

# TRANSPORT FOR NSW (TfNSW)

## QA SPECIFICATION R33

### TRENCH DRAINS

#### NOTICE

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#### REVISION REGISTER

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
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 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

<b>Ed/Rev Number</b>	<b>Clause Number</b>	<b>Description of Revision</b>	<b>Authorised By</b>	<b>Date</b>
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	1.1  2  3.1  3.3  3.4  3.5  3.6  4  5	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.  Requirement to allow in program for construction of trench drains not shown on Drawings deleted. Reference to spec R38 for edge drains requirements inserted.  Expanded to include no fines concrete, filter fabric, aggregate filter material.  Previous clause 4.1. Requirement to prevent contamination of filter material inserted.  Previous clause 4.3 retitled “Geotextile Installation” and requirements expanded.  Previous clause 4.4. Requirements for pipe laying expanded.  Previous clause 4.5. Backfilling requirements changed.  New clause titled “Stage Construction”. All clauses relating to stage construction previously under other clauses collated under this clause 3.6.  Previous clause 4.7. Outlets requirements expanded under 3 sub-clauses 4.1, 4.2 & 4.3.  New clause titled “Pavement Interface Drains” added.	GM, IC	16.05.11

<b>Ed/Rev Number</b>	<b>Clause Number</b>	<b>Description of Revision</b>	<b>Authorised By</b>	<b>Date</b>
Ed 4/Rev 0 (cont'd)	6  Annex B  Annex C Annex D Annex L Annex M	Previous clause 5 retitled "Marking of Trench Drains". Physical marking replaced by GPS coordinates.  Pay Items rearranged and renumbered. Measurement and Payment description of excavation and backfill volumes changed. Pay items for sand filter material and cleanouts deleted.  Updated.  Updated.  Requirements changed.  Reference documents updated.		
Ed 4/Rev 1	6	Clarification of requirement to mark drains physically on site.	GM, IC	17.06.11
Ed 4/Rev 2	6	Clause reworded to improve clarity.	GM, CPS	24.09.13
Ed 4/Rev 3	2  Annex B	Headings added to form new (sub-)clauses 2.1 to 2.4.  Pay Item P1 - Clarification added that no further payment will be made under R44 for excavation and backfilling work.  Pay Item P2 – Scope of rate clarified.	MCQ	28.06.19
Ed 4/Rev 4	Global	References to "Roads and Maritime Services" or "RMS" changed to "Transport for NSW" or "TfNSW" respectively.	DCS	22.06.20
Ed 4/Rev 5	Global	Minor editorial changes.	EDCS	21.08.20





# 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 Specification TfNSW R33 Edition 4 Revision 4.

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 are 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~~.



# TfNSW QA SPECIFICATION R33

## TRENCH DRAINS

### 1 GENERAL

#### 1.1 SCOPE

This Specification sets out the requirements for the construction 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 TfNSW 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 TfNSW Q for the definition of **HOLD POINTS**.

The records listed in Annexure R33/C are **Identified Records** for the purposes of TfNSW 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.

##### 1.2.4 Minimum Frequency of Testing

The 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 Referenced Documents

Unless specified otherwise or is specifically supplied by the Principal, the applicable issue of a referenced 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. TfNSW 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 “filter material” in this Specification applies to both aggregate filter material and no fines concrete.

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

## **2 MATERIALS**

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.

### **2.1 CORRUGATED DRAINAGE PIPE AND RIGID STRIP FILTER DRAIN**

Corrugated plastic drainage pipe (both perforated and non-perforated) must comply with Specification TfNSW 3552. Caps and other fittings must be in accordance with the manufacturer’s recommendations.

Seamless tubular filter fabric for use with corrugated perforated plastic drainage pipe must comply with Specification TfNSW 3553.

Rigid strip filter drain must comply with Specification TfNSW 3556.

### **2.2 GEOTEXTILE**

Geotextile must comply with Specification TfNSW R63.

Geotextile for wrapping around rigid strip filter drain (see Clause 3.4) must be non-woven geotextile of Strength Class A.

### **2.3 AGGREGATE FILTER MATERIAL AND NO FINES CONCRETE**

Filter material for the trench drain may be either aggregate filter material or no fines concrete.

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

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

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

### **2.4 SELECTED MATERIAL**

Selected Material must meet the requirements of Specification TfNSW R44. 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.

Selected Fill Material for the plug used in staged construction must meet the requirements of Specification TfNSW R44 and must, in addition, have a maximum particle size not exceeding 20 mm

and Plasticity Index not exceeding 12, as determined by Test Methods TfNSW T108 and TfNSW T109.

### **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**

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 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.

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.

Excavated material must either be stockpiled and incorporated in the Works or disposed of in accordance with TfNSW R44.

#### **3.3 GEOTEXTILE INSTALLATION**

Where shown on the Drawings, provide a geotextile at the interface between the filter material 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 DRAINS**

Lay the pipe/rigid strip filter in the centre of the trench on a bed of filter material 100 mm thick 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 TfNSW 3580),

- (a) for corrugated perforated plastic drainage pipe, install a seamless tubular filter fabric around the pipe;
- (b) for rigid strip filter drain, wrap the strip filter drain 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 the trench with filter material 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.

Where no fines concrete is used, implement measures during placing to prevent segregation and formation of a slurry layer at the surface of the concrete, which may prevent the passage of water into the filter material. Ensure that the no fines concrete as placed allows the free flow of water through it.

Detail in the PROJECT QUALITY PLAN the method of placing and compacting the filter material to achieve the above requirements.

#### **HOLD POINT**

Process Held: Backfilling over the drainage pipe in the trench 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**

For 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.

### **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 m 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 TfNSW 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 TfNSW T166.

## **6 MARKING OF TRENCH DRAINS**

During construction, physically mark out on site the inlets (or upstream ends where there are no distinct inlets) and outlets of all subsurface drains, to avoid damage to them during construction. Detail in the PROJECT QUALITY PLAN the method of marking these locations.

Mark on the work-as-executed drawings of the completed drainage system the GPS coordinates of the “start” and “finish” positions of the subsurface drains on relevant extracts of half-size drawings for the Works and submit them to the Principal within 28 days of completion of the subsurface drainage work. The GPS coordinates must be in WGS 84 format.

## **ANNEXURE R33/A – (NOT USED)**

## **ANNEXURE R33/B – MEASUREMENT AND PAYMENT**

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

Where no specific pay items are provided for a particular item of work, the costs associated with that item of work are deemed to be included in the rates and prices generally for the Work Under the Contract.

Unless otherwise specified, a lump sum price for any of these items will not be accepted.

### **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 is 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 covers all costs associated with excavation, handling, stockpiling and incorporation into the Works or disposal off Site of the excavated material in accordance with the requirements of TfNSW R44. No further payment will be made for this work under TfNSW 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 Drains**

#### **Pay Item R33P2.4 - Non-perforated Rigid Strip Filter Drains**

The unit of measurement is the “lineal metre”, measured along the centreline of the pipe/drain.

The rate covers all costs associated with the supply and laying of the corrugated pipe or strip filter drains, including any connections, fittings, seamless tubular filter fabric, geotextile wrapping (around the strip filter drain) and markers where necessary.

Geotextile wrapping around the filter material is paid under Pay Item R33P4.



**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”, computed from the length, width and depth of the volume of aggregate filter material or no fines concrete within the trench as shown on the Drawings or as directed by the Principal.

The rate covers all costs associated with 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”, computed using the length, cross sectional width and depth (including any overlaps) as shown on the Drawings.

The rate covers all costs associated with the 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 is computed from the length, depth and width of Selected Material backfill as shown on the Drawings or as directed by the Principal.

The rate covers all costs associated with 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 is “each” outlet provided in accordance with this Specification. The rate includes concrete, reinforcing bar and galvanized mesh cover.

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

Refer to Clause 1.2.2.

### **C1 SCHEDULE OF HOLD POINTS**

<b>Clause</b>	<b>Description</b>
3.5	Covering drainage pipe with filter material

### **C2 SCHEDULE OF IDENTIFIED RECORDS**

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

<b>Clause</b>	<b>Description of Identified Record</b>
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.

<b>Clause</b>	<b>Description</b>
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**

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

**ANNEXURE R33/M – REFERENCED DOCUMENTS**

Refer to Clause 1.2.5.

**TfNSW Specifications**

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

**TfNSW Test Methods**

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