EXPERIMENTAL STUDY ON WAVE OVERTOPPING OF DOUBLE PARAPET TYPE SEAWALL

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INTRODUCTION

Considering a risk of the future sea level rise, it is urgent issue that seawalls should be improved to reduce overtopping waves for ports and harbors in Japan. To improve existing seawalls, not only raising height of the sea walls, but also installing wave-dissipating blocks in front of the seawalls might be restricted depending on locations due to their use. In such cases, additional installation of a parapet, namely a double parapet is effective in reducing wave overtopping. The wave overtopping rate over a rear parapet fluctuates depending on the storage of a water-ponding between the parapets, which has not been studied sufficiently. This study investigates the tendency of fluctuation of wave overtopping rate according to the drainage performance by conducting three-dimensional hydraulic experiments targeting a double-parapet type seawall at an existing airport, particularly with focusing on a corner. Further, some additional countermeasures to reduce the wave overtopping rate are tested and their effectiveness is investigated through the experiments.

EXPERIMENTAL CONDITIONS AND RESULTS

A 1/36 scaled double-parapet type seawall model with drainage pipes and a water catchment box to measure the wave overtopping rate were installed in a 10 m wide and 50 m long experimental basin as shown in Figure 1. The height and period of the generated irregular waves were set as $H_{1/3}$=0.178m and $T_{1/3}$=1.70s, respectively. The drainage performance can be adjusted by changing the number of the open drainage pipes. In addition, four countermeasures were installed at the corner to reduce the wave overtopping rate. The types of countermeasures are as follows: (1) a slope between parapets for preventing the overtopping water from flowing into the corner from the other sites, (2) a wave returner on the rear parapet, (3) a triple parapet, and (4) enhancement of drainage at the corner. From Figure 2 (top), it is found that the wave overtopping rate at the corner (position 6) increases 2 to 8 times more than in the other positions. And, the enhanced performance of drainage constantly contributes to suppressing wave overtopping, in particular, for the corner and its neighbors (positions 4 and 5). Its effectiveness is given even by a local improvement of drainage. These enhanced performances are generally limited depending on overtopping conditions. If the overtopping interval is long, the contribution by drainage gets low due to periods without water between parapets. Therefore, another approach is required for a condition of wave overtopping with a long interval but a huge amount at once. Figure 2 (bottom) shows a kind of resolutions for the problem, so that all of the additional countermeasures further reduce the wave overtopping rate at the corner. Since these methods do not conflict with each other, it is expected that the combination of each method can significantly reduce the wave overtopping rate even against relatively long waves.

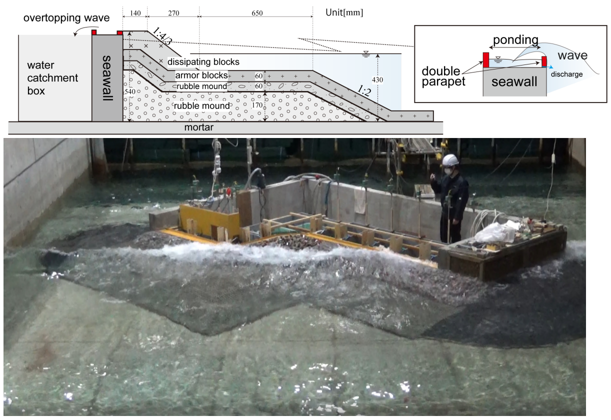

Figure 1 – Experimental (top) conditions and (bottom) snapshot

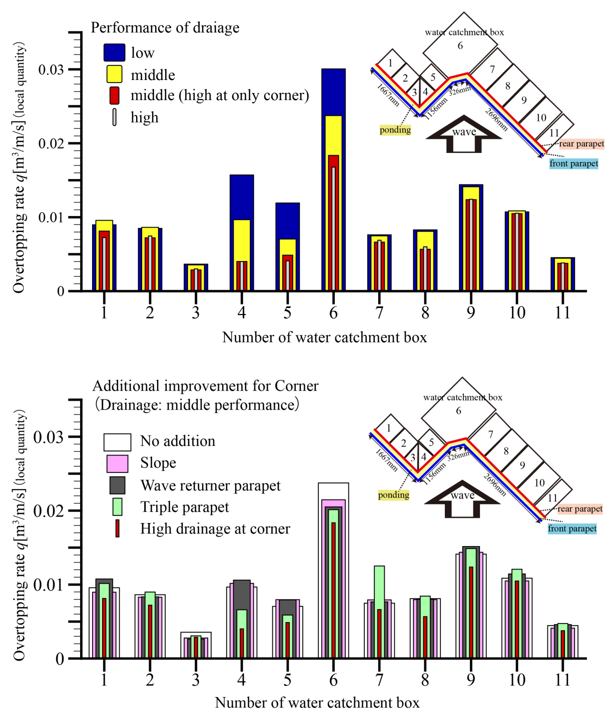

Figure 2 -Variations of wave overtopping rate by (top) drainage and (bottom) additional countermeasures