

TRANSPORT FOR NSW (TfNSW)

QA SPECIFICATION R63

GEOTEXTILES (SEPARATION AND FILTRATION)

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REVISION REGISTER

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 1/Rev 0		New specification. Issue for industry comment and trials.	GM, PSP	04.02.97
Ed 1/Rev 1	1.3, 2.1, 2.2, 2.3 2.3, 3 Tables R63.1 to .6	Minor editorial changes Woven types, other than slit film woven types permitted. Tables relocated to provide for RTA to specify classes.	GM, RNIC (W Ho)	13.03.97
	3, Annexure R63/1 5	Applies where classes are not specified. Location for each class to be notified.		
Ed 1/Rev 2	7.2	“R63.5” changes to “R63.2” in paragraphs 1 and 7.	GM, RNIC (J Woodward)	08.01.98
Ed 1/Rev 3	1.2, 5 5 7.2	ASTM D5261-96 added. Production control testing changed. Minimum frequency of testing reduced.	GM, RNIC	13.03.98
Ed 1/Rev 4	1.2, 1.4 1.4, 2.3 2.3, 3 2.3 3, Anx 63/1 Annex R63/4	AS1289.C6.1 now AS1289.3.6.1 D50s changed to D15s Filtration Class 5 added NOTE 5 added Changes to G1, G2(A&B), G3 New annexure listing Identified Records	GM, RNIC	28.09.99
Ed 1/Rev 5	Table R63.3	Note 1 added.	GM, RNIC	25.09.01

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 2/Rev 0	1.1	New Edition. Scope expanded.	GM, RNIC	30.09.02
	1.2	NFG 38017 Hydrodynamic Sieve Test deleted and replaced by ISO 12956.		
	1.4	Coefficient of Uniformity (Cu) defined Particle Sieve Size (D _n) defined.		
	2.1	Recycled materials permitted in geotextile manufacture complying with specification requirements.		
	2.2	Geotextile strength classes refer to survivability requirements. Table R63.1 moved to Annexure R63/5 and renamed Table R63A5.2.		
	2.3	Table R63.2 moved to Annexure R63A5 and incorporated with Table R63A5.1. Under G3 applications, filtration requirements now refer to three soil categories in Table R63A5.1		
	3	Table R63.3 moved to Annexure R63/1 Application Class G2B deleted. Filtration Classes relabelled in Table R63A5.1 for applications. Tables R63.4 to R63.6 amalgamated with Table R63A5.1.		
	6.1	Geotextile installation now refer to Contract Documents and Drawings. Installation requirements to avoid damage improved.		
	6.2	Table R63.7 renamed as Table R63.1. Minimum layer thickness now refer to two categories of fill particle size: 150mm and 150 to 400mm.		
	6.3	Sewing methods now permitted as an alternative to overlaps.		
	6.4	Contractor now required to demonstrate that the construction process will not damage geotextile. Site trials may be requested.		
	7.2	Geotextile strength and filtration requirements to be verified by on site sampling.		
	Ed 3/Rev 0	Global		

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 3/Rev 0 (cont'd)	2.1 6.4 Annex L 5, 7.2, Annex M	UV exposure requirement changed to 500 hours instead of 672 hours using AS 3706.11. 3rd paragraph, regarding site trial to demonstrate geotextile is not damaged by construction, reworded. Symbols for “Statistical Calculation for Lot Conformity” changed, to be consistent with specification RTA Q. Determination of mass per unit area of geotextile changed to be in accordance with AS 2001.2.13 instead of ASTM D5261-96.		
Ed 4/Rev 0	Global 1.1 1.2.4 1.3 2.1 2.2 2.3 2.4 2.4.2 2.4.4 2.5	Content reorganised and clauses reworded to improve clarity. Similar clauses consolidated. 3rd para in previous version merged with similar statement under clause 4.1. Standard clause on Planning Documents added. Subsequent clause renumbered. Units of measure added to definition of Q_{100} . Item (f) of “Definitions” for “ D_{ns} ” deleted. Sub-headings inserted to form new sub-clauses 2.1.1 to 2.1.4. Individual clauses reworded. Combining previous clauses 2.2 and 2.3, which became sub-clauses 2.2.1 and 2.2.2 respectively. Heading retitled. Previous clause 7.1, retitled “Statistical Techniques for Acceptance”. Sub-headings inserted to form new sub-clauses 2.3.1 and 2.3.2. Previous clause 7.2. Sub-headings inserted to form new sub-clauses 2.4.1 to 2.4.5. Individual clauses reworded or relocated. Title added to existing table on frequency of sampling. 3rd para on non-NATA accredited laboratory relocated here from previous clause 5. Previous clause 5, retitled “Product Certification”. Delivery requirements moved to clause 3. Clause on acceptance of test certificates from other projects moved here from previous clause 7.2. Sub-headings inserted to form new sub-clauses 2.5.1 and 2.5.2.	GM, IC	14.05.13

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 4/Rev 0 (cont'd)	3	Previous clause 4, incorporating delivery requirements from previous clause 5. Sub-headings inserted to form new sub-clauses 3.1 to 3.3.		
	4	Combining clauses 3 and 6. Sub-headings inserted to form new sub-clauses 4.2 and 4.3; subsequent sub-clauses renumbered. Individual clauses reworded.		
	4.1	Hold Point moved to this clause from previous clause 7.2.		
	4.4, Annex A and E	D ₈₅ replaced by D ₉₀ .		
	4.6	Previous clause 6.4, retitled "Working Over Placed Geotextile". Sub-headings inserted to form new sub-clauses 4.6.1 to 4.6.3.		
	4.6.3	Requirement added to provide in PQP compaction method that does not damage placed geotextile.		
	Annex A	Table A.1 reorganised.		
	Annex D	Schedule of Planning Documents added.		
	Annex E, Table E.1	Table reorganised, footnotes rearranged and reworded. Application G3 sub-category types corrected. Strength class for sub-category "Drainage Layer", raised by one class.		
Annex E, Table E.2	"AS 2001.2.3.2" changed to "AS 3706.2".			
Annex M	Reference documents updated.			
Ed 4/Rev 1	Annex A	Table A.1, Site Specific Details, Application G3 – Site subgrade CBR added.	Contracts Quality Manager	27.02.17
Ed 4/Rev 2	Global	References to "Roads and Maritime Services" or "RMS" changed to "Transport for NSW" or "TfNSW" respectively.	DCS	22.06.20



GEOTEXTILES (SEPARATION AND FILTRATION)

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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 R63 Edition 4 Revision 1.

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 R63

GEOTEXTILES (SEPARATION AND FILTRATION)

1 GENERAL

1.1 SCOPE

This specification describes the material and construction requirements for geotextiles used as separation and/or filtration elements in earthworks and road construction such as for bridging layers and subsoil drainage.

Applications using high strength geotextile basal reinforcement under embankments on soft ground to improve global stability are outside the scope of this specification.

1.2 STRUCTURE OF THE SPECIFICATION

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

1.2.1 Project Specific Requirements

Project specific details of work are shown in Annexure R63/A.

1.2.2 (Not Used)

1.2.3 Schedules of **HOLD POINTS**, **WITNESS POINTS** and **Identified Records**

The schedules in Annexure R63/C list the **HOLD POINTS** and **WITNESS POINTS** that must be observed. Refer to Specification TfNSW Q for the definitions of **HOLD POINTS** and **WITNESS POINTS**.

The records listed in Annexure R63/C are **Identified Records** for the purposes of TfNSW Q Annexure Q/E.

1.2.4 Planning Documents

The **PROJECT QUALITY PLAN** must include each of the documents and requirements listed in Annexure R63/D and must be implemented.

1.2.5 Referenced Documents

Unless specified otherwise, the applicable issue of a referenced document, other than a TfNSW Specification, must be 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. AS 1234). For convenience, the full titles are given in Annexure R63/M.

1.3 DEFINITIONS

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

The following definitions apply in respect of terms used to specify the physical and mechanical properties of geotextiles:

- (a) EOS = Equivalent opening size, defined as O_{95} , taken to be the mean value of the test results obtained in accordance with AS 3706.1 and AS 3706.7.
- (b) ψ = Permittivity (s^{-1}) determined in accordance with AS 3706.9.
- (c) Q_{100} = Flow rate under 100 mm constant head condition ($L/s/m^2$ of geotextile) determined in accordance with AS 3706.9.
- (d) C_u = Coefficient of Uniformity of soil, defined as D_{60}/D_{10} .
- (e) D_n = Nominal maximum stone or soil particle size defined as the sieve through which n % by mass of the soil being sieved will pass when tested in accordance with AS 1289.3.6.1.

2 MATERIAL REQUIREMENTS

2.1 GENERAL

2.1.1 Fibres and Filaments

The fibres of the geotextile and thread used in joining lengths must consist of long chain synthetic polymers composed of at least 95% by mass of polyolefins or polyesters.

The geotextile filaments must be rot-proof, chemically stable and must have low water absorbency. Filaments must resist delamination and maintain their relative dimensional stability in the geotextile.

2.1.2 Woven and Nonwoven Geotextiles

Woven geotextiles must have filaments interlaced in two sets, mutually at right angles. One set must be parallel to the longitudinal direction of the geotextile.

Nonwoven geotextiles must have filaments bonded by needle punching, heat or chemical bonding processes.

Geotextiles must be free of any flaws which may have an adverse effect on the physical and mechanical properties of the geotextile.

2.1.3 Ultraviolet Radiation Stability

Geotextiles must be stabilised against ultraviolet radiation to achieve a retained strength of at least 50% after 500 hours of test exposure, when tested in accordance with AS 3706.11.

2.1.4 Use of Recycled Materials

Geotextiles may be manufactured under controlled conditions from recycled materials.

Geotextiles manufactured from recycled materials must conform to the requirements of this Specification, be identified as such on the Certificate of Compliance (refer Clause 2.5), and must be homogeneous with respect to the content of recycled material.

2.2 GEOTEXTILE STRENGTH AND FILTRATION CLASS REQUIREMENTS

2.2.1 Geotextile Strength Class Requirements

Geotextiles for the applications of separation and/or filtration must meet the relevant Strength Class requirements of Table R63/E.2 to ensure survivability.

The geotextile survivability requirements must consider the subgrade condition against which the geotextile will be placed, fill material particle size, fill placement and construction process.

2.2.2 Geotextile Filtration Class Requirements

Geotextiles must meet the relevant filtration requirements of Table R63/E.1 for each application.

2.3 STATISTICAL TECHNIQUES FOR ACCEPTANCE

2.3.1 General

Statistical techniques in accordance with TfNSW Q must be used as the basis for compliance with strength requirements. This procedure, based on the characteristic value of attribute (Q) for the Lot, and reproduced in Annexure R63/L, is used to assess geotextile conformity.

The definition of a Lot together with sampling and testing requirements in respect of geotextiles is given in Clause 2.4 of this Specification.

2.3.2 Conformity of Lot

A Lot achieves conformity if Q is equal to or greater than the specified lower limit for the characteristic value of the attribute. For geotextile conformity for the relevant strength class, the attribute Q in terms of either grab strength, tearing strength or G Rating, must be greater than or equal to the relevant specified limits in Table R63/E.2.

If Q is less than the specified lower limit for the characteristic value, the Lot being examined must be re-sampled and retested to verify conformity. If, on retesting, Q is less than the specified value given in Table R63/E.2, then the Lot represented by the sample roll must be rejected.

2.4 SITE SAMPLING AND TESTING

2.4.1 General

Carry out control testing on each batch of geotextile delivered to site to ensure conformity for the properties specified in Tables R63/E.1 and R63/E.2. Testing must include the mean weight of the geotextile, determined in accordance with AS 3706.1 and AS 2001.2.13.

Geotextiles which has not been verified by site sampling and testing to prove compliance with strength and filtration requirements must not be used in the Works.

2.4.2 Frequency of Sampling

Frequency of sampling and testing must be in accordance with Table R63.1.

Table R63.1 – Frequency of Sampling and Testing

Batch or order size (m²) defined as Lot size	Number of rolls to be sampled representing Lot
Initial 10,000 or part thereof	1
Each subsequent 20,000 (maximum)	1

Determine the Lot characteristic grab and tearing strength, in accordance with AS 3706.2 and AS 3706.3 respectively, using 10 test specimens cut from the longitudinal direction and 10 specimens cut from the transverse direction of the sampled roll of geotextile. Use the Lot characteristic strength in the weaker direction to assess Lot conformity.

In the determination of CBR Burst Strength (AS 3706.4) and Drop Cone Puncture Resistance (AS 3706.5), a minimum of 10 test specimens is required for each test to determine Lot conformity.

WITNESS POINT

Process Witnessed: Sampling of geotextile on site.

Submission Details: Location, date and time of sampling and person sampling.

2.4.3 Procedure for Sampling

A representative sample, covering approximately 15 m² of geotextile (e.g. 3 m by 5 m), is cut from each sampled roll but not within 2 m of the start or end of the roll. Where directed, provide samples to the Principal.

Clearly mark, for example by means of a large arrow, the longitudinal direction of the geotextile on each sample. This is termed the warp direction if woven geotextiles are supplied. The directional marking is required to identify strength tests in both longitudinal and transverse directions. This applies to both woven and nonwoven geotextiles.

2.4.4 Testing of Samples

Test the geotextile samples at an approved NATA registered laboratory accredited for the range of tests given in Table R63/E.1 and Table R63/E.2.

Provide any associated documentation, such as geotextile supplier, geotextile type, batch identification, order represented by sample, sample date, roll directional markings, etc to the testing agency for their information, and show them on or attach them to the test reports.

If NATA has not accredited a laboratory for a test, the test must be carried out at a laboratory either:

- (a) accredited for the test by an organisation mutually recognised by NATA and approved by the Principal, with the test carried out and results certified in accordance with the accreditation conditions; or
- (b) approved by the Principal and results reported in a format approved by the Principal.

Where the mean of a tested characteristic differs from the mean shown on the reports submitted together with the Certificate of Compliance under Clause 2.5 by more than two standard deviations on one Lot, or one standard deviation on three succeeding Lots, the delivered geotextiles will be deemed to be nonconforming.

2.5 PRODUCT CERTIFICATION

2.5.1 Certificate of Compliance

Provide a Certificate of Compliance that the geotextile complies with all the requirements of this specification for its specified usage together with tests results reported on NATA endorsed test documents. The certificate must not be more than twelve months old.

2.5.2 Test Certificates from Other Projects

The Principal may accept test certificates, verifying compliance with Clause 2.4.2, for tests carried out for other projects from the same batch samples taken at site for the Principal in accordance with this clause. Acceptance is only provided where your quality management system ensures that the specified minimum frequency of testing is maintained and also ensures traceability of material to the same batch.

HOLD POINT

Process Held: Supply of geotextile.

Submission Details: Certificate of Compliance from the Supplier, and nomination of where each strength and filtration class will be used.

Release of Hold Point: The Principal will consider the submitted documents and may inspect the geotextile or direct further action, such as site sampling and testing in accordance with Clause 2.4 prior to authorising the release of the Hold Point.

3 STORAGE, PACKAGING, IDENTIFICATION AND DELIVERY

3.1 STORAGE AND PACKAGING

Geotextiles must be stored under protective cover or wrapped with a waterproof, opaque UV protective sheeting to avoid any damage prior to installation.

Geotextiles must not be stored directly on the ground or in any manner in which they may be affected adversely by heat, dirt or damage. The method of storage must be in accordance with any other recommendations set by the manufacturer.

3.2 IDENTIFICATION

The protected geotextile rolls must be clearly labelled showing manufacturer, type of geotextile and batch number identification number.

3.3 DELIVERY

Geotextile must be delivered to the site at least 14 days prior to commencement of installation.

4 CONSTRUCTION REQUIREMENTS

4.1 GENERAL

Place the geotextiles in accordance with the Specifications and as shown on the Drawings.

Unless specified otherwise, select geotextiles of the appropriate strength and filtration class in accordance with Table R63/A.1 and Table R63/E.1.

Selection of the appropriate class of geotextile require a knowledge of site soils, including its grading and plasticity, foundation strength characteristics (CBR), and the critical functions of the geotextile such as protecting proposed drainage blankets or layers.

HOLD POINT

Process Held:	Placement of geotextile.
Submission Details:	Site sampling test results referred to in Clause 2.4 at least 14 days prior to placement of geotextile.
Release of Hold Point:	The Principal will consider the submitted test documents verifying the conformity of the geotextile with the specification and may inspect the geotextile. The Principal may require additional testing prior to authorising the release of the Hold Point.

4.2 SITE PREPARATION

Prepare the site by clearing and grading the area required and remove all sharp objects and large stones. Cut all trees and shrubs flush with the ground surface. The topsoil and vegetation mat may be left in place unless otherwise specified.

4.3 GEOTEXTILE PLACEMENT

Place geotextiles just ahead of associated advancing construction work. Cover the placed geotextile with either the fill material or a suitable protective sheeting within 48 hours of being placed. The geotextile placed must not have punctures or tears and, if these occur, they must be rectified prior to covering over.

For geotextiles in trench drains, place them so as to conform loosely to the shape of the trenches. The geotextile must fully envelop the drainage material in the trench.

4.4 INITIAL LAYER THICKNESS REQUIREMENTS FOR SEPARATION APPLICATIONS

The minimum required initial layer thickness for fill material placed directly over the geotextile must meet the following requirements:

Table R63.2 - Minimum Initial Layer Thickness

Nominal Maximum Fill Particle Size D₉₀ (mm)	Minimum Initial Layer Thickness
< 150	The larger of 3 times maximum fill particle size or 300 mm
150 to 400	Two times maximum fill particle size up to a total thickness of 500 mm

4.5 OVERLAP REQUIREMENTS

Unless specified otherwise on the Drawings, the overlap must be 500 mm or greater where large ground deformations are expected.

Sewing may be permitted provided that the seam strength, as measured in accordance with AS 2001.2.3.2, is equal to or greater than 100% of the specified grab strength. Flat or “prayer” seams, “J” or “Double J” type or “butterfly” seams are permitted with a minimum number of two parallel rows of stitching required.

4.6 WORKING OVER PLACED GEOTEXTILE

4.6.1 Restrictions On Travelling Over Placed Geotextile

Plant and equipment may stand on or travel over the newly placed geotextile only with the Principal’s approval or after a minimum cover of 200 mm (uncompacted) of fill material has been placed over the geotextile to prevent damage to the placed geotextile. Unrestricted movement of plant and equipment over the placed geotextile is permitted only after the cover material has been compacted and is stable.

4.6.2 Placing Rock Directly On Geotextile

Rock armour placed directly on geotextile must be placed with a drop height of less than 1.5 m and in such a manner so as not to damage, puncture or tear the geotextile.

Where the maximum drop height of the rock armour exceeds 1.5 m, an aggregate layer with a nominal maximum stone size of less than 75 mm must be placed as an initial layer prior to the placement of larger revetment rock armour, to protect the geotextile.

4.6.3 Use of Vibratory and Heavy Compaction Plant

Unless otherwise approved in writing by the Principal, do not use vibratory and heavy compaction plant on the initial layers of fill materials.

Provide in your PROJECT QUALITY PLAN how you would ensure that your construction process and compaction method does not damage the geotextile.

The Principal may require a site trial to evaluate your construction process and compaction method.

ANNEXURE R63/A – PROJECT SPECIFIC REQUIREMENTS

NOTES TO TENDER DOCUMENTER: (Delete this boxed text after customising Annexure R63/A)

Nominate below the site soil type by deleting whichever is not applicable.

Table R63/A.1 – Site Specific Details

Geotextile Application	Site Specific Details	
G1 Separation under/within embankments (unsaturated ground) Primarily to prevent mixing of dissimilar soil types during construction appropriate for unsaturated soils where CBR > 3	Nominal maximum stone size in fill, D ₉₀ mm
	Site subgrade CBR
	Site soil type	Granular / Clays & silts
G2 Separation under/within embankments (saturated ground) Primarily to prevent mixing of dissimilar soil types in saturated conditions in working platform/bridging layer applications for subgrade soils where CBR ≤ 3 and where filtration is not a critical function	Nominal maximum stone size in fill, D ₉₀ mm
	Site soil type	Granular / Clays & silts
G3 Trench drains, edge drains, counterfort drains and drainage layers To provide the combined functions of separation and filtration	Nominal maximum stone size in fill, D ₉₀ mm
	Maximum trench depth metres
	Site subgrade CBR
	Site soil type	Pervious granular / Low to medium permeability granular/ Clays & silts
G4 Drainage and separation behind retaining structures, including rock filled mattresses and joints of pipes and arches To provide the combined functions of separation and filtration	Type of structure
	Site soil type	Granular / Clays & silts
G5 Under rock armour revetment layer in embankments	Nominal maximum stone size in revetment, D ₉₀ mm
	Site soil type	Granular / Clays & silts

ANNEXURE R63/B – (NOT USED)

ANNEXURE R63/C – SCHEDULES OF HOLD POINTS, WITNESS POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.2.3.

C1 SCHEDULE OF HOLD POINTS AND WITNESS POINTS

Clause	Type	Description
2.4.2	Witness	Site sampling of geotextile on site
2.5	Hold	Supply of geotextile
4.1	Hold	Placement of geotextile

C2 SCHEDULE OF IDENTIFIED RECORDS

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

Clause	Description of Identified Record
2.4	Site sampling test results
2.5	Certificate of Compliance from Supplier verifying that geotextile complies with all requirements of Specification for its specified usage together with test results

ANNEXURE R63/D – PLANNING DOCUMENTS

Refer to Clause 1.2.4.

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

Clause	Description
2.4	Site sampling and testing procedure.
4.6.2	Details to ensure that construction process and compaction method does not result in damage to the placed geotextile.

ANNEXURE R63/E – APPLICATION CATEGORIES

Table R63/E.1 – Geotextile Strength and Filtration Requirements

Application	Strength Requirements		Filtration Requirements ^(6, 7)		
	Nominal Maximum Stone Particle Size D ₉₀ (mm) ⁽¹⁾	Geotextile Strength Class ⁽²⁾	EOS and Flow Rate Requirements for D ₁₅ ≤ 75 μm ⁽³⁾ (predominantly low permeability soils including clays and silts)	EOS and Flow Rate Requirements for D ₁₅ > 75 μm ⁽³⁾ (predominantly pervious granular soils)	Geotextile Filtration Class
G1 Separation under/within embankments (unsaturated ground) Primarily to prevent mixing of dissimilar soil types during construction appropriate for unsaturated soils where CBR > 3	≤ 37.5	A	EOS ≤ 300 μm ⁽⁴⁾ Q ₁₀₀ ≥ 5 L/s/m ² ⁽⁵⁾ ψ ≥ 0.05 s ⁻¹	EOS ≤ 600 μm ⁽⁴⁾ Q ₁₀₀ ≥ 5 L/s/m ² ⁽⁵⁾ ψ ≥ 0.05 s ⁻¹	Class 5
	≤ 75	B			
	≤ 200	C			
	≤ 400	D			
	≤ 600	E			
G2 Separation under/within embankments (saturated ground) Primarily to prevent mixing of dissimilar soil types in saturated conditions in working platform/ bridging layer applications for subgrade soils where CBR ≤ 3 and where filtration is not a critical function ⁽⁸⁾	≤ 37.5	C	EOS ≤ 300 μm ⁽⁴⁾ Q ₁₀₀ ≥ 10 L/s/m ² ⁽⁵⁾ ψ ≥ 0.10 s ⁻¹	EOS ≤ 600 μm ⁽⁴⁾ Q ₁₀₀ ≥ 20 L/s/m ² ⁽⁵⁾ ψ ≥ 0.20 s ⁻¹	Class 4
	≤ 75	C			
	≤ 200	D			
	≤ 400	E ⁽⁹⁾			
	≤ 600	N/A ⁽¹⁰⁾			

Table R63/E.1 (continued) – Geotextile Strength and Filtration Requirements

Application	Strength Requirements			Filtration Requirements ^(6, 7)					
	Nominal Maximum Stone Particle Size D_{90} (mm) ⁽¹⁾	Geotextile Strength Class ⁽²⁾		EOS and Flow Rate Requirements for $D_{50} < 75 \mu\text{m}$ ⁽³⁾ (predominantly silt and clay soils) ⁽¹¹⁾	EOS and Flow Rate Requirements for $D_{50s} \geq 75 \mu\text{m}$ and $D_{15} \leq 75 \mu\text{m}$ ⁽³⁾ (predominantly granular soils with low permeability) ⁽¹²⁾	EOS and Flow Rate Requirements for $D_{15} > 75 \mu\text{m}$ ⁽³⁾ (predominantly pervious granular soils) ⁽¹³⁾	Geotextile Filtration Class		
G3 Trench drains, edge drains, counterfort drains, and Drainage Layers To provide the combined functions of separation and filtration	Trench drains, edge drains, counterfort drains	Depth < 2 m	Depth < 3 m	EOS $\leq 120 \mu\text{m}$ ⁽⁴⁾ $Q_{100} \geq 10 \text{ L/s/m}^2$ ⁽⁵⁾ $\psi \geq 0.1 \text{ s}^{-1}$	EOS $\leq 250 \mu\text{m}$ ⁽⁴⁾ $Q_{100} \geq 20 \text{ L/s/m}^2$ ⁽⁵⁾ $\psi \geq 0.2 \text{ s}^{-1}$	EOS $\leq 430 \mu\text{m}$ ⁽⁴⁾ $Q_{100} \geq 50 \text{ L/s/m}^2$ ⁽⁵⁾ $\psi \geq 0.5 \text{ s}^{-1}$	Class 1		
		≤ 37.5	A					B	
		≤ 75	B					C	
	≤ 200	C	D						
	Drainage Layers	CBR > 3						CBR ≤ 3	
		≤ 37.5	B					C	
		≤ 75	C					D	
≤ 200		D	E						
≤ 400	E	E ⁽⁹⁾							
≤ 600	N/A ⁽¹⁰⁾	N/A ⁽¹⁰⁾							

Table R63/E.1 (continued) – Geotextile Survivability Strength and Filtration Requirements

Application	Strength Requirements		Filtration Requirements ^(6, 7)		Geotextile Filtration Class
	Description	Geotextile Strength Class ⁽²⁾	EOS and Flow Rate Requirements for $D_{15} \leq 75 \mu\text{m}$ ⁽³⁾ (predominantly low permeability soils including clays and silts)	EOS and Flow Rate Requirements for $D_{15} > 75 \mu\text{m}$ ⁽³⁾ (predominantly pervious granular soils)	
G4 Drainage and separation behind retaining structures, including rock filled mattresses and joints of pipes and arches To provide the combined functions of separation and filtration	Type of Structure Conventional concrete retaining walls, segmental block walls, reinforced soil concrete panel walls	B	EOS $\leq 120 \mu\text{m}$ ⁽⁴⁾ Q ₁₀₀ $\geq 30 \text{ L/s/m}^2$ ⁽⁵⁾	EOS $\leq 250 \mu\text{m}$ ⁽⁴⁾ Q ₁₀₀ $\geq 50 \text{ L/s/m}^2$ ⁽⁵⁾	Class 2
	Gabion walls, crib walls, rock filled mattresses	C	$\psi \geq 0.3 \text{ s}^{-1}$	$\psi \geq 0.5 \text{ s}^{-1}$	
G5 Under rock armour revetment layer in embankments⁽¹⁴⁾	Maximum nominal revetment stone size, D₉₀ (mm)				Class 3
	200	D	EOS $\leq 120 \mu\text{m}$ ⁽⁴⁾ Q ₁₀₀ $\geq 30 \text{ L/s/m}^2$ ⁽⁵⁾	EOS $\leq 200 \mu\text{m}$ ⁽⁴⁾ Q ₁₀₀ $\geq 50 \text{ L/s/m}^2$ ⁽⁵⁾	
	400	E	$\psi \geq 0.3 \text{ s}^{-1}$	$\psi \geq 0.5 \text{ s}^{-1}$	

Notes:

- (1) Nominal maximum stone size of fill determined in accordance with AS 1289.3.6.1.
- (2) Geotextile Strength Class to ensure survivability for the given application. Geotextile survivability refers to the ability of the geotextile to withstand the installation stresses during construction. It is related to the construction method, subgrade condition, backfill material including stone size, and other factors.
- (3) D₁₅ refers to the sieve size through which 15% by mass of the soil being drained will pass. In general, granular soils (e.g. silty sand, sands and gravels) have D₁₅ > 75 μm whilst fine grained soils (e.g. silts, silt clays and clays) would have D₁₅ $\leq 75 \mu\text{m}$.
- (4) Equivalent opening size (EOS), defined as O₉₅, taken to be the mean value of the test results in accordance with AS 3706.1 and AS 3706.7. It is recognised that wet sieving generally results in lower EOS values than dry sieving.
- (5) Q₁₀₀, the flow rate under 100 mm constant head and permittivity (ψ) determined in accordance with AS 3706.9.

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- (6) The EOS, permittivity and flow rate requirements apply for soil types where water flow is predominantly unidirectional. Specialist advice is required where water flow may undergo reverse flow characteristics. Additional technical advice on EOS requirements is required for the following soil types; highly dispersive clay soils, gap graded soils, fine silt soils or artificially derived soils such as flyash. Combined soil/geotextile testing may be required and additional granular filters may be appropriate.
- (7) The above criteria are based on graded soils where the Coefficient of Uniformity ($C_u = D_{60}/D_{10}$) is greater than 3. Special consideration is required for $C_u < 3$.
- (8) Separation under saturated ground may encounter circumstances where filtration could become a critical function, e.g. shallow height embankments where foundation pumping can occur during the life of the roadway. In these circumstances, the selection of geotextile must also satisfy the filtration requirements as for Application Category G3.
- (9) Not applicable for geotextiles with elongation $< 30\%$ (refer to Note 1 of Table R63/E.2).
- (10) Not applicable for this case. Specialist design advice must be sought. As an alternative, a layer of fill material with a nominal maximum stone size of less than 75 mm may be used for the initial and final layer of the drainage layer, to prevent damage to the geotextile.
- (11) More than 50% mass of in-situ soil passes the 75 μm sieve; predominantly silt and clay soils.
- (12) Between 15% and 50% mass of in-situ soil passes the 75 μm sieve; predominantly low permeability granular soils.
- (13) Less than 15% mass of in-situ soil passes the 75 μm sieve; predominantly pervious granular soils.
- (14) Where the maximum drop height of the rock armour exceeds 1.5 m, an aggregate layer with a nominal maximum stone size of less than 75 mm must be placed as an initial layer prior to the placement of larger revetment rock armour, to protect the geotextile.

Table R63/E.2 – Geotextile Survivability Strength Class Requirements

Geotextile Strength Class	Elongation ⁽¹⁾	Grab Strength ⁽²⁾ (N)	Tearing Strength ⁽³⁾ (N)	G Rating ^(4, 5)
A	≥ 30%	500	180	900
	< 30%	800	300	1,350
B	≥ 30%	700	250	1,350
	< 30%	1,100	400	2,000
C	≥ 30%	900	350	2,000
	< 30%	1,400	500	3,000
D	≥ 30%	1,200	450	3,000
	< 30%	1,900	700	4,500
E	≥ 30%	1,600	650	4,500

Notes:

- (1) Elongation, to differentiate between woven geotextiles and nonwoven geotextiles, is the % CBR puncture elongation corresponding to maximum puncture strength determined in accordance with AS 3706.4. In general, woven geotextiles will break at elongations less than 30% while nonwoven geotextiles will break at elongations equal to or greater than 30%.
- (2) Grab strength is the characteristic value for Lot tested (i.e. mean grab strength – 0.83 x standard deviation). Mean grab strength and corresponding standard deviation is determined in accordance with AS 3706.2 Method B. For anisotropic geotextiles, use the characteristic grab strength in the weaker direction. Ten test specimens cut from each direction are required to determine the characteristic grab strength. (Refer to Clause 2.4.2 of this Specification.)
- (3) Tearing strength is the characteristic value for Lot tested (i.e. mean tearing strength – 0.83 x standard deviation). Mean tearing strength and corresponding standard deviation is determined in accordance with AS 3706.3. For anisotropic geotextiles, use the characteristic tearing strength in the weaker direction. Ten test specimens from each direction are required to determine the characteristic tear strength. (Refer to Clause 2.4.2 of this Specification.)
- (4) G Rating, or Geotextile Strength Rating, is determined from $(L_c \times h_{50c})^{1/2}$, where:
 - L_c is the characteristic value of CBR burst strength for the Lot tested (i.e. mean CBR burst strength L – 0.83 x standard deviation). CBR burst strength L is determined in accordance with AS 3706.4.
 - h_{50c} is the characteristic value of h_{50} for the Lot (i.e. mean h_{50} – 0.83 x standard deviation). h_{50} is determined in accordance with AS 3706.5.
 A minimum of ten (10) test specimens is required to determine the characteristic CBR and h_{50} values. (Refer to Clause 2.4.2 of this specification.)
 If the strain at failure exceeds 80%, then the characteristic CBR burst strength L_{80} at 80% strain must be used for the calculation of the G Rating.
- (5) Requirements for survivability class based on a 1.5 m drop height of material for the corresponding maximum nominal stone size.

ANNEXURES R63/F TO R63/K – (NOT USED)

ANNEXURE R63/L – STATISTICAL CALCULATION FOR LOT CONFORMITY

The calculation of the characteristic value of attribute (Q) for the Lot must be as follows:

$$Q_L = \bar{x} - ks$$

where \bar{x} = arithmetic mean of attribute test results for all sub-Lots

s = standard deviation of sub-Lot attribute test results

$$= \sqrt{\sum_{i=1}^n \frac{(x_i - \bar{x})^2}{n-1}}$$

k = acceptance constant of 0.83 for a sample size of 10 tests of geotextile taken from the sampled roll representing Lot. (This value of k is based on 10% producers' risk.)

n = 10 (i.e. number of specimens cut from the sampled roll and tested)

ANNEXURE R63/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.5.

TfNSW Specification

TfNSW Q Quality Management System

Australian Standards

AS 1289.3.6.1 Methods of testing soils for engineering purposes – Soil classification tests –
Determination of the particle size distribution of a soil – Standard method of
analysis by sieving

AS 2001.2 Methods of test for textiles – Physical tests

 AS 2001.2.3.2 Determination of maximum force using the Grab Method

 AS 2001.2.13 Determination of mass per unit area and mass per unit length of fabrics

AS 3706 Geotextiles – Methods of test

 AS 3706.1 General requirements, sampling, conditioning, basic physical properties and
statistical analysis

 AS 3706.2 Determination of tensile properties – Wide strip and grab method

 AS 3706.3 Determination of tearing strength – Trapezoidal method

 AS 3706.4 Determination of burst strength – California bearing ratio (CBR) – Plunger
method

 AS 3706.5 Determination of puncture resistance – Drop cone method

 AS 3706.7 Determination of pore-size distribution – Dry-sieving method

 AS 3706.9 Determination of permittivity, permeability and flow rate

 AS 3706.11 Determination of durability – Resistance to degradation by light, heat and
moisture

AS/NZS ISO 9001 Quality management systems – Requirements

Other Standards

ISO 12956 Determination of Characteristic Opening Size (Wet Sieving Method)