

COMMENTARY TO AG:PT/T144 - MORPHOLOGY OF CRUMB RUBBER – BULK DENSITY TEST

PREFACE

This modified binder test method was developed by ARRB Group on behalf of Austroads. Representatives of Austroads, ARRB Group and the Australian Asphalt Pavement Association have been involved in the review of this test method.

FOREWORD

Crumb rubber modified binders are prepared from mixtures of bitumen, crumb rubber and additives selected to optimise the properties of the digested binder system. The bulk density (morphology) of the rubber contributes significantly to the binders performance and is used as a property in the specification of the rubber. This test method provides a measure of the crumb rubber's bulk density.

SCOPE

This method describes a procedure for determining the bulk density of crumb rubber in the size range 600 to 300 μm .

Further Development

There is no development plans for this test method.

MORPHOLOGY OF CRUMB RUBBER – BULK DENSITY TEST

1 REFERENCED DOCUMENTS

The following documents are referred to in this method:

AUSTROADS

AG:PT/T101 Method of sampling polymer modified binders, polymers and crumb rubber.

AS /NZS

1152 Test Sieves

1141 Sampling and Testing Aggregates

ARRB GROUP

Method 25 A bulk density test to characterise the morphology of rubber particles.

2 APPARATUS

The following apparatus is required:

- a. Test sieves -of nominal 200 mm diameter, fitted with woven wire cloth having an aperture of 300 μ m and 600 μ m and conforming to the requirements of AS 1152.
- b. Riffle Box- consisting of an even number of rectangular chutes (about ten) discharging alternatively on opposite sides of the box, suitable for fine aggregate and similar to that specified in AS 1141, Fig. 2.4.6.
- c. Balance -accurate and readable to 0.1 g.
- d. Measuring cylinder -of 100 mL capacity with 1 mL graduations:
- e. Beaker- of 250 mL capacity, marked with graduations no greater than 50 mL apart.
- f. Stirring Rods -two glass rods of lengths suitable for use in the beaker and measuring cylinder specified above.
- g. Wash bottle -to provide a jet of washing water.
- h. Hotplate -fitted with controller and capable of gently boiling a beaker of water.

3 PROCEDURE

3.1 *Sample preparation*

Samples for testing shall be provided in accordance with AG:PT/T101.

- a. For bulk samples of less than 1 kg mass a sub-sample shall be obtained by pouring the bulk sample evenly over the top of the riffle box and thus dividing it into two

representative parts, which are collected in boxes placed beneath the chutes. The contents of one box is then divided into two by further riffing and the process repeated until a sub-sample of suitable size (20 to 25 g) for sieving is obtained.

- b. For bulk samples greater than 1 kg mass, a sample less than 1 kg shall be obtained by a systematic sample reduction procedure such as that used for fine mineral aggregates and as described in AS 1141.

3.2 Method

The procedure shall be as follows:

- a. Air dry the sub-sample.
- b. Clean and dry the test sieves.
- c. Add no more than 25 g of the rubber sub-sample to the 600 μm sieve and shake as described in AS 1141, section 11.5. Check whether the mass of material retained on the 300 μm sieve exceeds 20 g. If it does, divide the material in two and re-sieve on the 300 μm sieve only for at least 2 minutes. If there is less than 7.5 g of material on the 300 μm sieve, then it should be mixed thoroughly with a second lot of sieved material.
- d. Weigh into the clean, dry, 250 mL beaker 7.5 g of the material retained on the 300 μm sieve.
- e. Add 70 mL of tap water and bring to the boil on the hotplate. (Note in hard water areas distilled or deionised water shall be used.)
- f. Allow to boil for 30 minutes stirring occasionally with a stirring rod and washing down particles deposited on the walls with water from a wash bottle. Keep the total volume of material in the beaker between about 60 mL and 70 mL.
- g. At the end of the 30 minute period, transfer the contents of the beaker to a 100 mL measuring cylinder using the wash bottle as required and make up to 100 mL, with water from the wash bottle. Add 10 mL of diluted wetting agent solution and thoroughly agitate the contents by stirring in a circular motion. Reverse the direction of stirring to stop the rotation of the suspension and allow to remain undisturbed for 15 minutes.
- h. Measure the settled volume of the rubber particles to the nearest 0.5 mL, neglecting any still floating particles.

4. CALCULATIONS

Calculate the bulk density of the test portion by the following formula:

$$\text{Bulk density} = 7.5/V \times 1000 \quad (\text{kg/m}^3)$$

where V = settled volume of the rubber particles, in millilitres.

5. REPORTING

- a. Sample identification

- b. The bulk density of rubber as the mean of two determinations, made on separate sub-samples, to the nearest 0.01 percent
- c. Test date
- d. Reference to this method, i.e. AG:PT/T144.

6. PRECISION

The following criteria should be used for judging the acceptability of test results (95 per cent probability).

- a. Repeatability* Duplicate test results obtained by the same operator should not be considered suspect unless they differ by more than 4 per cent of their mean.
- b. Reproducibility. Not determined.

* Based on the results of single determinations of bulk density on four sub-samples of three different rubbers (data given in AIR 286-3 Table 11).

AMENDMENT RECORD

Amendment No.	Clauses amended	Action	Date
1	This method has been developed from ARRB-Transport Research test method 25 (reported in AIR 286-3 April 1981)	New	January 2002
2	Commentary Page	New	June 2005
	Footer and header	Format	
	Applied revised test method number	Format	
	Applied new styles	Format	
3	Applied revised test method number	Substitution	March 2006

Key

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