

PART S20
REINFORCED SOIL STRUCTURES

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1. GENERAL

- .1 This Part specifies the requirements for the supply of materials and the construction of Reinforced Soil Structures.
- .2 Reinforced Soil Structures shall consist of a composite system of compacted select backfill and reinforcing material with precast concrete wall facing.
- .3 Reinforced Soil Structures shall be installed in accordance with the manufacturer's instructions and the requirements of this Part. In the event an inconsistency, the higher standard shall apply.
- .4 Documents referenced in this Part are listed below:

Part R10	Earthworks
Part S10	Earthworks for Structures
Part CH10	Survey
AS 1289	Methods of Testing Soils for Engineering Purposes
AS 1554	Structural Steel Welding Code
AS 3678	Hot Rolled Structural Steel Plates, Floor Plates and Slabs
AS 3679	Hot Rolled Structural Steel Bars and Section
AS 4671	Steel Reinforcing Materials
AS 4680	Hot dip Galvanized (Zinc) Coatings on Fabricated Ferrous Articles
AS 5100	Bridge Design

Design of the Reinforced Soil Structures shall comply with DPTI Design Standard: Reinforced Soil Structures, available from: http://www.dpti.sa.gov.au/standards/major_structures_documents.

2. MATERIALS**Wall Facings**

- .1 Wall facing panels shall be of incremental height, precast reinforced concrete, manufactured in accordance with Division CC Concrete. The minimum concrete grade is S32.
- .2 Steel reinforcement shall be a minimum of 450 mm² per metre in each of two directions at right angles to each other and located at mid-depth of the panel thickness.
- .3 Wall facing panels shall be positively interconnected to prevent relative displacement normal to the wall face.

Joint Fillers

- .4 Joint fillers between wall facing panels shall be composed of durable inert material resistant to attack from the soil material and the atmosphere.
- .5 Joint fillers shall be provided to allow for joint rotation without spalling of concrete edges and to prevent loss of fines from the backfill material and staining of the panel faces.

Soil Reinforcing

- .6 Reinforcing strips or grids and their connections, which are attached to the wall facing panels and embedded in the fill, shall be fabricated from approved reinforcing products.

- .7 The Contractor shall provide all evidence necessary to verify that the soil reinforcing is sufficiently strong, stiff, stable and durable to satisfy the performance and design requirements of major reinforced soil structures and this Specification with a minimum of 10 years data from laboratory and site applications in representative conditions.
- .8 Steel reinforcing shall comply with AS 3679 with a minimum base metal thickness of 5 mm and hot dip galvanized after fabrication in accordance with AS 4680 with a minimum average coating thickness equivalent to 600 grams per square metre.
- .9 Steel mesh shall comply with AS 4671 and hot dip galvanized after fabrication with zinc to AS 4680 with a minimum average coating thickness equivalent to 600 grams per square metre.
- .10 Synthetic material shall comply with a British Board of Agreement Certificate and demonstrated by testing in a NATA accredited laboratory to satisfy the performance and design requirements of this Specification.

Connections

- .11 Materials connecting the wall facing panels with the reinforcing elements shall be electrolytically compatible to ensure that corrosion will not be promoted through the use of dissimilar metals.
- .12 All materials forming connections shall be adequately protected for the in-situ conditions, consistent with the protection provided for adjacent components and for the defined structure life.

Handling Transportation and Storage

- .13 Handling transportation and storage of prefabricated structure components shall not cause any damage or deterioration. Synthetic reinforcement elements susceptible to UV degradation and chemical attack shall be protected.

Backfill

- .14 Select backfill shall comply with the specified requirements (refer Clause 7 "Verification Requirements") and have a particle size distribution, shear strength and co-efficient of friction value to ensure the design parameters are achieved.
- .15 Pulverised fuel ash shall not be used as select backfill.

3. CONSTRUCTION

Levelling Pads

- .1 Levelling pads shall be cast from Grade N20 concrete to the lines levels and dimensions shown on the drawings, within the following tolerances:

Plan dimension	- 5 mm
Thickness	-10 mm
Reduced level of top surface of footing	- 5 mm to + 5 mm
Maximum variation of top surface from a 3 m straight edge	+ 5 mm.
- .2 The pads shall be cured for a minimum of 24 hours before placement of wall panels.

Panel Erection

- .3 Panels shall only be handled and lifted by a lifting device or other method specified by the designer. Each wall facing panel shall be supported immediately after erection and until the abutting fill material has been placed and compacted. Panels shall be erected without disturbance, damage or distortion of reinforcing strips or panels.
- .4 The Contractor shall set out an offset line in front of and parallel to each Reinforced Earth wall levelling pad. On completion of each row of panels and before commencing the next row, the Contractor shall submit details of the final position of the top and bottom of each panel.

Placement of Filling

- .5 Fill shall be placed on to the reinforcing strips so that the toe of the fill pile is approximately 1.5 m from the panels. The material shall be pushed parallel to the panels and spread toward the panels and toward the free end of the strips. Fill placement shall follow the erection of each run of panels.
- .6 At each reinforcing strip level, fill shall be compacted before placing and bolting strips. At the end of each days operations, the Contractor shall shape the top of fill so as to direct run off of rainwater away from the wall face.

Compaction of Filling

- .7 Fill shall be placed in layers of between 100 mm and 200 mm compacted thickness and the properties comply with those specified in Clause 7 "Verification Requirements". The location of tests shall be selected by the Contractor for each lot on a stratified random basis.
- .8 The minimum frequency of compaction testing shall be the greater of:
 - (a) 6 tests per 500 mm thickness of fill placed, and
 - (b) 6 tests per 50 cubic metres.
- .9 Heavy earthmoving and compaction equipment (in excess of 2 t Gross Vehicle Mass) shall be kept at least 1.5 m away from the back of the wall. Tracked machines or vehicles shall not be operated on top of reinforcing elements until the elements are covered by at least 150 mm of fill material. Sheepsfoot rollers shall not be used for compaction of fill material.

Tolerances

- .10 The finished wall shall comply with the tolerances in Table 3.10.

TABLE 3.10 TOLERANCES FOR FINISHED WALL	
PROPERTY	ACCEPTANCE LIMITS
Departure from plan position shown on the Drawings at base of wall	< ± 15 mm
Relative displacement of adjoining smooth panel faces measured normal to face of wall	< ± 15 mm
Local deviation of the wall face measured at any location with a 3 m straight edge	< 15 mm
Overall vertical tolerance of the exposed wall face	< 5 mm per metre of wall height
Reduced levels on the wall	< ± 20 mm
Variation in exposed gap width between panels	< 5 mm per metre length.

- .11 The Contractor shall provide a Survey Certificate (refer Part CH30 Survey), demonstrating that the wall complies with the tolerances specified by this Part.
- .12 Provision of the Survey Certificate shall constitute a **HOLD POINT**.

4. MISCELLANEOUS

- .1 Spoon drains shall be provided at the top of the walls to collect drainage from adjacent batter slopes and shall discharge to collection pits with outlets to the drainage system.
- .2 Vertical drops greater than 1.0 m created by construction of the wall shall be protected by safety fences along the top of the wall. The fence shall be 1.2 m high with a top and bottom rail of galvanized steel tube and faced with steel chain mesh unless otherwise specified on the Drawings.

5. HOLD POINTS

- .1 The following is a summary of Hold Points referenced in this Part:

CLAUSE REF.	HOLD POINT	RESPONSE TIME
3.12	Survey Certificate	5 Working Days

6. TEST PROCEDURES

- .1 The Contractor shall use the following test procedures (refer http://www.dpti.sa.gov.au/contractor_documents) to verify conformance with the Specification:

TEST	TEST PROCEDURE
Site Selection by Stratified Random Technique	TP 061
Dry Density Ratio	TP 320
Ph, Resistivity, SO ₄ Content	AS 1289

7. VERIFICATION REQUIREMENTS

- .1 The Contractor shall supply written verification that the following requirements have been complied with and supply the verification with the lot package.

CLAUSE REF.	SUBJECT	PROPERTY	TEST PROCEDURE	TEST FREQUENCY	ACCEPTANCE LIMITS
2.1	Concrete properties	Refer Division CC Concrete	Refer Division CC Concrete	Refer Division CC Concrete	Refer Division CC Concrete
2.7	Steel Soil Reinforcing	Refer AS 3679 or AS 4671	Refer AS 3679 or AS 4671	Refer AS 3679 or AS 4671	Refer AS 3679 or AS 4671
2.7	Synthetic Soil Reinforcing	Refer British Board of Agreement Certificate	Refer British Board of Agreement Certificate	Refer British Board of Agreement Certificate	Refer British Board of Agreement Certificate
2.14	Select backfill	Gradings and Soil Constants	Refer Part R10 Earthworks or S10 Earthworks for Structures	Refer Part R10 Earthworks or S10 Earthworks for Structures	Refer Part R10 Earthworks or S10 Earthworks for Structures
		Shear Strength & Coefficient of Friction	As specified by designer	As specified by designer	As specified by designer
2.14	Select backfill in contact with steel when structure is not subject to inundation	pH	AS 1289.4.3.1	1 test per 400 cubic metres	between 5 - 10
		Resistivity	AS 1289.4.4.1	1 test per 400 cubic metres	> 5 000 (ohm.cm). If in range 1 000 to 5 000, it will be accepted if SO ₄ is satisfactory
		SO ₄ content (only required if resistivity in range 1 000 to 5 000)	AS 1289.4.2.1	1 test per 400 cubic metres	< 1 000 (mg/kg)
2.14	Select backfill in contact with steel when structure is subject to inundation	pH	AS 1289.4.3.1	1 test per 400 cubic metres	between 5 – 10
		Resistivity	AS 1289.4.4.1	1 test per 400 cubic metres	> 3 000 (ohm.cm).
		SO ₄ content	AS 1289.4.2.1	1 test per 500 cubic metres	< 500 (mg/kg)
3	Wall Construction	Backfill Compaction	TP 320	Refer TP 320 Clause 5.4	Not less than 95%.
		Position of Levelling Pads	Survey Certificate in accordance with Part CH30 Survey	Refer Part CH30 Survey	Refer Clause 3.1 "Levelling Pads"

CLAUSE REF.	SUBJECT	PROPERTY	TEST PROCEDURE	TEST FREQUENCY	ACCEPTANCE LIMITS
		Panel Position at completion of each row	Survey Certificate in accordance with Part CH30 Survey	Refer Part CH30 Survey	Refer Part CH30 Table 5.5
		Panel Position at completion of wall	Survey Certificate in accordance with Part CH30 Survey	Refer Part CH30 Survey	Refer TPart CH30 able 5.5