



Ref : ETWB(W) 515/70/01

Group : 11

29 August 2003

Environment, Transport and Works Bureau
Technical Circular (Works) No. 24/2003

Permanent Reinforced Fill Structures and Slopes

Scope

This Circular governs the design and construction of permanent structures and slopes incorporating reinforced fill in all Government projects. The Director of Agriculture, Fisheries and Conservation, Director of Environmental Protection, Director of Home Affairs, Director of Housing, and Director of Lands have agreed to the contents of this Circular.

Effective Date

2. This Circular shall take immediate effect.

Effect on Existing Circulars

3. This Circular supersedes Works Bureau Technical Circular No. 30/99 which is hereby cancelled, and should be read in conjunction with ETWB TCW No. 29/2002.

Introduction

4. Reinforced fill is a compacted mass of fill with predominantly horizontal layered reinforcing elements to improve its tensile and shear capacities. The fill may be processed or naturally occurring materials (e.g. crushed rock from quarries or residual soils and saprolites derived from in-situ weathering of granitic and volcanic rocks). Permanent reinforced fill structures and slopes are defined as structures or slopes with an intended design life longer than two years, and which are constructed using reinforced fill with or without facing elements. A reinforced fill feature with a face inclination of more than 20° from the vertical shall be considered as a reinforced fill slope. A reinforced fill feature otherwise shall be considered as a reinforced fill structure.

Policy

5. The long-term strength and stress-strain characteristics of many reinforcing products (e.g. polymeric reinforcing products) suitable for used in permanent reinforced fill are temperature and time dependent. These products are required to be certified by the Civil Engineering Department (CED) before they are used in permanent reinforced fill structures and slopes in Government projects. Certificates are signed by the Director of Civil Engineering (DCE) to cover this type of reinforcing product found acceptable for use in Hong Kong. Individual product certificates specify the products' long-term design strengths and the conditions for use in Hong Kong. Metallic reinforcing products, the long-term strength and stress-strain characteristics of which are well established, do not require certification.

6. Notwithstanding certification, a structure or slope incorporating a certified reinforcing product will still need to be adequately designed by the designers, and checked by the Geotechnical Engineering Office (GEO) of the CED.

Certification System for Reinforcing Products

7. Reinforcing products whose characteristics are temperature and time dependent require extensive and long-term testing well in advance of the normal design phase of a project. The certification system examines the effects of material variability, construction damage, environmental effects on material durability, and other special factors including hydrolysis, creep and stress rupture that are related to these reinforcing products. Reinforcing products that have been found satisfactory for use in permanent reinforced fill structures and slopes are certified by the CED. Requirements for compliance testing are also stipulated in the certificates. The list of certified reinforcing products and their details could be found at the CED Website <http://www.ced.gov.hk>.

8. The certification system ensures consistent and satisfactory standards in the provision of these products, facilitates their specification, and saves time for designers, contractors, manufacturers, suppliers and the Government by eliminating repetitive checking of project proposals.

Guidance on Design, Construction and Maintenance

9. Guidance on the design of permanent reinforced fill structures and slopes can be found in Geoguide 6, "Guide to Reinforced Fill Structure and Slope Design", which was published in December 2002. Geoguide 6 recommends a standard of good practice for the design and construction supervision of permanent reinforced fill structures and slopes in Hong Kong. The Geoguide also provides a model specification which stipulates the general requirements on the quality of materials, standard of workmanship, testing methods and acceptance criteria for reinforced fill construction. When reinforcement types requiring certification are adopted in permanent reinforced fill design, the contract document should require the use of reinforcing products certified by the DCE. The model specification for reinforcing elements as recommended in Appendix A of Geoguide 6 can be used as a reference for the preparation of particular specification.

10. Geoguide 6 supersedes Geospec 2 and GEO Report 34. However, in order to allow time for designers to familiarise themselves with the guidance given in Geoguide 6, the design of permanent reinforced fill structures and slopes in accordance with the standards and provisions of Geospec 2 and GEO Report No. 34 will continue to be acceptable until 31 December 2003. During the transition period, permanent reinforced fill structure and slope designs may be carried out in their entirety to either the guidance given in Geospec 2 and GEO Report No. 34, or Geoguide 6. Designs based on a mixture of the guidance given in Geospec 2 and GEO Report No. 34, and Geoguide 6 are not acceptable. Design submissions must clearly state which technical guidance document has been used.

11. In accordance with the requirements stipulated in Chapter 7, Section 4.3 in the Project Administration Handbook (PAH), supervision for geotechnical works should be carried out by personnel with suitable qualification and experience. As suggested in Table 7.47.1 in the PAH, Category I and Category III geotechnical supervision are required for the construction of reinforced fill structures and slopes. To facilitate the spot-checks by the GEO, the project department shall provide the GEO with a copy of the master programme for their works contract and the Curriculum Vitae of the nominated supervision personnel on commencement of the contract. They shall notify the GEO the commencement date and target completion date of the geotechnical works under their contract and keep a full set of regular reports prepared by Category I qualified site supervision personnel on site.

12. In the design, consideration should be given to ways of ensuring that the reinforcing products are not disrupted by future installation of drains or utilities. The department responsible for maintenance should be consulted at an early stage where the reinforced fill structure or slope is proposed. On completion of the works, the project department should also highlight in the slope maintenance manual any specific requirements to protect the reinforcing products, and alert the maintenance department of such requirements accordingly.

Geotechnical Checking

13. Following the normal practice for slopes and retaining walls, the project department shall make a submission on the proposed works to the GEO for checking in accordance with the requirements of ETWB TCW No. 29/2002 "Geotechnical Control for Slopes and Retaining Walls". The submission should include drawings, design calculations, the specification for the reinforced fill, and a copy of the certificate of the reinforcing product (if applicable).

14. A submission may be made in two stages. In the first stage, external and internal stability shall be demonstrated and the reinforcing products could be specified generically. In the second stage, when the relevant reinforcing product details are known, another submission shall be made to demonstrate compliance with the design requirements. In the case of reinforcing products requiring certification, the submission should also include a copy of the certificate together with justifications that the design complies with the conditions stipulated in the certificate. Approval of the submission shall be obtained from the GEO before works on the reinforced fill commence.

(W S Chan)
Deputy Secretary for the Environment,
Transport and Works (Works) 2

