

ROADS AND MARITIME SERVICES (RMS)

QA SPECIFICATION R33

TRENCH DRAINS

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REVISION REGISTER

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 1/Rev 2	2.2	Clause numbers have been rewritten. Hold point has been clarified.	GM,CEC; J Woodward	24.03.95
Ed 2/Rev 0		Specification Number changed from R26 to R33. Specification Title changed from "Foundation Drains" to "Trench Drains" Converted to MS Word 6.0c. References to RTA Specifications changed. Specification supersedes and incorporates specifications RTA R26, R27 and R28.	GM, RNIC (W Ho)	13.03.97
Ed 2/Rev 1	2.5 4	Reference to plastic pipe deleted Pay Item R33P7 - Measurement of overlaps defined	GM, RNIC (W Ho)	03.07.97
Ed 2/Rev 2	Annexure R33/1	Drawing Numbers changed.	GM, RNIC (W Ho)	23.08.97
Ed 2/Rev 3	1.2, 1.3, 4 Annex R33/1 Annex R33/3	Minor changes. Drawing titles changed New schedule listing Identified Records	A/GM, RNIC	01.06.00
Ed 3/Rev 0	Various Foreword 1.1, 2.2, 2.3 1.2	Text revised to direct imperative style "Superintendent" replaced by "Principal" "Shall" replaced by "must" References updated Reformatting and minor editing New clause after the Table of Contents Materials requirements transferred to cl. 2 New clause, references transferred to Annexure R33/M	GM, RNIC	14.10.05

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 3/Rev 0 (cont'd)	1.3, 1.4 4 2, 3, R33/1, R33/2 R33/3	Replaced by 1.2.3 and 1.3 respectively Transferred to Annexure R33/B Renumbered 4, 5, R33/E respectively Renumbered R33/L, R33/C respectively		
Ed 3/Rev 1	“Notice” Global 1.3 Global Annex B	RTA PO Box and Fax numbers updated. “Typos” corrected. Clauses reworded to improve clarity. New clause: - Definitions of “you” and “your” included. - Definition of “pipe” moved to this clause from under “Scope”. Clauses rearranged: - Clause 1.3 “Order of Construction” relocated from under “General” to “Installation”; - Clause on staged drain construction under “Order of Construction” consolidated under one para in “Excavation”. - Flushing of cleanouts relocated from under “Backfilling” to “Cleanouts”. Pay Item P8 – scope clarified to include flushing out.	GM, IC	18.02.09
Ed 3/Rev 2	5 Annex M	“ceramic pavement markers” replaced by “Type B (non-retroreflective) pavement markers complying with AS 1906.3”. “a suitable epoxy adhesive” replaced by “an adhesive complying with RTA 3554”. Referenced documents updated.	GM, IC	31.03.09
Ed 3/Rev 3	4.6 Pay Item R33P1 Annex C, C2 Annex E Annex M	Clause on “Disposal of Surplus Excavated Material” added. Subsequent clauses renumbered as 4.7 and 4.8. Scope clarified to include disposal of surplus excavated material. Clause references updated. Drawing numbers and clause references updated. Referenced documents updated.	GM, IC	28.05.10
Ed 4/Rev 0		Previous clause 1.2.4 “Drawings”, clause 3 “Not Used”, clause 4.6 “Disposal of Surplus Excavated Material”, clause 4.8 “Cleanout and Inspection Structures” and Annex E deleted. Some clauses rearranged and renumbered.	GM, IC	16.05.11

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 4/Rev 0 (cont'd)	1.1	Requirement to allow in program for construction of trench drains not shown on Drawings deleted. Reference to spec R38 for edge drains requirements inserted.		
	2	Expanded to include no fines concrete, filter fabric, aggregate filter material.		
	3.1	Previous clause 4.1. Requirement to prevent contamination of filter material inserted.		
	3.3	Previous clause 4.3 retitled "Geotextile Installation" and requirements expanded.		
	3.4	Previous clause 4.4. Requirements for pipe laying expanded.		
	3.5	Previous clause 4.5. Backfilling requirements changed.		
	3.6	New clause titled "Stage Construction". All clauses relating to stage construction previously under other clauses collated under this clause 3.6.		
	4	Previous clause 4.7. Outlets requirements expanded under 3 sub-clauses 4.1, 4.2 & 4.3.		
	5	New clause titled "Pavement Interface Drains" added.		
	6	Previous clause 5 retitled "Marking of Trench Drains". Physical marking replaced by GPS coordinates.		
	Annex B	Pay Items rearranged and renumbered. Measurement and Payment description of excavation and backfill volumes changed. Pay items for sand filter material and cleanouts deleted.		
	Annex C	Updated.		
	Annex D	Updated.		
Annex L	Requirements changed.			
Annex M	Reference documents updated.			
Ed 4/Rev 1	6	Clarification of requirement to mark drains physically on site.	GM, IC	17.06.11



Transport
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QA SPECIFICATION R33

TRENCH DRAINS

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VERSION FOR: DATE:

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FOREWORD

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REVISIONS TO PREVIOUS VERSION

This document has been revised from RMS Specification R33 Edition 4 Revision 0.

All revisions to the previous version (other than minor editorial and project specific changes) are indicated by a vertical line in the margin as shown here, except when it is a new edition and the text has been extensively rewritten.

PROJECT SPECIFIC CHANGES

Any project specific changes have been indicated in the following manner:

- (a) Text which is additional to the base document and which is included in the Specification is shown in bold italics e.g. ***Additional Text***.
- (b) Text which has been deleted from the base document and which is not included in the Specification is shown struck out e.g. ~~Deleted Text~~.

RMS QA SPECIFICATION R33

TRENCH DRAINS

1 GENERAL

1.1 SCOPE

This Specification sets out the requirements for the supply and installation of all materials associated with the provision of trench drains.

Trench drains are installed within and adjacent to pavements. They are used to lower the water table, drain away water within pavements or free draining layers, and in rigid pavements, drain water from pavement layer interfaces in conjunction with edge drains.

The requirements for edge drains are set out in Specification RMS R38.

1.2 STRUCTURE OF THE SPECIFICATION

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

1.2.1 Measurement and Payment

The method of measurement and payment is detailed in Annexure R33/B.

1.2.2 Schedules of HOLD POINTS and Identified Records

The schedules in Annexure R33/C list the Hold Points that must be observed. Refer to Specification RMS Q for the definition of Hold Point.

The records listed in Annexure R33/C are Identified Records for the purposes of RMS Q Annexure Q/E.

1.2.3 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements shown in Annexure R33/D and must be implemented.

If the Contract does not require you to implement a PROJECT QUALITY PLAN, the documents shown in Annexure R33/D must be submitted to the Principal for consideration at least 5 working days prior to work commencing and must be implemented.

1.2.4 Minimum Frequency of Testing

Your Inspection and Test Plan must nominate the proposed testing frequency to verify conformity of the item, which must not be less than the frequency specified in Annexure R33/L. Where a minimum frequency is not specified, nominate an appropriate frequency.

1.2.5 Reference Documents

Unless otherwise specified or is specifically supplied by the Principal, the applicable issue of a reference document is the issue current at the date one week before the closing date for tenders, or where no issue is current at that date, the most recent issue.

Standards, specifications and test methods are referred to in abbreviated form (e.g. RMS T108). For convenience, the full titles are given in Annexure R33/M.

1.3 DEFINITIONS

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

The term “pipe” in this Specification also applies to rigid strip filter materials where relevant.

2 MATERIALS

Corrugated plastic drainage pipe must comply with Specification RMS 3552. Caps and other fittings must be in accordance with the manufacturer’s recommendations.

Seamless tubular filter fabric must comply with Specification RMS 3553.

Rigid strip filter must comply with Specification RMS 3556.

Geotextile must comply with Specification RMS R63. Geotextile for wrapping around rigid strip filter (see Clause 3.4) must be non-woven geotextile of Strength Class A.

Geocomposite plastic filter strips may also be accepted as an alternative for subsoil drainage subject to compliance with the relevant sections of AS 2439.1. The filter strip may be either a rigid or flexible plastic core with slots or openings and shall be totally encased in a specially manufactured and fitted geotextile fabric.

You must provide copies of certificate of compliance from the manufacturer verifying that the filter strip satisfies the requirements of AS2439.1 and details of manufacturers recommended construction method for the filter strip including connections to structures.

Filter material may be either aggregate filter material or no fines concrete.

Aggregate filter material must comply with Specification RMS 3580 and **Model Drawing MD.R33.A06** for the aggregate type.

No fines concrete must be Grade NFC SD complying with Specification RMS 3222.

Aggregate filter material of any size may be substituted by Grade NFC SD no fines concrete.

Selected material must meet the requirements of Specification RMS R44. Selected fill material for the plug used in staged construction must in addition have a maximum particle size not exceeding 20 mm and Plasticity Index not exceeding 12, as determined by Test Methods RMS T108 and RMS T109. Selected material at batter outlets and at the transverse outlets of pavement interface drains must in addition have a maximum particle size not exceeding 50 mm.

For each type of material, submit to the Principal the brand, the name of the supplier and compliance records at least seven (7) days prior to their use.

3 INSTALLATION OF TRENCH DRAINS

3.1 ORDER OF CONSTRUCTION

Where trench drains are to be installed in embankment foundations, construct the trench drains after completion of clearing, stripping and general excavation operations, but preceding the commencement of embankment construction adjacent to the trench drain.

If trench drains are required in cuttings, construct the trench drains as soon as practicable following completion of earthworks.

Where the top of earthworks is to be stabilised, construct the trench drains after completion of stabilisation. Where excessive ground water is encountered, trench drains may be installed prior to stabilisation if approved by the Principal.

3.2 EXCAVATION

Unless otherwise detailed or directed, locate trenches for longitudinal drains so that the pipe centre line will be either directly under the kerb or immediately in front of the kerb.

Excavate for the trench to the required line, grade, width and depth as shown on the Drawings or as directed by the Principal.

Unless otherwise detailed, trenches for corrugated plastic pipe subsoils shall be a minimum 200mm wide and 600mm deep under the Subgrade unless otherwise shown on the drawings.

Unless otherwise specified, the bottom of the trench must be at the same grade as the roadway. Where the longitudinal grade of the roadway is less than 0.5%, provide a minimum grade of 0.5% by increasing the depth of the trench. ***Trenches shall be graded such that the subsoil drains can discharge into a drainage structure.***

For trench drains constructed in foundations, the minimum grade must be 0.5%.

Prevent any localised ponding of water from occurring in the trench. Compact the floor of the trench and remove any loose material. ***If ponding occurs the trench floor shall be filled with non-porous subgrade material and compacted to 90% Modified Maximum Dry Density.***

Excavated material must be stockpiled and incorporated in the works or disposed of in accordance with RMS R44.

3.3 GEOTEXTILE INSTALLATION

Where shown on the Drawings, provide a geotextile at the interface between the filter material (comprising either aggregate or no fines concrete) and the adjacent earth material. Provide overlaps of the geotextile as shown on the Model Drawings.

When installing geotextile, do not allow loose material from trench walls or outside the trench to enter the excavation.

Keep all geotextiles clean, and secure the geotextile to ensure that they are located as shown on the Drawings on completion of backfilling.

3.4 LAYING OF PIPE/STRIP FILTER

Lay the pipe/strip filter in the centre of the trench on a bed of filter material 100 mm in thickness to the required line and grade as shown on the Drawings. Detail in the PROJECT QUALITY PLAN the method of maintaining the pipe at the required position.

Keep the number of joints in the pipeline to the minimum, and connect the pipes using couplings complying with the manufacturer's recommendations.

Where an inlet into the trench drain is provided at a stormwater pit, the invert level of the inlet must be above the hydraulic grade line of the pit and as close to the underside of the pavement layer as possible.

Cap the upstream end of buried pipes where the upstream end of the pipe is enclosed within filter material and is not connected to a stormwater pit.

Where the filter material around the pipe is Grade F5 or F7 aggregate filter material (refer RMS 3580),

- (i) for corrugated perforated plastic drainage pipe, install a seamless tubular filter fabric around the pipe;
- (ii) for rigid strip filter, wrap the pipe with non-woven geotextile of Strength Class A. The geotextile must encapsulate the rigid strip filter and be joined by heat or an electrically generated welding process.

3.5 BACKFILLING

Backfill and compact the trench with filter material *to a density index of 70. The first layer above the pipe shall be 300mm deep* ~~to the level shown on the Drawings~~. Trench drains under road pavement in trafficked areas or future trafficked areas must be backfilled with no fines concrete.

Compact the filter material to its full depth to avoid post-construction consolidation and to provide an even surface at the same level as the adjacent material.

Detail in the PROJECT QUALITY PLAN how aggregate filter material will be placed and compacted in trench drains to prevent post construction consolidation.

Where no fines concrete is used as filter material, detail in the PROJECT QUALITY PLAN your method of placing the no fines concrete to prevent segregation during placing and the formation of a slurry layer at the surface of the concrete which may prevent the passage of water into the filter material. The no fines concrete as placed must allow the free flow of water through it.

HOLD POINT

Process Held:	Covering the drainage pipe with filter material.
Submission Details:	Verification that pipe laying, jointing and bedding are complete and conforming.

Release of Hold Point: The Principal may inspect the drainage pipe in the trench, prior to authorising the release of the Hold Point.

3.6 STAGE CONSTRUCTION

In stage construction of trench drains (refer Model Drawing MD.R33.A07), after construction of the underlying trench drain, protect the filter material placed for the underlying trench drain from scour and/or contamination by overlapping the geotextile above the underlying trench drain and placing a sacrificial geotextile or plastic sheet as shown on the Model Drawings.

Any overlap must be at least 100 mm and must be made and secured in a manner such that no adjacent material can enter the trench drain.

Place and compact above the sacrificial geotextile or plastic sheet a 50 mm thick plug of selected fill material (Stage 1).

Place and compact above the plug the selected material for the Selected Material Zone (Stage 2).

Excavate and remove the selected material and plug above the underlying trench drain (Stage 3). Remove any contaminated filter material in the underlying trench drain to expose the clean filter material underneath. Do not disturb the previously laid perforated corrugated pipe and filter sock or damage the geotextile wrapping.

Extend the height of the underlying trench drain comprising filter material and geotextile wrapping to the underside of the pavement. The alignment and width of the trench must be the same as the underlying trench drain.

After completion of the extension of trench drain, place the overlying pavement layers (Stage 4). The trench drain including geotextile wrapping must not be disturbed or contaminated prior to placing the pavement layers above and adjacent to the drain.

4 OUTLETS

4.1 GENERAL

Provide outlets at the intervals as shown on the Drawings.

Ensure that suitable outlets are available for trench drains and that no surcharge of the trench drain system from water courses, table drains or stormwater systems occurs.

Where possible, water from trench drains must discharge to stormwater pits and other stormwater drainage structures.

Where discharge is to the surface or an open drain, construct an endwall as detailed in drawings. Fit wire guards to end walls as detailed in drawings.

4.2 OUTLETS AT STORMWATER DRAINAGE STRUCTURES

Where the outlet of the trench drain is at a stormwater pit or other stormwater drainage structure, the height of the pipe invert above the base of the trench drain must taper from 100 mm to zero within the end 5 metres from the outlet.

Where a trench drain is one without a pipe, provide 10 metres of corrugated perforated plastic pipe immediately upstream of the outlet and taper the height of the pipe invert as described above to facilitate discharge of water. Fit the upstream end of the pipe with a suitable cap to prevent entry of material.

4.3 OUTLETS AT BATTERS

Where it is not possible to connect the trench drain to a stormwater pit or other stormwater drainage structure, construct an outlet at the batter to discharge water beyond the edge of the road shoulder.

The outlet pipe must be of the same type and size as those in the trench drain but must be non-perforated for the length extending beyond the edge of the pavement.

Lay the non-perforated section of pipe at the base of the trench. Taper the height above the base of the trench of the connecting section of perforated pipe, from zero to 100 mm, over a 2 m length.

Backfill the trench along this section of pipe with selected material of maximum particle size of 50 mm, and compacted to a relative compaction of 95% as determined by Test Method RMS T166.

Construct a batter outlet structure at the discharge end in accordance with the Drawings. Locate the outlet so that erosion of the adjacent area does not occur, or protect the outlet by placing selected stone in the splash zone.

5 PAVEMENT INTERFACE DRAINS

5.1 GENERAL

Pavement interface drains are used to drain the interface between pavements with different structures. The interface may be in a transverse or longitudinal orientation.

The drain must extend 300 mm below the selected material zone and be constructed in accordance with the requirements for trench drains except that the filter material must be Grade NFC SD no fines concrete.

5.2 OUTLETS FOR PAVEMENT INTERFACE DRAINS

5.2.1 Transverse Pavement Interface Drains

Transverse pavement interface drains connect on to adjacent trench drains, or discharge directly into stormwater pits or at batter outlets.

5.2.2 Longitudinal Pavement Interface Drains

Outlets for longitudinal pavement interface drains must be created at the same spacing required for trench drains by either:

- (a) discharging into a non-perforated parallel carrier pipe in the same trench, or
- (b) discharging into a trench drain or pit at the outer edge of the pavement by a transverse non-perforated pipe.

Where a parallel carrier pipe is provided as an outlet, widen the trench to allow for the placement of an additional pipe, with 50 mm spacing between pipes, and connect the perforated pipe to the non-perforated carrier pipe using the pipe manufacturer's recommended Y-coupling. Cap the upstream end of the subsequent perforated pipe.

Where a transverse non-perforated pipe discharging to a trench drain at the outer edge of the pavement is provided as an outlet, excavate a 300 mm wide trench to a depth of 300 mm below the base of the selected material zone, lay the non-perforated pipe on a 100 mm thick bed of selected material and backfill to the top of the trench with selected material. In sags or low points, place the non-perforated pipe on the base of the excavation.

Compact the selected material to a relative compaction of 95% as determined by RMS T166.

6 MARKING OF TRENCH DRAINS

Record all inlets and outlets for the trench drains using GPS coordinates in WGS 84 format.

Mark "Work-as-Executed" drawings of the completed drainage system with GPS coordinates for the start and finish of the trench drains *and levels* on relevant extracts of half-size drawings for the Works and submit them to the Principal within 28 days of completion of the trench drain work.

Physically mark on site the inlets and outlets of all trench drains. Detail in the PROJECT QUALITY PLAN the method of marking the locations of trench drains, to prevent damage during construction.

Mark risers on all subsoil drains by stencilling "SS" in letters 50mm high on concrete surrounds to cast iron boxes, as per [Standard Drawing DS6-05](#)

Comment [dz1]: Need to find the standard drawing

7 NON-CONFORMING WORK

A non-conformance report shall be submitted to the Superintendent for any non-conformance detected. Work shall not proceed on any nonconforming item until the Superintendent has approved the disposition for the non-conformance.

For non-conforming compaction scarify the area for the full depth of the layer and add water as necessary. Mix mechanically to ensure uniform distribution of moisture before commencing rolling.

Correction of non-conforming work is at your expense.

ANNEXURE R33/A – (NOT USED)

ANNEXURE R33/B – MEASUREMENT AND PAYMENT

Payment will be made for all activities associated with completing the work detailed in this Specification in accordance with the following Pay Items.

A lump sum price for these items is not acceptable.

If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by you it is understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

Pay Item R33P1 – Excavation

The unit of measurement is the cubic metre measured, as bank volume of excavation in all types of material.

The volume of excavation must be computed from the length, depth and width of the trench, as shown on the Drawings or as directed by the Principal.

No payment will be made for any work as a result of over-excavation.

The rate includes excavation, handling, stockpiling, incorporation in the Works or disposal off site of the excavated material in accordance with the requirements of RMS R44.

Pay Item R33P2 – Drainage Pipe

Pay Item R33P2.1 - 100 mm dia Corrugated Perforated Plastic Drainage Pipe

Pay Item R33P2.2 - 100 mm dia Corrugated Non-perforated Plastic Drainage Pipe

Pay Item R33P2.3 - Perforated Rigid Strip Filter

Pay Item R33P2.4 - Non-perforated Rigid Strip Filter

The unit of measurement is the lineal metre, measured along the centreline of the pipe as the actual length laid.

The rate includes the supply and laying of the pipe or strip filter, including any connections, fittings or seamless tubular filter fabric where necessary.

Pay Item R33P3 – Filter Material

Pay Item R33P3.1 - Aggregate Filter Material

Pay Item R33P3.2 - No Fines Concrete

The unit of measurement is the compacted cubic metre.

The volume must be computed from the length, depth and width of aggregate or no fines concrete filter material as shown on the Drawings or as directed by the Principal.

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The rate includes the supply, placement and compaction of the filter material.

Pay Item R33P4 – Supply and Installation of Geotextile

The unit of measurement is the square metre, measured using the theoretical cross section (including any overlaps) as shown on the Drawings and the length installed in place.

The rate includes supply and installation of the geotextile.

Pay Item R33P5 – Selected Material Backfill

Pay Item R33P5.1 – Selected Fill Material for Plug

Pay Item R33P5.2 – Selected Material at Batter Outlets

The unit of measurement is the cubic metre, measured as the compacted volume.

The volume must be computed from the length, depth and width of selected material backfill as shown on the Drawings or as directed by the Principal.

The rate includes the supply, placement and compaction of the selected material.

Pay Item R33P6 – Batter Outlets

Pay Item R33P6.1 - Steep Batter Outlet

Pay Item R33P6.2 - Flat Batter Outlet

Steep batters are defined in Model Drawing MD.R33.A04 as steeper than 4(H):1(V).

The unit of measurement for Pay Items R33P6.1 and R33P6.2 is "each" outlet provided in accordance with this Specification. The rate includes concrete, reinforcing bar and galvanised mesh cover.

ANNEXURE R33/C – SCHEDULES OF HOLD POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.2.2.

C1 SCHEDULE OF HOLD POINTS

Clause	Description
3.5	Covering drainage pipe with filter material

C2 SCHEDULE OF IDENTIFIED RECORDS

The records listed below are Identified Records for the purposes of RMS Q Annexure Q/E.

Clause	Description of the Identified Record
2	Brand, supplier and compliance records for each type of material
3.5	Notification that pipe laying, jointing and bedding are complete and conforming
6	Work-as-Executed drawings of the completed drainage system

ANNEXURE R33/D – PLANNING DOCUMENTS

Refer to Clause 1.2.3.

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 Contract must be reviewed to determine additional documentation requirements.

Clause	Required Planning Document
3.4	Method of securing the pipe while backfilling
3.5	Method of compacting filter material
3.5	Method of placing aggregate filter material and no fines concrete
6	Method of marking trench drains

ANNEXURES R33/E TO R33/K – (NOT USED)

ANNEXURE R33/L – MINIMUM FREQUENCY OF TESTING

Clause	Characteristics Tested	Test Method	Minimum Frequency of Testing
2	Material properties	As per relevant materials specification	As per relevant materials specification
4.3	Relative compaction of selected material adjacent to batter outlets	RMS T166	One per 15 batter outlets or part thereof
5.2	Relative compaction of selected material in pavement interface drains	RMS T166	One per pavement interface drain

ANNEXURE R33/M – REFERENCE DOCUMENTS

Refer to Clause 1.2.5.

RMS Specifications

RMS Q	Quality Management System
RMS R38	Edge Drains
RMS R44	Earthworks
RMS R63	Geotextiles (Separation and Filtration)
RMS 3222	No Fines Concrete (for Subsurface Drainage)
RMS 3552	Subsurface Drainage Pipe (Corrugated Perforated and Non-Perforated Plastic)
RMS 3553	Seamless Tubular Filter Fabric
RMS 3556	Rigid Strip Filters
RMS 3580	Aggregate Filter Materials for Subsurface Drainage

RMS Test Methods

RMS T108	Liquid Limit of Road Materials
RMS T109	Plastic Limit and Plasticity Index of Road Materials
RMS T166	Relative Compaction of Road Construction Materials