

Technical Specification

**Transport and Main Roads Specifications
MRTS38 Pavement Drains**

July 2017

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1 Introduction

This Technical Specification applies to the supply and construction of pavement drains as follows:

- a) Type A - Pavement drains that are used in trafficked areas where new pavements abut old, and in other areas considered appropriate for their use. These drains shall consist of a strip filter and backfill (filter) material in accordance with the requirements of this Technical Specification.
- b) Type B – Not Used, and
- c) Type C – Not Used.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual and shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate (including those described in Clause 4), and the drawings for the Works.

For pavement drains, unless otherwise specified in the drawings, this Technical Specification has precedence over MRTS03 *Drainage, Retaining Structures and Protective Treatments*.

2 Definition of terms

The terms in this Technical Specification shall be as defined in Table 2 and the references listed below, with possible conflict of definition being resolved by prioritising them in order of the listing:

- a) MRTS01 *Introduction to Technical Specifications*, Clause 2, and
- b) AS 1348.

Pavement drains shall comply with the details shown on the drawings.

Table 2 – Definition of terms

Term	Definition
Distortion	The vertical bending, bowing, buckling or crushing of the rectangular, vertical cross-section of the strip filter. Distortion may be caused by a range of construction related activities including dragdown forces resulting from placement and compaction of the backfill. When distortion takes the shape similar to the letter “C” or “J”, it is known as “C”-ing or “J”-ing respectively. Distortion can substantially decrease flow, increase collection of fines, decrease strength to resist compression forces, and raise the effective interior fluid flow long to unacceptable elevations.
Flexible Strip Filter	Is a proprietary product consisting of a flexible geocomposite plastic strip filter consisting of cusped (single or double) or column type plastic core with or without slotted perforations, encased in a geotextile which acts as part of the structural composite.
Rigid Strip Filter	Is a proprietary product consisting of a rigid geocomposite plastic strip filter, being either: <ul style="list-style-type: none"> • an elongated corrugated core with slotted perforations encased in geotextile, or • a rectangular modular core with openings, encased in geotextile which acts as part of the hydraulic filter.
Strip Filter	Is either a flexible strip filter or a rigid strip filter
Strip Filter Fittings	Includes joints, connections, cleanout pipes and outlet pipes

3 Referenced documents

The Technical Specifications referred to or required for the purposes of this Technical Specification are detailed in Table 3.

Table 3 – Referenced documents

Reference	Title
AS 1348	<i>Road and Traffic Engineering – Glossary of Terms</i>
AS 1477 Series 1	<i>PVC pipes and fittings for pressure applications</i>
AS 2439.1	<i>Perforated plastics drainage and effluent pipe and fittings - Perforated drainage pipe and associated fittings</i>
MRTS01	<i>Introduction to Technical Specifications</i>
MRTS03	<i>Drainage, Retaining Structures and Protective Treatments</i>
MRTS04	<i>General Earthworks</i>
MRTS05	<i>Unbound Pavements</i>
MRTS27	<i>Geotextiles (Separation and Filtration)</i>
MRTS50	<i>Specific Quality System Requirements</i>
MRTS70	<i>Concrete</i>
SD1116	<i>Subsoil drains - Outlets and cleanouts</i>
SD1358	<i>Maintenance marker posts - Post and installation details</i>

4 Standard test methods

Standard test methods that are used in this Technical Specification are as detailed in:

- a) MRTS03 *Drainage, Retaining Structures and Protective Treatments*, MRTS05 *Unbound Pavements*, MRTS27 *Geotextiles (Separation and Filtrations)*, and
- b) Table 4.

Table 4 – Standard test methods

Tested Method	Test Method No.
Vertical Compression of Geocomposite Pavement Panel Drains	ASTM 6244
Compressive Properties of Rigid Cellular Plastics	ASTM D1621
Determining Dimensions of Thermoplastic Pipe and Fittings	ASTM D2122
Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading	ASTM D2412
Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head	ASTM D4716
Inspection of Installed Pavement Drains using Bore Scope	Q191

5 Quality system requirements

5.1 General

The strip filter manufacturer shall establish and maintain a Quality Management System in accordance with ISO 9001.

Testing under ASTM test methods shall be conducted by a laboratory accredited under the following:

- a) NATA
- b) NATA's partners by MRA (Mutual Recognition Arrangements), or
- c) GAI-LAP (USA).

5.2 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 5.2.

Table 5.2 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
5.3	1. Approval of construction procedures and strip filter data and sample		
6.1	2. Approval of no fines concrete mix design		Submit details of proposed no fines concrete mix design
7.2	3. Pavement drain installation trial		
7.3	4. Trench excavation		
8		1. As-constructed drawings prepared	

5.3 Construction procedures and strip filter data and sample

The Contractor shall prepare documented procedures for all construction processes as defined in Clause 5 of MRTS50 *Specific Quality System Requirements*. Procedures shall be submitted to the Administrator in accordance with Clause 5 of MRTS50 *Specific Quality System Requirements*.

The Contractor shall forward the following, all of which shall demonstrate compliance with the Technical Specification requirements, to the Administrator:

- a) A copy of the Manufacturer's Technical Data Sheet for the strip filter, which shall include at least the following:
 - i. manufacturer's name and trademark
 - ii. the nominal height and width of the strip filter
 - iii. the nominal slot width and length and % perforation area
 - iv. materials types and thicknesses, and

- v. typical range of test results for specified properties.
- b) The test results for the tests in Table 6.2.1 where the date of testing is consistent with the time limits specified in Clause 10.1.4.
- c) A sample of the strip filter from the manufacturer, and
- d) The Contractor's Construction Procedure where the Construction Procedure shall:
 - i. meet the requirements of the strip filter manufacturer and this Technical Specification
 - ii. detail procedures for trenching/excavation, and
 - iii. detail procedures for the strip filter installation including:
 - handling of and placement of strip filter including procedures for ensuring that the strip filter is held at the required grade and (vertical) upright positioning during backfilling (for example, staking, fixing with pins)
 - orientation of strip filter in relation to the pavement in order to assure drainage
 - installation and placement of fittings
 - inspection ports and their installation
 - methods and materials for ensuring rodents do not enter the drains, and
 - the Contractor's practices for ensuring fittings are not crushed during and after construction.
 - iv. backfilling including material placement and compaction technique, and
 - v. processes for removal and replacement of pavement drain if required.

The Contractor shall allow the Administrator 14 days to consider the sample, data, test results and Construction Procedure. The pavement drain shall not be trialled or placed in the works until written approval has been obtained from the Administrator for the sample, data, test results and Construction Procedure. **Hold Point 1**

The conformance requirements that apply to lots of pavement drains covered by the Technical Specification are summarised in Clauses 6, 7, 8, 9 and 10.

5.4 Testing frequencies

The minimum testing frequencies for work covered by this Technical Specification are specified in Clause 10.

6 Materials

6.1 No fines concrete

No fines concrete shall conform to the no fines concrete requirements stated in MRTS70 *Concrete* and be of 20 mm nominal size. The Contractor shall submit details of the no fines concrete mix design to the Administrator for approval not less than six weeks prior to the commencement of concrete operations in accordance with the requirements of Clause 11.2 of MRTS70 *Concrete*. **Milestone**

The no fines concrete backfill shall not be placed in the Works until written approval has been obtained from the Administrator for the mix design and concrete plant in accordance with the requirements of MRTS70 *Concrete*. **Hold Point 2**

6.2 Strip filter

6.2.1 Minimum requirements

The strip filter together with their fittings shall meet the requirements of Clauses 3, 4, 7 and 8 of AS 2439.1. In this Technical Specification, the work 'pipe' is to include both rigid and flexible geocomposite plastic strip filter.

The strip filter shall meet the following requirements:

- a) The plastic(s) that shall be used to manufacture the strip filter plastic core and fittings shall:
 - i. comply with the requirements of this Technical Specification at the time of manufacture and for a period of a minimum of 24 months after installation, and
 - ii. additives containing compounds based on lead, cadmium or mercury shall not be used.
- b) The strip filter shall be designed to allow the drainage of water along the drain and encased by a non-woven geotextile which complies with the provisions of MRTS27 *Geotextiles (Separation and Filtration)*.
- c) The strip filter and fittings shall comprise a high density polyethylene core where the strip filter minimum dimensions are:
 - i. 300 mm height, and
 - ii. 25 mm thickness.
- d) The tolerance on the specified height and thickness dimensions shall be within plus or minus 5.0% of the specified value and measurements of dimensions shall be made in accordance with Test Method ASTM D2122.
- e) The strip filter geotextile shall comply with the following requirements of MRTS27 *Geotextiles (Separation and Filtration)*:
 - i. for flexible strip filters – Strength Class B and Filtration Class I, and
 - ii. for rigid strip filters – Strength Class A and Filtration Class I.
- f) The geotextile sleeve may be seamed by sewing, gluing, or thermal bonding, or may be a tubular knit and:
 - i. For flexible strip filters, the geotextile shall be attached to the plastic core by gluing with a water insoluble glue where:
 - for flexible strip filters with cusps, the top of each cusp shall be glued to the geotextile
 - for flexible strip filters with a flat face, the flat face shall be sufficiently glued to ensure no slippage of the geotextile on the face of the strip filter during installation and use
 - for flexible strip filters with both a cusped face and a flat face, the top of each cusp shall be glued to the geotextile and the flat face shall be sufficiently glued to ensure no slippage of the geotextile on the face of the strip filter during installation and use, and
 - attachment of the geotextile by gluing shall remain intact during installation and use including during water inundation and temperature change.
 - ii. For rigid strip filters, geotextile shall be placed around the core.

- g) The core of a flexible strip filter shall have a minimum perforation open area of 10% of the total area on the least open side.
- h) The core of a rigid strip filter shall have a minimum perforation open area of 3.4% of the surface area.
- i) The strip filter shall comply with the performance requirements specified in Table 6.2.1.

Table 6.2.1 – Strip filter performance requirements

Property	Test Method	Unit	Limit	Value
Change in Core Area	ASTM D6244	% loss of cross-sectional area at 156.5 kPa	Maximum	5
Deficient condition	Q191	% of total length	Maximum	0
Flow Capacity with 200 kPa confining pressure and 0.5 hydraulic gradient	ASTM D4716	L / min / m width	Minimum	300
Horizontal Compressive Strength at 20% deflection	ASTM D2412 / ASTM D1621	kPa	Minimum	200

6.2.2 Storage, packaging, transportation

Strip filters and their fittings shall be stored, packaged and transported as follows:

- a) shall be packaged, stored and transported in such a way as to prevent damage
- b) shall be stored under protective cover or wrapped with a waterproof, opaque UV protective sheeting including the ends of rolls to avoid damage prior to installation
- c) shall not be stored on the ground or in a manner in which may result in it being crushed or affected by heat, sunlight or moisture
- d) any ties used shall not cause permanent denting or deformation of the pipe, and
- e) the method of storage shall be in accordance with any additional recommendations set by the Manufacturer.

6.2.3 Identification

Each lot of strip filter supplied must be clearly marked with the following information on an adhesive label affixed to the packaging:

- a) the manufacturer's name and / or trademark
- b) the nominal height and width of the strip filter
- c) the nominal slot width and length (if applicable)
- d) strip filter length
- e) date of manufacture, and
- f) unique coil / batch number.

6.3 Cleanout and outlet pipes

The cleanout and outlet pipes shall, as a minimum, be 100 mm PVC Class 18 pressure pipe to AS 1477 Series 1.

6.4 Marker posts

Marker posts shall be tubular steel and comply with the requirements shown on the Standard Drawings.

Concrete used for the installation of the marker posts shall be 20 MPa/20.

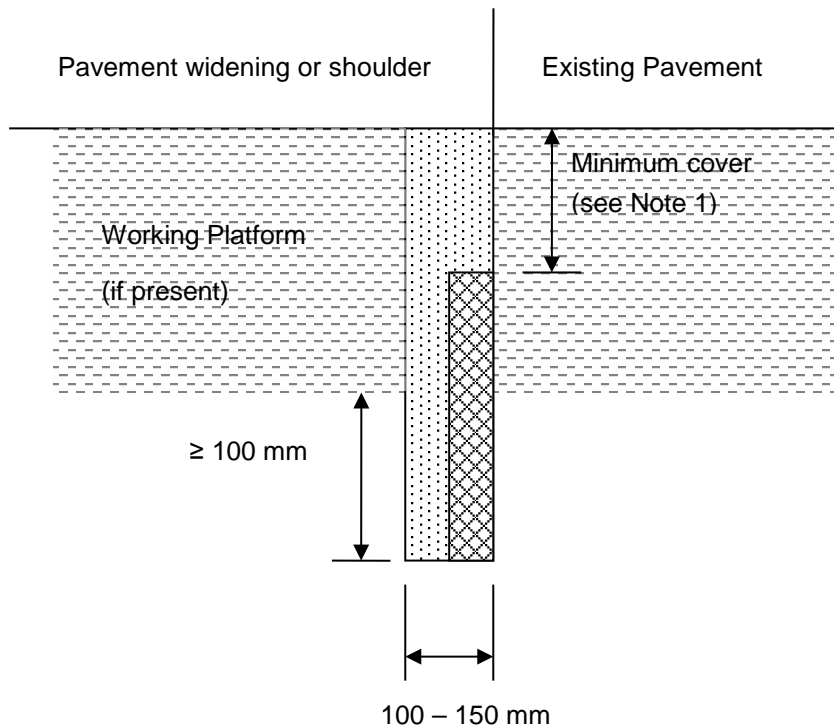
7 Construction

7.1 General

Pavement drains shall be constructed as shown on the Drawings. Where type cross-sections for pavement drains are not included in the Drawings, the following requirements shall also apply:

- dimensions shall be in accordance with the requirements detailed in Figure 7.1, and
- the bottom of the pavement drain shall be not less than 100 mm below the bottom of the Working Platform, or the bottom of the lowest pavement layer where a working platform is not provided.

Figure 7.1 – Pavement drain cross section



Note 1: Minimum cover for various compactors unless otherwise recommended by the manufacturer and approved by the Administrator:

Hand Held Units – 100 mm

Units < 15 tonnes – 200 mm

Units > 15 tonnes – 300 mm

Where pavement drains are to be installed after the construction of the working platform and / or pavement layer(s), the working platform material shall be excavated to the required line, grade, width and depth as shown on the Drawings.

Where a vertical face on the trench cannot be achieved, in order to meet the requirements for backfilling in accordance with Clause 7.4.3, the strip filter may be located centrally in the lateral direction of the trench where the positioning of the strip filter in the drain shall meet all other requirements of Clause 7.4.2.

7.2 Placement trial

The Contractor shall undertake a pavement drain installation trial using the Contractor's Construction Procedures. The trial may be incorporated into the Work and shall not be less than 100 m long. The trial shall determine the adequacy of the Construction Procedures to achieve the requirements of this Technical Specification for:

- a) excavation to achieve the strip filter location in the trench, and the line and grade within specified geometric tolerances, and
- b) installation of the strip filter and fittings including backfilling.

The Contractor shall install not less than one inspection port as part of the placement trial.

When instructed by the Administrator, the Contractor will test the pavement drain in accordance with Q191 after installation, but prior to construction of the overlying pavement. **Hold Point 3** Where the trial lot conforms to the requirements of Table 6.2.1, the Principal shall meet the costs of testing under Q191. Where the trial lot does not conform to the requirements of Table 6.2.1:

- i. the Contractor shall meet the costs of testing under Q191, and
- ii. the pavement drain shall be removed and replaced with a conforming pavement drain and further trials shall be undertaken.

If in the opinion of the Administrator the Contractor's Construction Procedures or materials have changed at any time during the project, the Administrator may order further trials to be undertaken.

7.3 Minimum grade

The bottom of the trench is to be constructed at the same grade as the roadway where the grade of the roadway is equal to or greater than 0.5%, and in such a manner that localised ponding of water does not occur. Where the grade of the roadway is less than 0.5%, the trench shall be excavated and trimmed to provide a minimum grade of 0.5%. **Hold Point 4**

7.4 Placement

7.4.1 General

The Contractor shall place the pavement drain in accordance with the Contractor's construction procedure.

The Administrator may elect to test the drain under Q191. Where the trial lot conforms to the requirements of Table 6.2.1, the Principal shall meet the costs of testing under Q191. Where the trial lot does not conform to the requirements of Table 6.2.1, the Contractor shall meet the costs of testing under Q191.

The pavement drain shall be removed and replaced at no cost to the Principal where:

- a) the pavement drain is not installed in accordance with the Contractor's Construction Procedure, and / or

- b) the strip filter fails to satisfy, during both construction and the defect liability period, the requirements of Table 6.2.1 when tested for percentage length at deficient condition under Q191.

7.4.2 Strip filter and fittings

The following minimum requirements shall apply:

- a) The pavement drains shall be installed just ahead of other construction work.
- b) The strip filter shall be placed such that the strip filter stands vertical and is held firmly in place.
- c) The strip filter and fittings do not twist, distort or crush during installation.
- d) Any tearing or puncturing of any component of the strip filter, including geotextile seam failure or geotextile cutting or puncture, shall be repaired or replaced so that the strip filter complies with the specified requirements for the material.
- e) Where the strip filter's glued geotextile becomes debonded from the plastic core, the strip filter shall be repaired or replaced so that the strip filter complies with the specified requirements for the material.
- f) The strip filter shall be laid:
 - i. against the vertical edge of the existing pavement as shown on the drawings, and
 - ii. to the required line and grade.
- g) Joints between adjacent sections of strip filter shall comply with the requirements of the following:
 - i. the number of joints shall be kept to the minimum
 - ii. joints shall be made using a suitable external joint coupling
 - iii. assembly of joints shall not damage the drainage produced and shall maintain open flow channels
 - iv. joints shall maintain the in-plane alignment of the strip filter, and
 - v. joints shall prevent the infiltration of soil particles.
- h) When installation is interrupted, the product shall be secured against movement and open ends shall be sealed to prevent the entrance of water, mud or foreign materials.

7.4.3 Backfilling

No fines concrete shall be used as the back fill / filter material.

Backfill material shall fill all voids surrounding the strip filter.

Backfill shall be compacted in accordance with the requirements of Figure 7.1.

During and after backfilling and compaction of backfill the strip filter and fittings:

- a) shall not be distorted or reoriented from its upright vertical position
- b) shall not be distorted, damaged or crushed, and
- c) shall be installed at the required line and grade.

7.5 Cleanout points and outlets

Cleanout points and outlets shall be provided at intervals as shown on the drawings.

Where possible, pavement drains shall discharge into gully pits and other stormwater drainage structures. Where this is not practicable, an outlet shall be constructed of 100 mm diameter unslotted plastic pressure pipe to discharge water below the pavement off the road shoulder.

An outlet structure in accordance with the Drawings shall be constructed at the discharge end. Where Drawings have not been provided, the cleanout points and outlet structures shall be constructed in accordance with Standard Drawing 1116.

The outlet pipe shall be installed at a 2% minimum grade (3% desirable) to ensure positive outflow. The outlet shall be located so that erosion of the adjacent area does not occur, or shall be protected by grouted rock pitching. Grouted rock pitching shall be undertaken in accordance with the requirements specified in Clause 40 of MRTS03 *Drainage, Retaining Structure and Protective Treatments*.

Collector pipes shall be jointed in accordance with the manufacturer's recommendations.

Fill material placed around collection pipes shall comply with requirements specified in MRTS04 *General Earthworks* and shall be compacted to a relative compaction not less than 97%.

8 Recording and marking of drains

The Contractor shall keep a detailed record of all pavement drain installations. As-constructed drawings of the completed drainage system shall be prepared. **Witness Point 1**

Drains shall be marked on the ground using maintenance marker posts as shown on Standard Drawing 1358. Markers shall be placed at the outlet of drains, and opposite junctions, bends and sump, if any.

9 Geometrics

9.1 General

The pavement drains shall be constructed so as not to depart from the widths, lengths, heights and shapes specified by more than the tolerances stated in Clause 9.

9.2 Horizontal tolerances

The horizontal location of any point on a surface or interface between material types shall not differ from the corresponding point shown on the Drawings, or determined in accordance with Clause 9.1 by more than ± 50 mm except for the following situation. Where alignment of the pavement with an existing road or other existing road structure is necessary, the new work shall be joined to the existing work in a smooth manner as shown in the Drawings.

The width of the pavement drain shall not vary by more than -0 and $+50$ mm.

9.3 Vertical tolerances

The gradient of the bottom surface of the pavement drain shall not be less than 0.5%.

The vertical location of any point on the bottom surface of the pavement drain shall not vary by more than ± 25 mm from those shown on the drawing.

The vertical location of any point on the upper surface of the pavement drain shall not vary by more than ± 10 mm from the levels of the adjacent working platform or subgrade layer.

10 Compliance testing

10.1 Materials compliance testing

10.1.1 General

Compliance testing of materials shall be undertaken for each lot.

Samples for compliance testing shall be selected by random stratified sampling.

The Contractor shall be responsible for carrying out sufficient testing to ensure the material complies with the standards and requirements of this Technical Specification. However, the Contractor's testing program shall be such that lot sizes are not greater than, and testing frequencies and number of tests are not less than, those stated in Clause 10.

The Reduced Test Frequency may apply after no non-conformances have been detected in two consecutive lots. Where a Contractor is operating at the Reduced Level and a nonconformance occurs for any standard or requirement for a lot, the Contractor shall immediately go back to the Normal Level of testing until no non-conformances have been detected in two consecutive lots.

10.1.2 Aggregate for no fines concrete filter material

Aggregate used in no fines concrete filter material shall be tested for conformance with the specified requirements in MRTS70 *Concrete*.

The maximum lot size for aggregate used in no fines concrete filter material is 5000 tonnes of combined aggregate. Testing frequencies shall be not less than those specified in Table 10.1.2.

Table 10.1.2 – Minimum testing frequencies for aggregate used in no fines concrete filter material

Property	Test Frequency	
	Normal	Reduced
Ten Percent Fines Value (wet)	1	1
Wet / Dry Variation	1	1
Flakiness Index	3	1
Water Absorption	1	1
Degradation Factor - Source rock	1	1
Weak Particles	2	1
Particle Size Distribution	1	1

10.1.3 No fines concrete

No fines concrete filter material shall be tested for conformance with the specified requirements in MRTS70 *Concrete*.

The maximum lot size for no fines concrete filter material is 1000 tonnes.

10.1.4 Strip filters and strip filter fittings

All product supplied to the works shall comply with the requirements of this Technical Specification and any additional properties specified on the Technical Data Sheet as approved by the Administrator **[refer Hold Point 1]**.

With each batch of strip filters and strip filter fittings delivered to the site, the Contractor shall provide a certificate of compliance that the strip filter complies with all the requirements of this Technical Specification and is appropriate for its specified usage together with test results reported on test documents endorsed in accordance with the laboratory accreditation requirements of Clause 5.1. The certificate and the test results shall not be dated later than 12 months prior to the close of tenders, except for Change in Core Area (ASTM D6244 test) which shall not be more than 24 months prior to close of tenders.

The Administrator may select samples from the site for audit testing. The Administrator shall advise the Contractor who may be present and who may select additional samples when samples for audit testing are taken.

10.2 Construction compliance testing

Compliance testing shall be undertaken for each lot.

The Contractor is responsible for carrying out sufficient testing to ensure that all pavement drains constructed under the Contract comply with the requirements of this Technical Specification.

The process requirements shall be checked for compliance with the specified requirements during and after the construction operation, as relevant.

The minimum testing frequencies for work covered by this Specification are as follows:

- a) Horizontal geometry 1 test per 50 m
- b) Vertical geometry
 - Trench grade \leq 1.0%: 1 test per 10 m
 - Trench grade $>$ 1.0%: 1 test per 20 m.

