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<th>Authorised By</th>
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FOREWORD

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This document should be read with all the documents forming the Project Deed.

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BASE SPECIFICATION

This document is based on Specification RMS R50 Edition 4 Revision 0.
RMS SPECIFICATION D&C R50
STABILISATION OF EARTHWORKS

1 GENERAL

1.1 SCOPE

This Specification sets out the requirements for stabilisation of earthworks, involving the supply and mixing of binder, and placement, compaction, trimming and curing of the mixed material.

The binder may be incorporated either by insitu mixing of the binder into the soil, or by premixing the binder with other materials in a stationary mixing plant before placing.

Typical uses include improvement of embankment foundations or cutting floors, intermediate embankment layers and Selected Material Zones.

1.2 STRUCTURE OF SPECIFICATION

This Specification includes a series of annexures that detail additional requirements.

1.2.1 (Not Used)

1.2.2 (Not Used)

1.2.3 Schedule of HOLD POINTS

The schedule in Annexure R50/C lists the HOLD POINTS that must be observed. Refer to Specification RMS D&C Q6 for the definition of HOLD POINTS.

1.2.4 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure R50/D and must be implemented.

1.2.5 Frequency of Testing

The Inspection and Test Plan must nominate the proposed frequency of testing to verify conformity of the item, which must not be less than the frequency specified in Annexure R50/L. Where a minimum frequency is not specified, nominate an appropriate frequency. Frequency of testing must conform to the requirements of RMS D&C Q6.

1.2.6 Referenced Documents

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 2350). For convenience, the full titles are given in Annexure R50/M.
1.3 DEFINITIONS

The terms “you” and “your” mean “the Contractor” and “the Contractor’s” respectively.

The following meanings apply to this Specification:
“Stabilisation” includes modification.
“Binder” refers to any one of the following: quicklime, hydrated lime, slag/lime blend, or cement.
“MTBS” refers to the material to be stabilised.

2 MATERIALS

2.1 BINDERS

2.1.1 General

Binders, including blended binders, must comply with the requirements of Specification RMS D&C 3211.

Do not use high early strength cement (Type HE) as a binder.

Include in the PROJECT QUALITY PLAN details of all cementitious and pozzolanic materials, and the blend proportions of blended binders if applicable, which are proposed for use in the Works, together with supporting test results traceable to the materials supplied.

2.1.2 Sampling and Testing

Sample and test the binders in accordance with RMS D&C 3211. Detail in the PROJECT QUALITY PLAN the method of sampling the binders.

2.1.3 Supply of Binder

Transport binders in watertight containers and protect the binders from moisture until use. Do not use binder that has become caked or lumpy in the Works.

2.2 WATER

Water for use in stabilisation must be free from deleterious amounts of materials such as oils, acids, alkalis, organic matter and any other matter which could affect the chemical reaction.

Water that is not taken from a town water supply system must comply with the requirements shown in Table R50.1.

Table R50.1 – Properties of Non-Town Water

<table>
<thead>
<tr>
<th>Property</th>
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<tr>
<td>Chloride ion (mg/L)</td>
<td>T1004</td>
<td>600</td>
</tr>
<tr>
<td>Sulfate ion (mg/L)</td>
<td>T1014</td>
<td>400</td>
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<tr>
<td>Undissolved solids (% by mass)</td>
<td>AS 3550.4</td>
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Stabilisation Of Earthworks

Where recycled water is proposed for use, the water must meet the above requirements and those in Specification RMS D&C G36, with a maximum concentration of 1,000 thermo-tolerant coliforms per 100 ml when tested in accordance with Test Method RMS T1015.

Include in the PROJECT QUALITY PLAN details of the water proposed for use in the Works, including the water source.

2.3 MATERIAL TO BE STABILISED

Material to be stabilised must comply with the requirements of Specification RMS D&C R44.

3 STABILISATION – GENERAL

3.1 (NOT USED)

3.2 CONTRACTOR’S MIX DESIGN

3.2.1 General

Prepare a mix design with the appropriate binder type and proportion to achieve the material properties specified in Clause 3.2.2. Submit the proposed mix design to the RMS Representative for acceptance at least 10 working days before the proposed commencement of stabilisation work.

The submission must include the details of the MTBS, the proposed binder and application rate, the proposed water source, and NATA endorsed test certificates to verify that the required material properties can be achieved with the proposed mix design.

3.2.2 Required Material Properties After Stabilisation

Unless specified otherwise, the proposed mix design must not result in a material after stabilisation with a UCS (after 7 days accelerated curing) greater than 1.5 MPa, when tested in accordance with Test Method RMS T131.

When stabilisation is used to create a working platform in the floor of cutting as a foundation treatment, or to improve the properties of the material in the top 150 mm layer of the Selected Material Zone, as part of the work carried out under Specification RMS D&C R44, the proposed mix design must be such that, after stabilisation, the CBR and PI values comply with that specified in RMS D&C R44.

3.3 WEATHER CONDITIONS

Do not carry out stabilisation work:

(a) during wet weather, or if wet weather appears imminent;

(b) during periods of high wind, which may result in the loss of binder or become a nuisance or danger to people and property or the environment.

Include in the PROJECT QUALITY PLAN details of procedures for cessation of operations in the event of adverse weather conditions.
3.4 CONSTRUCTION SEQUENCE FOR PAVEMENT SUBSOIL DRAINS

Where subsoil drains are required for the drainage of the pavement, carry out any stabilisation of the Selected Material Zone prior to construction of the subsoil drains.

4 STABILISATION BY INSITU MIXING

4.1 PREPARATION OF LAYER

Prior to insitu mixing, compact the layer to be stabilised to a minimum of 95% relative compaction as determined by Test Method RMS T166, and trim the surface parallel to the Designed Finished Surface Level.

Prior to spreading the binder, tyne and/or rip the insitu material where required, to facilitate insitu mixing, but do not disturb any material beneath the layer to be stabilised.

4.2 SPREADING OF BINDER

4.2.1 General

Provide your proposed binder type, spread rate and stabilisation depth to the RMS Representative for acceptance at least 5 working days before commencing any stabilisation work.

Include in the PROJECT QUALITY PLAN the procedures and equipment for the spreading of binder.

4.2.2 Required Binder Spread Rate

Determine the required spread rate of the binder, using the nominated proportion of stabilising binder, nominated depth of stabilisation, and density of MTBS.

4.2.3 Spreading Equipment

Spread the binder using a mechanical spreader capable of spreading it uniformly within -10% and +20% of the nominated rate.

4.2.4 Actual Binder Spread Rate

Determine the actual spread rate achieved for each spreader run using Test Method RMS T136.

For each spreader run, carry out at least two tests, with the first within 20 m of the start of each spreader run, and the spacing between tests must not exceed 200 m. The actual spread rate is calculated as the average of the two spread rate tests.

4.2.5 Slaking of Quicklime

Where quicklime is used as a binder, commence slaking of the quicklime within 30 minutes after spreading by spraying water on the spread quicklime. Repeat spraying until slaking is complete.

When carrying out stabilisation with quicklime over uneven ground to form a working platform, apply the water uniformly and in such quantities sufficient to produce a material that is at least 80%
hydrated. Avoid allowing water to concentrate in ruts and hollows, or over-application of water causing the production of a wet hydrate.

In all other applications using quicklime, the quicklime must be fully slaked prior to mixing with the soil.

4.2.6 Spillage of Binder

Remove any spilt binder within 4 hours of its occurrence.

4.3 MOISTURE CONTENT

Develop a work method with a target moisture content envelope that will ensure that there is adequate moisture in the mixed material to achieve binder hydration and the specified compaction.

Moisture must be uniformly distributed throughout the depth immediately prior to compaction. Adjust the moisture content of the material until it is within the target moisture content envelope for compaction.

Include in the PROJECT QUALITY PLAN the procedure to incorporate water into the MTBS and to achieve a uniform distribution of water and within the target moisture content envelope.

4.4 MIXING OF BINDER

4.4.1 Mixing Equipment

For insitu stabilisation, use purpose built mixing equipment which is capable of mixing to the depth specified, and distributing both the binder and moisture uniformly over the full depth and over the total area. It must also be capable of pulverising and mixing all bituminous surfacing and/or patches.

The moisture must be applied uniformly through a series of nozzles on a spray bar located in the mixing hood. Each nozzle on the spray bar must be independently controlled to ensure a uniform transverse moisture distribution in overlapping runs.

Include in the PROJECT QUALITY PLAN details of the mixing equipment proposed for use and its suitability for the materials to be processed.

Replace worn or damaged mixing blades or tynes to maintain mixing efficiency.

Fit the equipment with an adjustable screed plate and cover flaps.

4.4.2 Mixing Operation

Where the total amount of binder is spread in a single pass, mix the spread binder into the full specified depth of stabilisation.

Where the binder is spread in two or more passes, mix the binder spread in the first pass into approximately 90% of specified depth of stabilisation. Spread and mix the remaining binder to the required depth in the second and any successive mixing pass(es).

Mix to the depth required to obtain the required compacted thickness of stabilised material (after trimming) within a tolerance of -10 mm and +15 mm.
The resultant mixed material must be uniform over the full depth with no lenses, pockets, clumps or granules of binder visible within the mixed layer or in adjacent layers.

Adjust the screed bar of the machine throughout the process to obtain a smooth surface without humps or hollows, which will allow uniform compaction with minimal trimming and grading.

Do not add any further water to the mixed material after completion of mixing but before compaction is complete, other than light surface wetting to reduce moisture loss and dust.

5 STABILISATION USING PLANT MIXED MATERIAL

5.1 PLANT MIXING

5.1.1 Mixing Equipment

Carry out the premixing of the various constituent materials in a stationary mixing plant of the driven pugmill type, capable of processing at least 200 tonnes per hour. The mixing plant must be capable of incorporating the binder to an accuracy of 10% of the nominated rate.

Before commencing the mixing, calibrate the mixing plant to determine the rate of addition of the binder at various plant speeds. Detail the method of calibration in the PROJECT QUALITY PLAN. A suggested method is given in Annexure R50/E.

5.1.2 Mixing Operation

Feed the component materials of the mix, including water where necessary, into the pugmill at a steady and continuous rate and mix together for at least 30 seconds measured from the time all component materials have entered the pugmill until the time when the binder is uniformly distributed throughout the mix.

The mixing operation must avoid segregation occurring in the mix.

Do not use quicklime as the binder when mixing by stationary mixing plant.

Remove any spilt binder within 4 hours of its occurrence.

5.1.3 Quantity of Binder

Where the binder is hydrated lime or a blended binder, verify on a daily basis that the device for administering the binder remains within the tolerance of the mixing plant speed being used.

Where the binder is cement, determine the amount of binder incorporated on a daily basis using Test Method RMS T137.

Maintain the actual rate of incorporation of binder to within 10% of the specified rate.

5.2 MOISTURE CONTENT

If the mix is delivered in open bodied vehicles, cover the load to minimise loss of moisture during transport to the location where it is to be placed.
Control the moisture content of the mixed material delivered to a moisture content of between 60% and 90% of its optimum moisture content, determined using Test Method RMS T162.

Take samples of the mixed material before placing it, to determine the field moisture content, and complete the testing in accordance with RMS T162 as soon as practicable after mixing but no later than 8 hours after mixing.

### 5.3 Placement of Plant Mixed Material

Immediately prior to placement of the plant mixed material, lightly scarify/tyne the surface on which it is to be placed to a depth not exceeding 25 mm.

Do not incorporate segregated or non-uniformly mixed material that has been delivered into the Works.

Place and spread the plant mixed material such that the material is not segregated and can be compacted and trimmed to achieve the requirements of RMS D&C R44.

### 6 Compaction, Trimming, Curing and Protection of Work

#### 6.1 General

The entire process from spreading and mixing the binder into the in-situ material, or mixing binder into and spreading plant mixed stabilised material, to final compaction and trimming, must be a continuous operation.

#### 6.2 Compaction

After spreading the plant mixed material (refer Clause 4), or mixing the binder into the in-situ material (refer Clause 5), commence compaction of the mixed material immediately.

Compact the stabilised material in accordance with RMS D&C R44, to a characteristic relative compaction not less than the lower limits specified in Table R44.10.

#### 6.3 Trimming

On completion of compaction, carry out trimming to produce a surface which is parallel to the Designed Finished Surface Level shown on the Design Documentation drawings and within the tolerances stated in Table R44.11 of RMS D&C R44.

Do not incorporate any cut material from the trimming into the mixed layer, but reuse it as earth fill or dispose of it as spoil.

After trimming, the thickness of the stabilised layer must not be less than that specified.
6.4  WORKING TIME

Where the binder is quicklime, hydrated lime or slag/lime blend, complete the compaction and trimming within 24 hours after commencement of mixing. Reworking of the stabilised materials may be carried out up to 24 hours after mixing.

Where the binder is cement, complete the compaction and trimming within two hours after commencement of mixing. Reworking of the stabilised material is not permitted after mixing.

6.5  CONSTRUCTION JOINTS

Compact joints so that all the material complies in all respects with the Specification and the material placed on both sides of the joint is not damaged.

6.5.1  Longitudinal Joints

Longitudinal joints are permitted only where you can demonstrate that the joints are unavoidable. Plan your stabilisation work such that the full specified width of carriageway is completed within the one day’s operation, without the need for longitudinal joints.

If compaction of adjoining runs cannot be carried out within 2 hours of incorporating the binder where the binder is cement, and within 4 hours where the binder is other than cement, form a longitudinal joint between the runs as follows:

(a)  Insitu Mixing

(i)  Spread the binder on the side of the previously stabilised area to overlap the joint by 0 mm to +50 mm.

(ii) Mix the material on the side of the previously stabilised area to overlap the joint by +50 mm to +100 mm.

(b)  Plant Mixing and Placing

(i)  Just prior to placing the next run, cut back the edge of the previously placed and compacted run to the extent that the compacted mix at the cut face complies with the requirements of this Specification.

(ii) Remove and dispose of the cutback material from the joint area and leave the joint area clean. Do not incorporate cutback material into subsequent pavement courses.

(iii) Maintain the cut face of the previous run in a damp condition prior to placing the next run.

(iv) Support the roller partly on the previously compacted run when compacting the fresh mix placed against the cut face.

6.5.2  Transverse Joints

Transverse joints may be formed in the following circumstances:

(i)  Just prior to the commencement of the day's stabilising operation.

(ii) Following any delay in excess of 2 hours in the continuity of the stabilising operation.

Form a transverse joint as follows:
Stabilisation Of Earthworks

(a) Insitu Mixing
   (i) Spread the binder on the side of the previously stabilised area to overlap the joint by 0 mm to +50 mm.
   (ii) Mix the material on the side of the previously stabilised area to overlap the joint by half a mixing drum to ensure no unmixed material remains below the surface between runs.

(b) Plant Mixing and Placing
   (i) Just prior to placing the next run, cut back the edge of the previously placed and compacted run to the extent that the compacted mix at the cut face complies with the requirements of this Specification.
   (ii) Remove and dispose of the cutback material from the joint area and leave the joint area clean. Do not incorporate cutback material into subsequent pavement courses.
   (iii) Maintain the cut face of the previous run in a damp condition prior to placing the next run.
   (iv) Support the roller partly on the previously compacted run when compacting the fresh mix placed against the cut face.

6.6 CURING

Protect stabilised layers against rapid drying by keeping the surface of the layer continuously damp until such times as a covering layer is placed.

If the stabilised layer lies immediately beneath the pavement, and a pavement layer or bituminous surfacing will not be placed within 5 days of the completion of stabilisation, apply a layer of rapid setting bitumen emulsion complying with the requirements of Specification RMS D&C 3254 for Grade CRS, at the rate of at least 0.5 L/m², within 2 days of the completion of compaction and trimming.

Repair any damage to the emulsion coat caused by construction traffic within 24 hours of the damage occurring.

6.7 TRAFFICKING OF WORK AREAS

Do not allow any traffic and any equipment not actually used in the stabilisation work from travelling over the stabilised material until completion of compaction.

7 TRIAL SECTION

7.1 GENERAL

Prior to the commencement of stabilisation, and subsequent stabilisation for a different purpose, construct a trial section at a location agreed with the Project Verifier, using the same materials, equipment and methods for placing and finishing which will be used for the remaining work. Demonstrate during construction of the trial section the methods proposed for the construction of joints.

The section selected for the trial, if conforming, will become part of the Works.
The trial section must be between 100 m and 200 m long for the proposed Lot width.

**HOLD POINT**

<table>
<thead>
<tr>
<th>Process Held:</th>
<th>Stabilisation of earthworks using a particular combination of materials, equipment and methods not previously trialled.</th>
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</thead>
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<tr>
<td>Submission Details:</td>
<td>Documentation, including test results, verifying that the trial section conforms to the specified requirements.</td>
</tr>
<tr>
<td>Release of Hold Point:</td>
<td>The Nominated Authority will consider the submitted documents prior to authorising the release of the Hold Point.</td>
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### 7.2 NONCONFORMITIES

If there are nonconformities in the trial section, the Project Verifier may require the construction of another section of trial stabilisation before releasing the Hold Point. The Project Verifier may also require your proposed disposition to include modifications to the equipment and/or methods of construction.

Remove any stabilised earthworks carried out during the trial which does not conform to the Specification but avoid any damage to the remaining conforming stabilised earthworks and underlying materials.

Dispose of the removed materials at a location of your choice acceptable to the Project Verifier.

### 7.3 NEW TRIAL SECTION

The Project Verifier may require a new trial section to be carried out when you make changes to the plant, equipment, method of construction, materials, mix, rate of work or when any material or work does not comply with the Specification.

### 8 CONFORMITY

Each Lot must comply with the requirements in Clause 8.1 to 8.3.

#### 8.1 UNIFORMITY OF MIXING

When stabilisation is carried out using in situ mixing, determine the uniformity of mixing in the vertical direction by comparing the added binder content of the top half of a test hole against the added binder content of the bottom half of the same test hole in accordance with AS 5101.3.2.

This test must be undertaken only after at least 48 hours has elapsed after compaction of the stabilised area.

Mixing is considered to be uniform when the percentage difference in added binder content between the top half and bottom half of the layer is not greater than 0.3%.
8.2 **COMPACtion**

Determine the characteristic relative compaction in accordance with RMS D&C R44 Clause 7.3, except that the sample for determination of the maximum density of the stabilised material in the layer must be taken as soon as practicable after mixing (refer Clause 4.4) or placement (refer Clause 5.3), and before compaction.

Compact the sample within 3 hours of sampling. Record the time of sampling and compaction on the compaction test report submitted to the Project Verifier.

Determine the insitu density within 200 mm of the location of sampling for maximum density and within 24 hours of compaction.

The characteristic relative compaction of each compacted layer must conform to the requirements of RMS D&C R44.

8.3 **Material Properties – CBR and PI**

Where stabilisation is undertaken to meet the CBR and/or PI requirement specified in RMS D&C R44, the stabilised material must conform to the requirements of RMS D&C R44.
ANNEXURES R50/A TO R50/B – (NOT USED)

ANNEXURE R50/C – SCHEDULE OF HOLD POINTS

Refer to Clause 1.2.3.

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<th>Clause</th>
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<tr>
<td>7.1</td>
<td>Completion of trial section of stabilisation</td>
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ANNEXURE R50/D – PLANNING DOCUMENTS

Refer to Clause 1.2.4.

The following documents are a summary of documents that must be included in the PROJECT QUALITY PLAN. The requirements of this Specification and others included in the deed must be reviewed to determine additional documentation requirements.

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<td>Method of sampling binders</td>
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<td>2.2</td>
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</tbody>
</table>
ANNEXURE R50/E – SUGGESTED METHOD OF CALIBRATION OF STATIONARY MIXING PLANT

The rate of addition of the binder may be determined by the following method:

(a) Establish the rate of addition of binder, in mass per unit time, for various plant speeds, by running the plant at a specific speed and directing the flow of additive into a suitable sampling tray or container for a specific period of time. Calculate and record the rate of addition of binder for this plant speed.

Repeat this procedure for each plant speed setting which is to be used.

(b) Establish the rate of production of the mixing plant in dry mass per unit time, by loading a truck of known mass for a specific period of time with the mixing plant running at a specific speed. Weigh the truck on a weighbridge and calculate the mass of material. When carrying out this procedure, do not add the binder.

Determine the moisture content of the material at the point of loading using Test Method RMS T120. Calculate and record the output rate for this plant speed.

Repeat this procedure for each plant speed setting which is to be used.

(c) Calculate the rate of addition of the binder at each speed of operation of the mixing plant using the formula shown below:

\[
\left( \frac{\text{Mass of additive per unit time}}{\text{Dry mass of material per unit time}} \right) \times 100\%
\]

ANNEXURES R50/F TO R50/K – (NOT USED)
## ANNEXURE R50/L – MINIMUM FREQUENCY OF TESTING

<table>
<thead>
<tr>
<th>Clause</th>
<th>Characteristic Tested</th>
<th>Test Method</th>
<th>Minimum Frequency of Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1.1</td>
<td>Quality of binder</td>
<td>RMS 3211</td>
<td>As per RMS 3211</td>
</tr>
<tr>
<td>2.1.1</td>
<td>Proportion of blended binder</td>
<td>Verify proportion of constituents</td>
<td>1 per binder delivery</td>
</tr>
<tr>
<td>2.2</td>
<td>Quality of water:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chloride ion concentration</td>
<td>RMS T1004</td>
<td>1 per Contract per source</td>
</tr>
<tr>
<td></td>
<td>Sulfate ion concentration</td>
<td>RMS T1014</td>
<td>1 per Contract per source</td>
</tr>
<tr>
<td></td>
<td>Undissolved solids</td>
<td>AS 3550.4</td>
<td>1 per Contract per source</td>
</tr>
<tr>
<td></td>
<td>Concentration of thermo-tolerant coliforms</td>
<td>RMS T1015</td>
<td>1 per Contract per source</td>
</tr>
<tr>
<td>3.2.2</td>
<td>UCS</td>
<td>RMS T131</td>
<td>2 per Lot</td>
</tr>
<tr>
<td>4.2.4</td>
<td>Actual spread rate achieved</td>
<td>RMS T136</td>
<td>2 per spreader run (^{(1)})</td>
</tr>
<tr>
<td>8.1</td>
<td>Uniformity of mixing</td>
<td>AS 5101.3.2</td>
<td>1 per 200 m of insitu stabilisation</td>
</tr>
<tr>
<td>8.2</td>
<td>Compaction</td>
<td>As per RMS D&amp;C R44</td>
<td>As per RMS D&amp;C R44</td>
</tr>
<tr>
<td>8.3</td>
<td>CBR and PI</td>
<td>As per RMS D&amp;C R44</td>
<td>As per RMS D&amp;C R44</td>
</tr>
</tbody>
</table>

**Note:**

\(^{(1)}\) Refer Clause 4.2.4. The first test must be within 20 m of the start of each spreader run, and the second test must be within 200 m of the first.
ANNEXURE R50/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.6.

**RMS Specifications**

- RMS D&C Q6 Quality Management System (Type 6)
- RMS D&C G36 Environmental Protection
- RMS D&C R44 Earthworks
- RMS D&C 3211 Cements, Binders and Fillers
- RMS D&C 3254 Bitumen Emulsion

**RMS Test Methods**

- RMS T120 Moisture Content of Road Construction Materials (Standard Method)
- RMS T131 Unconfined Compressive Strength of Road Construction Materials (Blended in the Laboratory with Cementitious Binders)
- RMS T136 Rate of Spread of Dry Powder Binders
- RMS T137 Cement Content of Cement Stabilised Material (Heat of Neutralisation)
- RMS T162 Compaction Control Test (Rapid Method)
- RMS T166 Relative Compaction of Road Construction Materials
- RMS T1004 Quantitative Determination of Chloride Ion in Water
- RMS T1014 Quantitative Determination of Sulfate Ion in Water
- RMS T1015 Microbiology of Water used in Road Works (Thermotolerant Coliforms)

**Australian Standards**

- AS 3550.4 Waters – Determination of solids – Gravimetric method
- AS 5101.3.2 Methods for preparation and testing of stabilized materials – Lime or cement content of stabilized pavement materials (EDTA method)