DPTI DESIGN STANDARD: REINFORCED SOIL STRUCTURES

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1. GENERAL
This Design Standard specifies the requirements for the design of Reinforced Soil Structures which consist of facing panels and compacted fill incorporating reinforcing elements (e.g. strips or grids). It excludes the design of soil nailed structures.

2. REFERENCES
Unless specified otherwise, all design must be undertaken in accordance with the following:
1. DPTI: Structures Group Drafting Guidelines for Consultants
2. AS 1100: Technical Drawing
3. AS 3679: Hot Rolled Structural Steel Bars and Section
4. AS 4671: Steel Reinforcing Materials
5. AS 4678: Earth Retaining Structures
6. AS 4680: Hot-dip Galvanized (Zinc) Coatings on Fabricated Ferrous Articles
7. AS 5100: Bridge Design
In this Design Standard, “Part” means a part of the DPTI Master Specification.

3. DESIGN REQUIREMENTS

3.1. Design Criteria
The structures must be designed for a minimum life of 100 years.

The design loadings transferred from bridge abutments to the structures must be specified on the drawings. The live loading from the bridge approaches and the vertical and lateral loads from the earthwork must be taken into account in the design.

The structure must satisfy the stability requirements of the AS 5100 for earth retaining structures. The reinforced soil block consists of the compact fill and reinforcing elements. Allowable bearing pressures and settlements on the founding material under the reinforced soil block must be determined by the designer from the geotechnical investigations.
Surface and subsoil drainage provisions must be provided where necessary to intercept or divert groundwater and surface water to prevent scour or the development of hydrostatic pressure behind facing panels or saturation of any fill (approach and reinforced earth). If water or sewer mains are present, provisions to prevent saturation of the backfill in the event of a leaking main must be included. Subsoil drainage must be designed to prevent blockage from silt deposition. The drawings must clearly show all drainage provisions. If the Works include the extension of an existing Reinforced Soil Structure, the design must include details of the method of preventing erosion and maintaining stability while the existing structure is being modified.

For straight walls the design must provide for a 1 in 40 slope on the vertical wall face.

3.2. Settlement
Settlement of reinforced soil structures must comply with the settlement limits and other settlement requirements set out in Part D025 “Design – Earthworks”.

The wall panel design, including panel jointing, must accommodate design differential movement between adjacent panels during and post construction.

3.3. Foundation Stability
Reinforced soil structures must be designed and constructed in such a manner that at any time, the design geotechnical strength of the foundation exceeds the ultimate applied loading, in accordance with AS 5100.3. The design reports must include calculations for foundation stability.

3.4. Slope Stability
Slope stability of reinforced soil structures must comply with the slope stability requirements set out in Part D025 “Design – Earthworks”. In assessing the potential instability of slopes above and behind a reinforced soil structure, and of slopes where potential failure surfaces encompass part or all of a reinforced soil structure, such slopes are considered high risk slopes.

3.5. Ground Improvement
If any ground improvement measures, including staged construction of the reinforced soil structure and/or surcharging of the reinforced soil structure are proposed by the Contractor in order to meet the requirements for settlement and stability, then the Contractor must include design calculations and details of the proposed ground improvement measures the design reports.

4. MATERIALS

4.1. General
Materials must comply with requirements of Part 420 “Reinforced Soil Structures” and any specific requirements of the proprietary systems adopted.

4.2. Wall Facings
Wall facing panels must:

(a) be of incremental height, precast reinforced concrete, manufactured in accordance with Division 3 "Concrete" of the DPTI master Specification;

(b) be manufactured of a minimum concrete grade must be S32;
(c) include steel reinforcement at 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;

(d) be designed to prevent relative displacement; and

(e) incorporate anti graffiti measures and aesthetics in the design.

A footing must be designed to accommodate the wall facing panels.

4.3. Joint Fillers

Joint fillers between wall facing panels must be composed of durable inert material resistant to attack from the soil material and the atmosphere.

Joint fillers must 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.

4.4. Soil Reinforcing

Reinforcing strips or grids and their connections must be fabricated from approved reinforcing products.

Such products must be 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.

Steel reinforcing must comply with AS 3679, with a minimum base metal thickness of 5 mm and hot dip galvanised after fabrication in accordance with AS 4680 with a minimum average coating thickness equivalent to 600 grams per square metre.

Steel mesh must comply with AS 4671 and hot dip galvanised after fabrication with zinc to AS 4680 with a minimum average coating thickness equivalent to 600 grams per square metre.

Synthetic material must 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.

4.5. Backfill

Select backfill must comply with the requirements of the designer and have a particle size distribution, shear strength and co-efficient of friction value to ensure the design parameters are achieved.

If the backfill is in contact with galvanized steel components, it must comply with the properties specified in Part 420 Clause 8 “Verification Requirements”.

Pulverised fuel ash (PFA) must not be used as select backfill.

4.6. Connections

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

The following records must be prepared:

**Drawings**

Construction drawings in hard copy and AutoCAD format. The drawings must be to a level of detail such that no further production of drawings (e.g. ‘shop detail drawings’) will be required to assist construction. Any reference to any standard or ancillary drawings on any sheet must have the reference to its sheet number.

**Reports**

The design report(s) must include:

(a) A full set of design calculations, incorporating calculations and determinations for all elements, appropriate sketches and details; and

(b) Evidence of suitability of soil reinforcing products.