A Study on the Method for Raising the Yield of Beach Nourishment in Beach Erosion Control Measures

(Study period: FY2016 to FY2018)

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1. Introduction

In recent years, beach erosion has been becoming serious across the country. For the seashores where erosion is proceeding seriously, effect of erosion control measures only by structures is limited and beach nourishment is also required. In beach nourishment, sand and gravels, which constitute beaches, are laid onto the eroded seashore as shown in the **photo**. The total area of beach nourishment conducted in the country was 2.37 mil. m^3 in 1996 and increased to 23.51 mil. m^3 in 2016.

2. Experiment of yield improvement by changing material and structure of fills

Beach nourishment fills are collapsed by high waves to the offshore side, and some of the materials are stocked under the sea and returned by surging waves to the beach. In this study, decrease in the cross-sectional area of beach from the shore line is considered as "yield" in the process of changes in fills, and a method of optimizing yield changes was examined. "Yield" affects the width of recovery of wave run-up area and sand beach and the total cost of countermeasures. This study hence evaluated improvement in the yield by devising the selection of material for beach nourishment and structure of fills by conducting a hydraulic model experiment.

In this experiment, three types of materials, i.e. sand, fine gravels, and medium gravels, were used to create fills consisting of single-type material, fills mixed with multiple materials, and fills consisting of alternate layers of sand and gravels, and erosive waves with short length and depositing waves with long length were applied. **Figure** shows representative results of the experiment. In the case of only gravels as shown in the upper row of **Figure**, the fills were only eroded, while in the case of mixture of three types of materials in the lower row, the position of shore line shifted forward.

3. Conclusion

Table shows the results of organizing the factors improving yield by devising material selection for beach nourishment and structure of fills as slow decrease in cross-sectional area of beach nourishment fills, progress of the shore line by collapse of fills, and recovery of deposit in wave run-up area. With these results, efficient beach nourishment can be realized by selecting materials according to purposes, such as only gravels for urgent prevention of shore line retreat or mixture of sand, fine gravels, and medium gravels for recovery of beach. We aim to enhance the initiative to implement beach nourishment and recover sand beach by showing efficient beach nourishment methods based on reasonable support.

Photo: Gravel nourishment in Fuji Coast, Shizuoka

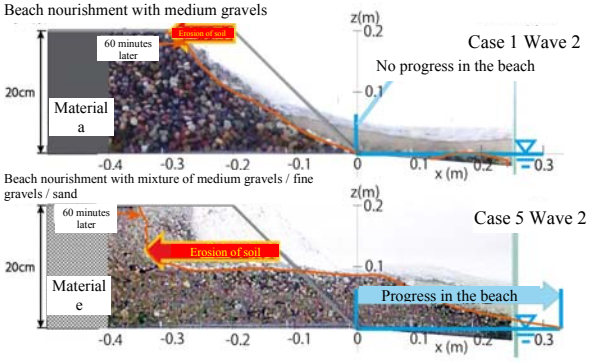

Figure: Profile changes according to difference in material and structure of beach nourishment fills

Table: Evaluation of yield improvement concerning the material and structure of nourishment fills

Material and structure	Erosion of fills	Shore line progress	Recoverability	Overall judgment	Reasons
Only sand	△	◎	○	○	Not resistant against high waves.
Only gravels	◎	X	△	△	Fills are hard to erode but beach cannot be recovered.
Alternate layers of sand and gravels	X	○	△	X	Collapse easily
Mixture of sand and gravels	△	◎	○	◎	Form a berm on the off-shore side to strengthen resistance to waves.

☞See the following for details.

1) NOGUCHI Kenji, KATO Fuminori, SATO Shinji, 2017, "Sand-gravel Mixed Foreshore Nourishment to Improve Erosion Resistant Performance," Japan Society of Civil Engineers Collection of Papers B-2 (Coastal engineering), vol. 73, No. 2, pp.I_799-I_804.