

An Experiment on Resilient Coastal Levees against High Waves (Study period: FY2015 to FY2016)

KATO Fuminori (Dr. Eng.), Head, TAKESHITA Tetsuya, Senior Researcher
Coast Division, River Department

Key words: high waves, coastal levee, resilient structure, overtopping flow

1. Background and objectives

The Seacoast Act, revised in 2014, requires coastal levees to be provided with the function to reduce damage from tsunami, storm surge, and high waves, which exceed the planned scale (resilient structure). For the resilient structure of coastal levees against tsunami overflow, the research findings of our department are used in the restoration works for the Great East Japan Earthquake, etc. This structure is also expected to have the effect of disaster mitigation when the height of a storm surge is greater than the levee crown and seawater overflows, since it is a phenomenon similar to tsunami. For high waves exceeding the planned scale, however, although the coastal levee is expected to suffer damage, seawater will not ingress to an extent exceeding tsunami or storm surge overflow. Therefore, the resilient structure for tsunami overflow may be over-spec for high waves. For this reason, we studied with experiment on the resilient structure of coastal levees against high waves.

2. Experiment description

As a cause of damage to coastal levees by high waves, scouring on the sea side is mentioned, but there are already countermeasures for this type of scouring including foot protection works and wave dissipating works at the levee seaward slope toe. For this reason, this study focused on an event where anchoring works or landward slope armor at levee landward slope toe suffers damage when the land ground is scoured by overtopping flow caused by the waves exceeding the planned scale. We experimented using a model of irregular wave waterway with the contraction scale of 1/30 as shown in Photo.



Photo: Experiment with a model (Case (8))
Anchoring works + Stacked blocks

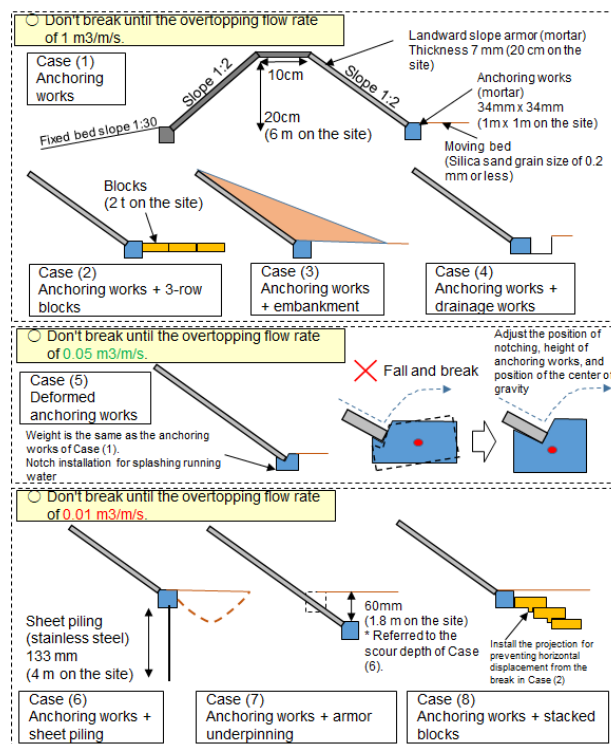


Figure: Experiment cases and critical overtopping flow rate

3. Experimental results

As the result of experiment with 8 cases of structures as shown in Figure, the anchoring works of Case (1) did not suffer damage until the overtopping flow rate of $0.01 \text{ m}^3/\text{m/s}$, but the anchoring works and landward slope armor moved when the overtopping flow rate exceeded that level. The disaster mitigation effect fixed was also observed with Cases (2), (3), and (4), but destruction occurred when the overtopping flow rate is between 0.01 and $0.05 \text{ m}^3/\text{m/s}$. In reference to the condition of destruction observed in Cases (1) to (4), we devised the structure and experimented again. As the result, no destruction occurred until the overtopping flow rate reached $0.05 \text{ m}^3/\text{m/s}$ for Case (5), and $0.1 \text{ m}^3/\text{m/s}$ for Cases (6) to (8).

For the findings of this study (Cases (5) to (8)), we are expecting the provision of information to coast administrators and reflection in the guidelines, etc. so that they may be used as resilient structure of coastal levees against high waves.