

METHOD OF TEST FOR DETERMINATION OF THE SEVERITY OF A SEGREGATED ASPHALT PAVEMENT SURFACE

1. SCOPE

1.1 This procedure¹ covers the method for determining the severity of a segregated area of an asphalt pavement by spreading out fine-graded glass beads in circular patches in the segregated and in adjacent non-segregated areas, and then comparing the calculated ratio of the average depth of the beads in the two areas to established ratios for various degrees of segregation for the same mix type.

2.1 This procedure may only be used on areas of pavements that are completely dry and flat, and do not contain any discontinuities such as joints or any other surface deficiencies such as fat spots and roller marks, etc.

Note 1: This method is a modification of a test that is commonly referred to as the "Sand-Patch" test.

2. RELEVANT DOCUMENTS

2.1 ASTM D1155-03 Standard Test Method for Roundness of Glass Spheres

2.2 ASTM E965-96 (Reapproved 2006) Standard Test Method For Measuring Pavement Macrotecture Depth Using a Volumetric Technique

3. DEFINITIONS

3.1 PAVEMENT MACROTEXTURE: The deviation of a pavement surface from a true planer surface with the characteristic dimensions of wavelength and amplitude from 0.5 mm up to those that no longer affect tire-pavement interaction.

3.2 SEGREGATION/SEGREGATED: A condition of an asphalt pavement characterized by areas with comparatively coarser or finer texture than that of the surrounding pavement.

4. APPARATUS

4.1 GRADED GLASS BEADS: Clean, solid glass spheres having a minimum of 90% roundness, in accordance with ASTM D1155, and a minimum of 90% passing a 250 µm (No. 60) sieve and retained on a 180 µm (No. 80) sieve by weight.

4.2 METAL CONTAINER: A thin-walled cylindrical container² with a predetermined volume of at least 25 cm³.

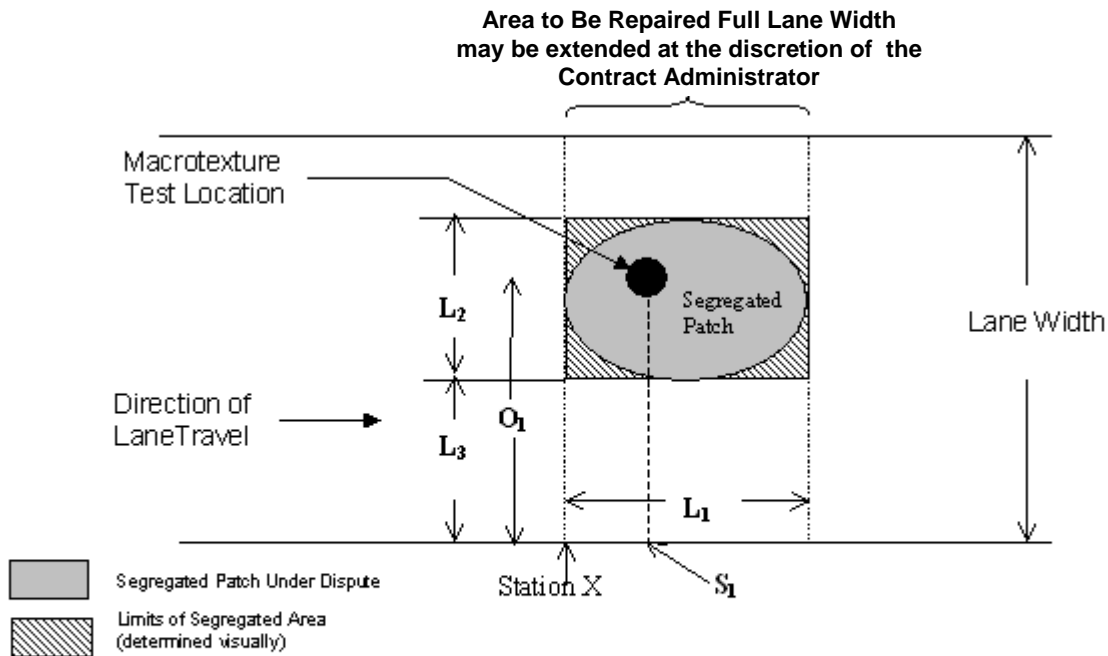
Note 2: A small aluminum laboratory penetration cup (with a volume approximately equal to 28.3 cm³) has been found to be suitable for this purpose. However, it is recommended that the volume of the container be accurately verified first before using it.

- 4.3 SOFT BRISTLE BRUSH: A paint brush or similar brush.
- 4.4 SPREADING DISC: A flat, hard rubber disc approximately 25 mm thick and 60 to 75 mm in diameter³.
- Note 3:* A regulation "hockey puck" is readily available and found to be suitable for this purpose.
- 4.5 SHIELDING FRAME: A suitable open frame⁴ with an inside width and length equal to approximately 40 cm and a height (i.e. thickness) of about 5 cm.
- Note 4:* A frame constructed of scrap pieces of wood has been found to be suitable for this purpose.
- 4.6 STEEL SCALE: A measuring scale with 1 mm divisions and a minimum length of 300 mm.
- 4.7 STIFF WIRE BRUSH: A steel brush of sufficient stiffness to remove any residue, debris, or loosely bonded aggregate particles from an asphalt pavement surface.

5. PROCEDURES

5.1 GENERAL

5.1.1 Visually establish the limits of a disputed segregated area both parallel to and perpendicular to the pavement lane, as shown in Figure 1.



Station (S_1) and Offset (O_1) of Macrotexture Test Location:

$$S_1 = \text{Station } X + R_1 \times L_1$$

$$O_1 = L_3 + R_2 \times L_2$$

Where: R_1 and R_2 are a set of random numbers between 0 and 1.0.

Figure 1
Establishing the limits of the disputed area and the station and offset
of a location for macrotexture testing

5.1.2 Choose a non-segregated area, adjacent to the disputed area, to act as one of the control areas.

5.1.3 Conduct a macrotexture test on the non-segregated area by following steps 5.2.1 to 5.2.10.

5.1.4 If it is found that the average macrotexture depth established for the first control area is greater than the maximum allowable average macrotexture depth for the particular mix type, as specified elsewhere in the contract, then choose another non-segregated area, adjacent to the disputed area.

5.1.5 Repeat steps 5.1.2 to 5.1.4 until macrotexture depths have been established for at least two acceptable non-segregated control areas, adjacent to the disputed segregated area.

5.1.6 Average the macrotexture depth determinations from all of the acceptable non-segregated control areas together to determine the average control macrotexture depth, M_c .

5.1.7 Randomly choose a set of two numbers, R_1 and R_2 between 0 and 1.0, and then multiply the distances from the limits of the disputed area by the two random numbers to determine the station, S_1 and offset, O_1 of a testing location within the disputed area (see Figure 1).

5.1.8 Conduct a macrotexture test at the established location within the disputed area by following steps 5.2.1 to 5.2.10.

5.1.9 Repeat steps 5.1.7 and 5.1.8 until at least two macrotexture depth determinations have been carried out in the disputed segregated area.

5.1.10 Average all of the individual average macrotexture depth determinations for the locations tested within the disputed area to determine the Average Macrotexture Depth, M_s .

5.1.11 Calculate the macrotexture ratio, M_R , for the disputed area, in accordance with the following equation:

$$\text{Macrotexture Ratio, } M_R = M_s/M_c$$

Where: M_s = the average macrotexture depth for the disputed segregated area, rounded to one decimal place, in accordance with LS-100.

M_c = the average macrotexture depth for the adjacent unsegregated area

5.1.12 Compare the macrotexture ratio determined in step 5.1.11 with the ratios that have been established for the mix type under consideration and the various degrees of segregation, as specified elsewhere in the contract.

5.2 CONDUCTING A MACROTEXTURE TEST

5.2.1 Where macrotexture testing is to be carried out, thoroughly clean the surface of the pavement by first brushing the pavement using a stiff wire brush and, following that, by brushing with a soft bristle brush to remove any residue, debris, or loosely bonded aggregate particles.

5.2.2 Position the shielding frame around the area that has just been cleaned, in order to prevent light breezes from moving the glass beads around.

5.2.3 Fill the metal container with graded glass beads and gently tap the base of the container several times on a rigid surface to allow the beads to slightly compact. Add more beads until the metal container is slightly overfilled, then slightly tap the base of the container once again. Continue doing this until the surface of the glass beads is above the edge of the container and additional tapping does not allow the beads to compact below the top of the container. At that point, level off the surface of the glass beads with a straightedge or the side of the metal scale (see Photograph 1).



Photograph 1
Filling up an aluminum container with graded glass beads

5.2.4 Gently pour the graded glass beads from the metal container into the middle of the cleaned surface, which is protected by the shielding frame.

5.2.5 Carefully spread out the graded glass beads by moving the spreading disk in a circular motion (see Photograph 2). The glass beads should be spread out into a “circle of beads” until they cannot be spread out any further and only the uppermost points of the aggregates can be seen. At this point, the spreading disc should be able to glide freely over the circle of beads.



Photograph 2
Spreading the glass beads out into a “circle of beads”
using a hockey puck

5.2.6 Determine the approximate centre of the circle of beads, then place one long edge of the metal scale through this point and carefully measure its diameter (see Photograph 3).



Photograph 3
Measuring the diameter of the circle of glass beads

5.2.7 Rotate the edge of the metal scale, which is still sitting through the approximate centre of the circle of beads, approximately 45°, and measure and record the diameter again.

5.2.8 Repeat 5.2.7 until a minimum of four equally spaced measurements of the diameter along the circumference of the circle of beads have been established.

5.2.9 Record the four individual measurements of the diameter of the circle of beads, and compute and record the average of those four measurements.

5.2.10 Calculate the average macrotexture depth, M_d , at the test location using the following equation:

$$M_d = \frac{4V}{\pi D^2}$$

Where: M_d = The average macrotexture depth, rounded to two decimal places, in accordance with LS-100;
 V = Volume of graded glass beads used in the test $\geq 25,000 \text{ mm}^3$;
 D = Average diameter of the "circle of beads" after spreading; and
 π = 3.14159

6. REPORTING

6.1 The locations of the macrotexture tests, individual measurements of the diameters of the circles of beads, the determination of the applicable macrotexture ratios, and the limits of the disputed areas are recorded in the accompanying data sheet, entitled "Determination of Macrotexture Ratio".

DETERMINATION OF MACROTEXTURE RATIO

Contract No:
Test Date:

Highway:
Volume of Glass-Beads in mm³ (V):

Mix-Type:

	Macrotexture Test of CONTROL (Unsegregated)						Macrotexture Test of SEGREGATED Area						Macrotexture Ratio	Limits of the Disputed Area and Other Comments
	Measured Dia (mm)				Av. Dia = $\Sigma D / 4$	Macrotexture Depth = $4V/(\pi D^2)$	Measured Dia (mm)				Av. Dia, = $\Sigma D / 4$	Macrotexture Depth = $4V/(\pi D^2)$		
	D ₁	D ₂	D ₃	D ₄			D ₁	D ₂	D ₃	D ₄				
Lane No.														
Direction														
Location: Station & Offset														
						↓						↓		
Lane No.														
Direction														
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Lane No.														
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MTO's Representative: (please print): _____ **Contractor's Representative (please print):** _____

Signature: _____

Signature: _____