

COMMENTARY TO AG:PT/T253 - SEAL BEHAVIOUR

PREFACE

This seal design method was prepared by the Bituminous Surfacing Research Review Group on behalf of Austroads. Representatives of Austroads, ARRB Group and the Australian Asphalt Pavement Association have been involved in the development and review of this method.

FOREWORD

The Austroads sprayed seal design method is loosely based on the available voids between the sealing aggregate. The procedure allows for embedment into the underlying substrate. This test can be used to assess both of these conditions.

SCOPE

This method describes the procedure for the recovery of sprayed seal samples from the pavement without disturbing the sealing aggregate orientation. The method stipulates how the void content of the sample is determined.

Further Development

None.

SEAL BEHAVIOUR

1 REFERENCED DOCUMENTS

The following documents are referred to in this method:

AUSTROADS

AG:PT/T250 Surface texture depth (pestle method)

AS /NZS

1289.1.4.2 Selection of sampling or test sites – Stratified random number method

1152 Specification for Test Sieves

2243.1 Safety in Laboratories - General

2891.3.1 Bitumen content and aggregate grading – Reflux method

2891.3.2 Bitumen content and aggregate grading – Pressure filter method

2891.3.3 Bitumen content and aggregate grading – Reflux method

1141.5 Particle density and water absorption of fine aggregate

1141.6.1 Particle density and water absorption of coarse aggregate – Weighing in water method

1141.6.2 Particle density and water absorption of coarse aggregate – Pycnometer method

2 DEFINITIONS

The following definitions are used in this test method:

- a. Aggregate Spread Rate (ASR) - The mass / volume per square metre of aggregate in a sprayed seal.
- b. Binder Application Rate (BAR) - The volume per square metre of bitumen in a sprayed seal (L/m²).
- c. Lower Voids (TD2) - Surface texture on bottom of reseal after removal of binder from the seal sample in the laboratory (mm).
- d. Embedment Voids (EV) - The difference between the Lower voids and the BAR is the embedment voids (L/m²). Embedment of the reseal aggregate may occur by displacement of the underlying surface and/or meshing of the reseal aggregate into the underlying surface.
- e. Material Suspended in Binder (MSB) - That material which occupies a volume within the binder but is not bound to the epoxy and is not part of a previous seal.

- f. Sample - A sample will be considered to be a set of sub-samples from the same spray-run, i.e. having the same BAR.
- g. Total Void Field (TVF) - The space within the volume occupied by the seal which is not filled with solid material, either aggregate or binder (L/m²).
- h. Upper Voids (TD1) - Surface texture on top of reseal (mm).
- i. Volume of Aggregate (VA) - The volume of a sample which is occupied by aggregate material retained on the plate.
- j. Volume of Seal (VS) - The total volume occupied by a sample, including aggregate and voids. Does not include material suspended in binder.
- k. Field Layer Thickness (FLT) - the height of the sample.

3 APPARATUS

The following apparatus is required:

- a. Rapid setting epoxy resin. (See Note 1)
- b. Surface Texture equipment, as per Austroads SDT 02
- c. Metal plates, 295 mm x 295 mm x 3 mm steel.
- d. Wooden form with handle, 300 mm x 300 mm.
- e. Potters (ceramic) clay.
- f. Road marking crayon.
- g. Vacuum cleaner or bannister brush.
- h. Pavement saw for cutting sample out of pavement.
- i. Masonry chisel, hammer and spade.
- j. Safety equipment, eye protection, ear muffs, breathing mask, gloves, traffic control signs and cones.
- k. Sample labels.
- l. Supports for plates.
- m. Thermostatically controlled oven capable of maintaining a temperature of $70 \pm 3^{\circ}\text{C}$.
- n. Trays deep enough to submerged plates in solvent.
- o. Aviation kerosene.
- p. Trichloroethylene.

4 PROCEDURE

Select a sample site in accordance with AS 1289.1.4.

- a. Part A – Recovery of Sample from Site
 - I. Select site, both within wheel track and between wheel track and mark with crayon.
 - II. Clean site with vacuum cleaner or bannister brush, removing any loose material.
 - III. Measure surface texture depth of site, as per Austroads AG:PT/T250. Record as TD1.
 - IV. Remove all surface texture depth sand with vacuum cleaner or bannister brush.
 - V. Place form over marked site and place a roll of clay around the form, taking care to press the clay down into the surface to form a tight seal.
 - VI. Remove form from surface.
 - VII. Combine epoxy components as per manufacturers requirements. If weather conditions are cool delay pouring epoxy until material has begun to set.
 - VIII. Pour epoxy onto site, ensuring complete coverage of all aggregate to a sufficient depth to ensure that the plate will not contact any aggregate.
 - IX. Place plate onto epoxy.
 - X. Do not disturb until epoxy has set, allow approximately 30 minutes in warm weather.
 - XI. Cut around the plate with the pavement saw, to a depth such that base course is reached.
 - XII. Using masonry chisel, hammer and/or spade remove sample from pavement.
- b. Part B - Removal of Surplus Material from Sample
 - I. Remove majority of material (base course and previous seals) by suspending plate/sample by it's handles and allowing gravity to drop excess off the underside of plate. An oven may be used if ambient conditions are not suitable for rapid removal of material. Care should be exercised to not disturb the surface seal attached to the epoxy.
 - II. Place the plate in a tray with sufficient aviation kerosene to completely submerge remaining surface seal attached to the epoxy, allow to soak for minimum 12 hours.
 - III. Wash remaining binder off plate with trichloro-ethylene.
 - IV. Allow all solvent to evaporate from plate.

- V. Pour all solvent from tray through 150 and 75 μm sieves. Dry and record mass of material retained, m_1 to the nearest 0.1 g.
- VI. Carry out bitumen content determination, as per AS 2891.3.1, AS 2891.3.2 or AS 2891.3.3, to determine fine material content of sample. Record the mass, m_2 to the nearest 0.1 g.
- VII. Measure texture depth of aggregate surface attached to epoxy, using Austroads SDT 02. Record as TD2.

5 CALCULATIONS

The following parameters are to be calculated for each seal sample:

- a. Material Suspended in Binder (mL) $\text{MSB} = (m_1 + m_2) / \text{aggregate particle density}^\#$
- b. Correction factor (mm): $\text{CF} = \text{MSB} / (1000 \times \text{area of plate})$
- c. Corrected Lower Voids (mm): $\text{TD2c} = \text{TD2} - \text{CF}$
- d. Embedment Voids (mm): $\text{EV} = \text{TD2c} - \text{BAR}^*$
- e. Total Void Field (L/m^2): $\text{TVF} = \text{TD1} + \text{TD2c}$
- f. Volume of Aggregate (L/m^2): $\text{VA} = \text{ASR}^+ / \text{aggregate particle density}$
- g. Volume of Seal (L/m^2): $\text{VS} = \text{TD1} + \text{TD2c} + \text{VA}$
- h. Field Layer Thickness (mm): $\text{FLT} = \text{VS}$.

[#] The aggregate particle density in t/m^3 should be determined in accordance with AS 1141.5, AS 1141.6.1 or AS 1141.6.2.

^{*} The binder application rate (BAR) in L/m^2 , is that determined at the time of placement of the seal and may need to be estimated.

⁺ The aggregate spread rate (ASR) in grams per mm^2 , is that determined at the time of placement of the seal and may need to be estimated.

7 INFORMATION TO BE REPORTED

Report for each sample:

- a. Sample number
- b. Sample location
- c. Sample description
- d. Date sample was taken
- e. Age of surface seal

- f. Nominal size of seal
- g. Report for each sub-sample:
- h. Location relative to the wheel tracks
- i. TD1 to 0.1 mm
- j. TD2 to 0.1 mm
- k. Correction Factor to 0.1 mm
- l. EV to 0.1 mm
- m. TVF to 0.1 L/m²
- n. VA to 0.1 L/m²
- o. FLT to 0.1 mm
- p. Reference to this test method, i.e. AG:PT/T253

NOTES

1. MR WA has found Epigen FC-4 to have a rapid set-time, whilst not generating excessive heat.

AMENDMENT RECORD

Amendment No.	Clauses amended	Action	Date
1	Commentary Page	New	June 2005
	Footer and header	Format	
	Applied revised test method number	Format	
	Applied new styles	Format	
2	Preface	Substitution	June 2006

Key

Format	Change in format
Substitution	Old clause removed and replaced with new clause
New	Insertion of new clause
Removed	Old clauses removed