THE EFFECTIVE METHOD OF BEACH NOURISHMENT PLACEMENT

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INTRODUCTION

When erosion occurs, sandy beach cannot maintain the sufficient sand width and the foreshore slope becomes steeper by the frequent erosion effect. As a result, the beach is trapped in a vicious circle of becoming vulnerable by the incident waves. In order to repair or protect the erosive beach, beach nourishment can be used as a countermeasure while minimizing the environmental impacts. However, beach nourishment is not a permanent solution and requires periodic renourishment after several years as shown in Figure 1. To alleviate such problem, minimizing the period of renourishment must be an economical alternative. In that respect, selecting the optimum grain size of the sand for the beach nourishment is very important. Generally, larger grain sized sand is more resistant to the erosion, thus extending the period of renourishment. In addition to selecting the optimum grain size of the sand nourishment, determining the durability as well as maintaining the familiarity of the users of the native sand should be considered.

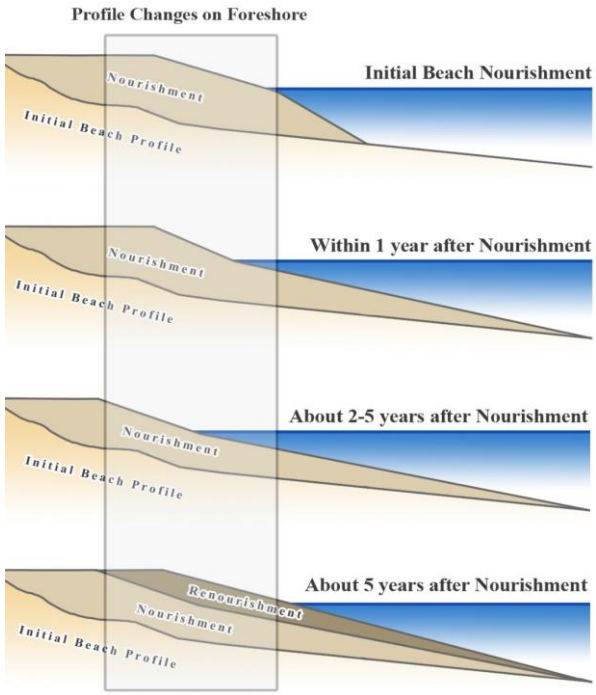

Figure 1 - Beach Nourishment Profile Changes Over Time

EXPERIMENT

In this study, four different test cases of cross-shore hydraulic model tests as shown in Figure 2 were selected and conducted to discover effective nourishment strategy specifically to find the effective alternative methods. Profile of beach in Funafuti Atoll, Tuvalu has been used for the experiment. Two types with different mean diameter, D50 of 0.16mm sand and D50 of 5mm coral gravel were used throughout the experiments in a wave flume which is 30m long, 1m wide and 1.8m high. The wave maker can generate both random and regular wave. Case 1 is a general nourishment using only sand, Case 2 is an actual gravel nourishment constructed in Tuvalu from the project for pilot gravel beach nourishment against coastal disaster on Fongafale Island in Tuvalu by Japan International Cooperation Agency. Case 3 and 4 are the nourishment with same amount of sand and gravel but using different placement. Case 3 and 4 are used in this experiment to compare the effectiveness of different placements as well as see how much difference will it have when not using complete gravel as used in Case 2.

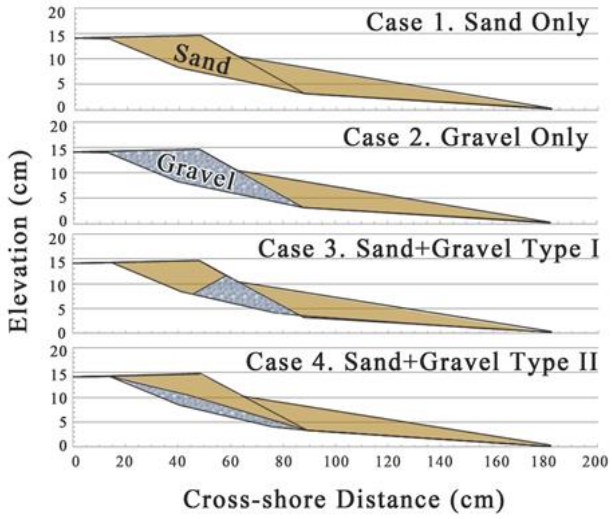

Figure 2 - Initial Profiles for Four Different Test Cases.

From the end of December 2015 to the beginning of January 2016, Cyclone Ula attacked this location and a large amount of sand loss has been caused. This cyclone has 1.3m wave height (H1/3) with 5 seconds period (T1/3) which is the same level of the predicted wave height with 10-year return period, such that this wave condition has been used for the experiments to reproduce the erosive beach condition to compare four different cases. Two sea levels have been used in the experiments, one with ground level (+EL 4.00) and the other with HHWL (+EL 3.50). The result showed that the optimum grain size of the nourishment sand could be determined by the height of the wave run-up and the best slope condition on the foreshore by using correlations between the wave breaking condition and the backwash. Having a large grain sized nourishment is more resistant to the erosion.

REFERENCES

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