At-SEA EXPERIMENT AND SITE MONITERING ON A NEW COASTAL PROTECTION ENGINEERING METHOD-ARTIFICIAL MARINE FOREST

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INTRODUCTION

A new engineering method on the coastal protection, "Artificial Marine Forest (AMF)" proposed by Liang et al.(2004) is composed by lots of tautly-moored floating structures (TMFS).The concept of this method is to establish a butter zone between the shoreline and the sea area by building a dense forest to reduce the wave energy and protect the coast. When deploying a larger number of cylindrical floating bodies in the offshore region, the scene is similar to the marine forest. The wave-dissipated mechanism of this method is related to the interaction of wave and floating structures. Based on the laboratory experiment, the magnitude of wave dissipation is significant influenced by the diameter of cylindrical floating body and the amount of its number. The target of this study is to verify the capabilities of prototype cylindrical floating bodies on the durability and the wave-dissipated in the real marine environment.

FIELD EXPERIMENT SETUP AND SITE MONITERING

The experimented site is located on the offshore region of north coast of Shuangchun, Tainan city, Taiwan. The site is 1.7km from the coast and its local mean water level is 7m. A set of prototype tautly-moored floating structure (TMFS) is made by a 7 m long bamboo with 0.1m diameter, a 1m long nylon rope with 4.5-8.5mm diameter, and four sand-bags with 100kgw for the anchor weight. The critical strength of TMFS is designed to endure the 3m wave height induced the wave force.
In first year, 520 and 350 sets were installed in the 1st and 2nd zones with the 100m length and 10 m width, respectively. The setup of two zones is parallel with the isometric lines. In this year, 620 sets are deployed in the 3rd zone with 100m length and 10m width. The average spacing is 1-2m.The deployment of AMF in the site is shown in Fig.1.
Two ADCP are respectively placed in front of and behind AMF along the wave direction to calculate the transmitted coefficient (Kt) by using the measured incident and transmitted wave height. On the other hand, the drone is used to regularly monitor the quantities of TMFS during the typhoons and monsoon periods. Former denotes the capability on the wave energy dissipation, and the latter is to estimate the loss rate and the durability of TMFS in the sea.

PRELIMINARY RESULTS

(1)The evaluation on the wave energy elimination
The twice measurement on the waves heights were implemented on the Sep. and Nov. 2016 after the construction of first two zones were completed, respectively. The typical time series on the significant wave height and corresponding transmitted coefficients is plotted in Fig.2. The field surveys are shown that the transmitted wave height is reduced after waves through AMF. The average transmitted coefficient during the measured duration is approximately 0.91-0.92. The average dissipated power percentage per unit width is 16.6-17.8%. It also finds that the wave energy on the short period component is significantly reduced due to the dense AMF.
(2)The evaluation on the durability of TMFS
Based on the aerial photography by the drone, the bodies in the 1st zone remained 350 sets until the end of 2016. Numerous typhoon events and the northeast monsoon during Sep.-Nov.2016 cause the decrease of amount of TMFS.
It is also observed that the average loss rates of TMFS in the 1st and 2nd zones are 20 sets per month. The decrease of quantities of TMFS depends on many factors. For long-term factors, the cyclical monsoon effect, the biodegradation and the wind-wave-current interaction in the real marine environment weaken the strength of bodies. On the other hand, for the short-term factor, the possible reason is that typhoons induced larger wave force exceeds the allowable strength. The field surveys are still implementing, more detail will be shown in the full text.

Figure 1 - Part of AMF on the experimented site, the offshore region of Shuangchun north coast, Tainan.

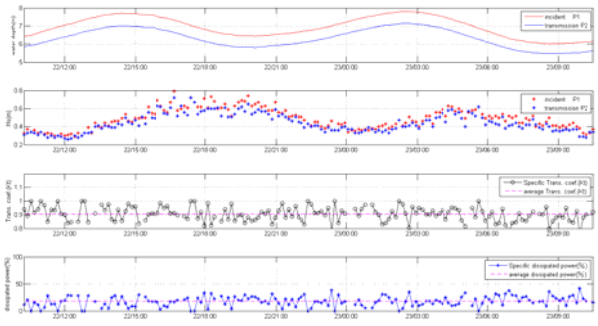

Figure 2 - Typical time series on the wave displacement and the corresponding transmitted coefficients (Kt).

REFERENCES

Liang, Nai-Kuang, Jen-Sheng Huang, Chih-Fei Li (2004): A study of spar buoy floating breakwater, Ocean Engineering, ELSEVIER, vol. 31, pp. 43-60.