

COMMENTARY TO AG:PT/T273 - DETERMINATION OF EXCESS BINDER IN BITUMINOUS SLURRY (LOADED WHEEL TEST)

PREFACE

This bituminous slurry surfacing test method was prepared by Working Group 1, Bituminous Slurry Surfacing, of the Bitumen Emulsions and Foamed Bitumen Project 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 test method.

PRINCIPLE

A sample of bituminous slurry is cast in a mould to a predetermined thickness and then is fully cured. The sample is subjected to a fixed number of loaded wheel tracking cycles. The surface is then covered with a weighed quantity of warm sand and further loaded wheel tracking is carried out. The quantity of sand retained through embedment in the sample surface is determined and is indicative of the tendency of the mix to flush under traffic. This test method is unsuitable for microsurfacing due to the presence of polymers which tend to produce a non-adhesive surface even when flush.

SCOPE

This Standard sets out the method for determining the amount of excess binder in a bituminous slurry after loading with a reciprocating loaded wheel.

Further Development

There are no further plans for the development of this test method.

DETERMINATION OF EXCESS BINDER IN BITUMINOUS SLURRY (LOADED WHEEL TEST)

1 REFERENCED DOCUMENTS

The following documents are referred to in this method:

AUSTROADS

AG:PT/T270 Consistency of Bituminous Slurry

AS /NZS

1152 Specification for Test Sieves

2 APPARATUS

The following apparatus is required:

- a. Loaded Wheel Testing machine consisting of the following main components:
 - Frame of adjustable steel channel
 - Mounting plate for specimens.
 - Electric motor of 0.25 kW capacity, capable of 1440 revolutions per minute.
 - Reduction box with 40:1 reduction ratio.
 - Drive cranks, 152 mm radius.
 - Adjustable steel connecting arms.
 - Weight box, centrally adjustable over the wheel.
 - Rubber tyre (76.2 ±0.2 mm diameter x 25.4 ±0.2 mm wide) mounted at a horizontal distance of 610 mm between drive and castor axles. (Bassick castor frame #3YY6-2 with wheel #WR6203 with 72.6 mm diameter at 25.4 mm wide, rubber hardness within the range 60 to 70 durometer have been found suitable.)
 - Re-settable revolution counter
 - Adjustable mass (e.g. lead shot or bars are suitable) such that the total applied to the sample by the wheel is 60 ± 0.1 kg
- b. Specimen mounting plates, 0.6 mm thick galvanised steel 75 mm x 406 mm deburred to fit inside the test frame.
- c. Specimen moulds of various thickness (3.2, 4.8, 8.0, 9.5 and 12.7 ±0.2 mm) having external dimensions of 75 mm wide by 406 mm long and internal dimensions of 50 mm wide by 380 mm long.

NOTE: Select mould appropriate to maximum aggregate particle size, i.e. depth of mould should be at least 25% greater than largest particle size.

- d. Metal or timber strike-off screed 25 mm diameter x 150 mm long or “U” shaped screed.
- e. Steel sand frame, 4.8 mm high by 63.5 mm wide and 380 mm long outside and 38 mm wide by 355 mm long inside, lined on one side with 12 mm x 12 mm adhesive-backed foam rubber insulation, with suitable holding clamps.
- f. Flat platform scale, capable of weighing up to 115 kg with limit of performance not greater than ± 0.5 kg. (Alternatively, a balance of lesser capacity, capable of weighing the unloaded wheel and the load weights separately, may be used).
- g. Balance capable of weighing at least 2.0 kg, with limit of performance not greater than ± 0.5 g.
- h. Oven capable of maintaining a temperature of $60 \pm 2^\circ\text{C}$, or hot plate.
- i. Mixing bowl or beaker of 600 to 1000 mL capacity.
- j. Mixing spatula or spoon of approximately 25 mm length.
- k. Fine quartz sand which all passes a 600 μm sieve but is retained on a 150 μm sieve.
- l. Hot plate or oven for heating sand to $80 \pm 2^\circ\text{C}$.
- m. Rust-resistant metal bowl of 1 to 5 L capacity.
- n. Thermometer capable of measuring up to 100°C and readable to 1°C .
- o. Flat metal strip, 3 mm x 35 mm x 352 mm.

3 SAMPLE PREPARATION PROCEDURE

- a. Select a suitable mould so that the test specimen will be no less than 25% thicker than the coarsest particle thickness. The mould thicknesses indicated in Table 1 are recommended for different size mixes, and must be in excess of that required to fill the mould.

TABLE 1 Mould thickness and mass to be mixed

Nominal mix size (mm)	Mould thickness (mm)	Mass of bituminous slurry mix required (g)
3, 4 or 5	6.3	400
7	9	600
10	12.5	800

- b. Use the selected mix design with water content as determined in accordance with Austroads SST02.
- c. Weigh sufficient quantities of the individual components of the mix design to obtain a sample of about the mass shown in Table 1. Place the weighed mass of aggregate and filler into the mixing bowl. Using the spoon, dry mix for one minute or until

uniformly distributed. Add the weighed amount of water and additive, if required, and mix again for one minute, or until all aggregate particles are uniformly wetted.

- d. Mix the components rapidly and thoroughly so that the specimen is cast 60 seconds after the addition of the emulsion
- e. Place the mould centrally over a previously weighed specimen mounting plate and uniformly over-fill it with the mixture. Using a horizontal sawing motion with the screed held in a vertical position, strike-off the specimen to be level with the specimen frame.
- f. When the specimen has set sufficiently to prevent displacement, remove the mould.
- g. Dry the specimen to constant mass in an oven at 60°C. At least 24 hours drying will be required.
- h. Allow the specimen to cool to room temperature.

4 TEST PROCEDURE

4.1 Sample Compaction

- a. Adjust and secure the connecting arm bearings and castor assembly so that the projected horizontal distance between the crank and wheel axles is 610 mm. Align the wheel assembly so that the wheel runs true and parallel with the frame.
- b. Centre and secure the weight box directly over the wheel axle.
- c. Inspect and thoroughly clean the wheel with a highly evaporative low aromatic hydrocarbon solvent (eg. less than 5% aromatics) and water. As solvents may saturate the rubber tyre and give false tack point and sand adhesion values, it is necessary to clean the rubber tyre regularly with a fine disc sander.

Note: Caution must be exercised as some solvents are highly flammable.

- d. Place the wheel on the platform scale so that the connecting arms are parallel with the frame. Add weights to the weight box to obtain the desired total weight of 60 ± 0.1 kg.
- e. Place the specimen on the mounting plate firmly against the locating pins and clamp in position with the clamp washers and wing nuts.
- f. Maintain the temperature of the specimen at $25 \pm 3^\circ\text{C}$ unless otherwise specified (operation at ambient laboratory temperature is normally satisfactory).
- g. Set the counter to zero and compact the specimen for 1000 cycles at 50 ± 5 cycles per minute. Record the number of cycles at the tack point, the point at which an audible tackiness or visible shine is noted, and add sufficient water from a wash bottle to prevent adhesion of the specimen to the wheel.

Note: With certain aggregates, it may become necessary to flush the wheel path liberally with water to prevent abraded fines from impacting the specimen.

CAUTION: Exercise care to avoid moving parts which can cause injury.

- h. Unload the specimen and wash away all loose particles.

- i. Dry the specimen to constant mass at 60°C. This normally takes about 4 hours.
- j. Determine the dry mass (m_1) of the specimen after compaction and drying.

4.2 Determination of Sand Loss

- a. Mount the specimen on the mounting plate in its original position in the loaded wheel tester. Centre the sand frame over the specimen with the foam rubber secured against the specimen to prevent loss of sand.
- b. Heat the sand and metal strip (3 mm x 35 mm x 352 mm) to $80 \pm 2^\circ\text{C}$. Place the sand mould over the test sample and clamp in place. Spread 300g of the hot sand uniformly over the specimen in the mould. Immediately cover the sand with the metal strip. It is convenient to preweigh and preheat the 300 g of sand in a suitable container (e.g. 200 ml beaker).
- c. Immediately load the specimen with the wheel for 100 cycles at 36 cycles per minute.
- d. Remove the specimen assembly as a unit, invert over a waste container and gently tap to remove unadhered sand.
- e. Determine the mass (m_2) of the specimen to the nearest 0.1 g.

5 CALCULATIONS

Calculate as follows:

$$\text{Sand adhesion } (S_a) = \frac{(m_2 - m_1)}{0.0123}$$

where

S_a = the sand adhesion in g.m^{-2}

m_2 = the mass of specimen after sanded loading, in g

m_1 = the mass of specimen before sanded loading, in g

6 INFORMATION TO BE REPORTED

- a. Sand adhesion to the nearest whole g.m^{-2} .
- b. The temperature of the test to the nearest 1°C .
- c. The mix design of the bituminous slurry.
- d. The number of cycles to tack point.

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	

Key

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