Ain Shams University - Faculty of Engineering

EFFECT OF USING MULTIPLE ROW-PILE BREAKWATERS AS WAVE ENERGY DISSIPATER IN COASTAL AREAS

A Thesis Submitted in the Partial Fulfillment of the

Doctor of Philosophy

Civil Engineering - Irrigation & Hydraulics

BY

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2017

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STATEMENT

This thesis is submitted to the Irrigation and Hydraulics Department, Faculty of Engineering, Ain Shams University in the partial fulfilment of the requirements for the Degree of Doctor of Philosophy in Civil Engineering.

The work in this thesis was carried out in the Civil Engineering, El Shourok Academy from 2014 to 2016

No part of this thesis has been submitted for a degree or a qualification at any other university or institution

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ACKNOWLEDGMENT

First and foremost, praise and thanks For God.

Deepest gratitude and appreciation are to be conveyed to **Prof. Dr. Sonia El-Serafy,** Professor of Coastal Engineering, Ain Shams University, for the kind supervision, support, guidance, help, encouragement and useful suggestions all through this work.

Indebted to **Dr. YASSER EL SAYED MOSTAFA**, Professor of Harbor Engineering & Marine Structures, Ain Shams University, for constant supervision, planning, generous support, helpful advice and constructive thoughts throughout this work.

Thanks are extended to **Dr. YASSER SADEK EL-SAIE**, Associate Professor in Irrigation and Hydraulics Department, Ain Shams University, for his constant supervision, planning, generous support and help during the course of this work.

Finally, appreciations are due to my parents and family for their support.

ABSTRACT

In terms of the importance of safeguarding the coastal zone in Egypt, this thesis was initiated with the motivation of proposing an innovative coastal protection measure and investigating its capability of energy dissipation, experimentally. Primarily, literature was reviewed, analysed, categorized and comprehended. models to solid piles breakwater were designed and constructed. Experimental flume was set up to test these models, where measuring devices were arranged. Contributing parameters (i.e. wave height, period, steepness, piles arrangements, diameters…..etc.) were varied. Measurements were undertaken ;analysed; presented on graphs and discussed. Based on the discussions and within the experimented range of parameters, it was clear that solid piles so as the staggered possess an enormous capability of dissipating the wave energy by a percentage that ranged between 20 to 75%, which is considered to be a reasonable amount from the coastal engineering point of view. In terms of the importance of coastal zones, some previous research tried to reduce wave energy attacking the shoreline. This thesis presents a special coastal protection measure which is perforated piles, evenly distributed and staggered, breakwaters and experimentally investigates piles breakwaters capability of energy dissipation. Physical models of perforated piles breakwater were designed and constructed. Experimental flume was arranged to test these models and measuring devices were arranged. Contributing parameters such as wave height, period, steepness, piles arrangements and pile diameter were varied. Based on the discussions and within the experimented range of parameters, it was clear that perforated piles possess an enormous capability of dissipating the wave energy by a percentage ranged between 15 to 55% which is considered to be significant amount from the coastal engineering point of view. It can also be applied to the equation (C_t) on the solid piles. Moreover, the pile breakwater was investigated to assess it, in terms of the environmental impact (i.e. shoreline changes) and economic (i.e. cost estimate) , but found piles breakwater better than rubble mound breakwater.

Key words:

Pile breakwater ---Wave transmission -- Wave reflection—Energy dissipation

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