Test Method
Calculation of Assigned CBR and Assigned Percent Swell
RC 324.01
June 2017

1. Scope

The test calculates the Assigned California Bearing Ratio (CBR) and Assigned Percent Swell for:

- Type A or Type B earthworks fill material supplied to the road from a single source, and
- Pavement materials, where a minimum CBR value is specified and the material source does not have an assigned Los Angeles Value.

Assigned CBR and Assigned Percent Swell for a material shall be calculated from CBR and Swell test results for samples taken from the road bed after placement and compaction is completed.

> *Note: The testing and calculations are in accordance with the requirements of VicRoads Code of Practice (CoP) RC 500.20 –* Assignment of CBR and Percent Swell.

Sampling shall be in accordance with CoP RC 500.20.

The calculation is applied to test results from the first lot of material; for Scale A assessment where 6 samples are obtained; or for Scale B assessment where 3 samples are obtained, as appropriate.

> *Note: For lime stabilised earthworks materials, the Available Lime, Assigned CBR and Swell are determined in accordance with RC 301.04.*

2. Procedure

2.1. Material record

Record material source and description, placed location, layer, and nominal size.

2.2. Test Lot Bounds

The test lot must contain only areas which are essentially homogeneous. This occurs when material type, general appearance, test rolling response, moisture condition during compaction, compaction technique and nature of underlying materials are substantially alike. Areas which fail to meet these conditions must be excluded from the lot but may be tested independently.

Soils and pavement materials which do not appear essentially homogeneous and are not uniform in terms of maximum particle size and particle size distribution may be included provided that materials are of similar origin and type.

2.3. Selection of a Lot

The bounds of the lot shall be defined. Any areas to be excluded from the lot shall be designated on the basis of appearance or test-rolling response prior to the selection of sites.

2.4. Selection of Test Sites Within a Lot

Select the required number (n = 3 or 6, as appropriate to the assessment scale) of essentially randomly located test sites within the test lot in accordance with RC 316.10, or AS 1289.1.4.2. (Sampling site selection may be the same as used for field density testing, noting the maximum area limits for this testing).

Record the test site locations.

3. Apparatus

As required by the individual methods, and the requirements of steps 5(a) (iv) and (v) below.

4. Selection and Preparation of Samples - Prior to Testing

This section describes how the sampling and preparation of material for testing to develop an Assigned CBR is to be carried out.

4.1. Determining Assigned CBR

Assigned CBR and Assigned Percent Swell for a material shall be determined from samples taken from the road bed after placement and compaction is completed, with calculations as set out in the appropriate part of Clause 6.

The Assigned CBR and Assigned Percent Swell shall be confirmed during construction from samples taken from the road bed (Appendix A), at the frequency specified, in accordance with Appendix A.

4.2. Sampling Material from Initial Lot

4.2.1. Selection of test sites

Test sites for sampling from the road bed, shall be selected in accordance with RC 316.10.

The number of samples to be taken will depend upon the Scale of Assessment to be used.

For Scale A Assessment, obtain six random samples of the material from the first lot placed or one days production.

For Scale B Assessment, obtain three random samples of the material from the first lot placed or one days production.

4.2.2. Obtaining the sample

Sampling shall be undertaken by a testing officer with at least the qualifications and experience required for a Level 3 staff from a laboratory accredited for the sampling and site selection methods by National Association of Testing Authorities, Australia (NATA).

Sampling shall be in accordance with AS 1141.3.1 or AS 1289.1.2.1, as appropriate. The samples taken shall be representative of the material to be used as Type A or Type B filling or pavement construction. Samples shall be taken over the full depth of the compacted layer, from a sample hole with vertical sides.

4.2.3. Sample preparation

Determine and record the percentage of material retained on the 19 mm and 37.5 mm sieves.

Discard the material retained on the 19 mm sieve.

5. Testing

(a) The determination of the CBR and Percent Swell of a soil shall be in accordance with AS 1289.6.1.1, and the specific requirements below:

(i) The test is performed on the fraction of material passing the 19 mm sieve. Material retained on the 19 mm sieve shall be discarded. Material must not be crushed and returned to the sample.

(ii) Specimens compacted for CBR shall be re-moulded from the sample material using the same criteria as used in the determination of MDD/OMC defined in either AS 1289.5.1.1 or AS 1289.5.2.1, for dynamic compaction.

(iii) Specimens for CBR testing shall be re-moulded in accordance with:

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

Note: These requirements differ from the default position in Clause 5(e) of AS 1289.6.1.1.

(iv) 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.

(v) 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.

(b) The laboratory four-day soaked CBR and Percent Swell shall be determined for each specimen.

(c) For Scale A Assessment, 6 values of CBR and 6 values of Percent Swell shall be obtained from the lot.

(d) For Scale B Assessment, 3 values of CBR and 3 values of Percent Swell shall be obtained from the lot.

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

6. Calculation

6.1. Scale A Assessment

6.1.1. for CBR (scale A)

(a) Rank the 6 CBR values in ascending order.

(b) Select the second lowest CBR value.

(c) Separately calculate the mean of the lowest three CBR values.

(d) Select the lower of step (b) and step (c) as the Assigned CBR.

Note: The material shall be reported as inconsistent when, for a set of six test values, the mean of the highest three soaked CBR test values is more than 10 above the mean of the lowest three soaked CBR test values.

6.1.2. for Percent Swell (scale A)

(a) Rank the 6 Percent Swell values in descending order.

(b) Select the second highest Percent Swell value.

(c) Separately calculate the mean of the highest three Percent Swell values.

(d) Select the higher of step (b) and step (c) as the Assigned Percent Swell.

6.2. Scale B Assessment

6.2.1. for CBR (scale B)

(a) Rank the 3 CBR values in ascending order.

(b) Calculate the mean of the lowest two CBR values to obtain the Assigned CBR.

Note: If the mean value of the two lowest CBR values is both:

- less than 6; and
- the difference between the highest and lowest CBR test value is greater than 15 when using the Scale B assessment test procedure;

then the Scale A assessment procedure shall be adopted. This requires the CBR testing of three additional samples.

6.2.2. for Percent Swell (scale B)

(a) Rank the 3 Percent Swell values in descending order.

(b) Calculate the mean of the two highest Percent Swell values to obtain the Assigned Percent Swell.

7. Report

The test report shall include the following information:

(a) The source and description of the material.

(b) Location of test sites, and date of sampling.

(c) The report number(s), if applicable, to the test results, and the test values, used in the assigned value calculations.

(d) Assessment Scale A, or B.

(e) If appropriate, that the material is inconsistent.

(f) The Assigned CBR value, in percent, rounded in accordance with the reporting requirements of AS 1289 6.1.1, Clause 10(a).

(g) The Assigned Percent Swell value, in percent, to the nearest 0.5 %.

(h) The date the values were assigned.

(i) Reference to this Test Method (RC 324.01).

Appendix A – Confirmation of Assigned values for CBR and Percent Swell at single test sites (Normative)

A1 - Sampling

When material is to be sampled at a single site to confirm that material meets the minimum Assigned CBR and maximum Assigned Percent Swell, at the frequency specified, the following shall be undertaken:

- The site for sampling shall be one of the compaction test sites selected using RC 316.10, with the actual test site being based on the month day number, as in Table A1.

Table A1 Test site for sampling to confirm Assigned CBR and Assigned Percent Swell

Test Site	Month Day Number				
Site 1	1	7	13	19	25
Site 2	2	8	14	20	26
Site 3	3	9	15	21	27
Site 4	4	10	16	22	28
Site 5	5	11	17	23	29
Site 6	6	12	18	24	30,31

- Samples shall be obtained in accordance with AS 1289.1.2.1.
- Samples shall be taken over the full depth of the compacted layer.

A2 - Testing

Determine and record the percentage of material retained on the 37.5 mm and 19 mm sieves.

Discard the material retained on the 19 mm sieve.

The laboratory four-day soaked CBR and Percent Swell shall be determined for each specimen, in accordance with Clause 5(a) of RC 324.01.

A3 - Reporting

(a) The source and description of the material.

(b) Location of test sites, and date of sampling.

(c) The CBR value, in percent, rounded in accordance with the reporting requirements of AS 1289 6.1.1, Clause 10(a).

(d) The Percent Swell value, in percent, to the nearest 0.5 %.

(e) Reference to this Test Method (RC 324.01, Appendix A)

If you would like to receive this publication in an accessible format, please contact: vicroadstechnicalservices@roads.vic.gov.au, or request it using VicRoads website feedback form.

VicRoads Test Method - Revision Summary

RC 324.01 – Calculation of Assigned CBR and Assigned Percent Swell

Date	Clause	Description of Revision	Authorised by
June 2017	5(a) 5(a)(v) 6.1.1(d) Note	Re-structured and some text corrected Surcharge consistent with AS 1289.6.1.1 Unnecessary text deleted	Manager – Construction Materials
April 2016	Full method	New Issue	Manager – Construction Materials