Test Method

Moisture Ratio Determination for Assessment of Dry-Back of Granular Pavement Materials

RC 316.14

1. Scope

This test is used to assess the reduction of moisture content (dry-back) of the uppermost layer of granular pavement materials prior to application of bituminous surfacing.

Granular pavement materials include crushed rock, or gravel, sand and soft or ripped rock used as base course. These materials are treated during the preparation of granular pavements for bituminous surfacing to VicRoads Standard Specification Section 310.

The method applies to materials assigned an optimum moisture content (OMC) in accordance with AS 1289.5.4.2, with OMC determined using modified compactive effort in accordance with AS 1289.5.2.1.

2. Principle Of Method

The method uses the nuclear surface moisture/ density gauge for moisture measurement. The method requires that a moisture intercept (c value) is determined in accordance with AS 1289.5.8.1, Appendix B2, during compaction acceptance testing. The moisture ratio test uses that intercept to provide moisture content values for comparison to OMC.

Note: moisture bias or moisture correction factor are not appropriate adjustments as these both rely on a direct transmission wet density, which will not be determined at time of moisture dry-back test, and internal gauge microprocessor calculation.

The same nuclear gauge shall be used both for determining the moisture intercept (usually during compaction acceptance testing) and testing for moisture dry-back. Moisture intercepts are deemed nuclear gauge-specific).

At dry-back test, the moisture content for each dry-back test site is calculated as a percentage of the Assigned Maximum Dry Density (MDD) value for the material used on the works, as determined to AS 1289.5.4.2, using modified compactive effort.

The moisture content is then used to calculate a Moisture Ratio as a percentage of OMC, determined using modified compactive effort, for the pavement material.

Finally, a mean Moisture Ratio for the test lot is calculated.

The method is designated as a field procedure, but has sufficient precision to estimate the dry-back percentage to one percent (1%).

3. Method Restriction

At dry-back test, the nuclear gauge is used in backscatter mode, with testing otherwise to AS 1289.5.8.1, for taking the dry-back moisture counts. This avoids the need for moisture samples to be excavated from the intact road surface at the final preparation stage. Backscatter density readings are not required.

4. Apparatus

Apparatus as described in AS 1289.5.8.1 shall be used.

The same nuclear gauge shall be used for both step 5(a) and step 6(d).

The nuclear gauge shall be calibrated in accordance with AS 1289.5.8.4, for moisture.

Note that calibration of the nuclear gauge in backscatter density mode is not required because only the moisture readings are required for this test.

5. Preparation

(a) Determine the moisture intercept (c value) for the material, in accordance with AS 1289.5.8.1 Appendix B2. This test should be carried out with the compaction acceptance testing on the material at a recent, previous date.

(b) Determine the lot boundaries of the area to be sealed. The area shall consist of one or more complete compaction acceptance test lots and meet the requirements of VicRoads Standards Specification Section 310. The same material shall have been placed throughout the area prepared for sealing.

(c) Obtain the moisture slope constant (d) from the moisture calibration report for the nuclear gauge.

(d) Obtain the moisture intercept value (c value) from the moisture intercept report for the material, using the nuclear gauge.

Note: The c value should have been determined as part of the compaction acceptance testing even though the c value may not have been used in that testing.

(e) Obtain Assigned Values for MDD and OMC, (from AS 1289.5.4.2) for the material placed; such values to be current at the date of placement of the material.

(f) Record the required data.

Note: This data can be pre-processed prior to attending the site (refer Calculations).

6. Procedure

(a) Confirm the lot boundaries of the area to be sealed.

(b) Perform test site selection in accordance with RC316.10 and the following :

- For areas greater than 500 square metres, 6 test site lots shall be used. The maximum lot size is restricted to 4000 m^2 (VicRoads Standard Specification Section 310), or.
- Areas less than 500 square metres, may be treated as Small Areas and 3 test site lots may be used (VicRoads Standard Specification Section 173).

(c) Locate each test site on the carriageway surface.

(d) Perform a field density test to AS 1289.5.8.1 and Code of Practice RC 500.05 at each test site, except that the gamma source shall be positioned in backscatter mode at each selected test site, and two 60 second moisture counts (MC1 and MC2) shall be obtained.
The prepared surface of the area to be sealed may be swept clean and fines placed as permitted by the procedure of AS 1289.5.8.1. The surface shall not otherwise be disturbed.

(e) Record on the dry-back worksheet, moisture standard count (**MS**) and moisture mode counts (**MC1 & MC2**) for each test site.

7. Calculations

(a) Calculate the field moisture count ratio **(MCR)** for each dry-back test site tested at Step 6(d) above, using the following equation:

$$MCR = \frac{MC1 + MC2}{2 * MS}$$

(b) Calculate the field water content (**Wdb**), in tonnes per cubic metre, for each dry-back test site, using the moisture calibration equation:

$$Wdb = (d * MCR) + c$$

where:
d = moisture slope constant,
MCR = moisture count ratio, and
c = moisture intercept value for the material

(c) Calculate the moisture content (**w**) for each dry-back test site, in percent, using:

$$w = \frac{100 * Wdb}{MDD}$$

where:
Wdb = field water content, in t/m^3
MDD = maximum dry density, in t/m^3

(d) Calculate the moisture ratio (**MR**) for each dry-back test site, in percent, using:

$$MR = \frac{100 * w}{OMC}$$

(e) Calculate the mean Moisture Ratio (**meanMR**), in percent, as the mean of the individual site moisture ratios for the lot (mean of 3 or 6 values).

(f) Determine the highest individual Moisture Ratio.

8. Reporting

Report the following :

- Road and test area identification;
- The lot boundaries of the area tested;
- Material source, size and type;
- Optimum moisture content, as Assigned OMC (AS 1289.5.4.2) and report number(s);
- Maximum dry density, as Assigned MDD (AS 1289.5.4.2), and report number(s);
- Nuclear gauge serial number, moisture calibration constants including moisture intercept value for the material, and report number(s);
- Date of dry-back field test;
- The mean Moisture Ratio, to the nearest 1%, as a percentage of OMC;
- The highest individual Moisture Ratio, to the nearest 1%, as a percentage of OMC;
- Detail of field dry-back moisture test data used and calculations; and
- Reference to AS 1289.5.8.1 and this method (RC 316.14).

Test Method - Revision Summary

RC 316.14 Moisture Ratio Determination for Assessment of Dry-Back of Granular Materials

Date	Clause Number	Description of Revision	Authorised by
June 2013	Full document 7(c) Cl 2, 3, 5, & 8	Re-styled Changed definition of MeanPd to be Assigned MDD for test lots (Deleted need for a set of individual field dry density values from compaction reports). Consequential changes made, including "MCR".	Manager - Construction Materials