Estimation of Repair Cost for Caisson Breakwater Covered with Wave-dissipating Blocks Including Influence of Sea Level Rise Due to Global Warming

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ABSTRACT

The cost of reshaping a horizontally composite caisson breakwater (covered with wave-dissipating blocks) is estimated taking into account the effect of the sea level rise due to the global warming. The effect of the sea level rise on the water level at the toe of the breakwater is also discussed. When accounting for the sea level rise, the total expected repair cost increases due to increasing severity of the incident wave conditions at the toe of the breakwater.

KEY WORDS: Cost; repair; sea level rise; wave-dissipating block; caisson.

INTRODUCTION

Sea level rise due to global warming reduces not only the stability of coastal and harbor structures but also the hydraulic performances of structures. IPCC (2007) projected that the sea level could rise 18 to 59 cm by 2100. In shallow water regions, wave heights of high waves are limited by mainly water depth because waves break in shallow water regions. The probability of occurrence of larger waves will increase in shallow water regions if the sea level rises up, i.e., the water depth increases. Therefore, the stability of coastal and harbor structures is decreased. The hydraulic performances of the structures are also decreased if the crest heights of the coastal and harbor structures are decreased.

The percentage of the coastal and harbor structures constructed more than 30 years ago is increasing in Japan. In general, the performances of old structures are decreased and the maintenance cost for old structures is increased. However, the budget for replacing old structures with new structures is very limited. Under these circumstances, existing coastal and harbor structures need to be effectively repaired in order to save the cost. Therefore, the efficient repair in which the influence of the sea level rise for coastal and harbor structures is taken into account should be drawn up because coastal and harbor structures are used for longer periods.

METHOD OF ESTIMATING TOTAL REPAIR COST

Index of Breakwater Performance

Repair of breakwaters should be determined on the basis of the decrease in the breakwater performance. One of the major functions of caisson breakwaters covered with wave-dissipating blocks is to maintain tranquility behind the breakwaters. It is expected that the transmitted wave height behind the caisson breakwaters covered with wave-dissipating blocks increases as the crest height of a pile of the wave-dissipating blocks decreases due to wave attack. Therefore, the