

Wave impacts on structures with rectangular geometries: Part 1. Seawalls

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ABSTRACT

This paper considers steep wave impact on seawalls of various geometries. A simple analytical model for the pressure impulse due to a wave of idealized geometry and dynamics is developed and applied to the following geometries: (a) vertical seawall with a berm, (b) vertical seawall with a ditch at its base and (c) vertical seawall with a block missing (damaged condition). The method uses eigenfunction expansions in each of the rectangular regions that satisfy some of the rigid surface conditions and a simplified free-surface condition. Their unknown coefficients are determined from the impact boundary condition, rigid wall conditions and by matching the values and the horizontal derivatives of the solutions in each rectangular region at their mutual boundary. The method yields the pressure impulse throughout the entire region. The overall impulse and moment impulse on the seawall and a simple model for the uprush of the spray jet after the impact are also presented. The effects of different impact regions and different geometries can therefore be quickly estimated and used to show trends in the results. It is shown that berms generally have a beneficial effect on reducing the impulse, moment impulse and uprush, but not the maximum pressure impulse on the seawall, whereas ditches are generally and sometimes strongly detrimental for all effects except uprush. A missing block in the seawall gives an almost constant or linearly decreasing value inside the gap (depending on the boundary condition applied at the rear of the gap being hard or soft respectively); the soft case can affect the pressure impulse on the front face of the seawall, thereby affecting the impulse and moment impulse.

KEYWORDS: Wave impact; Pressure impulse; Total impulse; Impulse moment; Seawalls; Slamming; Spray jet

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