

Australian/New Zealand Standard™

Methods for sampling and testing aggregates Method 7: Apparent particle density of filler

AS/NZS 1141.7:2014

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CE-006, Asphalt and Sprayed Surfacing, to supersede AS 1141.7—1995.

The objective of this Standard is to set out the method for the determination of the apparent particle density of filler for asphalt.

The objective of this revision is to reflect current practices and place the bottle calibration procedure into an appendix.

The term ‘normative’ has been used in this Standard to define the application of the appendix to which it applies. A ‘normative’ appendix is an integral part of a Standard

METHOD

1 SCOPE

This Standard sets out the method for the determination of the apparent particle density of filler for asphalt.

NOTE: The apparent particle density is required to be ascertained in order to determine the voids in dry compacted filler by the method described in AS/NZS 1141.17.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1141	Methods for sampling and testing aggregates
1141.2	Method 2: Basic testing equipment
AS/NZS	
1141.17	Method 17: Voids in dry compacted filler

3 DEFINITION

For the purpose of this Standard, the definition below applies.

3.1 Apparent particle density

The ratio of the mass of solids in air to volume of solids and impermeable voids, at 25°C, expressed in tonnes per cubic metre.

4 APPARATUS

The following apparatus, complying with the relevant provisions of AS 1141.2, is required:

- (a) *Balance*—of at least 100 g capacity, with a limit of performance not exceeding ± 0.005 g.
- (b) *Water bath*—capable of maintaining a constant temperature of $25 \pm 0.1^\circ\text{C}$.
- (c) *Thermometer*—a thermometer or other suitable temperature measuring device readable and accurate to 0.1°C .
- (d) *Glassware*—consisting of the following:
 - (i) Density bottle, of 50 mL or 100 mL capacity and volume determined in accordance with Appendix A.
 - (ii) Small funnel.
- (e) *Oven*—drying oven with operating temperature 105°C to 110°C .
- (f) *Desiccator*—containing anhydrous silica gel.
- (g) *Vacuum vessel*—capable of holding the density bottle and of withstanding the applied vacuum.
- (h) *Vacuum device*—capable of reducing and maintaining the residual pressure in the vacuum vessel to below -90 kPa gauge pressure

5 DILATOMETRIC LIQUID

The dilatometric liquid shall be either of the following, as appropriate:

- (a) Kerosene.
- (b) Distilled or deionized water, when the filler is known not to react with water.

6 PROCEDURE

The test procedure shall be carried out on duplicate test portions as follows:

- (a) Using the procedure prescribed in Appendix A, Steps (a) to (g), weigh the density bottle and stopper when filled with the dilatometric liquid and record the mass (m_3).
- (b) Dry the test portion of filler for 4 h in the oven at a temperature of 105°C to 110°C and cool in the desiccator to room temperature.
- (c) Clean and dry the bottle and add the filler through the funnel until the bottle is approximately one-third full. Weigh the bottle plus contents and stopper and record the mass (m_4).
- (d) Add sufficient dilatometric liquid to cover the filler and half fill the bottle. Release entrapped air by giving the bottle and its contents a few light taps or gentle swirls on the bench and then subjecting the bottle and contents to reduced pressure (approximately -90 kPa gauge pressure) in a vacuum vessel for at least 5 min until no further bubbles appear.
- (e) Add further dilatometric liquid to fill the bottle completely then immerse the bottle in the water bath at $25 \pm 0.1^\circ\text{C}$. The level of water in the bath shall come to within approximately 5 mm of the top of the density bottle.
- (f) After 30 min, insert the stopper carefully so that no bubbles are trapped in the neck of the bottle and the excess liquid is expelled through the capillary in the stopper.

- (g) After a further 10 min, brush the top of the stopper with a slip of filter paper, holding the paper at an angle to ensure a flat surface is passed over the capillary opening. Do not hold the bottle by hand during this process.
- (h) Remove the bottle from the bath, dry carefully, preventing any static charge and weigh immediately, recording the mass of stopper, density bottle, filler and dilatometric liquid (m_5)

NOTE: On removing from the water bath the bottle should be handled gently by the neck to prevent distortion of the bottle sides using suitable tongs or gloves to prevent transfer of heat, static or contamination of the bottle.

7 CALCULATION

7.1 Calculate as follows:

- a) Apparent particle density, ρ , shall be calculated using the following equations:

$$D = \frac{m_3 - m_1}{V_w}$$

$$\rho = \frac{m_4 - m_1}{V_w - \frac{1}{D}(m_5 - m_4)}$$

where

- D = density of the dilatometric liquid at 25°C, in tonnes per cubic metre
- ρ = apparent particle density of the filler, in tonnes per cubic metre
- m_1 = mass of stopper and density bottle, empty, in grams
- m_3 = mass of stopper, density bottle and dilatometric liquid, in grams
- m_4 = mass of stopper, density bottle and filler, in grams
- m_5 = mass of stopper, density bottle, filler and dilatometric liquid, in grams
- V_w = volume of bottle at 25°C, as determined in Appendix A, in millilitres.

If the results of the two test portions differ by more than 0.020 t/m³, the results shall be discarded and two fresh determinations made.

8 REPORTING OF RESULTS

The following shall be reported:

- (a) The apparent particle density of the filler in tonnes per cubic metre, being the mean of the two results to three decimal places.
- (b) Type of filler.
- (c) Dilatometric liquid used.
- (d) The number of this Australian/New Zealand Standard, i.e. AS/NZS 1141.7.

9 REPEATABILITY

Results obtained by one operator using the same equipment in one repeat test on different test portions drawn from the same sample should not vary by more than 0.5% of the mean value.

APPENDIX A
CALIBRATION OF DENSITY BOTTLE

(Normative)

The volume of the density bottle shall be determined in accordance with the following procedure:

- (a) Remove any static charge from the clean, dry density bottle by wiping it with a clean, lint-free cloth which has been slightly dampened with water.
- (b) Weigh the density bottle and stopper to the nearest 0.0001 g and record the mass (m_1).
- (c) Fill the bottle completely with distilled or deionized water.
- (d) Immerse the bottle in the water bath set to $25 \pm 0.5^\circ\text{C}$. The level of water in the bath shall come to within approximately 5 mm of the top of the density bottle.
- (e) After 30 min, insert the stopper carefully so that no bubbles are trapped in the neck of the bottle and the excess water is expelled through the capillary in the stopper.
- (f) After a further 10 min, brush the top of the stopper with a slip of filter paper, holding the paper at an angle to ensure a flat surface is passed over the capillary opening. Do not hold the bottle by hand during this process.
- (g) Remove the bottle from the water bath, dry carefully, preventing any static charge and weigh immediately. Record the mass of bottle plus contents (m_2) to the nearest 0.0001 g.

NOTE: On removing from the water bath the bottle should be handled gently by the neck to prevent distortion of the bottle sides using suitable tongs or gloves to prevent transfer of heat, static or contamination of the bottle. Calculate the mass of water in the bottle (m_{WB}) by subtracting m_1 from m_2 .

- (h) Calculate the volume of the bottle, in millilitres, at 25°C (V_{W}) as follows:

$$V_{\text{W}} = \frac{m_{\text{WB}}}{0.997}$$

where

m_{WB} = mass of distilled water in the bottle at 25°C , in grams

0.997 = density of distilled water at 25°C , in kilograms per litre.

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The following are represented on Committee CE-006:

ARRB Group—Australian Road Research Board
Australian Asphalt Pavement Association
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