



STONE COATING AND WATER RESISTANCE TEST CATIONIC BITUMINOUS EMULSIONS

1 SCOPE

This method describes the procedure for determining the stone coating and water resistance properties of cationic bituminous emulsions. The test can be performed on wet or dry aggregate of any type. It is intended that the test is carried out on the same type of aggregate that will be used with the proposed emulsion in the field.

2 SAFETY

This method does not attempt to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this method to establish appropriate occupational health and safety practices that meet statutory regulations.

3 REFERENCED DOCUMENTS

Main Roads Western Australia

WA 200.1 Sampling Procedures for Aggregates

British Standard

BS ISO 3310-2 Test sieves – Technical requirements and testing – Test sieves of perforated metal plate

4 APPARATUS

(a) 250 mm porcelain **evaporating dish**.

(b) Plastic **spatula**, about 20 mm in width.

(c) **Balance** of suitable capacity, readable to 0.1 g, with a limit of performance of not more than 0.5 g.

(d) **Test sieves** 19.0 mm and 4.75 mm complying with BS ISO 3310-2.

(e) **Measuring Cylinder**, 2 L capacity with 20 mL graduations.

(f) A thermostatically controlled **oven** with good air ventilation capable of maintaining a temperature within the range of 105°C to 110°C.

(g) **Timer** readable to the nearest 1 second.

(h) **Drying dishes** or containers of at least 500 mL capacity.

(i) **Absorbent Paper**.

(j) **Thermometer** readable to 1°C.

(k) **Relative Humidity Meter** readable to 1%.

5 MATERIALS

(a) Obtain a representative sample of the aggregate to be used in the field in accordance with WA 200.1. The sample shall be air dried and sieved through the 19.0 mm and 4.75 mm sieves. A test sample of at least 1000 g shall be prepared from the material passing the 19.0 mm sieve and retained on the 4.75 mm sieve.

(b) Obtain a representative sample of the emulsion to be used in the field.

6 ENVIRONMENTAL CONDITIONS

The testing environment shall have a temperature of $23 \pm 2^\circ\text{C}$, minimum relative humidity of 40% and free from strong drafts during testing.

7 PROCEDURE

6.1 Dry Aggregate Method

(a) Using sample division obtain a test portion of approximately 500 g from the test sample.

(b) Place 465 g of the test portion into the dry porcelain evaporating dish.

(c) Tare the dish and its contents on the balance and add 35 ± 1 g of emulsion.

NOTE: The time taken to add the emulsion should be kept to the minimum possible.

(d) Immediately remove the dish from the balance and vigorously mix the aggregate and emulsion using the spatula. During mixing the dish should be continuously rotated and the aggregate and emulsion should be mixed from the outside edge of the dish into the centre. The aggregate and emulsion should be mixed for a period of 180 ± 5 seconds from the first spatula stroke.

(e) Drain excess emulsion from the dish after mixing has finished. Tilt the dish such that further free emulsion is drained away from the coated aggregate. Leave the dish in this position for a period of 30 ± 0.5 minutes.

(f) Wash the coated aggregate with tap water to remove excess emulsion. The rate of water flow should be in the order of 1200 mL to 1600 mL per minute discharging into the dish without force or creating turbulence. Periodically during the washing process the dish should be removed from the water flow and the wash water carefully decanted. At this

stage the aggregate may be gently stirred with the spatula to expose all surfaces of the aggregate to the washing process. Return the dish to the water flow. Continue the washing process until the wash water overflow is clear and no free emulsion remains on the aggregate.

NOTE: The purpose of the washing is to remove excess emulsion from the aggregate but not to force off bitumen that has adhered to stones.

(g) Drain off the excess water from the dish and place the aggregate on the absorbent paper, spreading the stones apart such that individual stones are not in contact with each other.

(h) Determine the percentage of stone coating in accordance with Procedure 6.3.

6.2 Wet Aggregate Method

(a) Prepare a test portion in accordance with Procedure 6.1(a) to 6.1(b).

(b) Add 9.0 to 9.5 g of water into the dish and mix thoroughly until the aggregate is uniformly damp.

(c) Complete the stone coating and washing in accordance with Procedure 6.1(c) to 6.1(h).

6.3 Degree of Stone Coating

(a) Inspect each stone and classify the degree of stone coating into one of the four following groups:

Group 1 - where > 80% of the surface area of the stone is coated with bitumen.

Group 2 - where > 60% and ≤ 80% of the surface area of the stone is coated with bitumen.

Group 3 - where > 40% and ≤ 60% of the surface area of the stone is coated with bitumen.

Group 4 - where ≤ 40% of the surface area of the stone is coated with bitumen.

NOTE: A coating is where there is a sufficiently thick coating of bitumen to provide a tacky surface which will facilitate the adhesion of one stone to another.

(b) Place each stone into one of four piles corresponding to the four groups.

(c) Weigh four dry drying dishes or containers to the nearest 0.1 g. Record the mass of each dish as (d₁) to (d₄) corresponding to Groups 1 to 4.

(d) Place the aggregate from each of the four piles into the corresponding dish and dry in the oven at 105°C to 110°C for at least 30 minutes.

(e) Remove each dish and contents from the oven, cool to ambient and determine the mass to the nearest

0.1 g. Record the mass of each dish and contents as (m₁) to (m₄) corresponding to Groups 1 to 4.

8 CALCULATIONS

(a) Calculate the total mass of all the coated aggregate using the following formula:

$$m_T = (m_1 + m_2 + m_3 + m_4) - (d_1 + d_2 + d_3 + d_4)$$

Where:

d₁ = mass of dish used for Group 1 material

d₂ = mass of dish used for Group 2 material

d₃ = mass of dish used for Group 3 material

d₄ = mass of dish used for Group 4 material

m₁ = mass of dish + contents for Group 1 material

m₂ = mass of dish + contents for Group 2 material

m₃ = mass of dish + contents for Group 3 material

m₄ = mass of dish + contents for Group 4 material

(b) Calculate the percentage of surface area coated with bitumen using the following formula:

$$\% \text{ Surface area coated (SA)} =$$

$$\frac{(m_1 - d_1) \times 90}{m_T} + \frac{(m_2 - d_2) \times 70}{m_T} + \frac{(m_3 - d_3) \times 50}{m_T} + \frac{(m_4 - d_4) \times 20}{m_T}$$

9 REPORTING

(a) Report the percentage of surface area coated for both the dry and wet aggregate methods to the nearest 1%.

(b) Report the type and origin of emulsion used in the test.

(c) Report the type and source of the aggregate used in the test.

9 ISSUING AUTHORITY

Document Owner
Bituminous Product Consultant

10 REVISION STATUS RECORD

Page No.	Section	Revision Description / Reference
1	3	Change sieve compliance to British Standard.
1	4	Add temperature and humidity devices for recording environmental conditions. Change sieve compliance to British Standard.
1	6	Add environmental conditions – temperature and humidity.
2	9	Issuing Authority Updated