

# Australian/New Zealand Standard™

AS/NZS 2891.8:2014

## Methods of sampling and testing asphalt

### Method 8: Voids and volumetric properties of compacted asphalt mixes

#### PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CE-006, Asphalt and Sprayed Surfacing, to supersede AS 2891.8—2005, *Methods of sampling and testing asphalt*, Method 8: *Voids and density relationships for compacted asphalt mixes*.

The objective of this revision is to adopt the same terminology used in aggregate test methods and to amend the scope with respect to air void content in relation to field compaction testing.

#### METHOD

##### 1 SCOPE

This Standard sets out the method for determining the following properties of compacted asphalt:

- (a) Percentage air voids from separately determined values of bulk density and maximum density.
- (b) Absorbed binder, effective binder, maximum theoretical density, voids in the mineral aggregate, and voids filled with binder where the proportions of component materials are known.

NOTE: The relationship between these properties is demonstrated in Appendix A.

Where the air void content of in-situ compacted asphalt is required, for compaction compliance testing, determine the air void content in accordance with AS/NZS 2891.14.5.

NOTE: The air void content can be determined using either this Standard or AS/NZS 2891.14.5. This Standard is intended for laboratory compacted asphalt and field samples of asphalt for investigation. AS/NZS 2891.14.5 is intended where percentage compaction and percentage in-situ air voids are determined for compaction compliance testing.

##### 2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- 1141 Methods for sampling and testing aggregates
- 1141.5 Method 5: Particle density and water absorption of fine aggregate
- 1141.6.1 Method 6.1: Particle density and water absorption of coarse aggregate—  
Weighing-in-water method
- 1141.6.2 Method 6.2: Particle density and water absorption of coarse aggregate—  
Pycnometer method

**AS**

2150 Hot mix asphalt—A guide to good practice

2341 Methods of testing bitumen and related roadmaking products

2341.6 Method 6: Determination of density using a hydrometer

2341.7 Method 7: Determination of density using a density bottle

**AS/NZS**

1141 Methods for sampling and testing aggregates

1141.7 Method 7: Apparent particle density of filler

2891 Methods of sampling and testing asphalt

2891.1.1 Method 1.1 Sampling—Loose asphalt

2891.3.1 Method 3.1: Binder content and aggregate grading—Reflux method

2891.3.2 Method 3.2: Binder content and aggregate grading—Centrifugal extraction method

2891.3.3 Method 3.3: Binder content and aggregate grading—Pressure filter method

2891.7.1 Method 7.1 Determination of maximum density of asphalt—Water displacement method

2891.7.3 Method 7.3 Determination of maximum density of asphalt—Methylated spirits displacement

2891.9.1 Method 9.1: Determination of bulk density of compacted asphalt—Waxing procedure

2891.9.2 Method 9.2: Determination of bulk density of compacted asphalt—Presaturation method

2891.9.3 Method 9.3: Determination of bulk density of compacted asphalt—Mensuration method

2891.14.5 Method 14.5: Field density tests—Density ratio of compacted asphalt and percentage air voids of compacted asphalt

**3 DEFINITIONS**

For the purpose of this Standard, the definitions given in AS/NZS 2891.1.1 and AS 2150 apply.

**4 PROCEDURE**

The procedure shall be as follows:

- (a) Determine the particle density, on a dry basis, of the combined coarse aggregate components in accordance with AS 1141.6.1 or AS 1141.6.2.
- (b) Determine the particle density, on a dry basis, of the combined fine aggregate components in accordance with AS 1141.5.
- (c) Determine the apparent particle density of the filler in accordance with AS/NZS 1141.7.
- (d) Determine the density of the binder in accordance with AS 2341.6 or AS 2341.7.

NOTE: The density determined by the binder supplier may be used. Where the density is reported at 15°C multiply the reported density at 15°C by 0.9937 to determine a density at 25°C.

- (e) Determine the proportions of the coarse aggregate, fine aggregate and filler as percentages of the total combined aggregate only.

NOTE: These proportions should relate directly to the raw material components upon which the corresponding density determinations in Steps (a) to (c) have been performed. These proportions are usually obtained from the mix design data.

- (f) Determine the bulk density of the compacted mix in accordance with AS/NZS 2891.9.1, AS/NZS 2891.9.2 or AS/NZS 2891.9.3.

- (g) Determine the maximum density of the mix in accordance with AS/NZS 2891.7.1 or AS/NZS 2891.7.3.
- (h) If required, determine the binder content and particle size distribution in accordance with AS/NZS 2891.3.1, AS/NZS 2891.3.2 or AS/NZS 2891.3.3.

## 5 CALCULATIONS

Carry out the following calculations as appropriate:

- (a) Calculate the percentage of air voids in the compacted sample ( $AV$ ) using the following equation:

$$AV = \frac{\rho_{\max} - \rho_{\text{bulk}}}{\rho_{\max}} \times 100 \quad \dots 5(1)$$

where

$\rho_{\max}$  = maximum density of the mix, in tonnes per cubic metre (from AS/NZS 2891.7.1 or AS/NZS 2891.7.3)

$\rho_{\text{bulk}}$  = bulk density of the compacted mix, in tonnes per cubic metre (from AS/NZS 2891.9.1, AS/NZS 2891.9.2 or AS/NZS 2891.9.3)

- (b) Calculate the particle density of the combined mineral aggregates ( $\rho_a$ ), in tonnes per cubic metre, using the following equation:

$$\rho_a = \frac{100}{\frac{P_c}{\rho_c} + \frac{P_f}{\rho_f} + \frac{P_{\text{fill}}}{\rho_{\text{fill}}}} \quad \dots 5(2)$$

where

$P_c$  = proportion of combined coarse aggregate, as a percentage

$P_f$  = proportion of combined fine aggregate, as a percentage

$P_{\text{fill}}$  = proportion of filler, as a percentage

$\rho_c$  = particle density of the combined coarse aggregate, in tonnes per cubic metre

$\rho_f$  = particle density of the combined fine aggregate, in tonnes per cubic metre

$\rho_{\text{fill}}$  = apparent particle density of the filler, in tonnes per cubic metre

- (c) Calculate the proportion by mass of the binder absorbed ( $b$ ), as a percentage, using the following equation:

$$b = B - \rho_b \left( \frac{100}{\rho_{\max}} - \frac{(100 - B)}{\rho_a} \right) \quad \dots 5(3)$$

where

$B$  = proportion by mass of binder in total mix, in per cent (from AS/NZS 2891.3.1, AS/NZS 2891.3.2, or AS/NZS 2891.3.3)

$\rho_b$  = density of binder at 25°C, in tonnes per cubic metre

$\rho_{\max}$  = maximum density of mix, in tonnes per cubic metre (from AS/NZS 2891.7.1 or AS/NZS 2891.7.3)

$\rho_a$  = particle density of combined mineral aggregates, in tonnes per cubic metre