

# Determination of the Maximum Allowable Working Time for a Cementitious Binder

## 1. Scope

This Method covers the laboratory procedure used for the determination of the maximum allowable working time for a cementitious binder used for the stabilisation of granular pavement materials (either in-situ or as cementitious treated crushed rock) and earthwork materials.

## 2. Definitions

### (a) Cementitious Binder

A cementitious material capable of being uniformly mixed into a (host) material to bind the particles together to increase its strength. Cementitious binders include Portland cement Type GP or blended cement Type GB, hydrated lime, quicklime, or a blend of ground granulated blast furnace slag (GGBFS), hydrated lime, fly ash, alkali activated slag or other pozzolanic material.

### (b) Maximum Allowable Working Time

The time available, to the nearest hour, for a crushed rock pavement material, or an earthworks material, stabilised with a cementitious binder, to reach a value of 90% of the Unconfined Compressive Strength (UCS) determined for the stabilised material after storage for one hour at the specified temperature. This time is measured from the time cement is added to the material.

### (c) Design Distribution Rate of Cementitious Binder

The rate of addition of cementitious binder, by dry mass, as the greater of either 1.5%, or the amount (%) required to achieve the specified Assigned CBR and Assigned Swell, as determined in accordance with RC 324.01, using the results from six specimens tested in accordance with AS 1289.6.1.1.

### (d) Specified Temperature

The temperature at which mixed material and test specimens are moist cured for the required period.

## 3. Apparatus

- (a) For grading – as detailed in AS 1289.3.6.1.
- (b) For unconfined compressive strength – as detailed in AS 5101.4.

- (c) For maximum dry density and optimum moisture content of:
  - Pavement material – as detailed in AS 1289.5.2.1, or
  - Earthworks material – as detailed in AS 1289.5.1.1.
- (d) For standing of mixed material or curing of specimens, apparatus to maintain the specified temperature.

## 4. Material Selection

- (a) Obtain a representative sample of the granular pavement material, or the earthworks material, to be stabilised.
- (b) Obtain the appropriate cementitious binder that will be used in construction of the layer.

**Note:** Obtain sufficient material to determine the maximum dry density (MDD) and optimum moisture content (OMC), and for the preparation of at least 12 moulded UCS test specimens.

## 5. Procedure

### 5.1 General

All mixed material and all test specimens shall be moist cured at the specified temperature for the construction period in Table 1, for the time interval required at the relevant steps of step 5.2 – *Preparation* and step 5.3 – *Maximum Allowable Working Time*.

**Table 1 – Specified Temperature**

Construction Period, months inclusive	Specified Temperature
October to April	20° to 25°C
May to September	10° to 15°C

### 5.2 Preparation

- (a) Prepare and precondition the sample in accordance with Clauses 5.1 and 5.4 of AS 1289.1.1, so that only material passing 19 mm sieve is included in the sample.
- (b) Split a sufficient sub-sample from the sample for the determination of MDD and OMC.

- (c) Mix by dry mass of sample, either:
  - the pavement material sub-sample with 3% cementitious binder, or
  - the earthworks material sub-sample with the Design Distribution Rate of the cementitious binder,
- (d) Place the mixed sub-sample in sealed plastic bags and allow to stand for one hour at the specified temperature (refer to step 5.1 above).
- (e) After the one hour standing time, prepare the cured sub-sample over a 10 mm screen and recombine all material passing and retained on the screen.
- (f) Determine the MDD and OMC of the recombined material in accordance with either:
  - AS 1289.5.2.1 for the pavement material;
  - or
  - AS 1289.5.1.1 for the earthworks material.
- (f) Repeat steps (b) to (e), using standing times of 2, 4 and 8 hours after addition of the cementitious binder.
- (g) Moist cure the compacted test specimens for 7 days at the specified temperature (refer to step 5.1 above).
- (h) On completion of curing, immediately perform the procedure for compression testing as described in AS 5101.4, Clause 9, for each specimen. (If step 9(c) of AS 5101.4 is required, the test specimen must stand in the sealed container at the specified temperature.)
- (i) If the UCS values obtained are greater than 90% of the UCS determined after one hour standing time, repeat steps (b) to (e) for 16 and 24 hours standing time.
- (j) Calculate the average value of the two determinations of UCS at each standing time.
- (k) Plot average UCS versus standing time. Draw the line of best fit to the points and determine, to the nearest hour, the maximum allowable working time for the cementitious binder, at the time where the UCS is 90% of the UCS determined after one hour standing time (refer to Figure 1 as an example).

**5.3 Maximum Allowable Working Time**

- (a) Split the remaining sample into multiple sub-samples, each sufficient to compact two specimens at the nominated standing times.
- (b) Select a sub-sample. Add the required proportion of the cementitious binder, as at step 5.2(c), by dry mass of the sample, and water to achieve a laboratory moisture ratio within the range of 95% to 105% of OMC determined at step 5.2 (f). Thoroughly mix the stabilised sub-sample. Record the time of adding the cementitious binder.
- (c) Place the mixed sub-sample in sealed plastic bags and allow to stand for one hour after addition of the cementitious binder, at the specified temperature (refer to step 5.1 above).
- (d) After the one hour standing time, prepare the cured sub-sample over a 10 mm screen and recombine material passing and retained on the screen.
- (e) Compact two specimens using dynamic compaction in accordance with AS 5101.4, Clauses 7.2 and 7.4, using:
  - Clause 7.2 (d)(ii) (Modified) for crushed rock, , or
  - Clause 7.2 (d)(i) (Standard) for earthworks material, as appropriate.

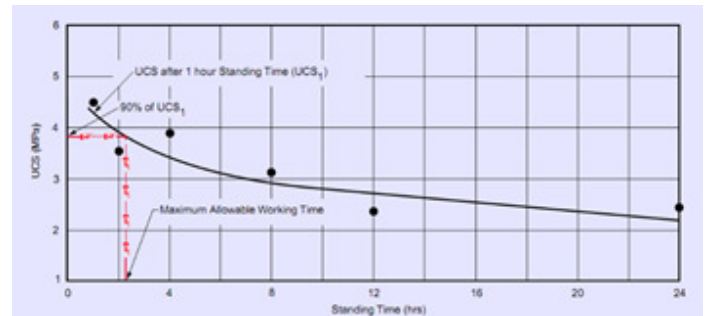
Samples shall be compacted using a 'split' mould as per AS 5101.4, Clause 4 (h).

Complete compaction of both specimens within 30 minutes of mixing at step (b) for the one hour standing time.

**6. Report**

Report the following information:

- (a) The source and description of material.
- (b) The type and proportion of cementitious binder used.
- (c) The maximum allowable working time for the cementitious binder to the nearest hour.
- (d) The temperature range at which the value was determined.
- (e) The curing regime used.
- (f) Reference to this Test Method (RC 330.02).



**Figure 1 – Unconfined Compressive Strength for Standing Time**

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**VicRoads Test Method - Revision Summary**

**RC 330.02 – Determination of the Maximum Allowable Working Time for a Cementitious Binder**

Date	Clause	Description of Revision	Authorised by
October 2019	Various Full document	Addition of text for the determination of maximum allowable working time of a cementitious binder used for the stabilisation of earthwork material. Complete revision, and re-structured to make specimen moulding and testing clear	Manager – Construction Materials