Australian/New Zealand Standard™



# Methods of sampling and testing asphalt

# Method 14.2: Field density tests—Determination of field density of compacted asphalt using a nuclear thin-layer density gauge

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CE-006, Asphalt and Sprayed Surfacing, to supersede AS/NZS 2891.14.2:1999.

*This Standard incorporates Amendment No. 1 (December 2016). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.*

METHOD

## 1 SCOPE

This Standard sets out the method for determining the field density of thin layers of asphalt using a nuclear thin-layer density gauge with two backscatter modes of operation or geometrics. The gauge simultaneously determines, by the independent backscatter geometrics, two values of gross mass per unit volume. These values are then used, with the depth calibration, to estimate the density of the top layer of asphalt, at the thickness selected, using a proportioning calculation.

The method is applicable to asphalt layers between 25 mm and 100 mm thick and to asphalts having a nominal maximum size not greater than 40 mm.

The method does not detail the operation of the gauge but refers the operator to the manufacturer's handbook.

When nuclear gauges are used for density measurement, the quantity of material being assessed is not precisely known. However, reference to the manufacturer's handbook and to current literature may indicate the likely volume.

A nuclear gauge gives an indirect measure of field density and, hence, requires calibration, in accordance with AS/NZS 2891.14.3. Regular checks on the operation and the calibration of the gauge are also required (see Appendix A). A density offset is determined for each material being tested (see Appendix B).

## 2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

| | |
|---|---|
| AS | |
| 2891 | Methods of sampling and testing asphalt |
| 2891.1.2 | Method 1.2: Sampling—Coring method |

| | | |
|---|---|---|
| 2891.9.1 | Method 9.1: | Determination of bulk density of compacted asphalt—Waxing procedure |
| AS 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 |
| AS/NZS 2891.14.3 | Method 14.3: | Field density tests—Calibration of nuclear thin-layer density gauge using standard blocks |

## 3 SAFETY PRECAUTIONS

The equipment used in this procedure utilizes radioactive materials which may be hazardous to health unless proper precautions are taken. Therefore, it is essential that operators receive instruction on potential hazards and precautions, together with routine safety check procedures such as the use of personal radiation monitors, source leak testing and the use of radiation survey meters. Statutory regulations cover the use and transport of radioactive substances and users need to ensure that these regulations are complied with, for the State or Territory in which the instrument is to be used.

## 4 APPARATUS

The following items of apparatus are required for the correct performance of the test (additional apparatus may be required for the correct usage of a particular model of gauge).

### 4.1 Nuclear thin-layer density gauge

With a calibration density uncertainty of less than 0.06 t/m$^3$, complete with manufacturer's handbook for the gauge, and the manufacturer's reference block for standard counts, which was used during the calibration of the gauge.

NOTE: The gauges are usually equipped with in-built data processing circuitry, and can indicate directly the density reading, in tonnes per cubic metre.

The applicability of any calibration data programmed into the gauge should be verified before the gauge is used for routine density determinations.

### 4.2 Radiation monitoring apparatus and personal radiation monitors

As required by the appropriate regulatory authority.

### 4.3 Broom or brush

Suitable for cleaning road surface.

### 4.4 Steel straightedge

About 300 mm long and 5 mm thick.

### 4.5 Fine material

100% passing 0.600 mm sieve. This material may be natural sand or fines from the source rock of the aggregate in the asphalt.

### 4.6 Secondary block of naturally occurring stone or concrete

Of minimum size 500 mm long by 300 mm wide by at least 200 mm deep. The density of this block does not need to be known.

NOTE: Concrete secondary blocks may be used provided that they have been allowed to dry to a stable state following manufacture, and are kept in a stable moisture condition. If smaller blocks are used, external influences may produce variations which could affect the density system consistency check.

## 5 GAUGE CALIBRATION AND OPERATIONAL CHECKS

Nuclear thin-layer density gauges shall be calibrated for density and depth factor at each backscatter probe geometry in accordance with AS/NZS 2891.14.3. The gauge shall be recalibrated at least once every 2 years or after any major repair or component replacement. Regular checks on the operation and calibration of the gauge shall be made as follows:

(a) Standard count checks, as detailed in Paragraph A1 of Appendix A, shall be made on each day of use.

(b) Gauge function checks, as detailed in Paragraph A2 of Appendix A, shall be made at least once per month.

(c) Density system consistency checks, as detailed in Paragraph A3 of Appendix A, shall be made at least once per month.

## 6 PROCEDURE

The procedure shall be as follows:

(a) Obtain and record, for the asphalt to be tested, the source, nominal size, type and nominal layer thickness, and the reference density of the asphalt mix; and, for the nuclear gauge to be used, the serial number and the current calibration report number.

(b) Obtain the value of the density offset ($\Delta\rho$) adjustment for the particular asphalt mix and thickness to be tested, and record the source of this information. Follow the procedures of Appendix B if a current density offset value is not available.

(c) At the works site, obtain and record the field standard density counts, with the manufacturer's reference block placed on the material to be tested, in accordance with the procedure specified for the gauge by the manufacturer.

(d) If appropriate, enter the reference density of the asphalt mix, and the appropriate density offset into the nuclear gauge in accordance with the manufacturer's instructions. Enable the density offset function, unless the density offset is being either determined or checked in accordance with Appendix B, or being applied manually. Set the gauge to the required thickness and record the value.

NOTE: The density offset may be positive or negative.

(e) Select a test site on which density is to be determined and ensure that—

(i) loose material is swept or cleared off the surface; and

(ii) the surface is essentially dry, flat and free of cracks and depressions.

(f) Place the fine material on the test site. Using the steel straightedge, spread the fine material to fill small surface voids, leaving the tops of the surface aggregate exposed. The fine material shall not form an added layer on the surface.

NOTE: Fines should not be used when testing open-graded asphalts, as they will fill the surface voids and affect the density reading.

(g) Place the gauge on the test site checking that it is firmly seated, without rocking. The longitudinal axis of the gauge shall be aligned parallel to the direction of traffic flow.

(h) Lower the probe to the test position.

(i) Follow the gauge manufacturer's instructions to obtain at least one density reading, using a combined counting period of at least 4 min. Record the field density ($\rho$) or the field density reading ($\rho_N$), as appropriate, and the corresponding density counts.

NOTE: If desired, additional readings may be taken, and longer count times may be used. The gauge may be rotated 180° about the axis of the source rod, ensuring that the gauge is firmly seated, and another reading(s) taken. If more than one reading is taken, the density readings obtained may be averaged if the readings do not differ by more than 3%. Otherwise, repeat the test on an adjacent site.