INFLUENCE OF CROWN-WALL ON WAVE OVERTOPPING PROBABILITY AND PROBABILITY DISTRIBUTION OVER A SEAWALL

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ABSTRACT

In the past decades, the crest height of the seawall was determined by the allowable average wave overtopping rate q. Franco (1994) concluded that individual wave overtopping，particularly the maximum individual volume, provided a better design method than q, considering the stability of the seawall and the safety of vehicles and people along the coastal area protected by the coastal defense structures.

Shanghai, located on the west bank of the Pacific Ocean, is quite sensitive to the risk of storm surges and violent wave overtopping. The typical seawalls in Shanghai are generally equipped with crown-walls shown in Figure 1. The crown-wall serves as an engineering measure to reduce the wave overtopping effectively.

Recently, researches on the probability distribution of individual wave overtopping and the probability of wave overtopping of seawalls featured with mild smooth slope, high crest freeboards and diverse slope angles have been conducted. It seems that there is a lack of the influence of crown-walls on the probability distribution of individual wave overtopping and the probability of wave overtopping. In the study, 130 experiments were carried out on the seawalls with diverse heights of crown-walls. It is concluded that the probability distribution of the individual overtopping volumes can be well fitted by a Weibull Distribution. The shape factor b and the probability of wave overtopping P_{ow} (related to the scale factor of the Weibull Distribution) are both related to the relative freeboard (R_c/H_{m0}) and the relative wall height (h_{wall}/R_c). A reduction factor γ_v is introduced to the formulas of b and P_{ow} to take the reductive effect of crown-walls into account. It is revealed that the shape factor b increases exponentially with the increasing of the relative wall height, while the probability of wave overtopping P_{ow} decreases exponentially as the wall height increases. New empirical fitting formulas for the reductive effects of crown-walls on b and P_{ow} have been derived based on the experimental results, which can be applied in the design of seawalls after future perfection and verification.

Figure 1 – The typical seawall in Yangtze River Estuary, Shanghai

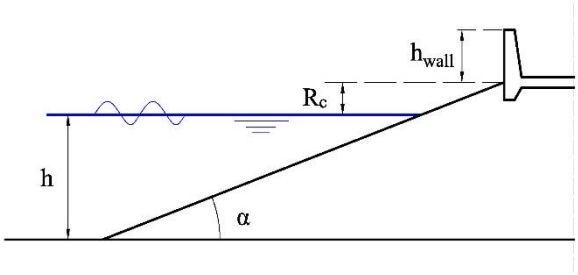

Figure 2 – The definition sketch of the test section

REFERENCES

Franco, De Gerloni, Van der Meer (1994): Wave overtopping on vertical and composite breakwaters, Coastal Engineering, pp.1030-1044.

Pan, Kuang, Li, (2015):Full-scale laboratory study on distribution of individual wave overtopping volumes over a levee under negative freeboard, Coastal Engineering, vol. 97, pp. 11-20.

Victor, Van der Meer, Troch (2012):Probability distribution of individual wave overtopping volumes for smooth impermeable steep slopes with low crest freeboards. Coastal Engineering，vol.64, pp.87-101.