**1.0** **PURPOSE**

This procedure describes a method for determining the resistance to stripping of aggregate from bituminous binders by immersion in water.

It is not applicable to aggregate particles, which pass a 9.5 mm sieve. The preferred aggregate size is ‑ 13.2 mm + 9.5 mm (14 mm ‑ 10 mm screenings).

It may also be used for the evaluation of adhesion agents applied either as a precoat to the aggregate or by inclusion in the binder. See DPTI PC045 Approval and Registration of Adhesion Agents for Spray Sealing. Aggregates used for these evaluations shall be treated as dusty as per Part 5.2 of this Technical Procedure.

**2.0** **REFERENCES**

Resistance to Stripping of Cover Aggregates from Binders, AS 1141.50.

Methods for sampling and testing aggregates – Sampling – Aggregates AS 1141.3.1

Sampling of Aggregates and Rock, TP226

DPTI PC045 Approval and Registration of Adhesion Agents for Spray Sealing.

**3.0** **DEFINITIONS**

Nil.

**4.0** **APPARATUS AND MATERIALS**

**4.1 Apparatus**

* Flat bottomed, rigid, shallow metal plates 150 x 150 mm with a 5‑10 mm rim, individually numbered.
* Oven, controlled at 60 ± 3 oC.
* Oven, controlled not exceeding 50oC.
* Water bath, controlled at 50 oC ± 3 oC.
* Racks to accommodate the metal plates.
* Water bath, controlled at 23 ± 3 oC. (A large sink is sufficient for this purpose).
* Balance, top pan, 2kg minimum capacity, readable and accurate to 0.1 g.
* Sieve, 4.75mm aperture and 300mm diameter.
* Heating oven, fan forced, controlled at 175 ± 5 oC.
* Long nose pliers or wide blade screw driver.
* Heat resistant gloves.
* Measuring cylinder, 100mL capacity, with stopper.
* Measuring cylinder, plastic, 1 litre capacity.
* Plastic bags, self sealing, approximate dimensions 200 x 250 mm.
* Sample tins, 500mL and 3L, clean and dry, with tight fitting lids.
* Hot plate, electric, with adjustable temperature control.

**4.2** **Materials**

* Bitumen, Class 170 (or binder as specified).
* Industrial Diesel Fuel (IDF).
* Adhesion agent.
* Aggregate under test, dried, 10kg sample of 14mm - 10mm screenings..

**5.0** **SAMPLING AND SAMPLE PREPARATIONS – PROCEDURE TO BE FOLLOWED**

**5.1 Sampling**

Sampling of aggregate shall be carried out in accordance with Procedure TP226.

**5.2 Aggregate**

The aggregate sample shall be placed in an oven not exceeding 50oC for at least 12 hours prior to any testing.

It is not applicable to aggregate particles, which pass a 9.5 mm sieve. The preferred aggregate size is ‑ 13.2 mm + 9.5 mm (14 mm ‑ 10 mm screenings).

Two x 1 litre representative portions of the sieved aggregate shall be taken. One portion shall be immersed in water at room temperature for one hour. After immersion the aggregate shall be spread evenly on the 4.75mm sieve and allowed to drain for 15 minutes. The other portion shall remain dry.

***Note: Subject to the application, if the aggregate is excessively dusty then it may be washed and dried prior to preparation for the test.***

**5.3 Manufacture of Precoat**

The standard precoat contains C170 bitumen, IDF and approved adhesion additive in the proportions of 30:100:1.5.

Blend 30g of C170 bitumen into 100ml of IDF, then incorporate 1.5g of adhesion additive. Gentle warming and stirring is needed to ensure that the precoat is homogeneous. Allow precoat to cool to room temperature before precoating aggregate.

***Note: Only freshly prepared precoat shall be used in the test.***

***Note: When handling hot binder, eye protection, gloves and appropriate clothing shall be worn.***

**5.4 Blanks – When Requested**

Select 4 x 50 representative pieces of aggregate. Two lots shall be immersed in water for 1 hour and drained for 15 minutes. Two lots shall remain dry. Seal all four lots in airtight plastic bags or tins overnight. Label the bags or tins.

**5.5 Precoating the Aggregate**

5.5.1 Add approximately 10mL of precoat to a clean, dry, labelled, 3L tin. Place a labelled lid on the tin and shake thoroughly ensuring that entire inside surface is coated. Remove the lid and allow the contents to drain for 10 minutes.

5.5.2 Add the prepared 1 litre dry aggregate to the tin and add 4.5g\* (~ 5L/m3) of precoat in three aliquots of 1.5g. Immediately put the lid on, rotate and shake for one minute after the addition of each aliquot.

***Note - \* Density of precoat = 890kg/m3.***

 ***In the case of dusty or porous aggregate, the application rate may be increased to 6 or 8L/m3***

5.5.3 Observe the aggregate to ensure that the mixing has been satisfactory. Allow further mixing if required. Stand the aggregate in the tin with the lid on overnight. Remix prior to the test.

5.5.4 Repeat steps 5.5.1 to 5.5.4 for the saturated surface wet aggregate. Discard any remaining precoat once all aggregate has been coated.

**5.6 Preparation of Testing Plates**

5.6.1 Place eight labelled plates and a 400g+ tin of bitumen in a cool oven and program oven to switch on the following morning, allowing sufficient time for plates and bitumen to be preheated to 175 ± 5 oC prior to testing.

5.6.2 Program a second oven to switch on the following morning to achieve a temperature of 60 ± 3 oC

5.6.3 Next day switch on two water baths capable of maintaining 50 ± 3 oC and 23 ± 3 oC

5.6.4 Pour 35 ± 1g of bitumen onto each plate to give an application rate of 1.5L/m2.

***Note - When handling hot binder, eye protection, gloves and appropriate clothing shall be worn.***

***In some cases, adhesion agent may be added to the bitumen and the test conducted with or without precoating the aggregate. For 0.5 parts adhesion agent per 100 parts bitumen (m/v) add 2.0g of agent to 416g of bitumen. IDF may also be added to the bitumen. For 2.5 parts IDF per 100 parts bitumen (v/v) add 8.5g of IDF to 416g of bitumen.***

***Duplicate plates are prepared for each condition of test. A standard test, including blanks, involves eight plates.***

5.6.5 Place the bitumen filled plates in the oven at 175 ± 5 oC for 15 minutes to give an even film of bitumen.

5.6.6 Remove a plate from the oven and immediately press 50 pieces from one aggregate lot firmly into the bitumen film. Record the plate number and the aggregate condition.

5.6.7 Repeat step 5.6.6 until each lot of aggregate has been pressed into a plate.

5.6.8 Place the plates on to racks and place into an oven at 60 ± 3 oC for one hour.

5.6.9 Transfer the racks of plates to a water bath at 50 ± 3 oC and totally immerse for four hours.

***Note - Ensure that the level of the water is maintained at least 20mm above the aggregate at all times.***

5.6.10 Remove the plates from the water bath and allow to cool to 23 ± 3 oC in water for 30 minutes.

5.6.11 One at a time, remove the plates and carefully pluck out each piece of aggregate from the bitumen with either the pliers or the screwdriver without any twisting or shoving motion.

5.6.12 On the basis of the amount of bitumen adhering to the bottom of each piece, sort the aggregate into the following classifications:

 ***Nil Stripped - Bitumen adhering to 75‑100% of contact area.***

 ***Partly Stripped - Bitumen adhering to 25‑75% of contact area.***

 ***Completely Stripped - Bitumen adhering to 0‑25% of contact area.***

**6.0 CALCULATIONS**

The percentage of stripped aggregate after visual classification is calculated as follows:

For complete stripping - Count two units for each aggregate particle.

For part stripping - Count one unit for each aggregate particle.

For nil stripping - Count nil.

Then % stripped = Sum of units.

**7.0 PRECISION**

The uncertainty of measurement has been determined as + 5.0% of the test result, at a confidence limit of 95% with a nominal coverage factor of 2, when calculated in accordance with the accreditation requirements as detailed in AS/ISO 17025.

Uncertainty of Measurement determined by and for DPTI Technical Services Group, Field Services Section.

**8.0 REPORTS AND DOCUMENTATION**

**8.1 Reports**

Report results for the precoated and blank samples as % stripped for dry and wet aggregate by averaging the duplicate results. Report the precoating conditions and the binder used. Any pre-treatment of the aggregate shall also be reported.

**8.2 Documentation**

Complete - Form TP705 – 1 & Report TP705

Department of Planning, Transport & Infrastructure

19 Bridge Road Walkley Heights Ph (08) 8260 0320, GPO Box 1533 Adelaide SA 5001

Technical Services Group

Procedure

**Determination of Aggregate Stripping Value by the One Day Plate Stripping Test**

TP705

Material: ............................................…........ Sample ID: ................…………....…................

Binder: .......................................................... Adhesion Agent ID: …………..…......................

Tested by: .............……............…....…..…… Date: ...................……………………………….

Oven Id. (175 ± 5 oC) ……………… Sieve Set ………… / ………… Oven Id. (60 ± 3 oC) ……………..

Waterbath ID. (50 ±3 oC) ……………….. Waterbath ID. (23 ± 3 oC) …………….

Balance ID. …………/………….. Pre‑coat Type…………………… 30:100:1.5 @ ……………..

**SAMPLE PREPARATION DETAILS** **Time In Time Out**

Soak (wet) sample for 1 h Date ...../...../..... …………... …………...

Allow to drain for 15 min …………... …………...

Precoat aggregate, 4.5 g/L; …………. g/L \*

35 ± 1 g bitumen to plate, in oven 175 oC (15 min) …………... …………...

Add 50 stones, cure at 60 ± 3 oC for 1 h …………... …………...

Immerse in waterbath, 50 ± 3 oC for 4 h …………... …………...

Immerse in waterbath, 23 ± 3 oC for 30 min …………... …………...

|  |  |  |
| --- | --- | --- |
|  | C170 bitumen | C170 bitumen + ……………… |
|  | Dry | Dry | Wet | Wet | Dry | Dry | Wet | Wet |
| Plate Identification |  |  |  |  |  |  |  |  |
| Nil Stripped(75-100% of Contact Area) |  |  |  |  |  |  |  |  |
| Partly Stripped(25-75% of Contact Area) |  |  |  |  |  |  |  |  |
| Completely Stripped(0-25% of Contact Area) |  |  |  |  |  |  |  |  |
| Nil Stripped | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Partly Stripped (x1) |  |  |  |  |  |  |  |  |
| Completely Stripped (x2) |  |  |  |  |  |  |  |  |
| Stripped (%) |  |  |  |  |  |  |  |  |
| MEAN STRIPPED (%) |  |  |  |  |

Comments …………………………………………………………………………………………………………………………

\* Indicate as appropriate - If using 3 L tin to precoat, shake 10 mL of precoat in tin prior to use. Remove lid and allow to drain for 10 minutes.

Calculated by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Checked by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_

Form TP705-1, Revn. 6.0