

Selection of Test Methods for Testing of Materials and Work

RC 500.16

July 2018

1. Introduction

1.1. General

Wherever possible, VicRoads has adopted Australian Standards (prefix AS), or Austroads Test Methods (prefix AGPT), for the testing of materials and work. In some cases Australian Standards are not available or are not considered suitable for the testing involved. VicRoads has developed VicRoads Test Methods (prefix RC) to cover such situations.

This Code sets down the appropriate test methods to be used for testing of materials and work, and provides extra detail where the test method permits alternatives.

1.2. Hierarchy of Documents

In order to interpret which test methods are to be selected, the following is the hierarchy of documents to be used. The highest documents in the list have precedence over any lower documents:

- Contract Specific Clauses
- All other Standard Specification Sections
- VicRoads Codes of Practice
- Australian Standards (except test methods)
- VicRoads Test Methods
- Australian Standards Test Methods
- Austroads Test Methods
- Other Standards and Test Methods

Precedence in test methods is established by:

- (a) Higher order method(s), that may call on other test methods, have precedence in reporting accuracies and procedures;
- (b) Lower order method(s) that require certain information to be reported, such information shall be included in the report.

Where test methods include statements in the reporting clause such as:

- as required;
- where (as) applicable; or
- where relevant:

such details shall be included in the report wherever possible. The applicability, relevance, etc., is based on whether that part of the test is performed or such information was obtained in accordance with the method requirements.

1.3. Test Methods

Appropriate VicRoads Codes of Practice and applicable test methods (including Australian Standards, VicRoads Test Methods and other methods) are fully referenced in VicRoads Standard Specification Section 175 - *Referenced Documents for Standard Specifications for Roadworks and Bridgeworks*.

Current VicRoads Codes of Practice and Test Methods are available online at the VicRoads website (www.vicroads.vic.gov.au).

Australian Standards are available online at the SAI Global website (www.saiglobal.com).

1.4. Accreditation of Testing

Laboratories that perform tests required by VicRoads Standard Specification Sections, Codes of Practice and applicable test methods shall meet the requirements of AS ISO/IEC 17025.

All test reports shall be endorsed in accordance with the AS ISO/IEC 17025 accreditation for that laboratory. Testing laboratories shall comply with the resource requirements for competent testing personnel and appropriate supervision as required by AS ISO/IEC 17025. (Test reports may be called test certificates.)

Note: Accreditation bodies which are signatories to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA) for testing laboratories can offer accreditation against the requirements of AS ISO/IEC 17025. A listing of ILAC signatories is available from the ILAC website (www.ilac.org). In Australia, the National Association of Testing Authorities (NATA, <https://www.nata.com.au>) is a signatory to the ILAC MRA.

Note: To conform with ILAC requirements, any additional tests may need to be covered by the terms of the accreditation or, if this is not the case, the testing may need to be reported such that it is clear the testing is not covered by accreditation. A separate report may be necessary.

2. Sampling

All sampling of materials shall be carried out in accordance with the appropriate Australian Standards except for the following:

- Polymer modified binders shall be sampled in accordance with Austroads AGPT/T190.

Sampling of loose asphalt shall be as detailed in Clause 5 of this Code of Practice.

3. Aggregates

(a) General

Aggregates shall be tested in accordance with the relevant methods listed in AS 1141.

(b) Unsound and Marginal Particles

RC 372.01 shall be used to determine the amount of unsound and marginal particles in aggregates.

(c) Alkali Aggregate Reactivity (AAR)

Petrographic examination of aggregate, where required, is to be carried out in accordance with ASTM C295 - *Petrographic Examination of Aggregates for Concrete*.

Potential Alkali-Silica Reactivity (ASR) of concrete aggregates shall be determined using RC 376.03.

Alkali Aggregate Reactivity (AAR), shall be determined using RC 376.04.

Note: RC 376.04 can also be used to measure Aggregate Carbonate Reactivity (ACR).

(d) Sealing aggregates

Code of Practice RC 500.09 details test methods to be used for testing sealing aggregates.

4. Soils and Crushed Rock

When testing the properties of a soil or crushed rock, such as California Bearing Ratio (CBR) and permeability, for suitability of use in pavements and earthworks, particle size and plasticity index (PI) tests shall also be performed on the same samples when the specification requires that the assessment of the quality of the soil is to be made based on particle size distribution and plasticity.

Samples compacted for CBR shall be re-moulded in the laboratory using the same criteria as used in the determination of Maximum Dry Density (MDD) and Optimum Moisture Content (OMC) defined in either AS 1289.5.1 or AS 1289.5.2.1, for dynamic compaction.

Unless otherwise specified, Standard compactive effort shall be used for Type A and Type B fill, and Modified compactive effort shall be used for all pavement materials.

Note: Classification of samples of soils and rocks, on the basis of grading and plasticity, shall be performed in accordance with AS 1726, Appendix A.

(a) Preparation

Soils shall be prepared in accordance with AS 1289.1.1.

(b) Soil Classification Tests

Australian Standards shall be used for plasticity, and particle density tests. Soil to be tested for plasticity tests shall be

prepared in accordance with AS 1289.1.1, Clause 5.3.3, and classified in accordance with AS 1726 Appendix A.

Liquid Limit tests on pavement materials such as Class 1 to Class 4 crushed rocks and granular Type A fills shall be in accordance with AS 1289.3.1.1.

When testing soils or crushed rock for particle size distribution, samples shall be washed as detailed in the test methods. Particle size distribution tests shall be performed in accordance with AS 1289.3.6.1; however, tests for crushed rock and aggregates may also be performed in accordance with AS 1141.11.1.

When testing crushed rock for flakiness index, AS 1141.11.1 and AS 1141.15 shall be used.

(c) Soil Compaction and Field Density Tests

Details for selection and application of the test methods for field density assessment are specified in VicRoads Code of Practice RC 500.05.

(d) Soil Strength and Swell Tests

The determination of the CBR and Swell of a soil shall be in accordance with AS 1289.6.1.1 and the following requirements.

The test is performed on the fraction of material passing the 19.0 mm sieve. Material retained on the 19.0 mm sieve shall be discarded. Material must not be crushed and returned to the sample.

Soil classification tests (plasticity index and grading) shall be performed for each sample to be tested for CBR and Swell.

Specimens for CBR testing shall be re-moulded in the laboratory in accordance with the following requirements:

- Density Ratio at 98 % \pm 1 % of the MDD for the material; and
- Moisture Ratio within the range 95 % to 105 % of the OMC for the material.

Note: These requirements both (a) apply to Clause 6(e), and (b) differ from the default position in Clause 5(i), of AS 1289.6.1.1.

Surcharge for soaking period: The surcharge to be applied during the soaking period shall be 4.5 kg. This surcharge shall be in addition to the mass (1.0 kg) of the stem and perforated plate placed on the specimen during soaking. The total mass applied during the soaking period shall be 5.5 kg.

Surcharge for penetration test: The surcharge to be applied during the CBR penetration test procedure shall be 4.5 kg. The surcharge shall be applied in accordance with Clause 8(a) of AS 1289.6.1.1.

Testing: The laboratory four day soaked CBR and Percentage Swell shall be determined for each specimen.

Individual values of CBR and Percent Swell shall not be rounded before calculating mean values.

Report the moisture content (in percent), after penetration, of both:

- the top 30 mm (w_{30}) of the specimen, and
- the remaining depth of the specimen (w_r).

Application: When assessing the assignment of CBR and Swell, the requirements of VicRoads Test Method RC 324.01 for raw material, and RC 301.04 for lime stabilised material, shall be followed.

(e) Soil Permeability Tests

Permeability tests are to be performed on the fraction of material passing the 19.0 mm sieve. Material retained on the 19.0 mm sieve shall be discarded and not crushed and returned to the sample. The hierarchy of use of the permeability methods is detailed below.

Soil classification tests (plasticity index and grading) shall be performed for each sample to be tested for permeability.

A constant head of 117 mm shall be used when testing in accordance with AS 1289.6.7.1.

If the volume of fluid collected in a 24 hour period is small (e.g. less than 150 ml), the constant head method is not applicable, and the falling head method described in AS 1289.6.7.2 should be used.

Where material is being tested and the specimen is being saturated, if there is no overflow but some drainage from the burette, increase the negative pressure to its maximum and leave the specimen under vacuum for 24 hours. If there is still no overflow or drop in the height of the water in the burette, the sample is deemed impermeable, for the purposes of road pavement materials and the test can be halted.

If the material is intended for use as embankment fill, continue testing using the triaxial permeability method described in AS 1289.6.7.3.

Note: AS 1289.6.7.3 may be used as the commencing test without progression through the other methods.

(f) Electrical Conductivity and pH for Sulphide Mineralisation

For testing for Electrical Conductivity and pH for assessing a crushed rock for sulphide and sulphate mineralisation, the fraction passing the 2.36 mm sieve shall be prepared in accordance with AS 1289.1, Clause 5.6.

5. Asphalt

Sampling of loose asphalt shall comply with AS 2891.1.1 except that the sample size shall be as given in Table 1.

| Type of material to be sampled | Property to be determined | Minimum sample size* |
|--|--|-------------------------------|
| Freshly mixed or supplied material | Bitumen content and aggregate grading | 4 kg |
| | Moisture content | 1 kg |
| | Bulk density, stability and flow of laboratory compacted specimens | 5 kg |
| | Maximum density | 2 kg |
| Placed and compacted material (core specimens) | Bulk density | An isolated layer of the core |
| | Maximum density | 1 kg (one or more cores) |

* Where referee samples are required the minimum sample size should be adjusted accordingly.

(a) Binder Content and Particle Size Distribution

Tests shall be performed in accordance with either:

1. Austroads AGPT/T234, or
2. AS 2891.3.3.

If the asphalt mix contains added cellulose fibres, then AS 2891.3.3 shall be performed and the mass of fibres shall be measured and reported, as a percentage of the total mix.

(b) Mix Design

RC 201.01 shall be used for testing of asphalt mix designs produced using the Marshall method.

RC 201.12 and RC 201.13 shall be used for testing of asphalt mix designs produced using the Gyratory compaction method.

Austroads AGPT04B-07 Guide to Pavement Technology Part 4B: *Asphalt* shall also be referred to for testing for Gyratory mix designs.

(c) Asphalt performance testing

AS 2891.13.1 shall be used to determine resilient modulus of asphalt using repeated load indirect tensile techniques.

Austroads AGPT/T232 shall be used to determine wet and dry strength and tensile strength ratio.

Austroads AGPT/T233 shall be used to determine resistance to fatigue by repeated flexural bending.

(d) Field Compaction

Details for selection and application of test methods are shown in VicRoads Code of Practice RC 500.05.

(e) Moisture Content

Moisture content of hot-mixed asphalt shall be determined by drying to constant mass in accordance with RC 211.01.

(f) Binder Drain-off

Binder drain-off shall be determined in accordance with Austroads AGPT/T235.

6. Bituminous Products

Australian Standards and Austroads Test Methods shall be used.

Viscosity at 135°C shall be determined in accordance with ASTM D88.

7. Steel, Concrete, Elastomeric Bearings, Geosynthetics, Paint, Glass Beads and Delineators

Australian Standard Test Methods shall be used.

When using concrete or grout, the following applies:

7.1. Concrete

- Slump of concrete shall be determined in accordance with AS 1012.3.1.
- Entrained air in freshly mixed concrete shall be determined in accordance with AS 1012.4.
- Test specimens used to test for compressive, indirect tensile or flexural strength shall be made and cured in accordance with AS 1012.8.1 or AS 1012.8.2.
- Compressive strength of concrete specimens shall be determined in accordance with AS 1012.9.
- The drying shrinkage of concrete shall be determined in accordance with AS 1012.13.
- The compressive and tensile strength of concrete cores extracted from hardened concrete shall be determined in accordance with AS 1012.14.
- The chloride and sulphate in hardened concrete and concrete aggregates shall be determined in accordance with AS 1012.20.1 or AS 1012.20.2.
- The VPV (volume of permeable voids) of either concrete cylinders or concrete cores shall be determined in accordance with AS 1012.21.
- The slump flow, T500 time and passing ability of Self Compacting Concrete (SCC) shall be in accordance with AS 1012.3.5.
- Other relevant test methods in the series AS 1012 – *Methods of Testing Concrete* shall be used to test concrete as required.

7.2. Grout

The compressive strength of grout shall be determined from test cubes made, cured and tested in accordance with AS 1478.2.

8. Quality of Source Rock

Details of sampling and testing are given in VicRoads Code of Practice RC 500.00.

9. Crushed Concrete

9.1. Liquid Limit, Plasticity Index, Moisture Content and CBR.

These tests shall be performed in accordance with AS 1289.2.1.1, AS 1289.3.1.1, AS 1289.3.1.2, AS 1289.3.2.1, AS 1298.3.3.1 and AS 1289.6.1.1, as appropriate.

AS 1289.3.1.2 may be used in lieu of AS 1289.3.1.1, where additive content does not deliver a stable plasticity index value.

9.2. Particle Size Distribution

AS 1141.11.1 or AS 1289.3.6.1 shall be used.

9.3. Foreign matter

The amount of foreign matter, as described in VicRoads Standard Specification Section 820, shall be determined in accordance with RC 372.04.

9.4. Los Angeles Value (LAV)

LAV shall be determined in accordance with AS 1141.23.

10. Stabilised Materials

(a) Insitu Stabilised Materials

When determining binder content for insitu stabilisation of pavements, RC 330.01 shall be used.

Maximum allowable working time for a cementitious binder shall be determined in accordance with RC 330.02.

RC 330.03 shall be used to determine the density decay correction factor when required for field density testing of stabilised material.

Test specimens shall not be pre-soaked after curing and prior to testing except where the cementitious binder content is 3% or greater.

(b) Plant mixed – Cementitious Treated Crushed Rock and Cementitious Treated Crushed Concrete

Samples used for the manufacture of Unconfined Compressive Strength (UCS) tests specimens shall be obtained in accordance with AS 1141.3.1.

The cement content of Cementitious Treated Crushed Rock and Cementitious Treated Crushed Concrete shall be determined in accordance with AS 5101.3.3. The calibration chart for each combination of material type and cementitious additive type shall be re-determined at least every 12 months.

Samples used for the manufacture of UCS test specimens shall have a moisture content as near as practical to the Optimum Moisture Content and comply with VicRoads Standard Specification Section 815, Clause 815.11.

Samples shall be compacted using dynamic compaction in accordance with AS 5101.4, Clause 7.2 (d) (ii). Samples shall be compacted using a 'split' mould as per AS 5101.4, Clause 4 (h).

Test specimens made remote from the testing laboratory where compression testing is to be performed, shall be cured in accordance with AS 5101.4, Clause 8 (a) until they are transported.

If compacted test specimens are to be transported from where they are manufactured to a testing laboratory, they shall not be transported until at least 24 hours after compaction. All specimens shall be transported in a safe manner and not subject to movement.

All curing and testing of test specimens shall be in accordance with AS 5101.4.

Test specimens shall be immersed in water prior to compression testing as per AS 5101.4, Clause 8 (a), and allowed to drain as per Clause 9 (a).

11. Assessment of Pavement Surfaces

(a) Sprayed Seals

Assessment of the texture of a surface to be resealed for the purpose of estimating binder allowances for surface texture shall be tested in accordance with RC 317.01.

Note : Estimation of binder allowances for surface texture is detailed in Austroads AP-T68/06 - Update of the Austroads Sprayed Seal Design Method, Section 2.1.7.

If assessment of the texture of completed sprayed seals under VicRoads Standard Specification Section 408 is required, the surface shall be tested for surface texture in accordance with RC 317.01.

If assessment of aggregate retention of completed sprayed seals under VicRoads Standard Specification Section 408 is required, the surface shall be tested for Degree of Stripping in accordance with RC 317.03.

(b) Slurry Surfacing

If assessment of the texture of completed bituminous slurry surfacing under VicRoads Standard Specification Section 427 is required, the surface shall be tested for surface texture in accordance with RC 317.01.

(c) Concrete Pavements

Assessment of a concrete pavement for surface texture shall be tested in accordance with RC 317.01.

12. Quality of Pavement Construction

12.1. Levels

Measurement of the surface levels of pavement layers shall be performed in accordance with RC 423.02 – *Measurement of Surface Levels of Pavement Layers (Random Site Selection)*.

12.2. Ride Quality

Measurement of the ride quality of constructed pavement, VicRoads Standard Specification Section 180, shall be made in accordance with either of the following VicRoads Test Methods:

- RC 422.03 - *Pavement Roughness (Inertial Laser Profiler Method)*; or
- RC 422.06 - *Pavement Roughness (ARRB TR Walking Profiler Method)*.

12.3. Rut Depth

Measurement of the rut depth of constructed pavement shall be made in accordance with RC 422.04 - *Pavement Rutting Depth (Inertial Laser Profiler Method)*;

12.4. Cracking and Patching Defects

Cracking and pavement defects shall be measured in accordance with RC 423.09 – *Measurement of Cracking and Patching Defects in a Pavement*.

12.5. Pavement Markings

Retroreflectivity of Pavement Marking shall be measured and calculated in accordance with RC 424.01 – *Determination of Retroreflectivity of Pavement Markings*, and the requirements of VicRoads Standard Specification Section 721 – *Pavement Markings*.

13. Other Tests

In cases not specifically mentioned in this Code of Practice, VicRoads Principal Advisor – Pavements, Geotech. and Materials shall be consulted.

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VicRoads Code of Practice - Revision Summary

RC 500.16 - Selection of Test Methods for Testing of Materials and Work

| Date | Clause | Description of Revision | Authorised by |
|------------|---|--|---|
| July 2018 | 1.3 1.4 | New clause consistent with Section 160.E5 New clause re AS ISO/IEC 17025 | Principal Advisor – Pavements, Geotech. and Materials |
| June 2017 | Cl 4(b) Cl 4(d) Cl 7.1 Cl 7.2 Cl 12 | Removed RC 302.11 Added VicRoads re-moulding requirements Penetration surcharge consistent with AS 1289.6.1.1 Deleted text re un-soaked and soaked Referenced RC 324.01 Added AS 1012.3.1, AS 1012.3.5, AS 1012.8.2, AS 1012.20.2 Added AS 1478.2 Deleted reference to geosynthetics Adjusted methods to be consistent with published methods | Principal Advisor – Pavements, Geotech. and Materials |
| March 2014 | Cl 4(d) para 3, para 4, para 5 Cl 10(b) para 7 | Corrected to "... CBR and Swell" Mass (1.0 kg) and soaking period made clear Un-soaked samples (not normally used in VicRoads) VicRoads surcharge requirement is consistent with AS 1289.6.1.1, Clause 8(a) Corrected to AS 5101.4 | Principal Advisor – Pavements, Geotech. and Materials |
| June 2013 | Cl 4(d) | Added requirement for reporting both w30 and wr moisture contents | Principal Advisor – PGM |
| Dec 2012 | Cl 2 Cl 4(d) Cl 4(e) Cl 5 Cl 10(b) Cl 12.5 | RC 155.00 withdrawn Clarified total surcharge for soaking and testing of CBR samples Modified to indicate testing hierarchy for permeability to AS 1289.6.7.1, .6.7.2 & .6.7.3 methods Inserted Table 1 detailing sample sizes for loose asphalt Clarified stabilized materials to be tested and frequency of determinations for UCS Sampling for retroreflectivity now covered in RC 424.01. | Principal Advisor – Pavements & Materials |