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

GEO Technical Guidance Note No. 30 (TGN 30)
Updated Intensity-Duration-Frequency Curves with Provision for Climate Change for Slope Drainage Design

1. SCOPE

1.1 This Technical Guidance Note (TGN) promulgates a set of updated Intensity-Duration-Frequency (IDF) curves, which supersede the IDF curves given in Figure 8.2 of the Geotechnical Manual for Slopes (GCO, 1984).

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

2. TECHNICAL POLICY

2.1 The technical recommendations promulgated in this TGN were agreed by the GEO Geotechnical Control Conference in October 2018.

3. RELATED DOCUMENTS

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

3.2 Tang, C.S.C. & Cheung, S.P.Y. (2011). *Frequency Analysis of Extreme Rainfall Values (GEO Report No. 261)*. Geotechnical Engineering Office, Hong Kong, 209 p.

3.3 DSD (2018). *Stormwater Drainage Manual, Fifth Edition.* Drainage Services Department, Hong Kong, 193 p.

4. BACKGROUND

4.1 DSD (2018) suggests a set of new IDF curves derived from regional frequency analyses of rainfall data up to 2014 and recommends projected effects of climate change on the design rainfall intensity. A review of DSD's suggestions has been carried out with consideration given to the cost effectiveness and lessons learned from previous slope failures due to blockage of slope drains, as well as the IDF curves established by Tang & Cheung (2011).

4.2 This TGN recommends updated IDF curves for slope drainage design developed based on the results of the review. Recommendations pertaining to the inclusion of projected climate change effects in slope drainage design are also made.

5. TECHNICAL RECOMMENDATIONS

5.1 For slope drainage design, the design mean rainfall intensity shall be determined according to the IDF curves given in Figure 1 of Annex TGN 30 A1 with the inclusion of projected increase in rainfall intensity as described in para. 5.2 below. The corresponding formulae are given in Table 1 of the Annex.

5.2 Except for temporary slope drainage design, the mean rainfall intensity given by the IDF curves shall be increased by 13.8% for incorporating the climate change effects projected up to the end 21st century.

5.3 The updated IDF curves and the projected rainfall increase for climate change effects shall be applicable to the design of surface drainage provisions for new slopes. For existing slope drainage provisions, there is no urgent need to review or upgrade them, except for those with obvious deficiency as observed during rainfall. Where an existing slope is to be upgraded or improved, the opportunity should be taken to review the adequacy of the prevailing drainage provisions using the updated IDF curves and the projected rainfall increase for climate change effects.

5.4 The IDF curves given in Figure 1 of Annex TGN 30 A1 were developed for slope drainage design purposes. Their application for determining return periods of rainstorms is not recommended.

6. ANNEX

6.1 TGN 30 A1 – Updated Intensity-Duration-Frequency Curves

(W K Pun)
Head, Geotechnical Engineering Office

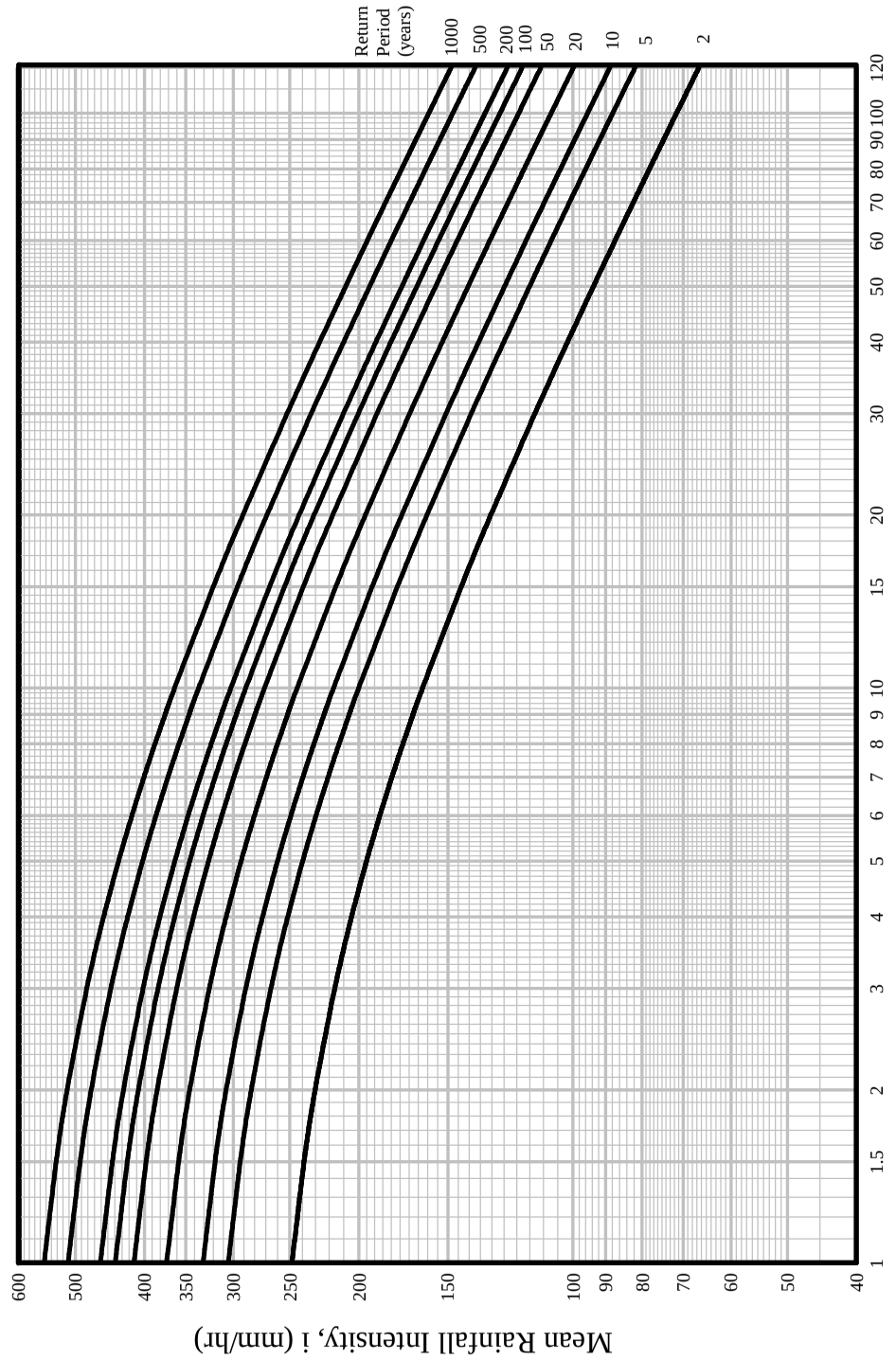

Figure 1 – Updated Intensity-Duration-Frequency Curves

Notes:
1. These IDF curves are to supersede those given in Figure 8.2 of the Geotechnical Manual for Slopes (GCO, 1984).
2. These IDF curves have not incorporated any projected climate change effects. Except for temporary slope drainage design, the mean rainfall intensity given by these IDF curves shall be increased by 13.8% for incorporating climate change effects.
3. The mathematical formulae of these IDF curves are shown in Table 1 of Annex TGN 30 A1.

Table 1 – Mathematical Formulae of Updated Intensity-Duration-Frequency Curves

	Storm constants		
Return period (years)	*a*	*b*	*c*
2	480	4	0.41
5	590	4	0.41
10	640	4	0.41
20	720	4	0.41
50	800	4	0.41
100	850	4	0.41
200	892	4	0.41
500	990	4	0.41
1000	1070	4	0.41

$$i = \frac{a}{(t + b)^c}$$

where i = mean rainfall intensity (mm/hr)
t = duration, time of concentration (min)
a, b, c = storm constants

Note: The above storm constants have not incorporated any projected climate change effects.