DELIVERING FOR QUEENSLAND

Technical Specification

Transport and Main Roads Specifications MRTS58 Geosynthetics for Subgrade and Pavement Reinforcement

November 2025

Queensland Government

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1 Introduction

This Technical Specification applies to the material and construction requirements for geosynthetics used in subgrade and pavement reinforcement applications (geogrids, geotextiles and geocomposites).

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

This Technical Specification describes the requirements for geosynthetics used in pavement and subgrade reinforcement applications (that is, geogrids and geocomposites). Transport and Main Roads currently has no published pavement or subgrade design methodology to quantify this reinforcement function. This Technical Specification provides minimum property and construction requirements for using geosynthetics in road pavements and should not be considered as a design guide, manual or performance specification.

For geotextiles used as separation and/or filtration elements in drainage, earthworks, and pavements, refer to MRTS27 *Geotextile (Separation and Filtration)*.

For geotextiles used in geotextile reinforced spray seals, refer to MRTS57 *Geotextiles for Geotextile Reinforced Seals*.

Refer to MRTS100 *High Strength Geosynthetic Reinforcement in Road Embankments* for the following geosynthetic embankment applications:

1. as embankment basal reinforcement (for example, embankment over soft ground, load transfer mats, piled embankments and platforms), and
2. within reinforced embankment (batter slope ≤ 70°).

For asphalt geosynthetics, refer to MRTS104 *Asphalt Geosynthetics for Delaying Pavement Reflective Cracking*.

2 Definition of terms

The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Further definitions are defined in Table 2. Where indicated in Table 2 a more complete definition is contained in the referenced clause.

Table 2 – Definition of terms

Term	Definition
Cross Machine Direction (CMD)	Direction of the geosynthetic that is perpendicular to the Machine Direction (MD).
Filtration	A geotextile function that allows liquid to flow across its plane while retaining fine soil particles on its upstream side.
Geocomposite	A manufactured or assembled material which combines a geogrid with a non-woven geotextile. The geogrid provides the strength (or reinforcement) function, and the non-woven geotextile provides the separation and filtration function.
Geogrid	A polymeric geogrid formed by a regular network of connected tensile elements (commonly referred to as ribs) with apertures of sufficient size to allow interaction (for example, interlock) with surrounding soil, rock, or earth to function primarily as reinforcement. The geogrid may be formed by any of the following means: • stretching and drawing a punched sheet of polymer (commonly referred to as extruded). • welding together highly oriented discrete strands or bars of polymer, or • weaving / knitting together discrete polymer yarns or elements. The geogrid may be coated to protect the polymer. Geogrids can be manufactured using high density polyethylene (HDPE), polypropylene (PP) polyester (PET) and/or polyvinyl alcohol (PVA).
Geogrid aperture size	Dimension of the geogrid opening through direct measure.
Geogrid junction (commonly referred to as a node)	The point where geogrid ribs are interconnected to provide structure and dimensional stability.
Geogrid junction strength	The capacity of the geogrid’s junction (or node) to withstand tensile forces and transfer loads between interconnected ribs. Geogrid junction strength is reported in terms of force per width of the material.
Geosynthetics	A polymeric material used in contact with soil / rock and/or any other geotechnical material in civil engineering applications. For geosynthetics used in subgrade and pavement reinforcement, refer to the 'pavement geosynthetic' definition.
Machine Direction (MD)	The manufacture production direction of the pavement geosynthetic.

Term	Definition
Manufacture batch	The amount of geosynthetic produced under the same standard operating conditions. Each *manufacture batch* shall have a unique identification code which can be traced to the manufacture test reports and the geosynthetic rolls delivered to site.
Manufacture sample	A representative sample taken during a *manufacture batch*. This sample shall be tested in accordance with Clause 9.2.1.
Non-woven geotextile	A manufactured sheet, web or batt of directionally or randomly orientated fibres, filaments or other elements mechanically bonded by needle punching.
Onsite sample	A representative sample taken from the geosynthetic product supplied to the Works. The sample shall be taken and tested in accordance with Clause 9.2.2.
Pavement geosynthetic	A geosynthetic product used in subgrades and pavements such as geogrids, geotextiles and geocomposites. The primary function shall provide improvements to the pavement system through sufficient interlocking or uniform stress transmissions mechanisms to reduce permissible strains on the subgrade.
Subgrade	The portion of the road formation on which the pavement is constructed and which provides support to the pavement.
Reinforcement	The improvement of the subgrade and pavement system by introducing a pavement geosynthetic to improve lateral restraint, bearing capacity and/or membrane support. Lateral restraint is primarily achieved through interlock and uniform stress transmission mechanisms together with contribution from frictional interface between soils particles and geosynthetic products.
Resistance to construction damage	Damage during the construction process which can reduce the ultimate tensile strength of a geosynthetic. A geosynthetic's resistance to construction damage shall be determined using Test Method ISO 10722 *Evaluate Construction Damage of Geosynthetics*.
Resistance to weathering (UV, moisture, and heat)	Deterioration of geosynthetics through exposure to ultraviolet (UV) light, moisture, and heat. A geosynthetic's resistance to weathering (UV, moisture, and heat) shall be determined using Test Method ASTM D4355 or EN 12224 *Resistance to Weathering*.
Separation	A geotextile function that prevents the intermixing between 2 dissimilar materials, so that the integrity of the materials on both sides of the geotextile remains intact.
Strain	The ratio of extension to the original length.

Term	Definition
Tensile strength	For pavement geosynthetics, the resistance to deformation developed for a specific material when subject to tension by an external force. Tensile strength of pavement geosynthetics is the characteristic of a sample as distinct from a specimen and is expressed in force per unit width.
Woven geotextile	A geotextile produced by interlacing 2 or more sets of yarns, filaments, tapes, or other elements. The elements pass each other essentially at right angles and one set of elements is parallel to the fabric machine direction. A woven geotextile product can provide the functions of reinforcement, separation, and filtration. A woven geotextile provides reinforcement primarily through a combination of friction and tension membrane effect. A woven geotextile does not provide reinforcement through lateral restraint (that is, interlock). Therefore, a woven geotextile is typically applied as an interlayer treatment for fine-grained, soft subgrade materials. It is recommended to seek advice from the Director (Pavement Rehabilitation) regarding the suitability to use a woven geotextile in lieu of a geogrid or geocomposite.

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
AGPT Part 4G	*Austroads Guide to Pavement Technology Part 4G: Geotextiles and Geogrids*
AS 3705	*Geotextiles – Identification, marking and general data*
MRTS01	*Introduction to Technical Specifications*
MRTS04	*General Earthworks*
MRTS05	*Unbound Pavements*
MRTS27	*Geotextile (Separation and Filtration)*
MRTS50	*Specific Quality System Requirements*
MRTS57	*Geotextiles for Geotextile Reinforced Seals*
MRTS100	*High Strength Geosynthetic Reinforcement in Road Embankments*
MRTS104	*Asphalt Geosynthetics for Delaying Pavement Reflective Cracking*
PRM	*Transport and Main Roads Pavement Rehabilitation Manual*

Reference	Title
-	*Geosynthetic Supplier's Installation Guidelines*
-	*Geosynthetic Supplier's Product Specifications*

4 Standard Test Methods

The standard test methods listed in Table 4 shall be used in this Technical Specification. Further testing details and requirements are given in Clauses 6 to 9.

Table 4 – Standard Test Methods

Property to be tested	Test Method	Test description
Coefficient of direct shear	ASTM D5321 / D5321M	Determines the shear strength of soil / geosynthetic and geosynthetic / geosynthetic interfaces by using direct shear.
Geogrid junction strength at 2% strain	ASTM D7737	Test which determines the strength of an individual geogrid junction (also referred to as a node).
Resistance to construction damage	ISO 10722	Laboratory index test procedure for the evaluation of mechanical damage under repeated loading. For the test, the damage is simulated using granular materials.
Resistance to weathering (UV, moisture, and heat)	ASTM D4355 or EN 12224	Deterioration of geosynthetics by exposure to light, moisture, and heat.
Sampling of geosynthetics	ASTM D4354	Standard practice for sampling of geosynthetics for testing.
Ultimate tensile strength and tensile strength at 2% strain	ASTM D6637	Determines the tensile properties of geosynthetics using the single or multi-rib tensile method.
	ASTM D4595 or ISO 10319	Determines the tensile properties of geosynthetics using the wide width strip method.

Ultimate tensile strength and tensile strength at 2% strain

The geosynthetic is tested at a constant speed and the increase in length of a specimen is measured during the test, this is referred to as strain. During the test, the load is measured and strain is recorded. The results are plotted on a load / strain curve and from the curve ultimate tensile strength (maximum load) and the tensile strength at 2% strain can be determined.

For the *wide width strip method (*ASTM D4595 or ISO 10319), roller or capstan grips are used to clamp the geosynthetics to prevent damage to the test samples.

Resistance to construction damage

The placement and compaction of subgrade and pavement materials on top of a geosynthetic may damage the geosynthetic. This damage is typically reflected by a reduction of the tensile strength properties of the geosynthetic.

Quantifying the amount of construction damage is determined by subjecting the geosynthetic to a backfill and compaction cycle, exhuming the geosynthetic and determining the ultimate tensile strength retained within the geosynthetic. The ultimate tensile strength of the uninstalled geosynthetic is compared to the ultimate tensile strength of the installed geosynthetic to derive at the construction damage reduction factor.

ISO 10722 is a laboratory index test which nominates a granular material to be placed and compacted on the geosynthetic sample to simulate construction damage.

ASTM D5818 is an alternative test method for assessing a geosynthetic's resistance to construction damage. ASTM D5818 defines the standard practise for exposure and retrieval of geosynthetic samples to evaluate construction damage in full-scale test sections.

Geogrid junction strength at 2% strain

Geogrid junction strength is required to maintain the aperture size and to provide a state of confinement with the granular materials. The junctions (or nodes) should have the ability to transfer stress at low strains and should be strong enough for installation survivability. During construction operations, the geogrid experiences relatively high levels of localised load as overlying material is placed, spread, and compacted on top of the geosynthetic.

4.1 Accreditation of laboratories and technical facilities

All geosynthetic materials shall be manufactured under controlled conditions and shall have quality assurance to ensure a high standard of long-term performance. Testing under ASTM / EN / ISO Test Methods shall be conducted by a laboratory accredited under the following:

a) National Association of Testing Authorities (NATA)

b) NATA's partners by Mutual Recognition Arrangements (MRA), or

c) GAI-LAP.

The requirement for the laboratory to be a registered Construction Materials Testing (CMT) Supplier in accordance with MRTS50 *Specific Quality System Requirements* shall be relaxed.

There is a very limited number of accredited geosynthetic testing laboratories located in Australia, with most laboratories located overseas. Therefore, provided the geosynthetic testing laboratory meets the accreditation requirements of this clause, the requirement for the laboratory to be a registered CMT Supplier can be relaxed.

5 Quality system requirements

5.1 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 5.1.

Table 5.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
5.2	1. Acceptance of construction procedures.		Supply of construction procedures (14 days).
6.1.1	2. Acceptance of technical data sheets, test reports and certificates.		Supply of technical data sheets, test reports and certificates (14 days).
7	3. Acceptance of onsite storage.		Delivery of geosynthetic material to Site (14 days).

Clause	Hold Point	Witness Point	Milestone
8.4		1. Inspection of geosynthetic joints and overlaps.	
8.5		2. Inspection of placed geosynthetic prior to placement of overlying material.	
9.2.2		3. Onsite sampling of geosynthetic material.	
9.3	4. Acceptance.		

5.2 Construction procedures

The Contractor shall prepare documented procedures for all construction processes, as defined in Clause 6 of MRTS50 *Specific Quality System Requirements*.

The Contractor shall prepare documented procedures detailing all work described in this Technical Specification.

The Contractor's construction procedure should consider the details provided in the following documents:

- Transport and Main Roads *Pavement Rehabilitation Manual*
- Austroads *Guide to Pavement Technology Part 4G: Geotextiles and Geogrids*
- Geosynthetic *Supplier's Installation Guidelines*, and
- Geosynthetic *Supplier's Product Specifications*.

The construction procedure shall include, but not be limited to, the following:

a) details of the nominated geosynthetic product(s)

b) geosynthetic manufacture test reports and certificates (refer to Clauses 6.1 and 9.2.1)

c) details for the transport, handling and onsite storage of the geosynthetic (refer to Clause 7)

d) details for the onsite sampling and testing of the geosynthetic (refer to Clauses 9.2.2)

e) details for all aspects of the geosynthetic placement Works, including:

i. procedures for the transport, loading and placement of the geosynthetic

ii. details of all plant and equipment associated with the Works to be used to place the geosynthetic

iii. procedures for the preparation and inspection of the subgrade / pavement surface (refer to Clause 8.2)

iv. details for the management of construction traffic over the prepared subgrade / pavement surface and installed geosynthetic to prevent contamination and/or damage

v. placement plan which details the lengths and widths of each geosynthetic placement run considering the subgrade / pavement geometry, joint and overlap requirements (refer to Clause 8.3)

vi. procedures for the transport, loading and placement of the geosynthetic (refer to Clause 8.3).

vii. procedures for joints and overlaps (transverse and longitudinal) of the geosynthetic (refer to Clause 8.4) including:

- details for staggering or offsetting multiple overlaps which are in the same area
- overlaps between work shifts, and
- overlaps at the centreline or crown.

viii. any procedures for the placement of the overlying material which will supplement the relevant Technical Specification (refer to Clause 8.5), and

ix. details for all material and construction compliance testing, including:

- all materials compliance testing for the *manufacture sample*, and
- all materials compliance testing for the *onsite sample.*

The proposed construction procedure shall be submitted to the Administrator at least 14 days prior to the commencement of any Works related to the placement of the pavement geosynthetic. **Milestone**

No Works related to the placement of pavement geosynthetic shall commence until the construction procedure has been accepted by the Administrator and the Administrator has given the Contractor permission to proceed. **Hold Point 1**

5.3 Conformance requirements

The conformance requirements that apply to pavement geosynthetic materials and construction processes covered by this Technical Specification, are given in Clauses 6 to 9.

5.4 Testing frequencies and lot sizes

The maximum lot sizes shall be as specified in Table A.1 of Appendix A.

Material compliance testing requirements and minimum testing frequencies shall be as specified in Table A.2 and A.3 of Appendix A.

6 Material requirements

6.1 Pavement geosynthetics

6.1.1 Property requirements

The pavement geosynthetic (geogrid or geocomposite) shall have high tensile modulus in relation to the material being reinforced and shall also have high continuity of tensile strength through all ribs and junctions of the geogrid structure. The pavement geosynthetic shall maintain its reinforcement and interlock capabilities under repeated dynamic loads while in service and shall also be resistant to weathering, UV degradation, damage under construction practices and all forms of biological or chemical degradation normally encountered in the material being reinforced.

The geosynthetic product to be used in the Works shall be as stated in Clause 1 of Annexure MRTS58.1. Where it is not so stated in the Annexure or shown in the Drawings, it shall be nominated by the Contractor and be *geogrid* or *geocomposite.*

The geosynthetic type to be used in the Works shall be as stated in Clause 1 of Annexure MRTS58.1. Where it is not so stated in the Annexure or shown in the Drawings, it shall be nominated by the Contractor and be *Type 1* or *Type 2*.

Identification and traceability information including pavement geosynthetic type, materials source, Manufacturer, *manufacture batch* identification code, sample date and roll directional markings shall be shown on or attached to the test reports.

Test reports and certificates demonstrating compliance with this Technical Specification, shall be provided by the Contractor to the Administrator for each pavement geosynthetic product to be used in the Works. The testing can be undertaken through the pavement geosynthetic Manufacturer, geosynthetic Supplier and/or Contractor.

All manufacture test reports and certificates (refer to Clause 9.2.1) shall be submitted to the Administrator at least 14 days prior to the commencement of any Works related to the placement of the pavement geosynthetic. **Milestone**

No pavement geosynthetic products shall be incorporated into the Works until all manufacture test reports and certificates (refer to Clause 9.2.1) have been accepted by the Administrator and the Administrator has given the Contractor permission to proceed.
Hold Point 2

The pavement geosynthetic shall conform in all respects to the property requirements listed in Table 6.1.1.

Table 6.1.1 – Property requirements of pavement geosynthetic

Property	Test Method	Unit	Type 1	Type 2
Application	-	-	Design subgrade strength CBR > 3%	Design subgrade strength CBR ≤ 3%
Geogrid aperture size[1],[2]	-	mm	20 to 50	
Tensile strength at 2% strain[3]	ASTM D6637	kN / m	≥ 10.5	≥ 14
	ASTM D4595 or ISO 10319			
Junction strength at 2% strain	ASTM D6637 and D7737	kN / m	≥ 9.5	≥ 12.5
Resistance to construction damage[4]	ISO 10722	%	≥ 90	
Resistance to weathering[5]	ASTM D4355 or EN 12224	%	≥ 90	
Coefficient of direct shear[6]	ASTM D5321 / D5321 M	%	≥ 75	

[1] For biaxial geogrids, measure the maximum inside dimension of the aperture in each principal direction (MD and CMD). Take 5 measurements from apertures in each direction by means of vernier callipers.

[2] Where the overlying materials are not granular in nature, the suitability of the geogrid aperture size shall be considered. For example, where the overlying material has very large particle sizes (for example, rock fill) a larger geogrid aperture size may be more appropriate.

[3] For biaxial geogrids, the tensile strength at 2% strain shall be tested in both directions (MD and CMD) and shall comply with the requirements of Table 6.1.1.

[4] The particle size distribution (or grading envelope) to be used for the construction damage Test Method ISO 10722 shall be consistent with a '2.1 and 2.2' or '2.3 and 2.4' particle size distribution as defined in MRTS05 *Unbound Pavements*.

[5] Weathering resistance shall be measured and reported at 500 hours of exposure for ASTM D4355, or, at 50 MJ/m² radiant exposure for EN 12224.

[6] The coefficient of direct shear test is primarily used in validating the uniform stress transmission mechanisms of a woven geotextile in both directions. The coefficient of direct shear test is not considered appropriate for geogrids. Coefficient of direct shear tests shall apply vertical stress of 50 kPa, 100 kPa and 150 kPa. Granular base layer shall consist of granular material with friction angle of 30 degrees. It is recommended to seek advice from the Director (Pavement Rehabilitation) regarding the suitability to use a woven geotextile in lieu of a geogrid or geocomposite.

6.1.2 Geocomposite's non-woven geotextile property requirements

Where a pavement geosynthetic is to be placed directly onto a prepared subgrade surface, a geocomposite (geogrid with geotextile) shall be used to provide additional separation and filtration functions.

The geocomposite shall be a manufactured or assembled by combining a geogrid with a non-woven geotextile (integrated, laminated, glued or thermal bonded).

In addition to the property requirements listed in Table 6.1.1, the geocomposite's non-woven geotextile shall also conform to the filtration and strength property requirements listed in Tables 6.1.2(a) and 6.1.2(b) respectively.

Table 6.1.2(a) – Property requirements of geocomposite's non-woven geotextile: filtration

Application	Filtration class	Reference
To prevent mixing of dissimilar soil types and the deterioration of the overlying layer by minimising the migration of fines.	I or IIa	MRTS27 *Geotextiles (Separation and Filtration)*

Table 6.1.2(b) – Property requirements of geocomposite's non-woven geotextile: strength

Application	Minimum strength class	Reference
To ensure survivability of the geotextile for the given application.[1]	A	MRTS27 *Geotextiles (Separation and Filtration)*

[1] Geotextile survivability refers to the ability of the geotextile to withstand the installation stresses during construction. It is related to construction method, subgrade condition, backfill material including stone size and other factors.

The geocomposite shall be placed so that the non-woven geotextile is placed directly on the subgrade surface.

The non-woven geotextile shall be adequately bonded to the geogrid so that no delamination or damage occurs to the geocomposite during transport, handling, and installation processes.

Any damaged or delaminated geocomposite shall be replaced by the Contractor at no additional cost to the Principal (refer to Clause 8.6).

For a geocomposite, the geogrid provides the tensile strength function, and the non-woven geotextile provides the separation and filtration functions.

To prevent damaging (ripping, tearing and/or punching) the non-woven geotextile during the installation process (that is, ensure survivability), it is imperative that the non-woven geotextile remains completely bonded to the geogrid, to allow the geocomposite to act as a single, fully integrated engineered product. The non-woven geotextile must maintain its integrity during the installation process.

Where the underlying and overlying materials are not granular or earth fill in nature, increasing the strength of the geocomposite's non-woven geotextile should be considered. For example, where the underlying or overlying material is rock fill, a non-woven geotextile with strength Class D or E may be more appropriate to resist installation damage. Refer to MRTS27 *Geotextiles (Separation and Filtration)* for further guidance.

A woven geotextile product can provide the functions of reinforcement, separation, and filtration. However, due to the closely spaced interwoven fibres of a woven geotextile required for tensile strength properties, achieving the Filtration Class I or IIa is typically not feasible. It is recommended to seek advice from the Director (Pavement Rehabilitation) regarding the suitability to use a woven geotextile in lieu of a geogrid or geocomposite.

7 Identification, packaging, delivery, storage and protection

Pavement geosynthetic materials shall be delivered to the site at least 14 days prior to commencement of installation. **Milestone**

14 days has been nominated to allow enough time for onsite sampling and testing as described in Clause 9.2.2. Where a Contractor has a limited Site establishment period (for example, road maintenance activities), the Administrator may choose to reduce the 14 days requirement. However, the Contractor will need to consider the risks of placing the pavement geosynthetic, without confirmation of the onsite sample test results.

The geosynthetic materials used for the Works shall be new and shall not have been exposed to UV radiation or moisture (for example, during transportation or storage). Geosynthetic materials which have been affected by UV radiation or moisture (for example, prior to or during supply and onsite storage), shall not be used. Any geosynthetic materials delivered to the Site which has evidence of prolonged exposure to UV radiation or moisture, shall be removed from the Site and replaced with conforming geosynthetic materials at no additional cost to the Principal.

All pavement geosynthetic rolls delivered to the Site shall comply with AS 3705 *Geotextiles – Identification, marking and general data* for identification and marking. Each pavement geosynthetic roll supplied to the Site, shall have adhesive tape fixing bands or printing directly on the material which identifies the product name and its manufacturing batch code. The labelling shall be at increments no greater than 10 m along the total length of the roll. If the pavement geosynthetic product to be used for the Works has difficulties with labelling / printing, the geosynthetic Supplier shall propose a method of identification to be considered by the Administrator.

It is imperative that there is clear traceability between the pavement geosynthetic rolls delivered to the Site, its representative *manufacture batch* and the manufacture test reports provided to the Administrator.

All geosynthetic materials delivered to the Site shall be stored in a manner which will avoid any damage. Geosynthetic materials shall be stored under protective cover, or wrapped with a waterproof, opaque UV protective sheeting to avoid any exposure and damage prior to installation.

Geosynthetic materials shall not be left directly exposed to sunlight. At all times, the Contractor shall make the necessary arrangements to reduce the risk of deterioration of the geosynthetic materials material under the action of UV light.

The geosynthetic materials shall not be stored directly on the ground, or in any way that it may be affected by heat or moisture.

Rolled geosynthetic materials may be laid flat or stood on end.

The method of storage shall be in accordance with any other recommendations set by the Manufacturer and/or Supplier. The *Supplier's Product Specifications and/or Installation Guidelines* shall be adhered to with regards to protection and storage.

No geosynthetic materials shall be incorporated into the Works, unless it has been stored correctly onsite and the Administrator has given the Contractor permission to proceed.
Hold Point 3

8 Construction requirements

8.1 General

Pavement geosynthetic materials shall be installed at the locations shown on the Contract and/or Drawings.

8.2 Surface preparation

In all cases, the underlying pavement / subgrade layer shall be adequately prepared in accordance with their relevant Technical Specification prior to placement of the geosynthetic.

A level and uniform ground surface shall be provided, with appropriate clearing, grubbing and sweeping performed to accomplish this.

Any additional surface preparation, as specified in the Contract and/or Drawings, shall be adhered to by the Contractor.

Any additional surface preparation, as outlined in the *Supplier's Installation Guidelines,* shall be adhered to by the Contractor.

Subgrade pH value

The pH value of the underlying subgrade can affect the performance of geosynthetic products.

It is recommended for polyester non-woven geotextiles and geogrids to be installed in soils ranging between $4 < pH < 9$.

Polypropylene non-woven geotextiles and geogrids can be installed in soils exhibiting pH ranges beyond the 4 to 9 limits.

Geosynthetic Suppliers shall provide additional tests to confirm their use in the pH environment.

8.3 Placement of pavement geosynthetic

As part of the Contractor's construction procedure (refer to Clause 5.2), a placement plan shall be prepared which considers the pavement geometry (lane widths, grades, crossfalls and so on), joints and overlaps.

The pavement geosynthetic shall be installed in accordance with the lines and grades shown on Contract and/or Drawings. The pavement geosynthetic shall be oriented such that the roll length runs parallel to the road direction.

The pavement geosynthetic shall be laid flat and smooth directly on the prepared surface. The pavement geosynthetic shall be installed by the Contractor to avoid wrinkles and folds. All wrinkles and folds that form during the placement process shall be removed. All wrinkles and folds rectification Works shall be completed by the Contractor at no additional cost to the Principal.

Where required, the pavement geosynthetic may be pretensioned to eliminate slack.

8.4 Joints and overlaps

The pavement geosynthetic shall be overlapped in all directions as shown in Figure 8.4. The minimum overlap widths are shown in Table 8.4.

Alternatively, the pavement geosynthetic may be overlapped and joined as specified in the Contract and/or Drawings, or as directed by the Administrator.

Geogrids may be joined using cable ties or other suitable methods to maintain the geogrids' location and orientation during the overlying fill / pavement placement.

The Administrator shall inspect the completed geosynthetic joints and overlaps.
Witness Point 1

Figure 8.4 – Diagram illustrating a typical minimum 300 mm overlap configuration

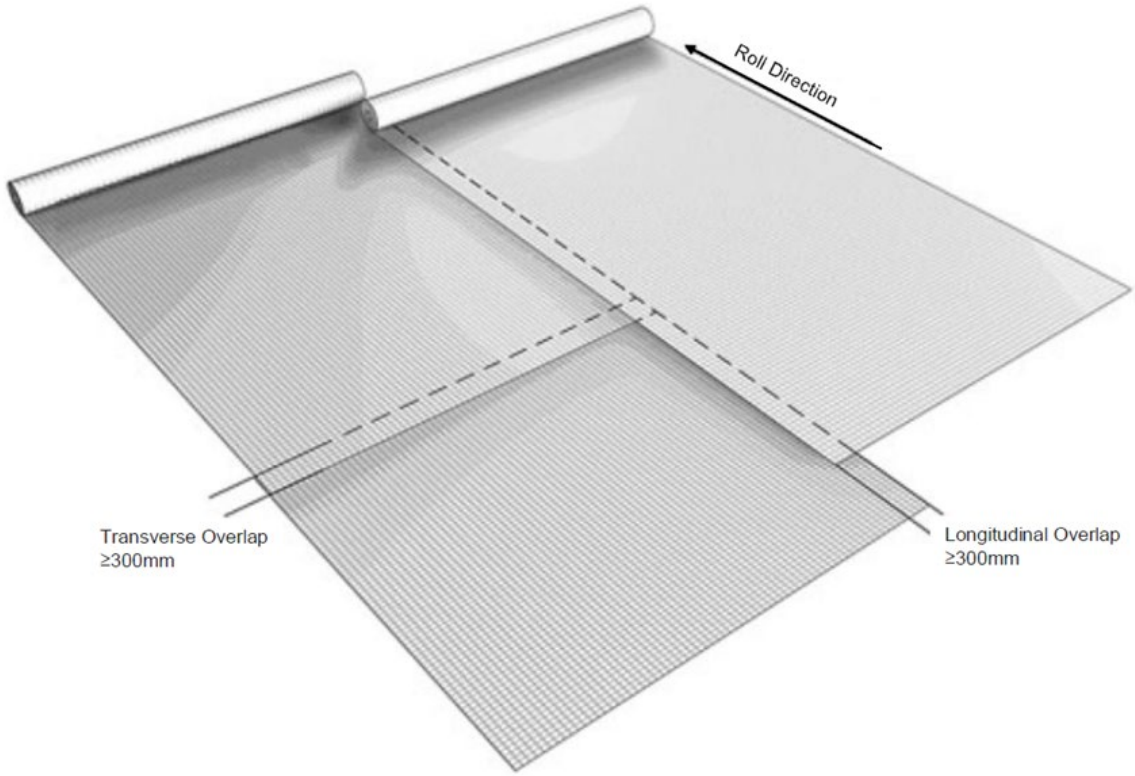


Table 8.4 – Minimum overlap widths

Design subgrade CBR strength	Minimum overlap widths (mm)
> 2	300–450
1–2	600–900
0.5–1	900
< 0.5	Seek advice from the Director (Pavement Rehabilitation)
All geosynthetic roll ends	900

8.5 Placement of overlying material

Prior to placement of the overlying granular or fill material, the pavement geosynthetic shall be inspected by the Administrator to ensure that the geosynthetic is installed as per this Technical Specification requirements and not damaged, wrinkled or folded.

Witness Point 2

Any damaged pavement geosynthetic shall be removed and replaced by the Contractor in accordance with Clause 8.6 at no additional cost to the Principal.

After placement of the pavement geosynthetic, the overlying material shall be placed on the pavement geosynthetic within 24 hours, unless otherwise agreed to by the Administrator.

Care shall be taken to ensure that the pavement geosynthetic sections do not separate at the overlaps and joints during the placement of the overlying granular or fill material.

Overlying granular or fill material shall be placed in lift thickness as shown on the Contract, Drawings and/or relevant Technical Specification.

Trafficking of the geosynthetic shall be restricted to essential construction traffic only. Sharp braking and turning on the geosynthetic shall be avoided.

Tracked construction equipment shall not operate directly upon the pavement geosynthetic. A minimum compacted granular or fill thickness of 200 mm shall be placed prior to operation of tracked vehicles over the pavement geosynthetic (refer Figure 8.5 for guidance).

On firm subgrades or pavements, rubber tyred vehicles may be allowed to operate directly upon the pavement geosynthetic. The Contractor shall demonstrate to the Administrator’s satisfaction that the rubber tyred vehicles and construction processes do not damage, wrinkle and/or fold the pavement geosynthetic.

Any ruts occurring during the placement of the overlying material shall be immediately filled in with a suitable capping material.

In most cases, unbound granular material conforming to the requirements of MRTS05 *Unbound Pavements* is specified as the overlying material. In some cases, fill material conforming to the requirements of MRTS04 *General Earthworks* is specified as the overlying material. In all cases, the overlying material which is specified in the Contract and/or Drawings shall comply with the relevant Technical Specification.

Any additional placement of overlying material requirements as outlined in the *Supplier's Installation Guidelines* shall be adhered to by the Contractor.

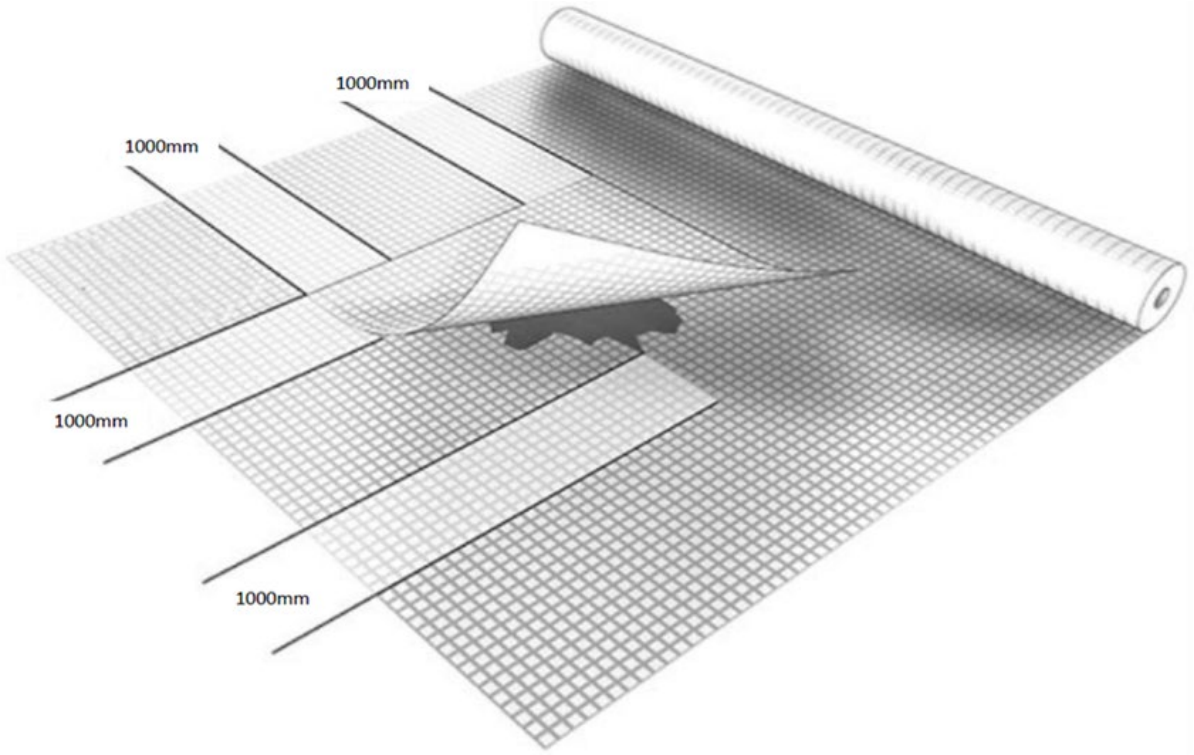
Figure 8.5 – Diagram illustrating granular or fill materials being placed on the geosynthetic in a manner which minimises damage to the geosynthetic

8.6 Replacement of damaged pavement geosynthetic

Any pavement geosynthetic damaged before or during installation, shall be replaced by the Contractor at no additional cost to the Principal.

Proper replacement shall consist of replacing the affected area and adding at least one metre additional geosynthetic to all sides of the affected area (refer Figure 8.6).

Figure 8.6 – Diagram illustrating the repair of damaged geosynthetic



9 Compliance testing

9.1 General

Conformance testing on the pavement geosynthetics delivered to the Site shall be undertaken by the Contractor in accordance with the requirements of Clause 9.

Compliance testing of pavement geosynthetics shall be undertaken on a lot basis in accordance with MRTS01 *Introduction to Technical Specifications.*

For each lot, the Contractor is responsible for undertaking sufficient testing to ensure that the pavement geosynthetic complies in all regards with the requirements of this Technical Specification.

The Contractor shall ensure that sufficient, clearly documented construction compliance records are provided to the Administrator, to ensure that traceability of the pavement geosynthetic from its manufacture to the constructed pavement.

Maximum lot sizes, minimum test frequencies and the minimum number of tests required are specified in Appendix A.

9.2 Compliance testing requirements

9.2.1 Manufacture sampling and testing requirements

A representative sample shall be taken during a *manufacture batch* and tested. The *manufacture batch* and corresponding test results shall be clearly traceable to the geosynthetic rolls supplied to the Works.

The following properties of the *manufacture sample* shall be tested as per the requirements of Table A.2 of Appendix A:

- geogrid aperture size
- geogrid junction strength at 2% strain
- tensile strength at 2% strain
- resistance to construction damage
- resistance to weathering, and
- filtration and strength class (for geocomposite's non-woven geotextile).

Refer to Tables 6.1.1 and 6.1.2 for the minimum requirements for the abovementioned property tests.

The testing can be undertaken through the pavement geosynthetic Manufacturer, pavement geosynthetic Supplier and/or the Contractor.

Identification and traceability information including pavement geosynthetic type, materials source, Manufacturer, *manufacture batch* identification code, sample date and roll directional markings shall be shown on or attached to the test reports.

All manufacture test reports and certificates shall be provided to the Administrator as per the requirements of Clause 6.1.1 (Hold Point 2).

9.2.2 Onsite sampling and testing requirements

Where the total required quantity for the Contract is less than 2000 m², the requirements for onsite sampling and subsequent testing shall be relaxed by the Administrator, provided all manufacture test reports and certificates comply with the requirements of Tables 6.1.1 and 6.1.2.

Where the total quantity supplied for the Works is more than 2000 m², onsite sampling shall be carried out in accordance with ASTM D4354 at the frequency stated in Table A.3 of Appendix A.

Upon delivery of the geosynthetic to Site (refer to Clause 7), a representative sample shall be taken from the roll(s) to be tested in accordance with ASTM D4354. The representative sample shall be 1.2 m along the roll for the full production width, but not within 2 m of the start or end of the roll. **Witness Point 3**

Each sample shall be clearly marked with a large arrow, showing the Machine Direction (MD) and Cross Machine Direction (CMD) of the pavement geosynthetic. The directional marking shall be used to identify the direction of samples for tensile strength tests in MD and CMD.

The Administrator may select additional samples to be taken at the Site for audit testing (refer to Clause 9.4).

The following property of the *onsite sample* pavement geosynthetic shall be tested as per the requirements of Table A.3 of Appendix A:

- tensile strength at 2% strain.

The testing can be undertaken through the pavement geosynthetic Supplier and/or the Contractor.

The tensile strength at 2% strain test results shall be calculated from the results of tests carried on a minimum number of 5 test specimens. The characteristic value of the tensile strength at 2% strain shall be calculated in accordance with the requirements of Clause 12 of MRTS01 *Introduction to Technical Specifications*. The characteristic value shall comply with the requirements shown in Table 6.1.1.

All *onsite sample* test reports and certificates shall be provided to the Administrator as soon as practical.

9.3 Acceptance

A pavement geosynthetic supply and placement lot shall be deemed to achieve conformance and be accepted by the Administrator, if all material and construction requirements comply with this Technical Specification. **Hold Point 4**

If a pavement geosynthetic lot fails to comply with the properties defined in Table 6.1.1, this will constitute a Nonconformance under the Contract. As part of the corrective action, the pavement geosynthetic lot can be resampled and retested in accordance with Clause 9.2.2 to verify whether the lot conforms or not. If upon retesting the pavement geosynthetic lot fails to achieve conformance, then the lot should be rejected.

For subgrade and pavement Works, any Nonconformances are to be raised and actioned as per the relevant Technical Specifications.

9.4 Audit testing

The Administrator may select samples from the Site and make arrangements for audit testing to be carried out, regardless of the quantity of pavement geosynthetics supplied.

10 Supplementary requirements

The requirements of this Technical Specification are varied by the supplementary requirements specified in Clause 2 of Annexure MRTS58.1.

Appendix A: Maximum lot sizes and minimum testing frequencies

Table A.1 – Maximum lot size requirements

Construction activity	Maximum lot size
Supply of geosynthetic (refer to Clause 9.2.2).	10,000 m²
Placement of geosynthetic.	The area (in m²) of placement achieved during a single work period.

Table A.2 – Manufacture material testing compliance requirements (refer to Clause 9.2.1)

<table>
<tr><th rowspan="2">Material property</th><th rowspan="2">Test Method</th><th colspan="2">Normal testing level</th></tr>
<tr><th>Minimum testing frequency</th><th>Minimum no. of tests</th></tr>
<tr><td>Geogrid aperture size</td><td>-</td><td rowspan="5">The currency of test reports and certificates shall be no older than 12 months from the date of the supply to the Works.</td><td rowspan="5">1 test on the manufacturing batch for the rolls supplied to the Works.</td></tr>
<tr><td>Geogrid junction strength at 2% strain</td><td>ASTM D7737</td></tr>
<tr><td rowspan="2">Tensile strength at 2% strain</td><td>ASTM D6637</td></tr>
<tr><td>ASTM D4595 or ISO 10319</td></tr>
<tr><td>Filtration and strength class (for geocomposite’s non-woven geotextile)</td><td>Refer to MRTS27 Geotextiles (Separation and Filtration)</td></tr>
<tr><td>Resistance to weathering</td><td>ASTM D4355 or EN 12224</td><td rowspan="2">The currency of test reports and certificates shall be no older than 5 years from the date of the supply to the Works.</td><td rowspan="2">1 test on a manufacturing batch which is representative of the rolls supplied for the Works.</td></tr>
<tr><td>Resistance to construction damage</td><td>ISO 10722</td></tr>
</table>

Table A.3 – Onsite material testing compliance requirements (refer to Clause 9.2.2)

Material property	Test Method	Normal testing level		Reduced testing level	
		Minimum testing frequency	**Minimum no. of tests**	**Minimum testing frequency**	**Minimum no. of tests**
Tensile strength at 2% strain	ASTM D6637 ASTM D4595 or ISO 10319	1 test per 5,000 m²	1 test per lot	1 test per 10,000 m²	1 test per lot