بسم الله الرحمن الرحيم

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تم رفع هذه الرسالة بواسطة / سلوي محمود عقل

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

ملاحظات: لا يوجد

Ain Shams University

Faculty of Engineering

Irrigation and Hydraulics Department

Wave Energy Dissipation by Using Some Different Types of Breakwaters

A Thesis submitted in partial fulfillment of the requirements of the degree
of Master of Science in Civil Engineering
(Irrigation and Hydraulics)

By

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Statement

This thesis is submitted as a partial fulfilment of Master of Science in Civil Engineering (Irrigation and Hydraulics), Faculty of Engineering, Ain Shams University.

The author carried out the work included in this thesis in the irrigation and hydraulics department, Faculty of Engineering, Ain Shams University from September 2019 to September 2021. and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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Abstract

This research investigates the effectiveness of three different types of permeable breakwaters experimentally (floating breakwaters, submerged breakwaters, and piled breakwaters), as often overestimated during the design process. Choosing the appropriate type of breakwater is one of the main concerns in the design of shore protection or energy dissipation measures. Several factors affect the selection of the breakwater's type, such as the water depth at the site of the breakwater (y), the wave period (T), the wave height (H), soil conditions, and available material near the site. Different physical models have been tested under a various wave and water depth conditions to examine the efficiency of the three types of breakwaters with varying draught in floating models, crest freeboards in submerged models, and transverse spacing, arrangement, and geometry in piled models. The results show that the transmission coefficient, which is the most dominant factor in representing the effectiveness of breakwaters, decreases with increasing wave steepness and relative water depths for all types of breakwaters. Also, it decreases with increasing relative draught depth and relative breakwater width for floating breakwaters. It decreases with increasing relative crest freeboard and relative crest width for the submerged breakwaters. Finally, it decreases with increasing relative pile diameter, staggering piles, and using suspended breakwaters (adding horizontal strips suspended on the piles).

From studying the comparison between the three types, it was clear that floating breakwaters give much the same efficiency as submerged breakwaters, although more economically, especially if applicable in deep-water depths or on poor foundations at the seafloor. Suspended breakwaters provide good results when compared to closely spaced piles breakwaters. A general comparison was made between the three types regarding their efficiency in dissipating wave energy, their environmental impacts on marine life in the short and long terms, and their impacts on sediment transport and water quality and also compared to each other according to ease of installation, the effect of scouring, and the economic aspects.

Keywords: Breakwaters, Floating Breakwater, Submerged breakwaters, Piles Breakwaters, Wave energy dissipation, Marine Structures, Shore Protection.

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List of Abbreviations

BW	Breakwater
FB	Floating breakwater
PB	Piles breakwater
SB	Submerged breakwater (Low crested breakwater)
SPB	Suspended pile breakwater (Piles with suspended horizontal strips)
SLR	Sea level rise
SWL	Still water level

List of symbols

A_p	Arrangement of piles	-
a	Amplitude of wave	[L]
B	Crest width for submerged breakwater	[L]
b	Clear spacing between piles	[L]
D	Draught of floating breakwater	[L]
D_{50}	Median diameter of the core or armor material	[L]
d	Pile diameter	[L]
g	Gravitational acceleration (g=9.81 m/s²)	$[LT^{-2}]$
k	Wave number (k= 2π/L)	-
H_i	Incident wave height	[L]
H_T	Transmitted wave height	[L]
h	Height of breakwater.	[L]
h_c	Height of crest for submerged breakwater	[L]