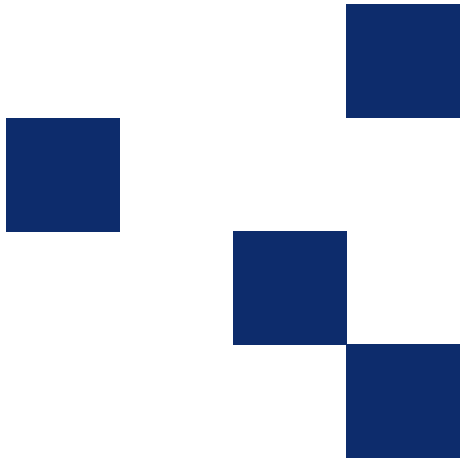
Transport Roads & Maritime Services

NSW GOVERNMENT

Test method T147

Working time for road construction materials (Blended in the laboratory with slow setting binders)

OCTOBER 2012



Revision Summary

Ed/Rev Number	Clause Number	Description of Revision	Authorisation	Date
Ed 1/ Rev 0	All	New Issue	G. Donald	November 2007
Ed 1/ Rev 1	4; 6.1(a), 7(a), (b), (c)	Preparation Heading added; corrected UOM for density; Report added details.	D. Hazell	December 2009
Ed 2/ Rev 0	All	Reformatted RMS template	J Friedrich	October 2012

Note that Roads and Maritime Services is hereafter referred to as 'RMS'.

The most recent revision to Test method T147 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T147

Working time for road construction materials (Blended in the laboratory with slow setting binders)

1. Scope

This test method sets out the procedure to determine the Working Time of bound materials based on Maximum Dry Density and Unconfined Compressive Strength.

2. General

(a) The test is performed on material:

(i) Passing the 19.0 mm AS sieve

(ii) Blended in the laboratory with cementitious binders that are expected to be slow setting

(b) Standard compaction shall be used unless otherwise specified

(c) Time limits are imposed on testing

(d) Quicklime is NOT to be used in the Laboratory

NOTE: Replace quicklime for laboratory testing: 1% of quicklime is equivalent to 1.32% of hydrated lime.

(e) The following terms and definitions are used in this Test Method

	Term	Definition
	Curing period	(a) The time interval measured from the addition of the binder to the commencement of moulding.
	Slow setting binder	(a) A binder that is expected to give a Working Time greater than 6 hours.

3. Apparatus

Calibrated timing device.

4. Preparation

Prepare samples in accordance with T105.

5. Procedure

5.1 Working Time for Maximum Dry Density

(a) Carry out T130 on the first sample assuming a Working Time greater than 6 hrs (i.e. a slow setting binder).

(i) For the first sample:

- The time constraints in Table 1 of T130 apply
- Record the time at the completion of moulding (T_R)

NOTE: T_R should be approximately 1 hour.

- Calculate the MDD and this is referred to as the Reference Maximum Dry Density (*RMDD*)

(b) Repeat T130 on 3 additional samples except that the moulding of the specimen is delayed (i.e. longer than 1 hour after adding the binder):

(i) The time constraints in Table 1 of T130 are replaced by the following requirements:

- Start timing when the binder is incorporated into the sample (unchanged)

- Select three different curing periods (T_1, T_2, T_3) for each sample that will cover the expected Working Time

NOTE: The shortest time will be at least 6 hrs.

- Moulding of the specimen must be completed within ¼ hr after the curing period

(ii) Carry out testing for each of the 3 samples:

- Record the time at commencement of adding binder
- Commence moulding after one of the selected curing periods and record the time at the completion of moulding
- Calculate the time (T_1, T_2 *or* T_3) as the difference in time between completion of moulding and adding the binder
- Calculate the MDD for each specimen (MDD_1, MDD_2 *or* MDD_3)

5.2 Working time for Unconfined Compressive Strength

(a) Carry out T131 on the first sample assuming a Working Time greater than 6 hrs (i.e. a slow setting binder).

(i) For the first sample:

- Only one specimen from each sample is to be moulded.
- The time constraints in Table 1 of T131 apply.
- Record the time at the completion of moulding (T_R).

NOTE: T_R should be approximately 1 hour.

- Calculate the UCS and this is referred to as the Reference Unconfined Compressive Strength (*RUCS*).

(b) Repeat T131 using 3 additional samples except that the moulding of each specimen is delayed (i.e. a time interval greater than 1¼ hours after adding the binder):

(i) The time constraints in Table 1 of T131 are replaced by the following requirements:

- Only one specimen from each sample is to be moulded.
- Start timing when the binder is incorporated into the sample (unchanged).
- Select three different curing periods (T_1, T_2, T_3) for each sample that will cover the expected Working Time.

NOTE: The shortest time will be at least 6 hrs.

- Moulding of the specimen must be completed within ¼ hr after the curing period.

(ii) Carry out testing for each of the 3 samples:

- Record the time at commencement of adding binder.
- Commence moulding after one of the selected curing periods and record the time at the completion of moulding.
- Calculate the time (T_1, T_2 *or* T_3) as the difference in time between completion of moulding and adding the binder.
- Calculate the UCS for each specimen (UCS_1, UCS_2 *or* UCS_3).

6. Calculations

6.1 Working Time for Maximum Dry Density

(a) Calculate MDD_{WT} as follows:

$$MDD_{WT} = 0.97 \times RMDD$$

Where:

$RMDD$ = Reference Maximum Dry Density at T_R (t/m³)

(b) Determine the Working Time for MDD (T_{MDD}) by either:

(i) A mathematical procedure:

- Use the four co-ordinates (T_R, $RMDD$), (T_1, MDD_1), (T_2, MDD_2) and (T_3, MDD_3) in a quadratic regression with T as the dependent variable.
- Substitute MDD_{WT} in the resulting equation and calculate the time (T_{MDD}).

OR

(ii) A graphical method:

- Plot the four results as the points (T_R, $RMDD$), (T_1, MDD_1), (T_2, MDD_2) and (T_3, MDD_3) as shown in Figure 1.

NOTE: T_1, T_2, T_3 are the three intervals of time between completion of moulding and adding the binder.

- Draw a smooth curve of best fit through the four points.
- From the graph, read off the time in hours corresponding to MDD_{WT}. This is the Working Time for MDD (T_{MDD}).

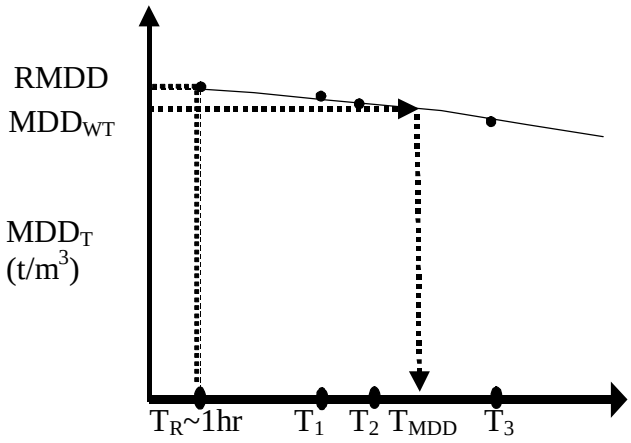


Figure 1 - Working Time for Maximum Dry Density

6.2 Working time for Unconfined Compressive Strength

(a) Calculate the UCS_{WT} as follows:

$$UCS_{WT} = 0.80 \times RUCS$$

Where:

$RUCS$ = Reference UCS at T_R (MPa).

(b) Determine the Working Time for UCS (T_{UCS}) by either:

(i) A mathematical procedure:

- Use the four co-ordinates (T_R, $RUCS$), (T_1, UCS_1), (T_2, UCS_2) and (T_3, UCS_3) in a quadratic regression with T as the dependent variable.
- Substitute UCS_{WT} in the resulting equation and calculate the time (T_{UCS}).

OR

(ii) A graphical method:

- Plot the four results as the points (T_R, $RUCS$), (T_1, UCS_1), (T_2, UCS_2) and (T_3, UCS_3) as shown in Figure 2.

NOTE: T_1, T_2, T_3 are the three intervals of time between completion of moulding and adding the binder.

- Draw a smooth curve of best fit through the four points.
- From the graph read off the time corresponding to UCS_{WT} in hours. This is the Working Time for UCS (T_{UCS}).

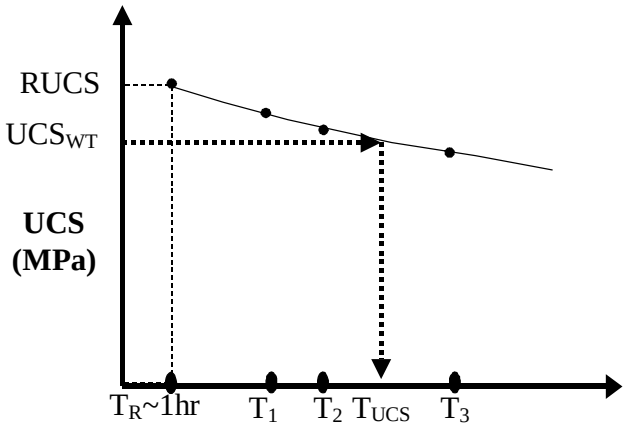


Figure 2 - Working Time for Unconfined Compressive Strength

7. Reporting

Include the following data and results in the report:

(a) Source of sample (i.e. location or laboratory)

(b) The percentage by mass of material retained on the 19 mm AS sieve from T105 (to the nearest 1%)

(c) Type, sources and percentage of binder

(d) The Working Time for the Maximum Dry Density (T_{MDD}) in hours to the nearest half hour

(e) The Working Time for the Unconfined Compressive Strength (T_{UCS}) in hours to the nearest half hour

(f) The Nominated Working Time which is the lesser value of T_{MDD} and T_{UCS} to the nearest half hour

(g) Reference to this test method