The improved formulae for the stability of the toe (see also Figure 5.74), in which the relative toe depth is given in two ways – as h_t/D_{n50} and as h_t/h – are given here as Equations 5.187 and 5.188 respectively (see also Pilarczyk, 1998).

$$\frac{H_s}{\Delta D_{n50}} = \left(1.6 + 0.24\left(\frac{h_t}{D_{n50}}\right)\right) N_{od}^{0.15} \tag{5.187}$$

and:

$$\frac{H_s}{\Delta D_{n50}} = \left(2 + 6.2\left(\frac{h_t}{h}\right)^{2.7}\right) N_{od}^{0.15} \tag{5.188}$$

A toe with a relatively high level, say $h_t/h < 0.4$, comes close to a berm and therefore, close to the stability of the armour layer on the sloping front face of the structure see Section 5.2.2.2. These armourstone cover layers have stability numbers close to $H_s/(\Delta D_{n50}) = 2$. This is the reason that Equation 5.187 as shown in Figure 5.74, would if extended not start in the origin, but at $H_s/(\Delta D_{n50}) = 2$ for $h_t/h = 0$. The Equations 5.187 and 5.188 may be applied in the ranges of: $0.4 < h_t/h < 0.9$ and $3 < h_t/D_{n50} < 25$.

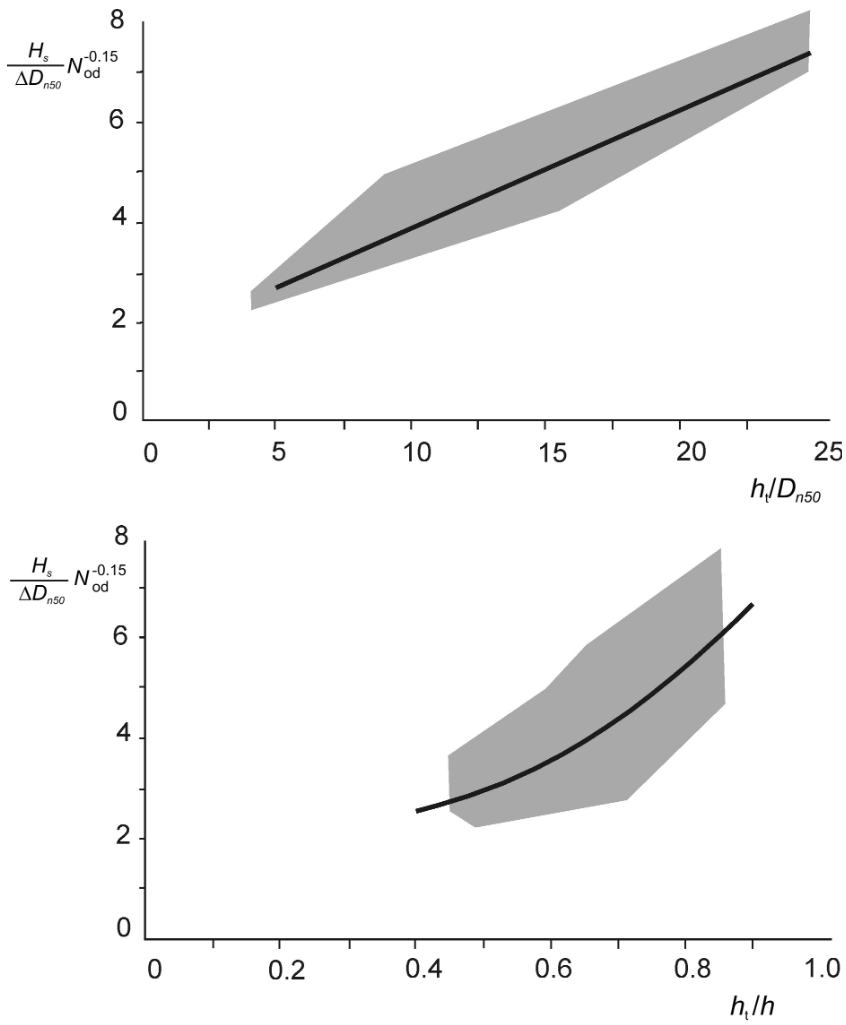

Figure 5.74 *Toe stability as function of h_t/D_{n50} and h_t/h; the grey areas indicates the range of measured data*

NOTE: The reader should realise that Equation 5.187 is only based on tests with a h_t/h ratio of 0.7–0.9. **Equation 5.187 should not be extrapolated**. When the water depth becomes more than approximately three times the wave height this formula gives unrealistic (even negative) results for the required size of the toe armourstone. A safe boundary for this equation is: $h_t/H_s < 2$.