GEO Technical Guidance Note No. 6 (TGN 6)
Application of Back Analysis Approach to the Design of Slope Preventive or Remedial Works

1. SCOPE

1.1 This Technical Guidance Note (TGN) provides technical guidance on the application of back analysis approach to the design of slope preventive or remedial works. The technical recommendations contained in this TGN supplement the information given in Section 5.2.2 of the Geotechnical Manual for Slopes (GCO, 1984) and Chapter 32 of Geoguide 2 (GCO, 1987).

1.2 Any feedback on this TGN should be directed to Chief Geotechnical Engineer/Landslip Preventive Measures 1 of the GEO.

2. TECHNICAL POLICY

2.1 The technical recommendations promulgated in this TGN were agreed by GEO Geotechnical Control Conference (GCC) on 28 June 2001.

3. RELATED DOCUMENTS

3.1 Geotechnical Control Office (1984). *Geotechnical Manual for Slopes. (Second edition)*. Geotechnical Control Office, Hong Kong, 295 p.

3.2 Geotechnical Control Office (1987). *Guide to Site Investigation (Geoguide 2)*. Geotechnical Control Office, Hong Kong, 359 p.

4. TECHNICAL RECOMMENDATIONS

4.1 Whilst the back analysis approach serves as a useful yardstick for assessing the mass shear strength, this approach should not be used in isolation. The application of the back analysis approach for the design of slope preventive or remedial works should be accompanied by rigorous geotechnical investigation, including ground investigation, laboratory testing and engineering geological mapping in order to provide a more reasonable basis for making judgement on suitable mass shear strength parameters.

4.2 Extreme care must be taken to avoid the adoption of unduly high shear strength parameters derived from back analysis which may have incorporated the effect of suction. Where the ground mass is relatively homogeneous with no corestones or boulders, binding effect of tree roots, three-dimensional effects of the slope geometry, etc., back-analysed shear strength parameters which are higher than those determined from laboratory tests on saturated specimens should not be used.

4.3 The notion that the continued stability of an existing slope may be proven by past

rainstorms should be treated with caution. Factors such as deterioration of the slope condition, progressive slope deformation and possible changes in environmental conditions (e.g. enhanced infiltration through a dilapidated hard surface cover, leakage from water-carrying services, etc.) should be carefully considered before one can confidently count on past performance in the use of the back analysis approach. In particular, the use of the back analysis approach to derive mass shear strength parameters for designing upgrading works should be done with extreme caution where the proposed works involve the replacement of a hard surface cover with a vegetated cover.

4.4 When back analysis is used, it should be for deriving the possible range of strength parameters. If more than one predominant soil type (e.g. fill and CDG) is involved, the back analysis approach, if used, should be applied to assess the strength parameters for the particular soil type with greater uncertainty (e.g. high spatial variability, difficulty in retrieving representative samples for laboratory testing, etc.), whilst the strength parameters for the other soil type(s) should be determined by other means such as conventional laboratory tests.

4.5 The back-analysed shear strength parameters for a certain slope section should not be applied to other sections of the slope in the case of a sizeable slope with highly varied characteristics (e.g. in terms of slope geometry, geology, catchment characteristics, etc.) along its length. Different sets of strength parameters may need to be obtained by back-analysing suitably selected sections.

4.6 Back analysis of a landslide or a slope with signs of distress can be useful where there is sufficient and reliable information on the ground conditions and the geometry of the rupture surface. This can assist in the diagnosis of failure mechanisms and examination of the likely combinations of soil shear strength and groundwater conditions at the time of failure. For the design of remedial works, however, the back-analysed groundwater conditions prevailing at the time of the landslide should not necessarily be taken as the design groundwater conditions. This is because the groundwater response for rainstorms with differing characteristics in terms of intensity, duration and return period may be different, and because the hydrogeological setting of the failed slope may be altered by the landslide and/or the proposed remedial works.

4.7 The above guidance on the use of the back analysis approach is also generally applicable to the design of preventive or remedial works for retaining walls.

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