An Experiment on Structure of Resilient Coastal Levees against Scouring by High Waves on the Sea Side

(Research period: FY2017 to FY2018)

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Keywords: coastal levee, waves, scouring, resilient structure

1. IntroductioOn

The Seacoast Act, revised in 2014, requires coastal levees to have a structure able to reduce damages from tsunami, storm surge, and high waves that exceed the design scale, in consideration of the situation of hinterland, etc. For the land side of levee, resilient levee structure against the overflow of tsunami has been used in practice, and the same structure also serves as reference for the overflow of storm surge. Further, for waves exceeding design scale ("high waves"), it was confirmed from the NILIM's past researches that securing of embedment depth with sheet piling, etc. on the levee side is effective for resilient structure.

On the sea side of levee, however, measures for scouring using sheet piling or foot protection works have been conventionally adopted but levees may be destroyed by high waves because their design conditions were set experientially based on past disasters. It is also possible to construct foot protection works larger than those designed, but large-scale foot protection works etc. will be required as expected scouring depth becomes larger and design may be excessive against the event of high waves with low frequency of occurrence. For these reasons, this study examined the structure of resilient coastal levees that are designed not excessively against scouring caused by high waves on the sea side and can demonstrate the effect sufficiently.

2. Experiment outline and main results

In the experiment, a levee model, 1/30 scale, 0.20 m high, 0.10 m in crown width in the wave experiment channel, 127.5 m long, 0.6 m wide, 1.5 m deep, (actual size conversion: height: 6 m, crown width: 3 m), outer slope-back slope ratio; 1:2, was installed and the experiment was conducted under 6 cases of conditions for outer slope toe as shown in Fig. As a wave generation condition, irregular waves with peak overtopping flow rate of 0.1 m^3/s/m (actual size conversion), which is larger than the design condition of general coastal levees, were used.

In case 1.1 (only foundation work), foundation works and figure experiment case (near the levee outer slope toe, model dimensions) outer slope armor moved by scouring but hardly moved in other 5 cases.

Since embedment depth was deeper than scouring depth, no destruction occurred in case 1.2 (sheet piling) and case 1.3 (soil improvement works). In case

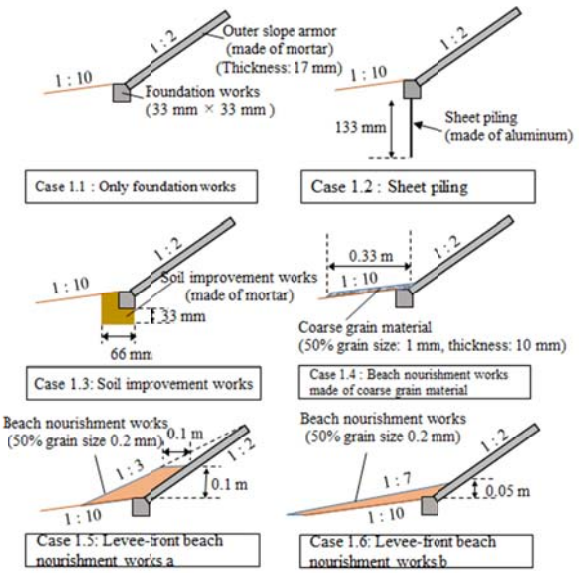

Fig. Experiment case (near the levee outer slope toe, model dimensions)

1.4 (Beach nourishment works with coarse materials) and cases 1.5 and 1.6 (Levee-front beach nourishment works a, b), scouring depth was less than the thickness of foundation works and the effect of reducing scouring by beach nourishment was confirmed. It was also suggested from the experiments in cases 1.2 to 1.6 that scouring depth becomes large and effect of scouring reduction is limited when exposed to the effect of waves longer than the time set in the experiment or when the size of beach nourishment materials is smaller.

3. Future schedule

We are going to conduct an experiment with a model in a scale of 1/8, closer to actual dimension, and prepare technical material for practical use after examining the effect on scouring due to difference in the size of sands constituting coastal landform.

☞**See the following for details.**

1) TAKESHITA Tetsuya, FUKHARA Naoki, KATO Fuminori, KOIZUMI Tomoyoshi, SHIGEHARA Toshihiro, IGARAAHI Tatsuyuki: Experimental Study on Structure of Resilient Coastal Levees against Scouring by High Waves on the Sea Side, Journal of Japan Society of Civil Engineers, B2 (Ocean Engineering), Vol. 74, No. 2, I_1087-I_1092, 2018.