5.2.2.1 Structure classification

Coastal structures exposed to direct wave attack can be classified by means of the stability number, $N_s = H/(\Delta D)$ (see Section 5.2.1.2). Small values of N_s represent structures with large armour units and large values of N_s represent for example dynamic slopes consisting of coarse armourstone, both exposed to the same wave height.

With respect to static and dynamic stability the structures can be classified as statically stable structures and dynamically stable (reshaping) structures:

Statically stable structures are structures where no or minor damage to the armour layer is allowed under design conditions. Damage to the armour layer is defined as displacement of the armour units. The mass of individual units must be large enough to withstand the wave forces during design conditions. Traditionally designed breakwaters belong to the group of statically stable structures. Statically stable structures have stability numbers N_s in the range of 1 to 4.

Dynamically stable (reshaping) structures are structures that are allowed to be reshaped by wave attack, resulting in a development of their profile. Individual pieces (stones or gravel) are displaced by wave action until the transport capacity along the profile is reduced to such a low level that an almost static profile is reached. Even if material around the still water level is continuously moving during each run-up and run-down of the waves, the net transport capacity may be zero as the profile has reached its equilibrium. The dynamic stability of a structure is characterised by a design profile. Dynamically stable structures have stability numbers N_s greater than 6. For these structures, which cover a wide range of $H_s/(\Delta D_{n50})$ – values, the dynamic profile can be described using a parameter that combines the effects of both wave height and wave period. This parameter, defined in Equation 5.132, is the dynamic stability number, $HoTo$, with Ho being an alternative notation of the (static) stability number $N_s = H_s/(\Delta D_{n50})$ and To being the wave period factor: $T_m\sqrt{(g/D_{n50})}$ (-).

$$HoTo = N_s \cdot T_m \sqrt{(g / D_{n50})} \tag{5.132}$$

where T_m is the mean wave period (s).

The relationship between $H_s/(\Delta D_{n50})$ and the dynamic stability number $HoTo$ (sometimes "N_{sd}" is used as notation) is listed in Table 5.21.

Table 5.21 *Relationship between static and dynamic stability number*

Structure type	$N_s = H_s/(\Delta D_{n50})$	$HoTo$
Statically stable breakwaters	1–4	< 100
Dynamically stable reshaping structures	3–6	100–200
Dynamic rock slopes	6–20	200–1500
Gravel beaches	15–500	1000–200 000

Note
Gravel beaches are not discussed in this manual, but the data are given here for information.

This manual focuses on rock-armoured breakwaters and slopes, and berm-type breakwaters, with stability numbers in the range of N_s = 1 to 20. For a final stability analysis to distinguish, for example, the static and dynamic stability, explicit definitions of (acceptable) movement have to be made.