da^2/4 \Rightarrow \pi\, 8.0^2/4 = 50.265 \text{ in.}^2$$

Volume of filler = 25 ml ➔ Converting ml to cubic inches = 25/16.387 = 1.525 in.^{3}

Depth = 1.525 in.^{3}/50.265 in.^{2} = 0.030 in.

12.2 Calculate the Average Texture Depth (ATD) of the selected PCCP panel by adding the individual macro-texture depth results and dividing by three.

12.3. Report the ATD to the nearest 0.001 inches.

13. REPORT

13.1 Report the following information:

Project Rep.
Date of Report
Project number
Contract ID
Name of the prime contractor and representative
Test #
Date of test
Station or Milepost of sample location
The offset of the sample location
The diameter of the filler area, D1, D2, D3, D4
The average diameter of the filler area
Macro-texture Depth

MACRO-TEXTURE REPORT (METHOD A)

Project Rep.: _____   Date of Report: _____

Project No: _____   Contract ID: _____

Milling Contractor: _____   Prime Contractor: _____

Milling Rep.: _____   Prime Rep.: _____

Test #	Date	Sta	Offset	Dia. D1 (in)	Dia. D2 (in)	Dia. D3 (in)	Dia. D4 (in)	Dia. Avg (in)	Macro Texture
								Average =	
								Average =	
								Average =	
								Average =	

MACRO-TEXTURE THICKNESS BASED ON 200 ML OF FILLER AND AVERAGE DIAMETER

Average Diameter (inches)	Macrotexture Thickness (inches)	Average Diameter (inches)	Macrotexture Thickness (inches)	Average Diameter (inches)	Macrotexture Thickness (inches)
7.1	0.308	8.8	0.201	10.5	0.141
7.2	0.300	8.9	0.196	10.6	0.138
7.3	0.292	9.0	0.192	10.7	0.136
7.4	0.284	9.1	0.188	10.8	0.133
7.5	0.276	9.2	0.184	10.9	0.131
7.6	0.269	9.3	0.180	11.0	0.128
7.7	0.262	9.4	0.176	11.1	0.126
7.8	0.255	9.5	0.172	11.2	0.124
7.9	0.249	9.6	0.169	11.3	0.122
8.0	0.243	9.7	0.165	11.4	0.120
8.1	0.237	9.8	0.162	11.5	0.117
8.2	0.231	9.9	0.159	11.6	0.115
8.3	0.226	10.0	0.155	11.7	0.113
8.4	0.220	10.1	0.152	11.8	0.112
8.5	0.215	10.2	0.149	11.9	0.110
8.6	0.210	10.3	0.146	12.0	0.108
8.7	0.205	10.4	0.144	12.1	0.106

MACRO-TEXTURE REPORT (METHOD B)

Project Rep.: _____

Date of Report: _____

Project No: _____

Contract ID: _____

Milling Contractor: _____

Prime Contractor: _____

Milling Rep.: _____

Prime Rep.: _____

Test #	Date	Station	Offset	Dia. D1 (in)	Dia. D2 (in)	Dia. D3 (in)	Dia. D4 (in)	Average Dia. (in)	Texture Depth
								Average =	

Test #	Date	Station	Offset	Dia. D1 (in)	Dia. D2 (in)	Dia. D3 (in)	Dia. D4 (in)	Average Dia. (in)	Texture Depth
								Average =	

Test #	Date	Station	Offset	Dia. D1 (in)	Dia. D2 (in)	Dia. D3 (in)	Dia. D4 (in)	Average Dia. (in)	Texture Depth
								Average =	

MACRO-TEXTURE DEPTH BASED ON 25 ML OF FILLER AND AVERAGE DIAMETER

Average Diameter (Inches)	Macrotexture Depth (Inches)	Average Diameter (Inches)	Macrotexture Depth (Inches)	Average Diameter (Inches)	Macrotexture Depth (Inches)	Average Diameter (Inches)	Macrotexture Depth (Inches)
5	0.078	6.5	0.046	8	0.030	9.5	0.022
5.1	0.075	6.6	0.045	8.1	0.030	9.6	0.021
5.2	0.072	6.7	0.043	8.2	0.029	9.7	0.021
5.3	0.069	6.8	0.042	8.3	0.028	9.8	0.020
5.4	0.067	6.9	0.041	8.4	0.028	9.9	0.020
5.5	0.064	7	0.040	8.5	0.027	10	0.019
5.6	0.062	7.1	0.039	8.6	0.026	10.1	0.019
5.7	0.060	7.2	0.037	8.7	0.026	10.2	0.019
5.8	0.058	7.3	0.036	8.8	0.025	10.3	0.018
5.9	0.056	7.4	0.035	8.9	0.025	10.4	0.018
6	0.054	7.5	0.035	9	0.024	10.5	0.018
6.1	0.052	7.6	0.034	9.1	0.023	10.6	0.017
6.2	0.050	7.7	0.033	9.2	0.023	10.7	0.017
6.3	0.049	7.8	0.032	9.3	0.022	10.8	0.017
6.4	0.047	7.9	0.031	9.4	0.022	10.9	0.016