Geotechnical Engineering Office, Civil Engineering and Development Department
The Government of the Hong Kong Special Administrative Region

GEO Technical Guidance Note No. 47 (TGN 47)
Updates of Design Guidance of Rigid Debris-resisting Barriers

1. SCOPE

1.1 This Technical Guidance Note (TGN) provides updates to the technical guidance of rigid debris-resisting barriers in GEO Report No. 270 (Kwan, 2012).

1.2 Any feedback on this TGN should be directed to the Chief Geotechnical Engineer/ Landslip Preventive Measures 2 of the Geotechnical Engineering Office (GEO).

2. TECHNICAL POLICY

2.1 The technical recommendations promulgated in this TGN were agreed by GEO Geotechnical Control Conference on 21 March 2016.

3. RELATED DOCUMENTS

3.1 GEO (2023a). *Supplementary Technical Guidance on Design of Rigid Debris-resisting Barriers (GEO TGN 33)*. Geotechnical Engineering Office, Hong Kong, 1 p.

3.2 GEO (2023b). *Assessment of Landslide Debris Impact Velocity for Design of Debris-resisting Barriers (GEO TGN 44)*. Geotechnical Engineering Office, Hong Kong, 4 p.

3.3 GEO (2023c). *Assessment of Design Debris Retention Volume of Debris-resisting Barriers (GEO TGN 45)*. Geotechnical Engineering Office, Hong Kong, 2 p.

3.4 Kwan, J.S.H. (2012). *Supplementary Technical Guidance on Design of Rigid Debris-resisting Barriers (GEO Report No. 270).* Geotechnical Engineering Office, Hong Kong, 88 p.

3.5 Kwan, J.S.H., Koo, R.C.H. & Lam, C. (2018). *A Review on the Design of Rigid Debris-resisting Barriers (GEO Report No. 339)*. Geotechnical Engineering Office, Hong Kong, 33 p.

4. BACKGROUND

4.1 Professor Oldrich Hungr has conducted a ‘walk through’ exercise and provided comments on the design of rigid debris-resisting barriers from the perspective of value engineering. The prevailing design guidelines were reviewed based on his comments, and enhancements on the prevailing guidelines have been identified. This TGN stipulates the updated technical guidance and clarifies/revises the guidelines given in GEO Report No. 270.

5. TECHNICAL RECOMMENDATIONS

5.1 Self weight of impact debris - Para 5.1(b) of GEO Report No. 270 is revised to incorporate the beneficial effects of the self weight of the impacting debris in geotechnical stability checking. In addition, a partial load factor of unity on the self weight of the debris should be adopted to produce a lateral earth pressure acting on the barriers.

5.2 Superposition of the debris flow impact load and boulder impact load - The value of dynamic pressure coefficient (i.e. $\alpha = 2.5$) recommended in Section 4.2 of GEO Report No. 270 aims to account for the impact load of debris flow and the impact loads induced by boulders of diameter up to 0.5 m. Superposition of debris flow impact load and boulder impact load is not required, if the diameter of the largest entrainable boulder is less than 0.5 m.

5.3 Simultaneous impacts by several boulders on barriers - The boulder line load recommended by para 2.1(b) of GEO Report No. 270 will be incurred only when several boulders impact on the barrier simultaneously, and this represents a very onerous impact scenario. Thus, simultaneous impact by several boulders need not be assumed in order to avoid undue conservatism. If there are abundant boulders perched along the stream course or potential debris flow path with diameters larger than 0.5 m, boulder impact scenarios to reflect the actual site conditions (e.g. impact load corresponding to an appropriate spacing of boulders over a certain portion of the barrier wall) can be applied in the design. Boulder baffles as illustrated by GEO Report No. 339 (Kwan et al, 2018) can be used to screen out large boulders at debris flow front, and consideration of boulder impacts on the stem of a rigid debris-resisting barrier would not be required. Provision of boulder baffles can be considered in design option assessment for deliberation of whether the use of baffles could achieve cost savings.

5.4 Debris mobility analysis - Further to para 4.4(a) of GEO Report No. 270, realistic topographic profiles of the landslide runout path reflecting the likely condition when a debris flow occurs in the future, such as the design profile of the debris retention zone, should be incorporated in the debris mobility analysis for barrier design purposes.

5.5 Geotechnical stability assessment - Consideration of three-dimensional effects e.g. frictional resistance on wing walls and their self weights should be made in geotechnical stability assessment of barriers as appropriate.

5.6 Design groundwater condition - The design groundwater conditions should be duly assessed based on relevant monitoring records, and appropriate ground model and seepage analysis as necessary. When significant groundwater pressure acting on the barrier is anticipated, suitable drainage provision may be provided to relieve the pressure for a more cost-effective design.

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