provision for the discharge of the flow through sufficiently large openings of the cover layer or by means of weepholes in impermeable cover layers.

Design information for granular filters and geotextiles is given in Section 5.4.3.6.

5.2.3.5 *Stability of rockfill closure dams*

Overview, definitions and design parameters

This section discusses the hydraulic stability of rockfill closure dams against **current attack**. The hydraulics of these structures is outlined in Section 5.1.2.3.

Both the vertical and the horizontal closure method are evaluated hereafter. The set-up and content of this section is summarised as follows: after the summary of the relevant hydraulic and structural design parameters, design guidance is given for various aspects and features related to the stability of rockfill closure dams:

- vertical closure method subdivided in the various relevant flow regimes, varying from low-dam flow to high dam flow and through-flow
- a comparison of the various design formulae discussed for the vertical closure method
- horizontal closure method with emphasis on relation between stability and loss of material
- closure-related issues, such as down-stream protection, three-dimensional effects etc.

The hydraulic stability of rockfill under current attack is evaluated by means of critical values of design parameters (see Section 5.2.1). For convenience, the corresponding non-dimensional numbers are repeated here.

NOTE: In this section D should read as D_{n50} throughout unless other definitions are given explicitly (see also Figure 5.96).

Design parameter	Non-dimensional number
• critical discharge	$q/\sqrt{[g(\Delta D_{n50})^3]}$
• critical shear stress	ψ
• critical velocity	$U^2/(2g\Delta D_{n50})$
• critical hydraulic head	$H/(\Delta D_{n50})$

In principle, shear stress ψ, and velocity U, are, when calculated properly, the best parameters to represent the actual loading on the stones. To a lesser extent, this still holds for discharge q, but hydraulic height (H- or $H - h_b$) parameters are only an overall representation for the loading. In principle, therefore better results from ψ and U methods may be expected (again, provided that reliable calculation methods for ψ and U are available). Moreover, the data describing the influence of geometry and *porosity* are represented by such structural parameters as (see Figure 5.96):

Design parameter	Non-dimensional number
• relative crest width	B/H
• relative stone size	D_{n50}/d
• structure slope angle	$\tan\alpha$