J. Indian Inst. Sci., Jan.–Feb. 2006, **86**, 15–31

Wave reflection, run-up, run-down and pressures on seawalls defended by an offshore breakwater

S. NEELAMANI*[1] AND B. V. SUMALATHA[2]
[1]Coastal & Air Pollution Department, Environment & Urban Development Division,
Kuwait Institute for Scientific Research, P.O. Box 24885, 13109 Safat, Kuwait.
[2]L&T-Rambøll Consulting Engineers Limited, 339/340, Anna Salai, Nandanam, Chennai 600 035, India.
email: nsubram@kisr.edu.kw; Phone: (965) 4836100 Ext: 5351; Fax: (965) 481 5192 (Off.)

Received on October 17, 2004; Revised on December 26, 2005.

Abstract

The hydrodynamic performance in terms of wave reflection, run-up and run-down and wave pressures on plane seawalls protected by an offshore breakwater has been studied in a random wave field. Plane seawalls with different slopes (i.e. $q = 90°$, 60° and 30°) and for different water depths relative to the height of the offshore breakwater covering both the submergence and emergence of the offshore breakwater are used. The hydrodynamic performance of a plane seawall without an offshore breakwater is compared with one protected. For 2% probability of exceedence, the run-up on the seawall can be reduced by about 50–60%, when there is a detached breakwater with a crest level at the still water level. For the same condition, the wave pressure on the seabed near the seawall can be reduced by about 35–40%. With a detached breakwater of 20% emergence in air, the wave pressure on the seawall can be reduced by about 80–85% when compared to the wave pressures without any protection. The present study reveals that when the crest of the breakwater is submerged by about 14% of the water depth, the configuration induces a water jetting effect over the detached breakwater and causes higher wave kinematics in front of the seawall and hence such conditions are recommended to be avoided in the field.

Keywords: Plane seawall, offshore breakwater, reflection coefficient, wave pressures, run-up, run-down, surf similarity parameter, random waves.

*Author for correspondence.