

Australian/New Zealand Standard™

AS/NZS 2891.13.1:2013

Methods of sampling and testing asphalt

Method 13.1: Determination of the resilient modulus of asphalt—Indirect tensile method

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CE-006, Asphalt and Sprayed Surfacing, to supersede AS 2891.13.1—1995.

METHOD

1 SCOPE

This Standard sets out the method for the laboratory determination of the resilient modulus of asphalt using repeated load indirect tensile techniques.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1545	Methods for the calibration and grading of extensometers
2193	Calibration and classification of force-measuring systems
2891	Methods of sampling and testing asphalt
2891.1.2	Method 1.2: Sampling—Coring method
2891.2.2	Method 2.2: Sample preparation—Compaction of asphalt test specimens using a gyratory compactor
4115	Hand torque tools

3 DEFINITION

For the purpose of this Standard the definition below applies.

3.1 Resilient horizontal deformation

The difference between the peak horizontal deformation associated with a load pulse and the horizontal deformation at the end of the rest time of that load pulse (see Figure 1).

4 APPARATUS

4.1 Testing machine

Pneumatic or hydraulic testing machine that is capable of applying an approximately triangular shaped or haversine load pulse with a rise time (defined as the time required for the load pulse to rise from 10% to 90% of the peak force) in the range of 0.025 s to 0.1 s with an accuracy of ± 0.005 s. The machine shall be capable of applying load pulses with peak load adjustable over the range 0.4 kN to 3.9 kN with an accuracy of ± 0.05 kN. The pulse repetition period shall be adjustable over the range 0.5 s to 10 s with an accuracy of ± 0.005 s. (See Figure 1 for pulse shapes.) The machine shall be capable of applying this load pulse for at least 10 cycles for each specimen.

NOTE: The testing apparatus is only required to operate for 10 cycles for each specimen in this test but it is recommended that it be designed to operate for at least 1000 cycles in preconditioning mode for future tests.

4.2 Temperature cabinet

A temperature-controlled cabinet capable of holding the loading frame, at least three test specimens and a dummy specimen and with sufficient internal space to permit adjustment of the frame, displacement measuring devices and specimens.

The cabinet shall be capable of maintaining a temperature of $25 \pm 0.5^\circ\text{C}$ and shall be fitted with an external device which indicates the temperature inside the cabinet.

NOTE: A dummy specimen, no smaller than the diameter and maximum height required for the test specimens in Table 2, may be used to record the equilibrium temperature. A temperature measuring device is placed at the internal centre of the dummy specimen and another on the surface of the dummy specimen. The temperature at each device is read at regular intervals until the temperature in the dummy specimen and that at the surface of the dummy specimen is within the test temperature range for at least 10 minutes. Normally, two hours in the cabinet is required to reach temperature equilibrium, this may be verified using the dummy specimen.

4.3 Measuring and recording apparatus

Consisting of—

- (a) a load measuring device of at least 3.9 kN capacity, meeting the requirements of an AS 2193 Grade B testing machine when calibrated statically;
- (b) a displacement measuring device meeting the requirements of an AS 1545 Grade B extensometer for gauge lengths equal to the diameter of the specimen, with a range of at least 100 μm for measurement of horizontal displacements for each pulse and capable of being held in contact with the specimen during the complete test. The device shall be capable of being anchored to the specimen through $\frac{1}{4}$ " UNF bolts to which a torque of approximately 250 mN.m will be applied; and
- (c) a recorder able to read and record the individual measurements of load, temperature and the peak horizontal deformation after application of a pulse and the horizontal deformation at the end of the pulse.

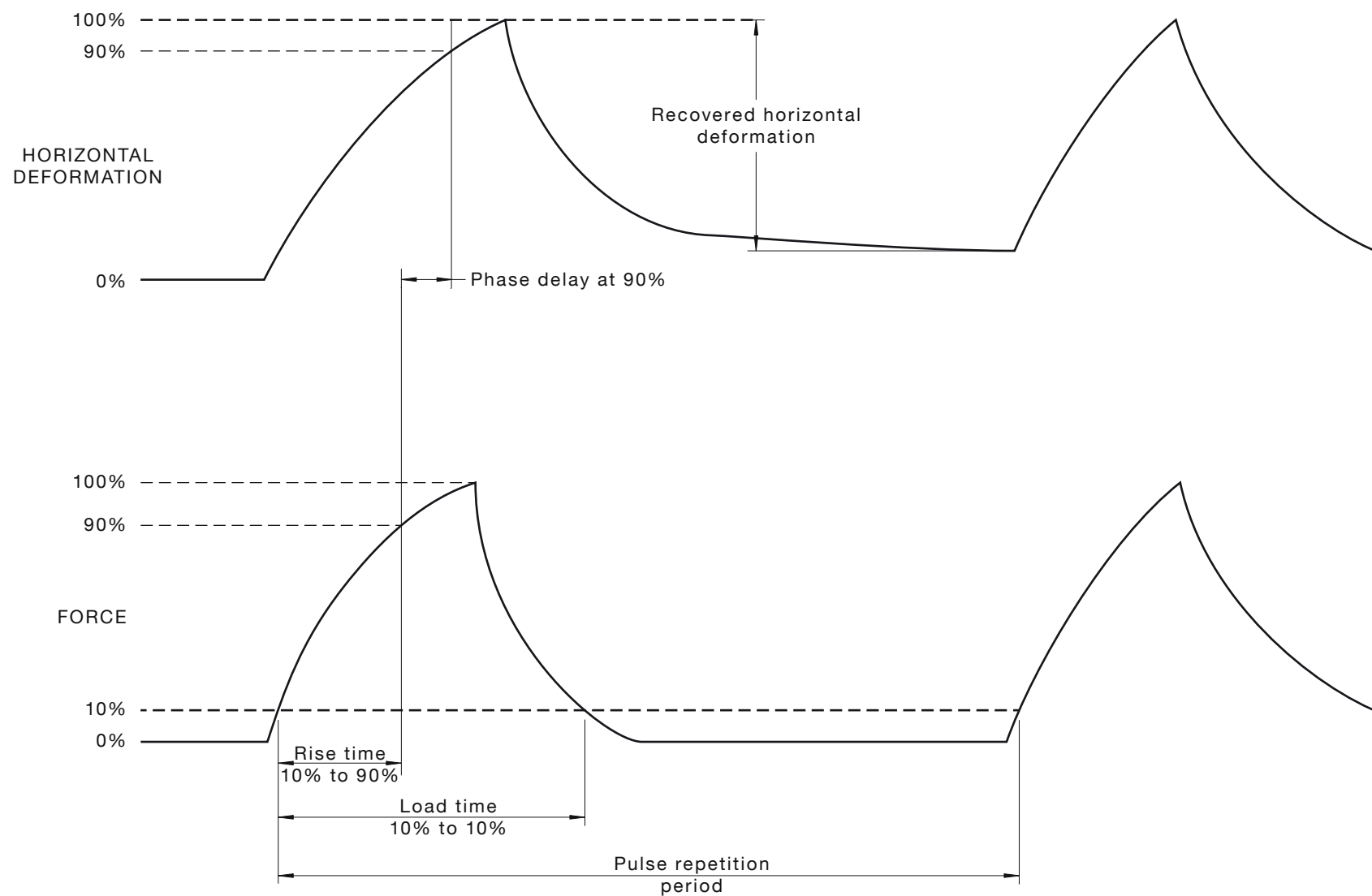


FIGURE 1 FORCE AND HORIZONTAL DEFORMATION PLUS SHAPES

4.4 Plano-cylindrical-concave steel loading blocks

The 125 mm long blocks shall be flat on the loading surface, and curved on the surface in contact with the specimen. The thickness of the blocks, measured at the thinnest section, between the concave surface and the flat surface on the other side shall be not less than 18 mm. The width of the loading blocks as measured from tip to tip of the concave face, and the radius of curvature are shown in Table 1. At each end of the blocks there shall be a hole to accommodate the locating bolts.

TABLE 1
WIDTH AND RADIUS OF CURVATURE
OF LOADING BLOCKS

millimetres		
Normal diameter of specimen	Width of loading block	Radius of curvature of the concave face
100	12.7 $\pm$ 2.0	50 $\pm$ 2.0
150	19.0 $\pm$ 2.0	75 $\pm$ 2.0

4.5 Vernier calliper

Or other suitable device capable of measuring the height and diameter of the sample to the nearest 0.1 mm.

4.6 Temperature measuring devices

Readable and accurate to 0.1°C.

NOTE: For the standard reference tests, the temperature-controlled cabinet and the thermometers need only operate at 25°C, but for other tests the temperature ranges may need to be extended. At any temperature the spatial variation of temperature within the cabinet needs to be taken into account, where conditioning specimens away from the dummy specimen, to ensure that at the time of testing a specimen complies with the test conditions.

4.7 Torque screwdriver

Complying with AS 4115, with minimum range 0.1 N.m to 1 N.m, readable to 10 mN.m.

5 TEST SPECIMENS

5.1 Number of specimens

Three specimens are required for each determination of resilient modulus.

5.2 Specimen dimensions

Specimens shall be cylindrical with smooth and uniform curved surfaces with dimensions dependent on maximum particle size as shown in Table 2. The top and bottom faces shall be smooth and shall not depart from squareness to the axis by more than 3° (about 7.5 mm in 150 mm). Specimens of other dimensions may be tested, if required and reported as non-standard dimensions.

NOTE: The dimensions of the curved loading blocks for non-standard specimens should be such that the width is about 12.5% of the diameter of the test specimen and the radius of curvature of the loading block is 50% the diameter of the test specimen.