

Australian/New Zealand Standard™

Methods of sampling and testing asphalt

Method 2.2: Sample preparation—Compaction of asphalt test specimens using a gyratory compactor

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CE-006, Asphalt and Sprayed Surfacing, to supersede AS 2891.2.2—1995.

The objective of this Standard is to set out the method for compacting asphalt specimens using a gyratory compactor.

The objective of this revision is to allow the use of a wider range of asphalt binders by specifying an equi-viscous compaction temperature. Editorial changes have also been made to aid interpretation and use of the method.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

METHOD

1 SCOPE

This Standard sets out a method for compacting asphalt specimens using a gyratory compactor.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
2008	Bitumen for pavements
2193	Calibration and classification of force-measuring systems
2891	Methods of sampling and testing asphalt
2891.2.1	Method 2.1 Sample preparation—Mixing, quartering and conditioning of asphalt in the laboratory
AS/NZS	
2891	Methods of sampling and testing asphalt
2891.1.1	Method 1.1: Sampling—Loose asphalt
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

AS/NZS

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

Austroroads

AGPT/T190 Specification framework for polymer modified binders and multigrade
bitumens

New Zealand Transport Agency

NZTA M1 Specification for roading bitumens

3 APPARATUS

The following apparatus is required:

- (a) *Specimen mould assembly*—capable of producing cylindrical specimens with smooth and uniform curved surfaces with dimensions dependent upon the nominal size of the mix as shown in Table 1. The mould shall have a removable base.
- (b) *Gyratory compactor*—pneumatic or hydraulic, capable of applying a vertical loading stress of 240 kPa to a specimen in the mould at a rate of 60 ± 5 rev/min, at a total fixed gyratory angle set between 0° and 3° , measured at the centre of the height of the mould. The compactor shall be fitted with a revolution counter, a force-measuring device meeting the requirements of an AS 2193 grade C testing machine, and sensors which are capable of stopping the application of the applied pressure at a set number of revolutions (within ± 1 revolution) or on the achievement of the height of the specimen.

The compactor shall be capable of locking the mould into place during gyratory movement.

TABLE 1
SPECIMEN AND TESTING EQUIPMENT REQUIREMENTS

Specimen and equipment details	Nominal size of mix, mm		
	>20 and ≤40	≤20	
		Either	Or
Diameter of specimen (mm)	150 ±2	100 ±2	150 ±2
Nominal height of specimen (mm)	85	65	85
Gyratory angle (°)	3 ±0.1	2 ±0.1	3 ±0.1
Vertical loading stress (kPa)	240 ±10	240 ±10	240 ±10
Diameter of top platen and baseplate (mm)	149.5 ±0.3	99.5 ±0.3	149.5 ±0.3

- (c) *Steel wearing discs*—about 0.9 mm thick, and diameter 99.8 ± 0.1 mm or 149.8 ± 0.1 mm, as appropriate for the mould.

NOTE: Some gyratory compactors do not require the use of wearing discs. If used, the discs should be tested when the mould is heated to ensure that adequate clearance is still maintained.

- (d) *Oven*—forced draught, thermostatically controlled, capable of maintaining temperatures up to 200 °C within 3 °C of the set temperature.
- (e) *Thermometer*—or other suitable temperature-measuring device, readable and accurate to 1 °C.

- (f) *Balance*—of sufficient capacity readable to 1 g, with a limit of performance not exceeding ± 5 g.
- (g) *Specimen extractor*—to remove the asphalt specimen from the mould.
- (h) *Circular paper discs*—cut to fit the mould.
- (i) *Heat-resistant boards*—on which to place the specimens when turning them.
- (j) *Mixing apparatus*—such as steel tray, trowel, spatulas and scoop.
- (k) *Gyratory angle indicator*—or another means to monitor compaction angle.

4 COMPACTION TEMPERATURES

Unless otherwise specified, the temperatures for the mix to be compacted shall be in accordance with Tables 2, 3 or 4.

TABLE 2
COMPACTION TEMPERATURES FOR AS 2008 BINDERS

Class	Stone mastic asphalt, °C	Dense graded asphalt, °C	Open graded asphalt, °C
C170	n/a	142 ± 3 °C	n/a
C320	150 ± 3 °C	150 ± 3 °C	125 ± 3 °C
C450	150 ± 3 °C	150 ± 3 °C	n/a
C600	n/a	155 ± 3 °C	n/a
M1000	n/a	155 ± 3 °C	n/a

TABLE 3
COMPACTION TEMPERATURES FOR AUSTROADS AGPT/T190 BINDERS

Bitumen class	Stone mastic asphalt, °C	Dense graded asphalt, °C	Open graded asphalt, °C
A10E	160 ± 3 °C	160 ± 3 °C	135 ± 3 °C
A15E	160 ± 3 °C	160 ± 3 °C	135 ± 3 °C
A20E	160 ± 3 °C	160 ± 3 °C	135 ± 3 °C
A25E	n/a	160 ± 3 °C	135 ± 3 °C
A35P	n/a	160 ± 3 °C	135 ± 3 °C

TABLE 4
COMPACTION TEMPERATURES FOR NZTA M1 BINDERS

Bitumen grade	Stone mastic asphalt, °C	Dense graded asphalt, °C	Open graded asphalt, °C
40–50	157 ± 3 °C	157 ± 3 °C	118 ± 3 °C
60–70	150 ± 3 °C	150 ± 3 °C	113 ± 3 °C
80–100	142 ± 3 °C	142 ± 3 °C	107 ± 3 °C

NOTE: Refer to Appendix A and Appendix B for guidance in establishing compaction temperatures for binders not included in Tables 2, 3 or 4, or for warm mix asphalt.

5 SPECIMEN PREPARATION

5.1 Laboratory prepared mixes

Laboratory prepared mix shall be prepared as follows:

- (a) Preheat the compaction moulds.

- (b) Prepare and condition a sample of asphalt in the laboratory in accordance with AS 2891.2.1.
- (c) Obtain a representative test portion of the asphalt of sufficient mass to meet the requirements of Table 1. Place the test portion in a compaction mould and spade the asphalt with a heated spatula 15 times around the perimeter and 10 times over the interior.

NOTE: The expected bulk density of the compacted asphalt may be used to calculate the mass necessary to give the desired specimen height. A mass of 1225 ± 25 g is usually sufficient for dense graded asphalt with 1110 ± 25 g for open graded or SMA type materials.

- (d) Place the mould in the oven for sufficient time for the test portion to reach the specified compaction temperature. If the test portion has not reached the specified temperature within 60 min, discard the test portion.

5.2 Plant-produced mix

Plant-produced mix samples shall be prepared as follows:

- (a) Preheat the compaction moulds.
- (b) Unless otherwise specified, obtain a bulk sample of asphalt in accordance with AS/NZS 2891.1.1.
- (c) Obtain a test portion of the asphalt of sufficient mass to meet the requirements of Table 1 by either of the following:
 - (i) A sample division of freshly produced asphalt that is at a temperature to facilitate sample division.
 - (ii) Placing a sample container in an oven, at a temperature not exceeding 160°C to reheat the sample. The sample shall not be in the oven for more than 3 h in total. When the sample is at a temperature to facilitate sample division, remove the sample container from the oven, transfer the sample to a mixing tray or bowl, and prepare test portions.
- (d) Place the test portion in a compaction mould and spade the asphalt with a heated spatula 15 times around the perimeter and 10 times over the interior.

NOTE: The expected bulk density of the compacted asphalt may be used to calculate the mass necessary to give the desired specimen height. A mass of 1225 ± 25 g is usually sufficient for dense graded asphalt with 1110 ± 25 g for open graded or SMA type materials.

- (e) Place the mould in the oven for sufficient time for the test portion to reach the specified compaction temperature. If the test portion has not reached the specified temperature within 60 min, discard the test portion.

NOTE: Suitable containers may be used instead of the moulds. The containers should be preheated to the compaction temperature prior to introduction of the test portion. Containers should be of a similar shape and size to the moulds.

6 PROCEDURE

The procedure for compacting specimens shall be as follows:

- (a) Set the required number of revolutions or specified specimen height, the gyratory angle and the vertical loading stress (see Table 1) on the gyratory compactor.
- (b) Remove the mould from the oven. Place a thermometer in the mould and verify that the temperature of the asphalt in the mould is within the tolerance for compaction temperature. Record the temperature.
- (c) Place a circular paper disc, if required, and then the upper wearing disc (if used) on top of the asphalt in the mould, and place the filled mould and assembly into the gyratory compactor.