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

GEO Technical Guidance Note No. 45 (TGN 45)
Assessment of Design Debris Retention Volume of Debris-resisting Barriers

1. SCOPE

1.1 This Technical Guidance Note (TGN) supplements the guidance on the assessment of design debris retention volume of rigid and flexible debris-resisting barriers.

1.2 Any feedback on this TGN should be directed to the Chief Geotechnical Engineer/Standards & Testing of the GEO.

2. TECHNICAL POLICY

2.1 The technical recommendations referred to in this TGN were agreed by the GEO's Geotechnical Control Conference on 19 May 2015.

3. RELATED DOCUMENTS

3.1 GEO (2014). *Guidelines on Enhanced Approach for Natural Terrain Hazard Studies (GEO TGN 36)*. Geotechnical Engineering Office, Hong Kong, 18 p.

3.2 GEO (2015). *Supplementary Technical Guidance on Design of Rigid Debris-resisting Barriers (GEO TGN 33)*. Geotechnical Engineering Office, Hong Kong, 1 p.

3.3 Kwan, J.S.H. & Cheung, R.W.M. (2012). *Suggestions on Design Approaches for Flexible Debris-resisting Barriers (DN 1/2012)*. Geotechnical Engineering Office, Hong Kong, 90 p.

3.4 Kwan, J.S.H., Koo, R.C.H. & Ko, F.W.Y. (2013). *A Pilot Study on the Design of Multiple Debris-resisting Barriers (GEO TN 3/2013)*. Geotechnical Engineering Office, 70 p.

3.5 Lo, D.O.K. (2000). *Review of Natural Terrain Landslide Debris resisting Barrier Design (GEO Report No. 104)*, Geotechnical Engineering Office, HKSAR Government, 91 p.

3.6 Ng, K.C., Parry, S., King, J.P., Franks, C.A.M. & Shaw, R. (2003). *Guidelines for Natural Terrain Hazard Studies (GEO Report No. 138)*. Geotechnical Engineering Office, Hong Kong, 138 p.

4. BACKGROUND

4.1 Debris-resisting barriers are commonly used to mitigate natural terrain landslide hazards. For the design of single or terminal barriers, the volume of landslide debris to be retained by the barriers is assessed with an aim to avoiding debris spilling over the barriers.

4.2 A review has been carried out to identify the key technical considerations to be made for assessing the design debris retention volume. This TGN promulgates the

recommendations of the review. The recommendations are generic in nature and should not be taken as exhaustive.

5. TECHNICAL RECOMMENDATIONS

5.1 The aggregate volume of landslide source volume and amount of entrainment, assessed in accordance with Ng et al (2003) and GEO (2014), gives an upper bound estimate of the design debris retention volume. The use of this upper bound value may result in over-sizing the debris retention zone. Designers should make reference to the calculated cumulative debris volume entering the debris retention zone with consideration of an appropriate debris bulking factor to assess the design retention volume.

5.2 Debris mobility analysis using suitable computer programmes with algorithm agreed by GEO should be used for estimating the amount of debris that could enter the retention zone (i.e. debris retention volume). However, the following factors/conditions should be considered in planning and undertaking the debris mobility analysis:

(a) realistic topographical profiles, inter alia, cross-sectional geometry of the runout path, should be adopted in the debris mobility analysis,

(b) attention should be given to the need of considering different landslide sources in debris runout assessment. For hillside catchments where several vulnerable landslide source locations exist, separate debris mobility analysis to account for the different vulnerable landslide source locations should be undertaken to determine the design debris retention volume. In the event that concurrent occurrence of failures at different landslide source locations is considered credible (e.g. where there is evidence of such occurrence in the catchment under consideration in past rainstorm(s)), 3-dimensional debris mobility assessments (e.g. 3d-DMM) to consider the appropriate combination of different landslide sources should be carried out,

(c) if the results of mobility analysis indicate that some debris would deposit at the upstream of the barrier's retention zone, some allowance should be made to accommodate possible additional volume of the debris that could be washed down to the retention zone, taking into account site-specific factors such as gradient of the runout path, catchment area, etc., and

(d) should the barriers be designed to retain debris flow and additional rock/boulder fall that would occur at the same time, the volume of the additional rock/boulder fall should be allowed for in the design.

(H N Wong)
Head, Geotechnical Engineering Office

[BLANK PAGE]