Test Method T105

Preparation of samples for testing (soils)

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This version is a draft issued for stakeholder's comments.

The template formatting has been adjusted and RMS has been replaced by Transport for NSW.

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About this release

Title:	Preparation of samples for testing (Soils)
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Authorised by:	

Summary of changes

Issue number	Clause number	Revision description	Authorised by	Publication date
Issue 4.0	All	Document restructured and reformatted to TfNSW template.		
	4.1	T102 Preparation clarified, Curing at room temperature. Oven curing of sample optional. Added calculation for portion retained on the 53 mm sieve.		
	4.2	T103 Preparation clarified. Added calculation for portion retained on the 53 mm sieve.		
	4.3	T106 Preparation clarified. References AS1289.3.6.1 for sample mass.		
	4.4	T107 Preparation clarified.		
	4.5	T108 Preparation clarified.		
	4.6	T109 Preparation clarified.		
	4.7	T111 Preparation clarified.		
	4.8	T112 Preparation clarified.		
	4.9	T113 Preparation clarified. Sample prepared using the fraction passing the 425 µm sieve.		
	4.11	T116 Preparation clarified.		
	4.12	T117 Preparation clarified. Screening on the 2.36 mm sieve removed.		
	4.22	T130 Preparation clarified.		
	4.23	T131 Preparation clarified.		

Issue number	Clause number	Revision description	Authorised by	Publication date
	4.24 4.34 4.40 A1 A3 A5 A6 A10	T132 Preparation clarified. CBR is used for materials blended with binders in the field. T162 Preparation clarified. T173 Preparation clarified. Process A.1 Mechanical aid added. Process A.3 Rotary sampler added. Process A.5 Determination of portion and density of oversize material clarified. Process A.6 Curing times added. Process A.10 Calculations added for moisture adjustment. Appendix B removed.		
Ed 3 Rev 0		Reformatted RMS template.	J. Friedrich	October 2012
Ed 2 Rev 2	4.3(c), Table 2/ T111, T120, T144, T162, & T172. App A, C, D.	Consistent sample. Clarify mould requirements & T120 sample sizes. Updated T141 & T172 requirements. New T2162 & T2163 requirements. Table A.4 sieves added. New A.11, A.12. & A.13. New App C. App D Two definitions added and App renumbered.	D. Hazell	March 2009
Ed 2 Rev 1	Table 2/ T102, T105, T130, T131, A.7(c)	Clarification about curing, moisture content and altered sieve size T103.	D. Hazell	September 2008
Ed 2 Rev 0	All	New issue with major revisions. Collated preparation sections from separate test methods. Tabulated requirements for each test. Preparation processes defined in Appendix. Preparation of binder for laboratory samples included. Made consistent with revised test methods.	G. Donald	November 2007
		Date on test method revised to agree with date on revision summary.	D. Dash	February 201

Issue number	Clause number	Revision description	Authorised by	Publication date
		Reformatted and revision summary added. Table 1 revised.	D. Dash	May 1999

NOTE: The functions of the former State Government agency Roads and Maritime Services (RMS or Roads and Maritime) are now administered by Transport for NSW.

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This section is not under review

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Test Method T105

Preparation of samples for testing (soils)

1 Scope

This test method sets out the procedures to prepare soil samples for testing.

2 General

(a) The test method applies to:

(i) Soil, gravel, crushed rock or similar road construction materials.

(ii) Aggregates used in road construction.

(iii) Samples that may have been treated or tested by other methods.

(iv) Material to be blended in the laboratory with binders.

(b) Clause 4 Preparation, presents each test method that has samples prepared using this test method and includes:

(i) The sample fraction, minimum mass of sample required and other information about the sample.

(ii) The preparation of a sample for a test which is subdivided into a number of processes. The processes numbered from A.1 to A.13 are described in Appendix A.

(c) Where portions are prepared for the determination of moisture contents, the process must be carried out as quickly as possible to limit moisture loss.

(d) Place the sample in a container and seal unless moisture loss or gain will not affect test results.

(e) The Processes (i.e. A.1 to A.13 in Appendix A) are also referred to by other test methods.

(f) The requirements for cementitious binders used in testing are presented in Appendix B.

(g) The terms and definitions are in Table 1.

Table 1. Terms and definitions

Term	Definition
CBR	California Bearing Ratio.
Cohesive	The ability of a material to resist by means of internal forces of attraction the separation of its constituent particles.

Term	Definition
Constant mass	The stage in the drying process where the loss in mass of the material between successive drying periods is less than 0.1% (refer to T120, T121 or T180).
Fraction	The material derived from a sample that is: (a) retained on a specific sieve. (b) passes a specific sieve. (c) retained between two specific sieves.
LL	Liquid Limit.
LS	Linear Shrinkage.
MDD	Maximum Dry Density.
Nominal size	The smallest size of sieve through which the entire amount of material can pass through it and retain up to 15% of the total mass of the sample.
Non-cohesive	A soil in which the fine fraction is lacking, resulting in the loss of the cohesive bonds associated with this fraction (also known as cohesionless).
OMC	Optimum Moisture Content.
Oversize	Particles that are retained on a specified sieve in the test (e.g., 37.5 mm, 19.0 mm). Ensure that material adhering to oversize particles is returned to the sample.
PI	Plasticity Index.
PL	Plastic Limit.
Portion	The material derived from a sample after screening and/or division (by quartering or riffling) for a particular test.
Sample	That which is submitted to the laboratory for testing as representative of the parent material. The following terms generally relate to parts of a sample: fraction, increment, portion, sub-sample and specimen.
Sub-sample	A quantity of material representative of a sample obtained by division (quartering or riffling).
Specimen	The product made using a test portion (e.g., compacted in a mould).

Term	Definition
UCS	Unconfined Compressive Strength.

3 Equipment

(a) Table 2 presents the equipment that correspond with a process used to prepare samples

(i) The processes are numbered A.1 to A.10 as columns.

NOTE: Processes A.11 to A.13 involve calculations and do not require equipment, reagents and consumables

(ii) The piece of equipment are listed at the start of each row.

(iii) The apparatus that is required to carry out the process is identified as a "✓" in the column indicating the apparatus to carry out the process and TfNSW test method in the column indicating that the equipment, reagents and consumables is only required to carry out the process for the nominated test(s).

Table 2. Equipment required for preparation process.

Process Refer Appendix A → / Equipment ↓	Estimate of sample mass	A.1 Crumbling	A.2.1 Air drying	A2.2 Oven drying	A.3.1 Riffling	A.3 (b) Cone & Quartering	A.4 Screening	A.6 Curing	A.9 Required mass of binder	A.10 Required mass of water to adjust moisture
Balance of suitable capacity with a limit of performance no greater than 5 g	✓				✓	✓	✓		✓	✓
Oven with good air circulation capable of maintaining a temperature of ≤ 50 °C and within a range of ± 5 °C				✓				T102		
A thermostatically controlled oven with good air circulation and maintained at a temperature between 105°C to 110°C				T107 T123						

Process Refer → Appendix A / Equipment ↓	Estimate of sample mass	A.1 Crumbling	A.2.1 Air drying	A2.2 Oven drying	A.3.1 Riffling	A.3 (b) Cone & Quartering	A.4 Screening	A.6 Curing	A.9 Required mass of binder	A.10 Required mass of water to adjust moisture
Heat proof dishes and containers of suitable size to hold samples and sub-samples as required				✓				✓		
Sieves as necessary conforming to AS 3310	✓	✓			✓	✓	✓			
Mixing and quartering tray and boards	✓	✓				✓	✓	✓		
Cone and quartering apparatus						✓				
Riffle box conforming to AS 1141.2 Figure 1					✓					
Mixing equipment (mechanical and/or manual)								✓		
Measuring cylinders								✓		
Porcelain mortar with rubber pestle		✓					✓			
Porcelain mortar with porcelain pestle							T102 T103			
Scoops, brushes, trowels, shovels, mixers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dishes of suitable size	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Suitable airtight containers	T119						✓	✓	✓	
Desiccator	Required for storage of dry samples before testing									

4 Preparation of samples for testing

4.1 Test method T102 Pre-treatment of road construction materials by repeated compaction

4.1.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: - 53 mm.

(b) Minimum mass: 6 kg.

4.1.2 Preparation

(a) Where material is pre-treated for subsequent testing, refer to the test requirements for mass.

(b) Where both TfNSW test methods T102 and T103 are required on the same sample, carry out TfNSW test method T103 first unless otherwise specified:

(i) Combine and mix the sample increments or bulk sample and divide into a representative sub-sample mass required for pre-treatment by a process described in Appendix A, Process A.3.

(ii) Determine the total mass (M_T) of the sub-sample undergoing pre-treatment and record to the nearest 1 g.

(iii) Pass the sub-sample through the 53 mm sieve.

(iv) Determine the total mass (M_R) of the material retained on the 53 mm sieve to the nearest 1 g.

(v) Crush or break all particles retained on the 53 mm sieve to the extent necessary to allow the particles to pass the 53 mm sieve. Include the broken oversize material passing the 53 mm sieve in the sub-sample for pre-treatment. Mix the material so there is no segregation.

NOTE: If TfNSW test method T103 was performed this step is omitted.

(vi) Add sufficient water (if required) in accordance with Appendix A, Process A.6 (b) (i).

(vii) Place the sub-samples in suitable air tight containers with labels in accordance with Appendix A, Process A.7.

(viii) Cure the sample in accordance with Appendix A, Process A.6 (b) (ii).

(ix) Record the start date/time and end date/time of curing in hours.

(x) If cured in an oven at a temperature of 45 °C ± 5 ° allow to cool for 1 hour before commencing pre-treatment.

(xi) Calculate the percentage of material retained on the 53 mm sieve, (R) the nearest 1 % using the following equation:

$$R = \left(\frac{M_R}{M_T}\right) \times 100 \quad \ldots 4(1)$$

Where:

This section is not under review

R = Material retained on the 53 mm sieve (%)

M_R = Mass of material retained on the 53 mm sieve (g)

M_T = Total mass of material undergoing pre-treatment t (g)

Equation 4(1). Material retained (R) on the 53 mm sieve

4.2 Test method T103 Pre-treatment of road construction materials by artificial weathering

4.2.1 Sieve size and material mass requirement

This section is not under review

(a) Sieve: - 53 mm.

(b) Minimum mass: 6 kg.

4.2.2 Preparation

(a) Where material is pre-treated for subsequent testing, refer to the test requirements for mass.

(b) Where both TfNSW test methods T102 and T103 are required on the same sample, carry out TfNSW test method T103 first unless otherwise specified.

(i) Combine and mix the sample increments or bulk sample and divide into a representative sub-sample mass required for pre-treatment by a process described in, Appendix A, Process A.3.

(ii) Determine the total mass (M_T) of the sub-sample undergoing pre-treatment and record to the nearest 1 g.

(iii) Pass the sub-sample through the 53 mm sieve.

(iv) Determine the total mass (M_R) of the material retained on the 53 mm sieve to the nearest 1 g.

(v) Crush or break all particles retained on the 53 mm sieve to the extent necessary to allow the particles to pass the 53 mm sieve. Include the broken oversize material passing the 53 mm sieve in the sub-sample for pre-treatment. Mix the material so there is no segregation.

(vi) Place the sub-samples in suitable air tight containers with labels in accordance with process Appendix A, Process A.7.

(vii) Calculate the percentage of material retained on the 53 mm sieve, (R) to the nearest 1 % using the following equation:

$$R = \left(\frac{M_R}{M_T}\right) \times 100 \qquad \ldots 4(2)$$

Where:

R = Material retained on the 53 mm sieve (%)

M_R = Mass of material retained on the 53 mm sieve (g)

M_T = Total mass of material undergoing pre-treatment (g)

Equation 4(2). Material retained (R) on the 53 mm sieve

4.3 Test method T106 Coarse particle distribution of road construction materials (by washing)

4.3.1 Sieve size and material mass requirements

This section is not under review

(a) Material is not screened prior to test.

(b) Minimum mass of sub-sample requirements for material is in accordance with AS 1289.1.1. Table 1.

4.3.2 Preparation

(a) Combine and mix the bulk sample or sample increments and if required divide into a representative sub-sample so when dry, the minimum mass for the nominal size of material is obtained by a process described in Appendix A, Process A.3.

(b) If required, dry the sub-sample in accordance with Appendix A, Process A.2, to facilitate breaking down aggregations.

NOTE: The temperature and period of drying must not disrupt or weaken particles to the extent that the property being measured changes (e.g. some fine grained sedimentary rocks such as mudstone).

4.4 Test method T107 Fine particle distribution of road construction materials

4.4.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: - 2.36 mm.

(b) Mass: 50 ± 2 g.

4.4.2 Preparation

(a) Combine and mix the sample increments or bulk sample and divide into a representative sub-sample of sufficient mass by a process described in Appendix A, Process A.3, so when the sub-sample is finally screened through a 2.36 mm sieve a mass of 48 g to 52 g can be obtained.

(b) Crumble the sub-sample in accordance with Appendix A, Process A.1 (if required) so that only discrete particles and not aggregations would be retained on the 2.36 mm sieve. A larger sieve may be used to minimise overloading of the 2.36 mm sieve.

(c) Screen the sub-sample on the 2.36 mm sieve in accordance with Appendix A, Process A.4. A larger sieve may be used to minimise overloading of the 2.36 mm sieve. Material retained on the 2.36 mm sieve and above may be discarded.

(d) If required divide the sub-sample passing the passing the 2.36 mm sieve by a process described in Appendix A, Process A.3 so when a sub-sample is finally screened through a 2.36 mm sieve a minimum mass between 48 g and 52 g is obtained.

(e) Place the sub-samples in suitable containers with labels in accordance with Appendix A, Process A.7.

4.5 Test method T108 Liquid limit of road construction materials

4.5.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: - 425 µm.

(b) Minimum mass: 250 g.

4.5.2 Standard Preparation

Additional material for the preparation of plastic limit (PL) and linear shrinkage (LS) can be included in the preparation of the liquid limit (LL).

(a) When material with particles retained on the 19.0 mm sieve are present:

(i) Combine and mix the sample increments or bulk sample and divide into a representative sub-sample of sufficient mass by a process described in Appendix A, Process A.3, so when the sub-sample is finally screened through a 425 µm sieve a minimum mass of 250 g can be obtained.

(ii) Crumble the sub-sample in accordance with Appendix A, Process A.1 (if required) so that only discrete particles and not aggregations are retained on the 19.0 mm sieve.

(iii) Screen the sub-sample on the 19.0 mm sieve in accordance with Appendix A, Process A.4. Discard the material retained on the 19.0 mm sieve.

(iv) Divide the sub-sample passing the passing the 19.0 mm sieve by a process described in Appendix A, Process A.3 so when the sub-sample is finally screened through a 425 µm sieve a minimum mass of 250 g can be obtained.

(b) When material with particles passing the 19.0 mm sieve and retained on the 2.36 mm sieve are present:

(i) If the sample being prepared has particles retained on the 19.0 mm sieve, omit Step (b) (ii) and begin from Step (b) (iii).

(ii) Mix the sample increments or bulk sample and divide into a representative sub-sample of sufficient mass by a process described in Appendix A, Process A.3.

(iii) Crumble the sub-sample in accordance with Appendix A, Process A.1 (if required) so that only discrete particles and not aggregations are retained on the 2.36 mm sieve.

(iv) Screen the sub-sample on the 2.36 mm sieve in accordance with Appendix A, Process A.4. Discard the material retained on the 2.36 mm sieve.

(v) Divide the material passing the 2.36 mm sieve by a process described in Appendix A, Process A.3 so when the sub-sample is finally screened through a 425 µm sieve minimum mass of 250 g can be obtained.

(c) When material with particles passing the 2.36 mm sieve are present:

(i) If the sample being prepared has material retained on the 19.0 mm sieve or 2.36 mm sieve, omit Steps (c) (ii) and (c) (iii), and begin from Step (c) (iv).

(ii) Combine and mix the sample increments or bulk sample and divide into a representative sub-sample of sufficient mass by a process described in Appendix A, Process A.3.

This section is not under review

(iii) Divide the material passing the 2.36 mm sieve into a representative sub-sample of sufficient mass by a process described in Appendix A, Process A.3 so when the sub-sample is finally screened through a 425 µm sieve a minimum mass of 250 g can be obtained.

(iv) Crumble the sub-sample in accordance with Appendix A – Process A.1 (if required) so that only discrete particles and not aggregations are retained on the 425 µm sieve.

(v) Screen the sub-sample on the 425 µm sieve in accordance with Appendix A, Process A.4. Discard the material retained on the 425 µm sieve.

(vi) Divide the material passing the passing the 425 µm sieve by a process described in Appendix A, Process A.3 so when the sub-sample is finally screened through a 425 µm sieve a minimum mass of 250 g is obtained.

(vii) Label the sample in accordance with Appendix A, Process A.7.

NOTE: Crumbling and screening may need to be repeated on the same material retained on the sieve to ensure all adhering particles are removed, aggregations are broken down and fine particles are included in the material for testing.

(d) Record:

(i) The history of the sample (i.e., as received, unknown, or sampling method).

(ii) The method of preparation (i.e., oven dried - dry sieved or air dried - dried sieved).

(iii) The presence of bituminous materials (if any).

4.5.3 Preparation of material in the natural state

(e) Mix the sample increments or bulk sample and divide into a representative sub-sample of sufficient mass by a process described in Appendix A, Process A.3, so when the sub-sample is finally screened through a 425 µm sieve a minimum mass of 250 g can be obtained. This method may be used on silt and clay materials, if a small proportion of stones are present, they may be removed during rubbing.

(f) If required, crumble the sample in accordance with Appendix A, Process A1. Do not dry the sample in an oven.

(g) Rub the soil through the 425 µm sieve. When preparing silt and clay materials, if a small proportion of stones are present, they may be removed during rubbing.

(h) Obtain a minimum mass of 250 g of the material passing the 425 µm sieve.

(i) Record:

(i) The history of the sample (i.e., as received, unknown, or sampling method).

(ii) The method of preparation (i.e., natural state).

This section is not under review

(j) Organic and tropical soils should be tested in their natural state. Where clays of a medium to high liquid limit are encountered containing for example gypsum, kaolinite, halloysite, these soils require to be tested in the natural state.

4.6 Test method T109 Plastic limit and plasticity index of road construction materials

4.6.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: - 425 µm.

(b) Minimum mass: 40 g.

4.6.2 Preparation

Additional material for the preparation of plastic limit (PL) can be included in the preparation of the liquid limit (LL).

(a) When liquid limit, plastic limit and plasticity index (PI) are performed together:

(i) Follow Clause 4.5 and include additional material to perform the Plastic Limit (PL) so when the sub-sample is finally screened through a 425 µm sieve a minimum mass of 40 g can be obtained.

4.7 Test method T111 Dry density/moisture relationship of road construction materials

4.7.1 Sieve size and material mass requirements

This section is not under review

(a) Minimum mass and mould selection requirements for material under test is shown in Table 3.

Table 3. Minimum mass and mould requirements for TfNSW test method T111

T111 Minimum mass and mould requirements			
Sieve size (mm)	**Minimum mass (kg)**	**Mould size (litre)**	**Selection of mould**
-19.0	10	1	Less than 5% retained on the 19.0 mm sieve.
-37.5	20	2	More than 5% retained on the 19.0 mm sieve.
-37.5	20	2	Less than 5% retained on the 19.0 mm sieve.

4.7.2 Preparation

(a) Where all the material passes the 37.5 mm sieve.

(i) Combine and mix the sample increments or bulk sample and divide into a representative sub-sample of sufficient mass by a process described in Appendix A, Process A.3, so when the sub-sample is finally screened through the nominated sieves a minimum mass can be obtained. Where there is excess sample, divide the sample in accordance with Appendix A, Process A.1 so a representative mass of sufficient quantity for testing is obtained.

(ii) Determine and record the mass of sample (M_E) to the nearest 1 g.

(iii) Crumble the sample on the 19.0 mm sieve in accordance with Appendix A, Process A.1.

(iv) Screen the sample on the 19.0 mm sieve in accordance with Appendix A, Processes A.4.

(v) Brush and clean any adhered fines and clay from the particles retained on the sieve and combine with the material passing the 19mm sieve.

(vi) Determine and record the mass of the moist material retained on the 19.0 mm sieve, (M_{A19}) to the nearest 1 g.

(vii) Determine the proportion of material retained (if any) on the 19.0 mm sieve (P_{O19}) in accordance with Appendix A, Processes A.5.

(viii) If less than 5% discard the material use a1 litre or 2 litre mould (optional).

(ix) If more than 5% is retained on the 19.0 mm sieve and all passes the 37.5 mm sieve include it in the sample and use a 2 litre mould.

(b) Where a portion of material is retained on the 37.5 mm sieve,

This section is not under review

(i) Combine and mix the sample thoroughly with the excavated material excavated.

NOTE: Material retained on the 37.5 mm sieve is considered oversize.

(ii) Determine and record the total mass of sample (M_E) to the nearest 1 g.

(iii) Crumble the entire sample on the 19.0 mm sieve in accordance with Appendix A, Process A.1.

(iv) If more than 5% is retained on the 19.0 mm then screen the material retained on the 19.0 mm sieve over a 37.5 mm sieve in accordance with Appendix A, Process A.4 and brush and clean any adhered fines and clay from the particles retained on the sieve. Combine the material passing the 37.5 mm sieve with the material passing the 19.0 mm sieve.

(v) Determine and record the portion of material retained on the 19.0 mm sieve, ($P_{A19.0}$) to the nearest 1 % in accordance with Appendix A, Process A.5.

(vi) Determine and record the portion of the oversize retained on the 37.5 mm sieve, ($P_{A37.5}$) to the nearest 1 g in accordance with Appendix A, Process A.5.

(vii) If required, determine and record the density of the oversize (J_O) retained on the 37.5 mm sieve to the nearest 0.01 t/m^3 in accordance with Appendix A, Process A.5. Where the results are to be used in subsequent calculations (e.g., TfNSW Specification QMS Q6, Method for Statistical Calculation for Conformity of lots) use and report all densities values to the nearest 0.001. t/m^3.

(viii) When the mass, volume and density of the oversize is determined, discard.

(ix) Recombine the material passing the 37.5 mm sieve and the 19.0 mm sieve and mix thoroughly.

(x) A 2 litre mould must be used.

(c) Prepare representative sub-samples from the sample obtained in Clause 4.7.3 (a) or Clause 4.7.3 (b):

(i) Mix and divide the sample by a process described in Appendix A, Process A.3 and prepare a minimum of four (4) representative sub-sample masses of sufficient mass to slightly overfill the compaction mould after compaction. Place the sub-samples in suitable containers with labels in accordance with process A.7.

(ii) When preparing sub-samples the mass shall not be adjusted to a predetermined mass.

NOTE: TfNSW test method T111 is applicable to material where less than 20% is retained on the 37.5 mm sieve when using TfNSW test method T173 and less than 40% is retained on the 37.5 mm sieve when using TfNSW test method T119 or T165.

4.8 Test method T112 Dry density/moisture relationship of road construction materials – (modified compaction)

4.8.1 Sieve size and material mass requirements

This section is not under review

(a) Minimum mass and mould selection requirements for material under test is shown in Table 4.

Table 4. Minimum mass and mould requirements for TfNSW test method T112

T112 Minimum mass and mould requirements			
Sieve size (mm)	**Minimum mass (kg)**	**Mould size (litre)**	**Selection of mould**
-19.0	10	1	Less than 5% retained on the 19.0 mm sieve
-37.5	20	2	More than 5% retained on the 19.0 mm sieve
-37.5	20	2	Less than 5% retained on the 19.0 mm sieve

4.8.2 Preparation

(a) Where all the material passes the 37.5 mm sieve.

(i) Combine and mix the sample increments or bulk sample and divide into a representative sub-sample of sufficient mass by a process described in Appendix A, Process A.3, so when the sub-sample is finally screened through the nominated sieves a minimum mass can be obtained. Where there is excess sample, divide the sample in accordance with Appendix A, Process A.1 so a representative mass of sufficient quantity for testing is obtained.

(ii) Determine and record the mass of sample (M_E) to the nearest 1 g.

(iii) Crumble the sample on the 19.0 mm sieve in accordance with Appendix A, Process A.1

(iv) Screen the sample on the 19.0 mm sieve in accordance with Appendix A, Processes A.4.

(v) Brush and clean any adhered fines and clay from the particles retained on the sieve and combine with the material passing the 19mm sieve.

(vi) Determine and record the mass of the moist material retained on the 19.0 mm sieve, (M_{A19}) to the nearest 1 g.

(vii) Determine the proportion of material retained (if any) on the 19.0 mm sieve (P_{O19}) in accordance with Appendix A, Processes A.5.

(viii) If less than 5% discard the material use a1 litre or 2 litre mould (optional).

(ix) If more than 5% is retained on the 19.0 mm sieve and all passes the 37.5 mm sieve include it in the sample and use a 2 litre mould.

This section is not under review

(b) Where a portion of material is retained on the 37.5 mm sieve:

(i) Combine and mix the sample increments, bulk sample or excavated material excavated.

NOTE: Material retained on the 37.5 mm sieve is considered oversize.

(ii) Determine and record the total mass of sample (M_E) to the nearest 1 g.

(iii) Crumble the entire sample on the 19.0 mm sieve in accordance with Appendix A, Process A.1.

(iv) If more than 5% is retained on the 19.0 mm then screen the material retained on the 19.0 mm sieve over a 37.5 mm sieve in accordance with Appendix A, Process A.4 and brush and clean any adhered fines and clay from the particles retained on the sieve. Combine the material passing the 37.5 mm sieve with the material passing the 19.0 mm sieve.

(v) Determine and record the portion of material retained on the 19.0 mm sieve, ($P_{A19.0}$) to the nearest 1% in accordance with Appendix A, Process A.5.

(vi) Determine and record the portion of the oversize retained on the 37.5 mm sieve, ($P_{A37.5}$) to the nearest 1 g in accordance with Appendix A, Process A.5.

(vii) If required, determine and record the density of the oversize (J_O) retained on the 37.5 mm sieve to the nearest 0.01 t/m^3 in accordance with Appendix A, Process A.5. Where the results are to be used in subsequent calculations (e.g., TfNSW Specification QMS Q6, Method for Statistical Calculation for Conformity of lots) use and report all densities values to the nearest 0.001 t/m^3.

(viii) When the mass, volume and density of the oversize is determined, discard.

(ix) Recombine the material passing the 37.5 mm sieve and the 19.0 mm sieve and mix thoroughly.

(x) A 2 litre mould must be used.

(c) Prepare representative sub-samples from the sample obtained in Clause 4.7.3 (a) or Clause 4.7.3 (b):

(i) Mix and divide the sample by a process described in Appendix A, Process A.3 and prepare a minimum of four (4) representative sub-sample masses of sufficient mass to slightly overfill the compaction mould after compaction. Place the sub-samples in suitable containers with labels in accordance with process A.7.

(ii) When preparing sub-samples the mass shall not be adjusted to a predetermined mass.

NOTE: TfNSW test method T112 is applicable to material where less than 20% is retained on the 37.5 mm sieve when using TfNSW test method T173 and less than 40% is retained on the 37.5 mm sieve when using TfNSW test method T119 or T165.

4.9 Test method T113 Linear shrinkage of road construction materials

4.9.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: - 425 μm.

(b) Minimum mass: 200 g.

4.9.2 Preparation

Additional material for the preparation of linear shrinkage (LS) can be included in the preparation of the liquid limit (LL) sample.

(a) When liquid limit and linear shrinkage are performed together:

(i) Follow Clause 4.5 and include additional material to perform the linear shrinkage so when the sub-sample is finally screened through a 425 μm sieve a linear shrinkage specimen can be prepared.

4.10 Test method T114 Maximum dry compressive strength of road construction materials

4.10.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: - 19.0 mm.

(b) Minimum mass: 4 kg.

4.10.2 Preparation

(a) Crumble the sample (A.1) to the extent required to pass the 19.0 mm sieve.

(b) Screen the sample (A.4) through the 19.0 mm sieve.

(c) Divide the portion (A.3) to provide sufficient material from the final screening.

(d) Divide the portion (A.3) into 4 sub-samples of at least 1 kg.

(e) Crumble the portion (A.1) to the extent required to pass the 4.75 mm sieve.

(f) Screen (A.4) each sub-sample on the 4.75 mm sieve.

(g) For each sub-sample, place the + 4.75 mm fraction and the - 4.75 mm fraction in separate containers.

(h) Label all fractions (A.7).

4.11 Test method T116 Unconfined compressive strength of remoulded specimens of road construction materials blended with proportions of cementitious binders (from a construction process or plant mixed)

This section is not under review

4.11.1 Sieve size and material mass requirements

(a) Sieve: - 19.0 mm.

(b) Minimum mass: 7 kg. For duplicate UCS specimens (plus a portion for moisture content determination). Additional material may be required to carry out TfNSW test method T162).

4.11.2 Preparation

(a) Combine and mix the bulk sample or sample increments and if required divide into a representative sub-sample so the minimum mass of material (7 kg) passing the 19.0 mm sieve is obtained by a process described in Appendix A, Process A.3.

(i) Crumble the entire sample on the 19.0 mm sieve in accordance with Appendix A, Process A.1. Do not dry back the sample. Prepare the sample to limit moisture loss.

(ii) Screen the sample on the 19.0 mm sieve mm sieve in accordance with Appendix A, Process A.4.

(iii) Brush and clean any adhered fines and clay from the particles retained on the sieve and combine with the material passing the 19.0 mm sieve.

(iv) Determine and record the mass of the moist material retained on the 19.0 mm sieve, (M_{A19}) to the nearest 1 g.

(v) Determine the proportion of material retained (if any) on the 19.0 mm sieve (P_{019}) to the nearest 1% in accordance with Appendix A, Process A.5.

(vi) Discard material retained on the 19.0 mm sieve.

(b) Mix and divide the sample by a process described in Appendix A, Process A.3 and prepare:

(i) A minimum of two (2) representative sub-sample masses (1 pair) of sufficient mass to slightly overfill the 1 litre compaction mould after compaction. Ensure additional material (minimum 300 g) is included to determine the moisture content at moulding for each UCS specimen in accordance with TfNSW test method T120. Place the sub-samples in suitable containers with labels in accordance with Appendix A, Process A.7.

(ii) When preparing sub-samples the mass shall not be adjusted to a predetermined mass.

4.12 Test method T117 California bearing ratio of remoulded specimens of road construction materials

4.12.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: - 19.0 mm.

(b) Minimum mass: 7 kg for CBR specimen (plus additional material of minimum 600 g when checking moisture content to ensure LMR is met). Additional material will be required to carry out TfNSW test methods T111 or T112.

4.12.2 Procedure

(a) Combine and mix the bulk sample or sample increments and if required divide into a representative sub-sample so the minimum mass of material passing the 19.0 mm sieve is obtained by a process described in Appendix A, Process A.3.

(i) Crumble the entire sample on the 19.0 mm sieve in accordance with Appendix A, Process A.1. Do not dry back the sample. Prepare the sample to limit moisture loss.

(ii) Screen the sample on the 19.0 mm sieve in accordance with Appendix A, Process A.4.

(iii) Brush and clean any adhered fines and clay from the particles retained on the sieve and combine with the material passing the 19.0 mm sieve.

(iv) Determine and record the mass of the moist material retained on the 19.0 mm sieve, (M_{A19}) to the nearest 1 g.

(v) Determine the proportion of material retained (if any) on the 19.0 mm sieve (P_{O19}) to the nearest 1% in accordance with Appendix A, Process A.5.

(vi) Discard material retained on the 19.0 mm sieve.

(b) Mix and divide the sample by a process described in Appendix A, Process A.3 and prepare:

(i) A representative subsample of minimum mass of 7 kg (plus additional material of minimum 600 g when checking moisture content to ensure LMR is met) each to slightly overfill the CBR mould after compaction. Place the sub-sample in suitable containers with labels in accordance with Appendix A, Process A.7.

(ii) When preparing sub-samples the mass shall not be adjusted to a predetermined mass.

4.13 Test method TXXX California bearing ratio of remoulded specimens of road construction materials (3 point method)

4.13.1 This method is under development

This section is not under review

4.13.2 Sieve size and material mass requirements

(a) Sieve: - 19.0 mm.

(b) Minimum mass: 21 kg for 3 CBR specimens (plus additional minimum 300 g for moisture content determination for each CBR specimen). It may be necessary to prepare an additional 7 kg of material if the point drier or wetter than optimum does not result in a drop in the dry density or CBR when straddling OMC. The determination of the MCBR value may occur at a moisture content lower than CBR OMC.

4.13.3 Procedure

(a) Combine and mix the bulk sample or sample increments and if required divide into a representative sub-sample so the minimum mass of material passing the 19.0 mm sieve is obtained by a process described in Appendix A, Process A.3.

(i) Crumble the entire sample on the 19.0 mm sieve in accordance with Appendix A, Process A.1. Prepare the sample to limit moisture loss.

(ii) Screen the sample on the 19.0 mm sieve in accordance with Appendix A, Process A.4.

(iii) Brush and clean any adhered fines and clay from the particles retained on the sieve and combine with the material passing the 19.0 mm sieve.

(iv) Determine and record the mass of the moist material retained on the 19.0 mm sieve, (M_{A19}) to the nearest 1 g.

(v) Determine the proportion of material retained (if any) on the 19.0 mm sieve (P_{O19}) to the nearest 1% in accordance with Appendix A, Process A.5.

(vi) Discard material retained on the 19.0 mm sieve.

(b) Mix and divide the sample by a process described in Appendix A, Process A.3 and prepare;

(i) Four (4) representative sub-sample of minimum mass of 7 kg (plus additional material of minimum 300 g for determining the moisture content at compaction) each to slightly overfill the CBR mould after compaction. Place the sub-samples in suitable containers with labels in accordance with Appendix A, Process A.7.

(ii) When preparing sub-samples the mass shall not be adjusted to a predetermined mass.

4.14 Test method T119 Field density of road construction materials (sand replacement method)

4.14.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: Where required, carry out other laboratory tests where sieve sizes are specified (e.g., TfNSW test methods T111, T112, T120 and T162).

(b) Minimum mass: Where required, obtain sufficient material in accordance with TfNSW test method T119 to carry out other laboratory tests where minimum masses are specified (e.g., TfNSW test methods T111, T112, T120 and T162).

4.14.2 Preparation

(a) Where required prepare sufficient mass of material for:

(i) TfNSW test method T111, Clause 4.7, or

(ii) TfNSW test method T112, Clause 4.8, or

(iii) TfNSW test method T162, Clause 4.32.

(b) Where required prepare sufficient mass of material for:

(i) TfNSW test method T120, Clause 4.14, or

(ii) TfNSW test method T121, Clause 4.15, or

(iii) TfNSW test method T180, Clause 4.41.

NOTE: A correlation between the standard TfNSW test method T120 and subsidiary test methods (T121 and T180) must be established.

4.15 Test method T120 Moisture content of road construction materials (standard method)

4.15.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: Not screened prior to test.

(b) Minimum mass requirements for material under test is shown in Table 5.

Table 5. Minimum mass requirements for TfNSW test method T120 based on particle size distribution

T120 Moisture content of road construction materials (standard method)	
Minimum mass (g)	**Particle size requirement**
30	Where the sample has more than 80% passing the 2.36 mm sieve (except for TfNSW test methods T108, T109 and T144 where the specified sample size is used).
300	Where the sample has more than 80% passing the 19.0 mm sieve.
3000	Where the sample has more than 20% retained on the 19.0 mm sieve.

4.15.2 Preparation

(a) Combine and mix the sample increments or bulk sample and divide into a representative sub-sample of minimum mass by a process described in Appendix A, Process A.3 to determine the moisture content.

(b) When preparing sub-samples the mass shall not be adjusted to a predetermined mass

(c) Minimise the loss of moisture of the sample by quickly completing division and sealing as required before proceeding.

NOTE: Drying in the test can be facilitated by breaking down the sample into smaller pieces.

4.16 Test method T121 Moisture content of road construction materials (sand bath or hot plate method)

4.16.1 Sieve size and material mass requirements

This section is not under review

(a) The sieve size and material mass requirements are identical to Clause 4.15, TfNSW test method T120.

4.16.2 Preparation

(a) Preparation requirements are identical to Clause 4.15, TfNSW test method T120.

(b) A correlation between the TfNSW standard test method T120 and TfNSW subsidiary test method T121 must be established by applying the requirements of TfNSW test method T2105.

4.17 Test method T123 pH value of a soil (electronic method)

4.17.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: - 2.36 mm.

(b) Minimum mass: 35 g.

4.17.2 Preparation

(i) Crumble the sample (Appendix A, Process A.1) to the extent required to pass the 19.0 mm sieve.

(ii) Screen the sample (Appendix A, Process A.4) through the 19.0 mm sieve.

(iii) Divide the portion (Appendix A, Process A.3) to provide sufficient material from the final screening.

(iv) Crumble the portion (Appendix A, Process A.1) to the extent required to pass the 2.36 mm sieve.

(v) Screen the portion (Appendix A, Process A.4) through the 2.36 mm sieve.

(vi) Use guard sieves to prevent overloading the 2.36 mm sieve.

(vii) Divide the portion (A.3) into the mass required.

(viii) Label the portion (Appendix A, Process A.7).

(ix) Dry to constant mass.

(x) Do not leave in the oven for more than 18 hours.

(xi) Cool in a desiccator.

4.18 Test method T126 Assessment of primer or binder absorption by road gravel

4.18.1 Sieve and material mass requirements

This section is not under review

(a) Sieve: - 4.75 mm.

(b) Minimum mass: 10 kg.

4.18.2 Preparation

(a) Refer to TfNSW test method T126.

4.19 Test method T127 Apparent density of fine soil particles

4.19.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: - 4.75 mm.

(b) Minimum mass: 1 kg.

4.19.2 Preparation

(a) Refer to TfNSW test method T127.

4.20 Test method T128 Apparent density of soils containing coarse particles

4.20.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: + 4.75 mm.

(b) Minimum mass: 5 kg.

4.20.2 Preparation

(a) Refer to TfNSW test method T128.

4.21 Test method T129 Bulk density and water absorption of the fine sand fraction of soil

4.21.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: - 2.36 mm.

(b) Minimum mass: 1 kg. Increase the mass where the sample has >50% - 13.5 μm.

4.21.2 Preparation

(a) Refer to TfNSW test method T129.

4.22 Test method T130 Dry density/moisture relationship for mixtures of road construction materials (blended in the laboratory with cementitious binders)

This section is not under review

4.22.1 Sieve and material mass requirements

(a) Sieve: - 19.0 mm.

(b) Minimum mass: 10 kg.

4.22.2 Preparation

Refer to Clause 4.23, TfNSW test method T131 (if required) for material requirements.

(c) Combine and mix the sample increments, bulk sample or excavated material. Where there is excess sample divide the sample in accordance with Appendix A, Process A.1 so a representative mass of sufficient quantity for testing is obtained.

(a) Determine and record the mass of sample (M_E) to the nearest 1 g.

(b) Crumble the entire sample on the 19.0 mm sieve in accordance with Appendix A, Process A.1.

(c) Screen the sub-sample on the 19.0 mm sieve in accordance with Appendix A, Process A.4.

(d) Brush and clean any adhered fines and clay from the particles retained on the sieve and combine with the material passing the 19mm sieve.

(e) Determine and record the mass of the moist material retained on the 19.0 mm sieve, (M_{A19}) to the nearest 1 g.

(f) Determine the proportion of material retained (if any) on the 19.0 mm (P_{O19}) in accordance with Appendix A, Process A.5 (1).

(g) Discard the material retained on the 19.0 mm sieve.

(h) Moisture adjustment:

(i) If required, adjust the moisture content of the sub-sample passing the 19.0 mm sieve so it is judged to be approximately 2% to 5% below OMC.

NOTE: Adjustment of the moisture content allows for a moisture content that is not to wet or to dry before blending with cementitious binders and compaction. It is important that the water is thoroughly mixed and uniformly distributed when water is added or subtracted. Inadequate mixing will result in variable test results.

(ii) Cure the sub-samples in accordance with the requirements in TfNSW test method T105 Appendix A.6 (c).

(iii) Record the start and finish times of curing periods and duration of curing in hours.

(iv) When curing is for a long period, check the moisture condition of the soil and add water if necessary to maintain the samples moisture content so that it is judged to be approximately 2% to 5% below OMC.

(i) Mix and divide the sub-sample passing the 19.0 mm sieve by a process described in Appendix A, Process A.3 and prepare:

This section is not under review

(i) A minimum of four (4) representative sub-sample masses of sufficient mass to slightly overfill the 1 litre compaction mould after compaction. Place the sub-samples in suitable containers with labels in accordance with process A.7.

(ii) When preparing sub-samples the mass shall not be adjusted to a predetermined mass.

(iii) A representative sample for the determination of the moisture content in accordance with TfNSW test method T120.

(j) Prepare the binder in accordance with process A.8.

(k) Calculate the quantity of binder in accordance with process A.9.

(l) Measure out the quantity of binder, place in a sealed container and label in accordance with process A.7.

(m) Do not blend the binder until directed in the test method.

4.23 Test method T131 Unconfined compressive strength of road construction materials (blended in the laboratory with cementitious binders)

This section is not under review

4.23.1 Sieve size and material mass requirements

(a) Sieve: - 19.0 mm.

(b) Minimum mass: 7 kg.

4.23.2 Preparation

Refer to Clause 4.22, T130 if required for compaction requirements.

(a) Combine and mix the sample increments or bulk sample and divide into a representative sub-sample of sufficient mass by a process described in Appendix A, Process A.3, so when the sample is finally screened through a 19.0 mm sieve a minimum mass can be obtained.

(b) Determine and record the mass of sample (M_E) to the nearest 1 g.

(c) Crumble the sub-sample in accordance with Appendix A, Process A.1 (if required) so that only discrete particles and not aggregations are retained on the 19.0 mm sieve.

(d) Screen the sub-sample on the 19.0 mm sieve in accordance with Appendix A, Process A.4.

(e) Determine and record the mass of the moist material retained on the 19.0 mm sieve, (M_{A19}) to the nearest 1 g.

(f) Determine the proportion of material retained (if any) on the 19.0 mm (P_{O19}) in accordance with Appendix A, Process A.5 (1).

(g) Discard the material retained on the 19.0 mm sieve.

(h) Moisture adjustment:

(i) If required, adjust the moisture content of the sub-sample passing the 19.0 mm sieve so it is judged to be approximately 2% to 5% below OMC.

NOTE: Adjustment of the moisture content allows for a moisture content that is not to wet or to dry before preparing UCS samples. It is important that the water is thoroughly mixed and uniformly distributed when water is added or subtracted. Inadequate mixing will result in variable test results.

(ii) Cure the sub-samples in accordance with the requirements in TfNSW test method T105 Appendix A.6 (c).

(iii) Record the start and finish times of curing periods and duration of curing in hours.

(iv) When curing is for a long period, check the moisture condition of the soil and add water if necessary to maintain the samples moisture content so that it is judged to be approximately 2% to 5% below OMC.

This section is not under review

(i) Mix and divide the sub-samples (see 9.6) in accordance with process described in Appendix A, Process A.3 and prepare:

(i) A minimum of 2 (a pair) of representative sub-sample masses of sufficient mass to slightly overfill the 1 litre compaction mould after compaction. Ensure additional material (minimum 300 g) is included to determine the moisture content at moulding for each UCS specimen in accordance with TfNSW test method T120.

(ii) Place the sub-samples in suitable containers with labels in accordance with Appendix A, Process A.7.

(iii) When preparing sub-samples the mass shall not be adjusted to a predetermined mass.

(iv) A representative sample for the determination of the moisture content in accordance with TfNSW test method T120.

(j) Prepare the binder in accordance with Appendix A, Process A.8.

(k) Calculate the quantity of binder in accordance with Appendix A, Process A.9.

(l) Measure out the quantity of binder, place in a sealed container and label in accordance with Appendix A, Process A.7.

(m) Where a target moisture content has been determined, calculate the required mass of water to be adjusted in accordance with Appendix A, Process A.9.

(n) Do not blend the binder until directed in the test method.

4.24 Test method T132 California Bearing Ratio of remoulded specimens of road construction materials blended with proportions of cementitious binders (from a construction process or plant mixed)

This section is not under review

4.24.1 Sieve size and material mass requirements

(a) Sieve: -19.0 mm.

(b) Minimum mass: 14 kg. For two (2) CBR specimens (plus a portion for moisture content determination). Additional material may be required to carry out TfNSW test method T162.

4.24.2 Preparation

(a) Combine and mix the bulk sample or sample increments and if required divide into a representative sub-sample so the minimum mass of material passing the 19.0 mm sieve is obtained by a process described in Appendix A, Process A.3.

(i) Crumble the entire sample on the nominated sieve in accordance with Appendix A, Process A.1. Do not dry back the sample. Prepare the sample to limit moisture loss.

(ii) Screen the sample on the 19.0 mm sieve mm sieve in accordance with Appendix A, Process A.4.

(iii) Brush and clean any adhered fines and clay from the particles retained on the sieve and combine with the material passing the nominated sieve.

(iv) Determine and record the mass of the moist material retained on the 19.0 mm sieve, (M_{A19}) to the nearest 1 g.

(v) Determine the proportion of material retained (if any) on the 19.0 mm sieve (P_{A19}) to the nearest 1% in accordance with Appendix A, Process A.5.

(vi) Discard material retained on the nominated sieve.

(b) Mix and divide the sample by a process described in Appendix A, Process A.3 and prepare:

(i) A subsample of minimum mass of 14 kg for two (2) CBR test. Ensure additional material (minimum 300 g) is included to determine the moisture content at moulding for each CBR specimen in accordance with TfNSW test method T120. Place the sub-sample in suitable containers with labels in accordance with Appendix A, Process A.7.

(ii) When preparing sub-samples the mass shall not be adjusted to a predetermined mass.

4.25 Test method T133 Durability of road materials modified or stabilised by the addition of cement

4.25.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: -19.0 mm.

(b) Minimum mass: 5 kg for each cement content to be tested.

4.25.2 Preparation

(a) Refer to TfNSW test method T133.

4.26 Test method T134 Lime or cement content of uncured stabilised soil (EDTA method)

4.26.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: - 4.75 mm.

(b) Minimum mass:

(i) 4 kg standard sample of material to be stabilised.

(ii) 3 kg stabilised sample at completion of mixing on-site.

4.26.2 Preparation

(a) Refer to TfNSW test method T134.

4.27 Test method T137 Cement content of cement stabilised material (heat of neutralisation method)

4.27.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: Not screened prior to testing.

(b) Minimum mass:

(i) 40 kg sample of material to be stabilised.

(ii) 1.5 kg of cement to be used.

4.27.2 Preparation

(a) Refer to TfNSW test method T137.

4.28 Test method T143 Lime content of stabilised materials

4.28.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: Not screened prior to t

(b) Minimum mass:

(i) 200 g for each lime binder, stabilised material and unstabilised material to be tested.

4.28.2 Preparation

(a) Refer to TfNSW test method T143.

4.29 Test method T144 Hydrated lime for road construction materials (lime demand test)

4.29.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: -2.36 mm.

(b) Minimum mass: 400 g (A mass greater than 400 g may be required to produce the necessary quantity).

4.29.2 Preparation

(a) Divide the sample (A.3) to provide sufficient material from the final screening.

(b) Crumble the sample (A.1) to the extent required to pass the 2.36 mm sieve as appropriate.

(c) Determine the mass of the sample (M).

(d) Screen the sample (A.4) through the 19.0 and 9.50 mm sieves to avoid overloading of sieves.

(e) Screen the -9.5 mm portion (A.4) through the 2.36 mm sieve.

(f) Determine the mass of the -2.36 mm portion prepared ($M_{-2.36}$).

(g) Calculate the percentage of material passing the 2.36 mm sieve, ($P_{-2.36}$) using the following equation:

$$P_{-2.36} = \frac{M_{-2.36}}{M} \times 100 \quad \ldots 4(3)$$

Where:

$P_{-2.36}$ = Material passing the 2.36 mm sieve to nearest 1 (%).
$M_{-2.36}$ = Mass of the -2.36 mm portion prepared to 1 (g).
M = Total mass of sample to 1 (g).

Equation 4(3). Material passing (P-2.36) the 2.36 mm sieve

(h) Place the portion passing the 2.36 mm sieve in a container and seal.

(i) Label the portion passing the 2.36 mm sieve (A.7).

(j) Prepare the hydrated lime (A.8), measure out at least 25 g of hydrated lime, place in a container, seal and label.

(k) Do not add the hydrated lime until directed in the test method.

4.30 Test method T147 Working time for road construction materials (blended in the laboratory with slow setting binders)

4.30.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: -19.0 mm.

(b) Minimum mass:

(i) 55 kg where the sample has ≥ 95% passing the 19.0 mm sieve.

(ii) 95 kg where the sample has < 95% passing the 19.0 mm sieve.

NOTE: The mass is 4x the requirements for T130 to allow for 4 time intervals, PLUS 2x the requirements for T131 to allow for 4 time intervals using 1x UCS specimen.

4.30.2 Preparation

As required for T130 and T131 except that single specimen are required for T131.

4.31 Test method T150 Dry density-moisture relations for mixtures of road materials and bituminous materials.

4.31.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: -19.0 mm.

(b) Minimum mass:

(i) 10 kg where the sample has ≥ 95% passing the 19.0 mm sieve

(ii) 20 kg where the sample has < 95% passing the 19.0 mm sieve.

4.31.2 Preparation

(a) Crumble the sample (A.1) to the extent required to pass the 19.0 mm sieve.

(b) Screen the sample (A.4) through the 19.0 mm sieve and determine the proportion of oversize +19.0 mm sieve (A.5).

(c) Divide the portion (A.3) to provide sufficient material from the final screening.

(d) Crumble the portion (A.1) to the extent required to pass the 2.36 mm sieve.

(e) Divide the portion (A.3) into at least 4 sub-samples.

(f) Label the sub-samples (A.7).

(g) Cure the sub-samples (A.6).

(h) Prepare the binder (A.8).

(i) Calculate the quantity of binder (A.9).

(j) Measure out the quantity of binder, place in a sealed container and label (A.7).

(k) Do not blend the binder until directed in the test method.

4.32 Test method T151 Determination of the absorption and unconfined compressive strength of road materials stabilised or modified with bituminous binders

This section is not under review

4.32.1 Sieve size and material mass requirements

(a) Sieve: -19.0 mm.

(b) Minimum mass: 7 kg. Duplicate UCS specimens plus a portion for moisture content determination. Additional material may be needed to carry out TfNSW test method T150.

4.32.2 Preparation

(a) Crumble the sample (A.1) to the extent required to pass the 19.0 mm sieve.

(b) Screen the sample (A.4) through the 19.0 mm sieve.

(c) Divide the portion (A.3) to provide sufficient material from the final screening.

(d) Crumble the portion (A.1) to the extent required to pass the 2.36 mm sieve.

(e) Divide the portion (A.3) into 2 sub-samples.

(f) Place each sub-sample in a container and seal.

(g) Label each sub-sample (A.7).

(h) Cure the sub-samples (A.6).

(i) Prepare the binder (A.8).

(j) Do not blend the binder until directed in the test method.

4.33 Test method T154 Resilient modulus of road construction materials stabilised by foam bitumen specimen (blended in the laboratory)

This section is not under review

4.33.1 Sieve size and material mass requirements

(a) Sieve: - 37.5 mm.

(b) Minimum mass: Minimum of 26 kg is required for each mix design. Each mix design includes 3 specimens for initial modulus and 3 specimens for cured and soaked modulus.

(c) Where classification testing using TfNSW test methods T106, T108, T109 and T113 is required, refer TfNSW test method T105 for minimum sample masses for testing.

4.33.2 Preparation

(a) Combine and mix the sample increments or bulk sample and divide into a representative sub-sample of sufficient mass by a process described in Appendix A, Process A.3, so when the sample is finally screened through a 37.5 mm sieve a minimum mass can be obtained.

(b) Determine and record the mass of sample (M_E) to the nearest 1 g.

(c) Crumble the sub-sample in accordance with Appendix A, Process A.1 (if required) so that only discrete particles and not aggregations are retained on the 37.5 mm sieve.

(d) Screen the sub-sample on the 37.5 mm sieve in accordance with Appendix A, Process A.4.

(e) Determine and record the mass of the moist material retained on the 37.5 mm sieve, ($M_{A37.5}$) to the nearest 1 g.

(f) Determine the proportion of material retained (if any) on the 37.5 mm ($P_{O37.5}$) in accordance with Appendix A, Process A.5 (1).

(g) Discard the material retained on the 37.5 mm sieve.

(h) Moisture adjustment:

(i) Determine the moisture content (w) of a sub-sample in accordance with TfNSW test method T120.

(ii) Adjust the moisture content of the sub-sample passing the 37.5 mm sieve so it is 0.5% to 2.5% below target compaction moisture content by using the equation accordance with Appendix A, Process A.10.2.

NOTE: Adjustment of the moisture content allows for a moisture content that is not too wet or too dry before the addition of the binder and foamed bitumen. It is important that the water is thoroughly mixed and uniformly distributed when water is added or subtracted. Inadequate mixing will result in variable test results.

(i) Cure the sub-samples in accordance with the requirements in TfNSW test method T105 Appendix A.6 (c).

(j) Record the start and finish times of curing periods and duration of curing in hours.

This section is not under review

(k) Determine the moisture content (w) of a sub-sample in accordance with TfNSW test method T120 to ensure the sub-sample is below target compaction moisture content by 0.5% to 2.5%.

(l) After curing, mix and divide the sub-sample passing the 37.5 mm sieve by a process described in Appendix A, Process A.3 and prepare:

  (i) A minimum of 6 representative sub-sample masses of sufficient mass to slightly overfill the compaction mould after compaction. Ensure additional material (minimum 300 g) is included to determine the moisture content at moulding for each foam bitumen specimen in accordance with TfNSW test method T120. Place the sub-samples in suitable containers with labels in accordance with Appendix A, Process A.7.

(m) When preparing sub-samples the mass shall not be adjusted to a predetermined mass.

4.34 Test method T162 Compaction control test (rapid method)

4.34.1 Sieve size and material mass requirements

(a) Minimum mass requirements for material under test is shown in Table 6.

This section is not under review

Table 6. Minimum mass and mould requirements for TfNSW test method T162

T162 Minimum mass and mould requirements			
Sieve size (mm)	**Minimum mass (kg)**	**Mould size (litre)**	**Selection of mould**
-19.0	10	1	Less than 5% retained on the 19.0 mm sieve.
-37.5	20	2	More than 5% retained on the 19.0 mm sieve.
-37.5	20	2	Less than 5% retained on the 19.0 mm sieve.

4.34.2 Preparation

(a) Where all the material passes the 37.5 mm sieve.

NOTE: TfNSW test method test T162 is applicable to material where less than 20% is retained on the 37.5 mm sieve when using TfNSW test method T173 and less than 40% is retained on the 37.5 mm sieve when using TfNSW test method T119 or T165.

(i) Combine and mix the sample increments, bulk sample or material excavated when performing TfNSW test methods T119, T165, and T173 to determine the maximum converted wet density (MCWD) and added moisture which corresponds to the peak point (Z_m).

(ii) Determine and record the mass of sample (M_E) to the nearest 1 g.

(iii) Crumble the entire sample on the 19.0 mm sieve in accordance with Appendix A, Process A.1 and omit Clause (a) (ii), DO NOT dry back the sample. Crumbling shall be done to minimise moisture loss in the sample.

NOTE: Results of testing rely on the material to be at field moisture content so that only discrete particles and not aggregations are retained on the sieve.

(iv) Screen the sample on the 19.0 mm sieve mm sieve in accordance with Appendix A, Process A.4.

(v) Brush and clean any adhered fines and clay from the particles retained on the sieve and combine with the material passing the 19mm sieve.

(vi) Determine and record the mass of the moist material retained on the 19.0 mm sieve, (M_{A19}) to the nearest 1 g.

(vii) Determine the proportion of material retained (if any) on the 19.0 mm sieve (P_{O19}) in accordance with Appendix A, Process A.5.

This section is not under review

(viii) If less than 5% discard the material use a 1 litre or 2 litre mould (optional).

(ix) If more than 5% is retained on the 19.0 mm sieve include it in the sample and use a 2 litre mould.

(b) Where a portion of material is retained on the 37.5 mm sieve:

NOTE: TfNSW test method test T162 is applicable to material where less than 20% is retained on the 37.5 mm sieve when using T173 and less than 40% is retained on the 37.5 mm sieve when using TfNSW test method T119 or T165.

(i) Combine and mix the sample increments, bulk sample or material excavated when performing TfNSW test methods T119, T165, and T173 to determine the Maximum converted wet density (MCWD) and added moisture which corresponds to the peak point (Z_m).

NOTE: Material retained on the 37.5 mm sieve is considered oversize.

(ii) Determine and record the mass of sample (M_E) to the nearest 1 g.

(iii) Crumble the entire sample on the 19.0 mm AS sieve in accordance with Appendix A, Process A.1 and omit Clause (a) (ii), DO NOT dry back the sample. Crumbling shall be done to minimise moisture loss in the sample.

(iv) If more than 5% is retained on the 19.0 mm then screen the material retained on the 19.0 mm sieve over a 37.5 mm sieve in accordance with Appendix A, Process A.4 and brush and clean any adhered fines and clay from the particles retained on the sieve. Combine the material passing the 37.5 mm sieve with the material passing the 19.0 mm sieve.

(v) Determine and record the mass of the oversize retained on the 37.5 mm AS sieve, ($M_{A37.5}$) to the nearest 1 g.

(vi) Determine the proportion of material retained (if any) on the 37.5 mm sieve ($P_{O37.5}$) in accordance with Appendix A, Process A.5.

(vii) If required, determine and record the density of the oversize (J_O) retained on the 37.5 mm sieve to the nearest 0.01 t/m3 in accordance with Appendix A, Process A.5. Where the results are to be used in subsequent calculations (e.g., TfNSW Specification QMS Q6, Method for Statistical Calculation for Conformity of lots) use and report all densities values to the nearest 0.001 t/m^3.

(viii) When the mass, volume and density of the oversize is determined, discard.

(ix) Recombine the material passing the 37.5 mm sieve and the 19.0 mm sieve and mix thoroughly.

(x) A 2 litre mould must be used.

(c) Prepare representative sub-samples from the sample obtained in Clause 4.34.3 (a) or Clause 4.34.3 (b).

This section is not under review

(i) Mix and divide the sample by quartering in accordance with Appendix A, Process A.3 and prepare a minimum of three (3) representative sub-sample masses of sufficient mass to slightly overfill the compaction mould after compaction. Place the sub-samples in suitable containers with labels in accordance with Appendix A, Process A.7.

(ii) When preparing sub-samples, the mass shall not be adjusted to a predetermined mass.

4.35 Test method T164 Maximum dry density of cohesionless materials (by vibration)

4.35.1 Sieve size and material mass requirements

This section is not under review

(a) Minimum mass requirement for material under test is shown in Table 7.

Table 7. Minimum mass requirements for TfNSW test method T164

T164 Maximum dry density of non-cohesive materials (by vibration)	
Sieve size (mm)	**Minimum mass (kg)**
-37.5	5 (Where the sample has material retained on the 19.0 mm sieve).
-37.5	2.5 (Where all the material passes the 19.0 mm sieve).

4.35.2 Preparation

(a) The preparation is applicable to clean sands and gravels that contain <5% fines (e.g., clay or silt) and that do not behave as a cohesive material.

(b) Refer to test method AS 1289.5.5.1.

4.36 Test method T167 Determination of the California bearing ratio of remoulded specimens of road materials (design method)

4.36.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: -19.0 mm.

(b) Minimum mass: 30 kg. Less material is required if the design moisture in known. Additional material may be required to carry out TfNSW test method T111.

4.36.2 Preparation

(a) Refer to TfNSW test method T167.

4.37 Test method T170 Determination of the soil suction-moisture content relationship for soils

4.37.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: -2.36 mm.

(b) Minimum mass: 3.5 kg. Additional material may be required to carry out TfNSW test method T111.

4.37.2 Preparation

(a) Refer to TfNSW test method T170.

4.38 Test method T171 Modified Texas Triaxial compression test for road construction materials

4.38.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: 37.5 mm.

(b) Minimum mass: 40 kg.

4.38.2 Preparation

(a) Crumble the sample (Appendix A, Process A.1) to the extent required to pass the 37.5 mm sieve.

(b) Screen the sample on the 37.5 mm sieve (Appendix A, Process A.4).

(c) Divide the portion into at least 4 sub-samples (Appendix A, Process A.3).

(d) Determine the proportion of oversize +37.5 mm (Appendix A, Process A.5).

(e) Label all sub-samples (Appendix A, Process A.7).

4.39 Test method T172 Determination of capillary rise and swell absorption of road materials

4.39.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: 19.0 mm.

(b) Minimum mass: 7 kg.

4.39.2 Preparation

(a) Specimens prepared according to TfNSW test methods T116, T131 or others as appropriate.

4.40 Test method T173 Field wet density of road construction materials (nuclear gauge in direct transmission method)

4.40.1 Sieve size and material mass requirements

(a) Sieve: Where required, carry out other laboratory tests where sieve sizes are specified (e.g., TfNSW test method T111, T112, T120 and T162).

(b) Minimum mass: Where required, obtain sufficient material according to TfNSW test method T173 to carry out other laboratory tests where minimum masses are specified (e.g., TfNSW test methods T111, T112, T120 and T162).

4.40.2 Preparation

(a) Where required prepare sufficient mass of material for:

(i) TfNSW test method T111 Clause 4.7, or

(ii) TfNSW test method T112 Clause 4.8, or

(iii) TfNSW test method T162 Clause 4.32.

(b) Where required prepare sufficient mass of material for:

(i) TfNSW test method T120 Clause 4.14, or

(ii) TfNSW test method T121 Clause 4.15, or

(iii) TfNSW test method T180 Clause 4.41.

NOTE: A correlation between the standard method T120 and subsidiary test methods (T121 and T180) must be established.

4.41 Test method T180 Moisture content of road construction materials (microwave oven method)

4.41.1 Sieve size and material mass requirements

This section is not under review

(a) The sieve size and material mass requirements are identical to Clause 4.14, TfNSW test method T120.

4.41.2 Preparation

(a) Preparation requirements are identical to Clause 4.14, TfNSW test method T120.

NOTE: A correlation between the TfNSW standard test method T120 and TfNSW subsidiary test method T180 must be established by applying the requirements of TfNSW test method T2105.

4.42 Test method T186 Erodibility of stabilised road construction material

4.42.1 Sieve size and material mass requirements

This section is not under review

(a) Sieve: -6.75 mm.

(b) Minimum mass: 2 specimens of 6 kg each. Additional material may be required to carry out TfNSW test method T120.

4.42.2 Preparation

(a) Crumble the sample (A.1) to the extent required to pass the 6.75 mm sieve.

(b) Screen the sample (A.4) on the 6.75 mm sieve.

(c) Divide the portion (A.3).

(d) Label the portion (A.7).

(e) Cure the portion (A.6).

(f) Prepare the binder (A.8).

(g) Calculate the quantity of binder (A.9).

(h) Measure out the quantity of binder, place in a sealed container and label (A.7).

NOTE: Do not blend the binder until directed in the test method.

4.43 Test method T276 Foreign materials content of recycled crushed concrete

4.43.1 Sieve size and material mass requirements

This section is not under review

(a) A minimum mass requirement for material under test is shown in Table 8.

Table 8. Minimum mass requirements for TfNSW test method T276

T276 Foreign material content of recycled crushed concrete	
Sieve (mm)	**Minimum mass (kg)**
Material not screened prior to test	20 (material of 50 mm to 150 mm nominal size).
	6 (material of 20 mm to 50 mm nominal size).
	4 (material of 10 mm to 20 mm nominal size).
	2 (material of ≤ 10 mm nominal size.

NOTE: The minimum mass of sample is based on the nominal maximum size of the sample i.e., not more than 15% by mass of the particles larger than the size stated. When the largest particles are much greater in size then the body of the sample the sub-sample mass should be determined by considering the "nominal maximum size of particle" as the maximum size of particle present in any proportion.

4.43.2 Preparation

(a) Combine and mix the bulk sample or sample increments and if required divide into a representative sub-sample so when dried to constant mass, the minimum mass for the nominal size of material is obtained by a process described in Appendix A, Process A.3.

5 References

The following documents are referred to in this document:

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- Transport T103. (2021). "Pretreatment of road construction materials by artificial weathering." Transport for NSW.
- Transport T106. (2021). "Coarse particle distribution in road construction materials (by washing)." Transport for NSW.
- Transport T107. (2021). "Fine particle distribution in road construction materials." Transport for NSW.
- Transport T108. (2021). "Liquid limit of road construction materials." Transport for NSW.
- Transport T109. (2021). "Plastic limit and plasticity index of road construction materials." Transport for NSW.
- Transport T111. (2022). "Dry density/moisture relationship of road construction materials." Transport for NSW.
- Transport T112. (2022). "Dry density/moisture relationship of road construction materials (Modified compaction)." Transport for NSW.
- Transport T113. (2021). "Linear shrinkage of road construction materials." Transport for NSW.
- T114. (2012). "Maximum dry compressive strength of road construction materials." Transport for NSW.
- Transport T116. (2022). "Unconfined compressive strength of remoulded specimens of road construction blended with proportions of cementitious materials or binders (mixed from a construction process or plant mixed)" Transport for NSW.
- Transport T117. (2022). "California bearing ratio of remolded specimens of road construction materials." Transport for NSW.
- T119. (2012). "Field dry density of road construction materials (sand replacement method)." Transport for NSW.
- T120. (2012). "Moisture content of road construction materials (standard method)." Transport for NSW.
- T121. (2012). "Moisture content of road construction materials (sand bath of hot plate method)." Transport for NSW.

- T123. (2012). "pH value of a soil (electronic method)." Transport for NSW.
- T126. (2012). "Assessment of primer or binder absorption by road gravel." Transport for NSW.
- T128. (2012). "Apparent density of soils containing coarse particles." Transport for NSW.
- T129. (2012). "Bulk density and water absorption of the fine sand fraction of soils." Transport for NSW.
- Transport T130. (2022). "Dry density/moisture relationship for mixtures of road construction materials (blended in the laboratory with cementitious binders)." Transport for NSW.
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- T133. (2012). "Durability of road materials modified or stabilised by the addition of cement." Transport for NSW.
- T134. (2012). "Lime or cement content of uncured stabilised soil (E.D.T.A. method)." Transport for NSW.
- T137. (2012). "Cement content of cement stabilised material (heat of neutralisation method)." Transport for NSW.
- T143. (2012). "Lime content of stabilised materials." Transport for NSW.
- T144. (2012). "Hydrated lime for road construction materials (Lime demand test)." Transport for NSW.
- T147. (2012). "Working time for road construction materials (blended in the laboratory with slow setting binders)." Transport for NSW.
- T150. (2012). "Dry density-moisture relations for mixtures of road materials and bituminous materials." Transport for NSW.
- T151. (2012). "Determination of the absorption and unconfined compressive strength of road materials stabilised or modified with bituminous binders." Transport for NSW.
- T153. (2012). "The half-life and expansion ratio of foamed bitumen." Transport for NSW.
- T154. (2013). "Resilient modulus of road construction materials stabilised by foam bitumen specimen (blended in the laboratory)." Transport for NSW.
- Transport T162. (2022). "Compaction control test (Rapid method)." Transport for NSW.
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- T165. (2012). "Density in-situ of road construction materials (fixed volume extraction)." Transport for NSW.
- T167. (2012). "Determination of the California bearing ratio of remoulded specimens of road materials (design method)." Transport for NSW.
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- T171. (2012). "Modified Texas Triaxial compression test for road construction materials." Transport for NSW.
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- AS1289.3.5.1 (2006). "Methods of testing soils for engineering purposes Soil classification tests – Determination of the soil particle density – Standard method." Standards Australia.
- QA Specification 3211 (2018). QA Specification 3211 Cements, binders and fillers. Transport for NSW.

Appendix A. Processes

A.1 Crumbling

(a) Break down aggregations of soil particles so that only discrete particles and not aggregations are retained on the specified sieve size/s. The extent of break down is to enable aggregations to pass the size of sieve used in screening or aperture used in division. To distinguish between aggregations and discrete particles, place some material in water and bring to the boil. If the material breaks down, then further treatment will be required. Carry out to assist break down:

(i) Breaking down the aggregations by hand.

(ii) Drying (if required) back the sample Appendix A, Process A.2.

(iii) Placing material into a mortar and using a rubber pestle to rub down aggregations of particles in such a way as to avoid crushing any discrete or sound particles. A mechanical aid that has a capability to rub down aggregations of particles in such a way as to avoid crushing any discrete or sound particles, similarly, to using a mortar and rubber pestle.

NOTE: Typically, a more thorough break down is required for material that is to be screened through finer apertures.

A.2 Drying

A.2.1. Air drying

(a) Spread the material on a smooth clean surface in an open space.

NOTE: Avoid contamination of the sample.

(b) Occasionally stir the material to assist evaporation and uniformity of drying.

NOTE: A fan or a fan with a heater may be used to assist drying by apply a flow if air across the material.

(c) Crumble the material when it is judged to be sufficiently dry or when the material is judged at a suitable moisture content for testing place in a sealed container and allow to cure in accordance with Appendix A, Process A.6.

A.2.2. Oven drying

(a) Place material in a suitable dish and place in an oven at a temperature not exceeding 50 °C.

(b) Occasionally stir the material to assist evaporation and uniformity of drying.

(c) Remove from the oven and crumble the material when it is judged to be sufficiently dry.

(d) Remove from the oven and when the material is judged to be sufficiently dry or when the material is judged at a suitable moisture content for testing place in a sealed container and allow to cure in accordance with Appendix A, Process A.6.

A.3 Division

A.3.1. Riffling

(a) Use a riffle box conforming to AS 1141.2 (refer to Figure 1).

(b) The bulk sample or sample increments shall be passed through the riffle box from alternate sides of the riffle box on each successive split. Material placed in the riffle box shall be evenly distributed along the full length of the box. One half of the bulk sample or sample increments is divided until sub-samples are of sufficient quantity for testing (e.g., reduction in size of sample for further testing, one compaction point, moisture content, CBR, grading, etc.).

NOTE: It is preferable to carry out riffling on material sufficiently dry but not dusty, so that fine particles are not lost.

A.3.2. Cone and quartering

(a) The bulk sample or sample increments shall be heaped using shovels or scoops and mixed to form a cone and turned over to form a new cone. This is repeated three (3) times. Form a flat top conical shape and divide the material in 4 equal quarters. Take diametrically opposite quarters and mix the material and form a flat top conical shape and divide material in 4 equal quarters. Repeat taking diametrically opposite quarters until sub-samples are of sufficient quantity for testing. (e.g., reduction in size of sample for further testing, one compaction point, moisture content, CBR, grading, etc.).

A.3.3. Rotary sampler

(a) Use a rotary sample divider conforming to AS4264.2 Appendix A, Manual Sampling Implements - A6 Rotary Sample Divider.

(b) When using a rotary sampler use segments to capture minimum sample mass requirements for testing. The rotating turntable shall revolve with a relative speed of not more than 0.6 m/s at the feed point and revolve a minimum of 20 rotations during sample division. The minimum size of the opening at slide gate is to be at least 3 times the maximum size of particles in the material to prevent bridging. The increments collected in each segment or a combination of material in the segments forms the sample for testing (e.g., one compaction point, moisture content, CBR, grading etc.). The rotary sampler is suitable for homogenising and dividing materials such as gravels, sands and road bases. The rotary sampler is not suitable for wet sands and clays or material with large clay lumps.

NOTE: The rotary sampler may be used to substitute riffling and cone and quartering. It is preferable for material to be sufficiently dry but not dusty, so that fine particles are not lost.

A.4 Screening

(a) Screen the sample by hand or with a mechanical shaker using the specified sieves.

(b) When sieving by hand, use a lateral and vertical motion of the sieve accompanied by a jarring action and with periodic stopping.

Table 9. Maximum mass of material to be retained on each sieve at the completion of screening/sieving

Sieve size	200 mm diameter sieve (g)	300 mm diameter sieve (g)	450 mm diameter sieve (g)
75 mm	1000	3000	6000
53.0 mm	1000	2750	5500
37.5 mm	1000	2200	5000
26.5 mm	800	1800	4000
19.0 mm	600	1200	3000
13.2 mm	400	900	2000
9.5 mm	250	600	1500
6.7 mm	225	500	1250
4.75 mm	200	400	1000
3.35 mm	180	350	800
2.36 mm	150	300	600
1.70 mm	125	250	500
1.18 mm	100	200	400
700 µm	90	170	-
600 µm	75	150	-
425 µm	60	120	-

300 µm	50	100	-
150 µm	35	-	-
75 µm	25	-	-

(c) When using mechanical sieving, estimate the minimum sieving time and set the timer to the estimated time.

(d) Take care not to overload the sieve(s). Where the mass of material retained on any sieve at the completion of screening/sieving exceeds the value in Table 9 then re-sieve the sample in two or more portions.

(e) Break down any aggregation of particles remaining on a screen by crumbling in accordance with Appendix a, Process A1 and re-screen the material.

(f) Use a stiff bristle brush on large particles to remove any adhering fine particles and return to the underlying sieve or pan. Use a mortar with a rubber pestle on smaller particles to rub down aggregations in such a way to avoid crushing any discrete or sound particles, prior to re-sieving.

(g) Continue screening until the mass passing each sieve in one minute is less than 1% of the mass of material retained on that sieve.

A.5 Proportion and density of oversize material

A.5.1. Proportion of material retained on sieves

(a) When determining the mass of moist material retained on the 19.0 mm or the 37.5 mm, ensure that all adhering soil particles are removed by brushing and washing.

(i) Determine and record the mass of the total sample (M_E) to the nearest 1 (g).

(ii) Determine and record the mass of the moist material (dry the particles so they have an appearance of saturated surface dry - SSD) retained on the 19.0 mm sieve ($M_{A19.0}$) and/or the 37.5 sieve ($M_{A37.5}$) to the nearest 1 g.

(iii) Calculate the proportion of particles retained on the 19 mm sieve ($P_{O19.0}$) or the 37.5 mm sieve ($P_{O37.5}$) to the nearest 1 % using the following equation:

$$P_{O19.0}\ or P_{O37.5} = \frac{M_{A19\ or\ A37.5}}{M_E} \times 100 \quad \ldots 5(1)$$

Where:

$P_{O19.0}\ or P_{O37.5}$ = Proportion retained on the nominated sieve (%).

$M_{A19}\ or M_{A37.5}$ = Mass retained on the nominated sieve (g).

M_E = Total mass of sample (g).

Equation 5(1). Portion of material retained on the nominated sieve ($P_{O19.0}$ OR $P_{O37.5}$)

A.5.2. Density of oversize material

(a) Determine the proportion of oversize particles ($P_{O37.5}$) of material retained on the 37.5 mm sieve from Clause A.5.1.

(b) Determine and record the mass of moist material ($M_{W37.5}$) retained on the 37.5 mm immersed in potable water (using a wire basket) to the nearest 1 g.

(c) Determine the density (J_O) of the moist particles retained on the 37.5 mm (oversize) sieve to the nearest 0.01 t/m^3 by using the following equation 5(2).

NOTE: The density of oversize is used when determining the Maximum Bulk Wet Density (MBWD) during compaction control testing.

(d) Where the results are to be used in subsequent calculations (e.g., TfNSW Specification QMS Q6, Method for Statistical Calculation for Conformity of lots) use and report all densities values to the nearest 0.001 t/m^3.

$$J_O = \frac{M_{A37.5}}{(M_{A37.5} - M_{W37.5})} \quad \ldots 5(2)$$

Where:

J_O = Density of oversize material retained on the 37.5 mm sieve (t/m^3).

$M_{A37.5}$ = Mass retained on the 37.5 mm sieve (in air) (g).

$M_{W37.5}$ = Mass retained on the 37.5 mm sieve (in water) (g).

Equation 5(2). Density of oversize material retained on the 37.5 mm sieve (J_O)

A.6 Curing

(a) For TfNSW test method T103, no curing required.

(b) For T102:

(i) Add sufficient water to adjust the moisture content of the sample to approximately OMC. Mix the material to ensure uniform distribution of moisture. The determination of the OMC is not required.

(ii) Cure the sample at room temperature for a period of time that allows the moisture to become uniformly distributed through the sample in accordance with Table 10. Unless otherwise specified accelerated curing at a temperature of 45 °C ± 5 °C for at least 18 hours may be used.

(c) For TfNSW test methods T108, T109 and T113 curing is specified in the test method.

(d) For all other tests, add sufficient water to produce moisture content as specified. Mix the material to ensure uniform distribution of moisture. Unless otherwise specified, cure the sample at room temperature for a period of time that allows the moisture to become uniformly distributed through the sample in accordance with Table 10.

Table 10. Curing periods of prepared samples

Plasticity	Minimum Curing periods of prepared samples	
	Between 4% dry and 6% wet from OMC	Drier than 4% and wetter than 6% wet from OMC
Sands, gravel, crushed rock, manufactured materials with less than 12% fines	2 hrs	2 hrs
Clays, silts and fine sand Low liquid limit, LL < 35%	24 hrs (1 day)	48 hrs (2 days)
Clays, silts and fine sand Medium liquid limit, 35% < LL ≤ 50%	48 hrs (2 days)	96 hrs(4 days)
Clays, silts and fine sand High liquid limit, LL > 50%	96 hrs (4 days)	168 hrs (7 days)

(e) Determine the liquid limit of the soil by:

(i) TfNSW test method T108.

(ii) Previous liquid limit results where records are available for the source of material.

(iii) Visual estimate of liquid limit from a competent experienced geotechnical worker within the laboratory.

(f) Place the moist sample in a suitable container, seal to prevent moisture loss and allow curing in accordance with Appendix A, Process A.7.

NOTE: Curing allows the water to permeate in to the drier particles of the soil and further adjustment of the moisture may be required. Inadequate curing will give variable results.

A.7 Labelling

(a) Place all test samples/sub-samples/portions/fractions in dishes or containers with labels for identification with laboratory registration number, sample number, test method number, and size fraction, as required. Seal container where required to prevent moisture loss.

NOTE: Treat and protect samples at all times to prevent contamination which could alter the result of a subsequent test.

(b) Sample butts must be placed in containers and labelled indicating laboratory registration number, sample number and whether or not any size fraction has been removed from it. Seal container where required to prevent moisture loss.

A.8 Preparation of cementitious binders for earthworks and granular pavement materials

CAUTION: Follow the safety requirements on the Material Safety Data Sheets for hazardous chemicals when handling and using cementitious binders.

A.8.1. General

(a) Cementitious binders used in laboratory investigations shall be the same type, from the same source of supply or manufacture, as the cementitious binders proposed for use in the field.

(b) Cementitious binders must be stored in a sealed container, labelled with binder type, manufacturer, date of manufacture and expiry date (the binder must not be used if more than 3 months from the date of manufacture). Cementitious binders are required to be protected from moisture until used.

(c) Unless otherwise specified or approved the cementitious binders shall comply with the relevant requirements of TfNSW Specification 3211 Cementitious Materials, Binders and Fillers, Clause 7 Binder for earthworks and granular material.

A.8.2. Cement

(a) Unless otherwise specified or approved, the cement shall be Type GP - General Purpose Cement. Follow manufacturer's recommendations and instructions prior to use.

(b) Unless otherwise specified or approved the blended cement shall be Type GB - Blended Cements. Follow manufacturer's recommendations and instructions prior to use.

A.8.3. Hydrated Lime

(c) Follow manufacturer's recommendations and instructions prior to use.

A.8.4. Quicklime

(d) Follow manufacturer's recommendations and instructions prior to use.

A.8.5. Ground granulated iron blast-furnace slag

(e) Follow manufacturer's recommendations and instructions prior to use.

A.8.6. Fly ash

(f) Follow manufacturer's recommendations and instructions prior to use.

A.8.7. Other binders

(g) Follow manufacturer's recommendations and instructions prior to use.

A.9 Required mass of cementitious binder and water adjustment

A.9.1. Dry mass of sample

(a) Determine the moisture content (w) of the sample according to TfNSW test method T120.

(b) Determine the wet mass of the sample (M_w) to the nearest 1 g.

(c) Convert the wet mass of the sample to a dry mass (M_d) to the nearest 1 g using the following equation:

$$M_d = M_w \times \frac{100}{(100 + w)} \quad \ldots 5(3)$$

Where:

M_d = Dry mass of sample (g).
M_w = Wet mass of sample (g).
w = Moisture content of sample (%).

Equation 5(3). Dry mass (M_d) of sample

A.9.2. Mass of cementitious binder

(a) Calculate the required mass of cementitious binder (M_B) to the nearest 1 g, using the following equation:

$$M_B = M_d \times \left(\frac{B_{\%}}{100}\right) \quad \ldots 5(4)$$

Where:

M_B = Mass of cementitious binder to be added (g).
M_d = Dry mass of sample (g) from equation A.9.1(1).
$B_{\%}$ = Specified cementitious material or binder proportion to be added (%).

Equation 5(4). Required mass of cementitious binder (M_B)

A.9.3. Target moisture content

(a) Where target moisture content (w_t) has been determined calculate the required mass of water (M_{wt}) to the nearest 1 g to be adjusted using the using the following equation:

$$M_{wt} = \left(M_w \times \frac{(w_t - w)}{(100 + w)}\right) + \left(M_B \times \frac{w_t}{100}\right) \quad \ldots 5(5)$$

Where:

M_{wt} = Mass of water to be adjusted (g).

M_w = Mass of wet sample (g).

w_t = Target moisture (%).

w = Moisture content of sample (%).

M_B = Mass of cementitious binder to be added (g) from equation A.9.2(1).

NOTE: If $w > w_t$ dry back the sample and repeat the process.

NOTE: The moisture content is the actual % and is not converted to a decimal.

NOTE: The volume of water can be measured in grams (g) or millilitres (mL) and is the same value (e.g. 5.2 g = 5.2 mL).

Equation 5(5). Mass of water to be adjusted with cementitious binder (M_{wt})

A.10 Required mass of water to adjust moisture content

A.10.1. Using the OMC for LMR

(a) Determine the moisture content (w) of the sample according to TfNSW test method T120.

(b) If the moisture content (w) is more than the target moisture content (w_t), dry back the sample in accordance with TfNSW test method T105 Appendix A, Process A.2

(c) Determine the wet mass of the sample (M_2) to the nearest 1 g.

(d) Calculate the required mass of water (M_W) to the nearest 1 g for adjustment using the following equation:

$$M_{wt} = M_w \times \left(\frac{\left(\left(OMC \times \frac{LMR_t}{100} \right) - w \right)}{(100 + w)} \right) \quad \ldots 5(6)$$

Where:

M_{wt} = Mass of water to be adjusted (g).

M_w = Wet mass of sample (g).

OMC = Optimum moisture content (%).

w = Moisture content of sample (%).

$LMRt$ = Target laboratory moisture ratio (%).

NOTE: The moisture content is the actual % and is not converted to a decimal.

NOTE: The volume of water can be measured in grams (g) or millilitres (mL) and is the same value (e.g. 5.2 g = 5.2 mL).

Equation 5(6). Mass of water to be adjusted for LMR

(e) If the result is positive "+" water is added to the sample. If the result is negative "-" the sample is dried back by a process described in Appendix A, Process A.2.

A.10.2. Using a moisture content (%) as a target moisture content

(a) Determine the moisture content (w) of the sample according to TfNSW test method T120. If the moisture content (w) is more than the target moisture content (w_t), dry back the sample by a process described in Appendix A, Process A.2.

(b) Determine the wet mass of the sample (M_2) to the nearest 1 g.

(c) Calculate the required mass of water (M_{wt}) to the nearest 1 g for adjustment using the following equation:

$$M_{wt} = M_w \times \left(\frac{(w_t - w)}{(100 + w)}\right) \quad \ldots 5(7)$$

Where:

M_{wt} = Mass of water to be adjusted (g).

M_w = Wet mass of sample (g).

w_t = Target moisture content (%).

w = Moisture content of sample (%).

NOTE: The moisture content is the actual % and is not converted to a decimal.

NOTE: The volume of water can be measured in grams (g) or millilitres (mL) and is the same value (e.g. 5.2 g = 5.2 mL).

Equation 5(7). Mass of water to be adjusted for target moisture content

(d) If the result is "+" positive, water is added to the sample. If the result is negative "-" the sample is dried back by a process described in Appendix A, Process A.2.

A.11 Required mass of material to fill mould

(a) Calculate the required mass (M_{fm}) of materials to the nearest 1 g to fill a mould using the following equation:

$$M_{fm} = V_M \times \left(\frac{(100 + w_t)}{100}\right) \times \left(\frac{(MDD + LDR_t)}{100}\right) \quad \ldots 5(8)$$

Where:

M_{fm} = Mass of moist sample (g)

V_m = Volume of mould (mL)

w_t = Target moisture content (%)

MDD = Maximum dry density (t/m^3)

LDR_t = Target laboratory density ratio (%)

Equation 5(8). Mass required to fill mould (M_{fm})

A.12 Required number of blows for compaction

(a) Calculate the required number of blows (B) from a drop rammer using the following equation:

$$B = \left(\frac{E}{M_P \times 9.8 \times h}\right) \times \left(\frac{V_m}{n}\right) \quad \ldots 5(9)$$

Where:

B = Number of blows per layer.

E = Energy input (kJ/m^3).

M_P = Drop mass of hammer (kg) .

h = Drop height of rammer (mm).

V_m = Volume of mould (mL).

n = Number of equal layers compacted.

NOTE: For standard compaction $E = 597$ (kJ/m^3).

NOTE: For modified compaction $E = 2703$ (kJ/m^3).

Equation 5(9). Number of blows per layer for compaction (B)

A.13 Air voids line

(a) Calculate and plot on a graph.

(i) The dry density (ϱd) of a soil (on the vertical "y" axis) for 0% air voids against the moisture content (w) (on the horizontal "x" axis) using the following equation:

$$\varrho_d = \frac{1}{\left(\frac{1}{\rho_{st}}\right) + \left(\frac{w}{100}\right)} \quad \ldots 5(10)$$

Where:

ϱ_d = Dry density of soil at 0% air voids (t/m^3).

ϱ_{st} = Soil particle density 2.67 (t/m^3).

w = Moisture content (%).

NOTE: AS1289.3.5.1 Results reported in (g/cm^3) or (t/m^3) can be used in the equation.

Equation 5(10). Dry density of soil at 0% air voids (ϱ_0)

(ii) The particle density of 2.67 t/m3 is generally applicable to rocks and clays containing quartz and feldspars. Basaltic and other material types will require separate determinations in accordance with AS1289.3.5.1 Determination of the soil particle density of a soil – standard method.

(iii) Obtain the value of the material's soil particle density for calculating the air voids lines using the method described in AS 1289.3.5.1 or assume the particle density based on previous tests. A rough check on the material soil particle density is to select the dry density and moisture content of the wettest data point, nominate a percent air voids (2% often gives a satisfactory result) and estimate the soil particle density of the material under test by using the following equation:

$$\rho_s = \frac{100\rho_d}{(100 - V_a) - (\rho_d \times w)} \quad \ldots 5(11)$$

Where:

ρ_s = Assumed soil particle density (t/m^3).

ρ_d = Dry density of material (t/m^3).

V_a = Nominated air voids (%).

w = Moisture content expressed as a percentage of the mass of dry material (%).

Equation 5(11). Estimate of soil particle density (ρ_s)

(iv) The dry density (ϱd) of a soil (on the vertical "y" axis) for 5% air voids against the moisture content (w) (on the horizontal "x" axis) using the following equation:

$$\varrho_5 = 0.95 \times \rho_0 \qquad \ldots 5(12)$$

Where:

ϱ_5 = Dry density of soil at 5% air voids (t/m³).

ϱ_0 = Dry density of soil at 0% air voids (t/m³).

Equation 5(12). Dry density of soil at 5% air voids (ϱ_5)

(b) Table 11 provides 0% and 5% air void with corresponding density of soil (t/m³) over the moisture content range of 0% to 25% based on a soil particle density of 2.67 (t/m³) when equation A.13(1) and A.13(2) are applied.

Table 11. Values of density of soil and moisture content for 0% and 5% air voids

Moisture content (%)	Dry density of soil for 0% air voids (ϱ_0)	Dry density of soil for 5% air voids (ϱ_5)
0.0	2.670	2.537
2.0	2.535	2.408
4.0	2.412	2.292
6.0	2.301	2.186
8.0	2.200	2.090
10.0	2.107	2.002
12.0	2.022	1.921
14.0	1.944	1.846
16.0	1.871	1.777
18.0	1.803	1.713
20.0	1.741	1.654
22.0	1.682	1.598

Moisture content (%)	Dry density of soil for 0% air voids (ϱ_0)	Dry density of soil for 5% air voids (ϱ_5)
24.0	1.627	1.546
26.0	1.576	1.497
28.0	1.528	1.451
30.0	1.483	1.408

(c) Plot the soil moisture content against the soil dry density on the air voids graph for.

(i) The relationship of dry density/moisture content in TfNSW test method T111, T112, T117, T130, T162, etc.

(ii) Field dry density and field moisture content in TfNSW test method T119 or T173 etc.

(iii) When required.

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