

**GEO Technical Guidance Note No. 43 (TGN 43)
Guidelines on Hydraulic Design of U-shaped and Half-round Channels on Slopes**

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1. SCOPE

- 1.1 This Technical Guidance Note (TGN) provides technical guidance on the hydraulic design of U-shaped and half-round channels on slopes. It supersedes the design methodology for U-shaped and half-round channels given in the second paragraph of Section 8.3.4 and the chart given in Figure 8.7 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 GEO Geotechnical Control Conference on 30 May 2014.

3. RELATED DOCUMENTS

- 3.1 Ackers, P. (1969). *Charts for the Hydraulic Design of Channels and Pipes*. Hydraulic Research Station, Wallingford, Hydraulics Research Paper No. 2, 46 p.
- 3.2 DSD (2013). *Stormwater Drainage Manual (with Eurocodes incorporated) - Planning, Design and Management (Fourth Edition)*. Drainage Services Department, Hong Kong, 172 p.
- 3.3 GCO (1984). *Geotechnical Manual for Slopes (Second Edition)*. Geotechnical Engineering Office, Hong Kong, 302 p. (Reprinted, 2011)
- 3.4 HR Wallingford (2006). *Tables for the Hydraulic Design of Pipes, Sewers and Channels (8th Edition)*. HR Wallingford, DIH Barr, 2006, Thomas Telford.

4. BACKGROUND

- 4.1 Second paragraph of Section 8.3.4 of GCO (1984) recommends the use of Manning's formula, with a maximum permissible velocity of 4 m/s and a roughness factor of 0.013, for design of U-shaped and half-round channels on slopes and provides a chart in Figure 8.7 for the rapid design of channels. It further recommends that channels larger than 600 mm may be designed using the charts developed by Ackers (1969) based on the Colebrook-White equation.
- 4.2 A review of the design methodology for both U-shaped and half-round channels given in Section 8.3.4 and the chart given in Figure 8.7 of GCO (1984) has been carried out. It is found that the use of Manning's formula and Colebrook-White equation for design of

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U-shaped and half-round channels is still valid and consistent with the recommendations given in DSD (2013). Nevertheless, discrepancies have been found between the design curves in the chart given in Figure 8.7 of GCO (1984) and the results of the Manning's formula.

- 4.3 This TGN provides an update to the design methodology for U-shaped and half-round channels given in the second paragraph of Section 8.3.4 and the chart given in Figure 8.7 of GCO (1984).

5. **TECHNICAL RECOMMENDATIONS**

- 5.1 U-shaped and half-round channels up to 600 mm should be designed in accordance with Figure 1 of Annex TGN 43 A1. Alternatively, assuming a maximum permissible velocity of 4 m/s and a roughness factor of 0.013, Manning's formula can be used:

$$V = \frac{1}{n} R^{0.67} S^{0.5} \quad (5.1)$$

where V = velocity (m/s)
n = roughness factor,
R = hydraulic mean depth based on a fully wetted cross-section = A/P,
A = wetted cross-sectional area (m²),
P = wetted perimeter (m), and
S = gradient of channel

- 5.2 Channels larger than 600 mm may be designed using the Colebrook-White equation presented in the design charts in HR Wallingford (2006), which is an updated version of Ackers (1969).

6. **ANNEX**

- 6.1 TGN 43 A1 - Chart for the rapid design of U-shaped and half-round channels up to 600 mm

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Figure 1 - Chart for the rapid design of U-shaped and half-round channels up to 600 mm

