SETTLEMENT OF ROCKSEAWALL ON ERODING FORESHORE OF SAND BEACH

Hyun Dong Kim, Mirae Ocean Corporation, hdkim@miraeocean.com
Nobuhisa Kobayashi, University of Delaware, nk@udel.edu

INTRODUCTION

The effectiveness of structures placed on the foreshore of a sand beach and a berm was tested and confirmed to reduce wave overtopping and sand overwash, expanding upon the previous comparison test conducted by Kim et al. (2016) with using sand and two different sizes of stones shown in Table 1. Test contains two test series of a rock seawall (Series R) and a dune with a buried seawall (Series B) on the foreshore as shown initial of the two structures in Figure 1 which reduced both wave overtopping and sand overwash even after its deformation. Damage was inflicted upon these two structures which seems to be caused by either stone displacement or structure settlement. To find out which was the case, detailed analysis has been conducted, along with an application of the cross-shore numerical model CSHORE (Kobayashi 2016) for the purpose of simulating sand and stone interactions in the swash zone on the sand beach.

Table 1 - Characteristics of Sand and Two Stones Used in Experiment

Parameter	Sand	Green Stone	Blue Stone
Diameter (cm)	0.018	3.52	3.81
Density (g/cm^3)	2.60	2.94	3.06
Porosity	0.40	0.44	0.44

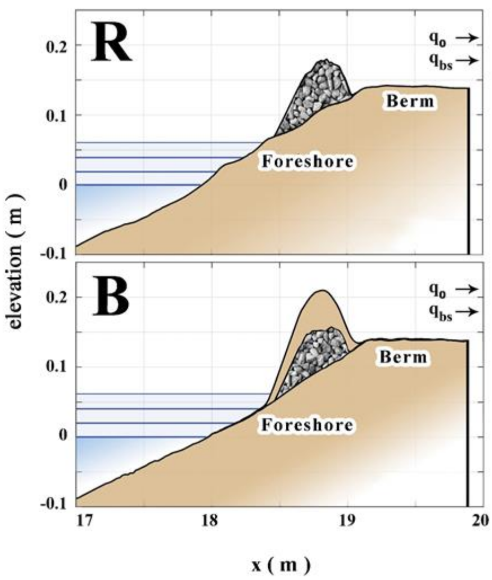

Figure 1 - Initial Profiles of Series R and Series B with the Still Water Level of 0,2,4, and 6 cm for total test duration of 16,000 sec

DATA ANALYSIS

Damages on the both series R and B on the foreshore have been analyzed by laser profiler before and after the experiment. Both series may have been caused by stone settlement rather than stone displacement by wave action based on the images acquired from the laser profiler. Not only profile images, but also eroded area A_e (the area of the lowered stone surface below the initial stone surface) shows clearly that the stone has been settled. Unlike the series R, the series B shows little eroded area, and it can be explained by the fact that a sand on top of the structure may have protected the structure from the settlement as shown in Figure 2.

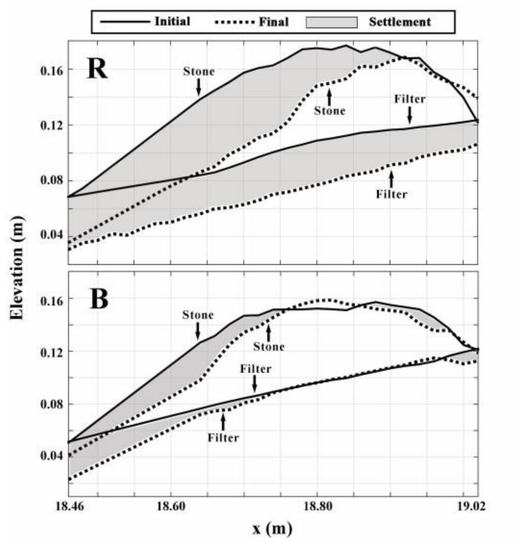

Figure 2 - Settlement of Stone Surface and Filter from Initial to Final for Seawall and Buried Seawall Test Series.

COMPARISON

Since CSHORE cannot predict the movement of both sand and stone simultaneously, damage on the rock seawall test series has been computed assuming no sand movement on the initial sand bottom. After adjusting CSHORE accordingly, hydrodynamic variables, excluding wave gauge placed on the swash zone, were predicted within errors of about 20%. The agreement was depending on the accuracy of the predicted bottom elevation change. The assumption of the fixed seawall implies no lowering of the bottom elevation at the swash zone and implies no lowering of the bottom elevation at the swash zone. Agreement with data in vicinity of seawall was marginal due to no settlement assumption. Thus, CSHORE is being extended to predict the filter and stone settlement and improve the agreement of measured and computed profile changes as well as wave overtopping and sand overwash rates.

REFERENCES

Kim, Kobayashi and Xavier (2016): “Comparison of Rock Seawall and Dune for Storm Damage Reduction”, Proc. 36th Coastal Eng.

Kobayashi (2016): “Coastal sediment transport modeling for engineering applications.” J. Waterway, Port, Coastal, Ocean Eng., 10.1061/(ASCE) WW.1943-5460.0000347, 03116001.