

University of Bologna
Harbour engineering

Exercise: stability of armor units on the side of a groin

A groin with side slope of 30 degrees is exposed to a significant wave height of 2 meters at its toe. The wave forcing originates a top wave run-up velocity of 4 m/s, and a top wave run-down velocity of 1.5 m/s. The value of the wave related friction factor f_w is 0.1 (plausible value for large stones) while the density of sea water is 1.024 kg/m^3 . It is assumed that the tidal velocity is negligible.

The groin is protected with boulder with characteristic size $d=100 \text{ cm}$ and specific mass of 2500 kg/m^3 and friction angle of 40 degrees.

- Verify the stability of the armor units with respect to the run-up and run-down by using the Shields criteria, by assuming that hiding effects and effects of armor shape are negligible.
- Verify the stability of the armor unit with the Hudson formula by assuming that $N_{cr}=2$.