

TRANSPORT FOR NSW (TfNSW)

QA SPECIFICATION R67

HIGH STRENGTH GEOSYNTHETIC REINFORCEMENT

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Ed 1/Rev 2	Global	References to "Roads and Maritime Services" or "RMS" changed to "Transport for NSW" or "TfNSW" respectively.	DCS	22.06.20



HIGH STRENGTH GEOSYNTHETIC REINFORCEMENT

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FOREWORD

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This document should be read with all the documents forming the Contract.

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REVISIONS TO PREVIOUS VERSION

This document has been revised from Specification TfNSW R67 Edition 1 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 R67

HIGH STRENGTH GEOSYNTHETIC REINFORCEMENT

1 GENERAL

1.1 SCOPE

This specification sets out the requirements for the supply and installation of high strength geosynthetic reinforcement to be used under road embankment fills constructed over soft ground.

As the design parameters for each embankment will likely be different, different types of reinforcement will likely be required for each embankment.

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 R67/A.

1.2.2 Measurement and Payment

The method of measurement and payment is detailed in Annexure R67/B.

1.2.3 Schedules of HOLD POINTS and Identified Records

The schedules in Annexure R67/C list the **HOLD POINTS** that must be observed. Refer to Specification TfNSW Q for the definition of **HOLD POINTS**.

The records listed in Annexure R67/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 R67/D and must be implemented.

In all cases where this Specification refers to the manufacturer's recommendations, these must be included in the PROJECT QUALITY PLAN.

1.2.5 Referenced Documents and Definitions

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 2350). For convenience, the full titles are given in Annexure R67/M.

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

1.2.6 Notations

The following notations apply to this Specification:

T_{cs} Extrapolated tensile load based on creep strain at the end of the design life.

T_{cr} Extrapolated creep rupture strength at the end of the design life.

F_m Material factor for reinforcement.

1.3 QUALITY MANAGEMENT SYSTEM

The Supplier must establish and maintain a Quality Management System complying with AS/NZS ISO 9001 as a means of ensuring that the product conforms to the Specification requirements.

When directed, supply copies of second or third party audit reports confirming that the manufacturer’s quality management system complies with the specified Quality Standard and the quality management system has been implemented.

2 MATERIAL REQUIREMENTS

2.1 GEOSYNTHETIC REINFORCEMENT

2.1.1 Reinforcement Types and Properties

Geosynthetic reinforcement may be either of grid, geocomposite strap or woven type structure.

Geosynthetic reinforcement must be directionally stable in both directions and have no tendency to unravel, loosen or tear under construction.

In addition, geosynthetic reinforcement must be UV stable and must not deteriorate, experience a reduction in strength or degrade when exposed to sunlight.

2.1.2 Chemical Composition

Geosynthetic reinforcement must be manufactured from either of the following polymers:

- (a) polyester; and
- (b) high-density polyethylene.

2.1.3 Design Strength Requirements

The short term and long term design longitudinal strength of geosynthetic reinforcement for the typical design section of the road embankments must be as specified in Annexure R67/A. “Short term” and “long term” is defined in Annexure R67/A.

In order to meet the design strength requirements, up to a maximum of four (4) layers of geosynthetic reinforcement (each layer sandwiched between Selected Material fill) may be used.

Whilst no strength requirements are specified for the transverse direction, geosynthetic reinforcements must be robust enough to resist any tendency to tear, unravel or debond in both directions.

Derive the design strength of geosynthetic reinforcement in accordance with Section 5.3.3, Annexure A and Annexure D of BS 8006:1995.

Take into account the following requirements in BS 8006:1995 in determining strength reduction factors and in calculating design strengths of geosynthetics:

- (a) Long term creep and durability (e.g. hydrolysis). Creep and creep rupture tests must be carried out in accordance with ISO 13431:1999 or equivalent. Creep and creep rupture tests based on the Stepped Isothermal method are not acceptable;
- (b) Stress rupture characteristics;
- (c) Chemical effects due to ground water and the fill;
- (d) Temperature;
- (e) Construction site installation damage;
- (f) Deviations from the manufacturer's quality control strength;
- (g) Pull out strength interaction values; and
- (h) Connection strengths.

Comply with the following requirements in Section 5.3.3 and Annexure A of BS 8006:1995:

- (i) Maximum operating temperature must not be less than 20°C; and
- (ii) Maximum creep strain must not exceed 1% over a design life of 100 years at the maximum operation temperature in the derivation of T_{cs} .

Furthermore, the long term design strength of the connections (if required) in the longitudinal direction must be higher than the reinforcement.

2.2 SELECTED MATERIAL ABOVE AND BELOW GEOSYNTHETIC REINFORCEMENT

The Selected Material above and below geosynthetic reinforcement must comply with Specification TfNSW R44 (i.e. with a minimum CBR value of 15 and a Plasticity Index not exceeding 15) and consist of a well graded gravel material with not more than 15% passing the 75 micron sieve size.

The Selected Material must be free from stone larger than 50 mm in order to minimise any damage to the geosynthetic reinforcement during placing of the fill.

The compacted thickness of Selected Material above and below the geosynthetic reinforcement must be between 300 mm and 350 mm.

Where multilayered reinforcement layers are used, the compacted fill thickness between reinforcement layers must not be less than 300 mm.

2.3 INFORMATION TO BE SUPPLIED BY THE CONTRACTOR

At least four (4) weeks prior to the supply of geosynthetic reinforcement, submit to the Principal design/manufacture information for geosynthetic reinforcement including:

- (a) Complete documentation (including raw data test details) for the derivation of T_{cs} , T_{cr} and F_m as defined in BS 8006:1995;
- (b) Results of any laboratory pull-out tests on the product;

- (c) Roll length and width;
- (d) Overlap details (both longitudinal and transverse) and connection details, including supporting calculations and test data;
- (e) Method of packing and identification;
- (f) Samples of the product; and
- (g) Manufacturer's specifications and instructions on storage and installation.

This information must also be supplied 4 weeks prior to changing the materials originally proposed.

2.4 PRODUCT CONFORMITY

Each consignment of geosynthetic reinforcement to be delivered to the site must be accompanied with a manufacturer's Certificate of Compliance certifying that the geosynthetic reinforcements comply with the strength requirements of this Specification.

At least 7 days prior to the proposed use of geosynthetic reinforcements, submit a signed statement certifying that the geosynthetic reinforcements comply with the requirements of this Specification. Support this statement with a copy of the relevant test reports from a laboratory registered by NATA or by a laboratory approved by the Principal.

HOLD POINT

Process Held:	Delivery to site of geosynthetic reinforcement.
Submission Details:	Certificate of Compliance from the Supplier, and design/manufacture information specified under Clause 2.3, 4 weeks before delivery/placement order to allow sufficient time for product evaluations.
Release of Hold Point:	The Principal will consider the submitted documents and may request further information or direct further action, such as directing site sampling and testing, prior to authorising the release of the Hold Point.

3 PACKAGING, DELIVERY AND STORAGE

Supply geosynthetic reinforcement in rolls with each roll having adhesive tape fixing bands identifying the manufacturer, product type and its manufacturing code.

Deliver geosynthetic reinforcement to the site at least 14 days prior to commencement of installation.

Store geosynthetic reinforcement under protective cover or wrapped with a waterproof, opaque UV protective sheeting to avoid any damage prior to installation. Do not store the reinforcement directly on the ground or in any manner in which it may be affected by heat. The method of storage must be in accordance with any other recommendations set by the manufacturer.

4. CONSTRUCTION

4.1 METHOD STATEMENT

At least five (5) working days prior to installation of geosynthetic reinforcement, submit to the Principal your Method Statement which must include the following:

- (a) A plan showing the proposed layout of the geosynthetic reinforcement, including locations of overlaps and connections (where permitted);
- (b) The construction plant to be used for laying and covering the reinforcement and any restrictions on construction plant, which may affect the installation or performance of the reinforcement; and
- (c) Method of filling and compaction over installed reinforcement.

Submission of the Method Statement constitutes a Hold Point.

HOLD POINT

Process Held: Placing of geosynthetic reinforcement.

Submission Details: At least 5 working days before the commencement of installation of geosynthetic reinforcement, submit to the Principal your Method Statement including the details stated in Clause 4.1.

Release of Hold Point: The Principal will consider the submitted documents and may require changes prior to authorising the release of the Hold Point.

Overlapping of the geosynthetic soil reinforcement in the primary (i.e. load carrying direction) is not permitted, unless otherwise approved by the Principal.

4.2 TRACEABILITY

Provide traceability in the use of geosynthetic reinforcement at all stages from delivery to installation.

4.3 FILLING OVER INSTALLED REINFORCEMENT

HOLD POINT

Process Held: Acceptance of laid geosynthetic reinforcement.

Submission Details: Inform the Principal 24 hours prior to the completion of the installation of a layer of geosynthetic reinforcement.

Release of Hold Point: The Principal will inspect the laid geosynthetic reinforcement prior to authorising the release of the Hold Point.

No construction equipment must stand or travel directly on the laid reinforcement without the Principal's approval.

Do not commence placing selected material on the laid reinforcement prior to the acceptance of the laid reinforcement by the Principal.

A minimum cover of 300 mm (uncompacted) of cover material must be placed over the reinforcement layer prior to construction equipment travelling over the area.

Unless otherwise approved in writing by the Principal, vibratory and heavy compaction plant must not be used on the initial lifts of filling materials to avoid damage to reinforcement.

5 SHORT TERM TENSILE TEST

For every 10,000 m² of each geosynthetic grade supplied, provide to the Principal a test certificate, related to the batch produced, verifying that its short term tensile strength (refer Annexure R67/A) complies with this Specification. Carry out the tensile strength tests in accordance with test method ISO 10319.

ANNEXURE R67/A – PROJECT SPECIFIC REQUIREMENTS

DESIGN LONGITUDINAL STRENGTH

Location	Design Strength (kN per metre width)	
	Short Term ⁽¹⁾	Long Term ⁽²⁾

Notes:

(1) Short Term refers to a time duration of ____ years.

(2) Long Term refers to a service life of 100 years.

TENDER DOCUMENTER to complete the above table and Note 1 based on advice by the Geotechnical Designer.

ANNEXURE R67/B – MEASUREMENT AND PAYMENT

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

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

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

Pay Item R67P1 - Supply and Installation of High Strength Geosynthetic Reinforcements

The unit of measurement is the plan square metre of high strength geosynthetic reinforcement placed.

The area of reinforcement will be based on the actual plan area laid, measured in place. No payment will be made for laps.

The Schedule Rate includes the supply, testing and installation of the reinforcement.

Pay Item R67P2 - Supply and Placing of Selected Material Above and Below Each Layer of Geosynthetic Reinforcements

The unit of measurement is the cubic metre measured in place of the selected material immediately above and below each layer of geosynthetic reinforcements. The width, depth and length must be taken as shown on the Drawings or as approved by the Principal, and no account is taken of the allowable placement tolerances.

Pay Item R67P2.1 – Selected Material from Cuttings Within the Limits of Works Area

Where the material is obtained from cuttings within the Limits of Works area, the rate is an “extra over” rate to cover any extra costs over and above those costs allowed for under Pay Item R44P5.1 in TfNSW R44.

Pay Item R67P2.2 – Selected Material Imported from Beyond the Limits of Works Area

Where the material is imported from beyond the Limits of Works area, the rate is an “extra over” rate to cover any extra costs over and above those costs allowed for under Pay Item R44P5.2 in TfNSW R44.

ANNEXURE R67/C – SCHEDULES OF HOLD POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.2.3.

C1 SCHEDULE OF HOLD POINTS

Clause	Description
2.4	Submission of Supplier's Certificate of Compliance and design/manufacture information.
4.1	Submission of Method Statement.
4.3	Informing the Principal 24 hours prior to the completion of the installation of a layer of geosynthetic reinforcement.

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
2.3	Design/manufacture information for geosynthetic reinforcement.
2.4	Certificate of Compliance and signed statement certifying material conformity.
5	Short term tensile test certificates.

ANNEXURE R67/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.

The information to be supplied by you as part of the PROJECT QUALITY PLAN must include, but not be limited, to the following:

- (a) Design/manufacture information in respect of particular construction requirements and Certificate of Compliance (Clauses 2.3 and 2.4);
- (b) Details of method of packaging, delivery and storage (Clause 3);
- (c) The construction plant to be used for laying and covering the reinforcement and any restrictions on construction plant (Clause 4.1); and
- (d) Method of filling and compaction over installed reinforcement (Clause 4.1).

ANNEXURES R67/E TO R67/L – (NOT USED)

ANNEXURE R67/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.5.

TfNSW Specifications

TfNSW Q	Quality Management System
TfNSW R44	Earthworks

Australian Standards

AS/NZS ISO 9001	Quality management systems – Requirements
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ISO Standards

ISO 10319	Geosynthetics – Wide-width tensile test
ISO 13431	Geotextiles and geotextile-related products – Determination of tensile creep and creep rupture behaviour

British Standards

BS 8006:1995	Code of practice for strengthened/reinforced soils and other fills
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