



Ain Shams University
Faculty of Engineering
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Impact of Detached Breakwaters Design Parameters on Beach Morphology Using Numerical Modeling

A Thesis

Submitted in Partial Fulfillment of the Requirement for the Degree of
MASTER OF SCIENCE IN CIVIL ENGINEERING

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Statement

This thesis is submitted to Ain Shams University for the degree of M.Sc. in Civil Engineering.

The work included in this thesis was carried out by the author at the Department of Irrigation and Hydraulics, Faculty of Engineering, Ain Shams University, Cairo, Egypt.

No part of this thesis has been submitted for a degree or a qualification at any other University or Institution.

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Abstract of M.Sc. Thesis

Coastal engineering is the branch of civil engineering related to problems arising from constructions along or near the coast, as well as the development of the coast itself.

Erosion and sedimentation are natural processes. The most noticeable aspect created by erosion is the loss of waterfront property. Waterfront property values are extremely high, which drives many owners and governments to spend considerable time and money protecting their shoreline from erosion.

There is a vital need to understand the characteristics and physical behavior of the coastal environment, as well as to apply engineering principles and concepts to develop opportunities and solve problems in this environment.

Detached breakwaters are considered one of the solutions that can be used as a protection measure. However, any change in the shoreline has an adverse impact. Several factors affect the decision of coastal engineers to select the suitable configuration of detached breakwaters to counteract these problems.

An intensive parametric study using different wave characteristics has been conducted to study the impact of different parameters of detached breakwaters on shoreline changes and beach morphology to guide designers in selecting the appropriate alternative. This was accomplished by using a hydrodynamic model (MIKE 21 software program) for simulating shoreline changes at three different study areas. The study areas were East El Burullus, West El Burullus and Marina El Alamein which all are located in the northern coast of Egypt. The thesis examined the effect of different parameters on shoreline changes due to the presence of detached breakwaters

parallel to the shoreline. Conclusions have been drawn to guide the
. practitioners how to effectively design the detached breakwater system

Keywords: Coastal, Detached breakwater, shoreline, MIKE

Summary of M.Sc. Thesis

Coastal Engineering is a combination of practical applications with modern technological and scientific approaches through modelling and observations. Also, it is the branch of civil engineering concerning with processes ongoing at the shoreline and construction within the coastal zone and attempts to solve some coastal zone problems.

A basic understanding is required of the characteristics of the coastal environment to apply engineering principles to solve coastal zone problems such as beach erosion.

A number of systems are used to prevent damage of beach that caused by waves. The most common shore protection structures are breakwaters, sea walls, revetments and groins. These are all structures built out of concrete, sand and stone to help dissipate the force of waves and control erosion.

Detached breakwaters can be used as a solution for this problem. Coastal engineers have to select many parameters to effectively design a suitable detached breakwater system for shore protection.

A numerical study at three areas (East El Burullus, West El Burullus and Marina El Alamien) using a hydrodynamic model (MIKE 21 software program) was carried out to study the effect of different parameters on shoreline changes due to detached breakwaters systems. These parameters included incident wave angle, wave height, wave period, time, gap between detached breakwaters, distance between shoreline and the detached breakwaters and number of detached breakwaters.

Organization and Description of the Thesis

The thesis comprised the following chapters:

Chapter one presents a brief introduction of the subject and brief description of the thesis.

Chapter two presents a review of basic hydrodynamic processes, littoral sediment transport, and coastal morphology. It also presents various types of shore protection structures and these characteristics especially detached breakwater.

Chapter three presents a detailed description of the numerical model (MIKE 21) and its components (LITCONVE, LINTABLE and LITLINE).

Chapter Four presents a case study which is located in northern coast of Egypt (East El Burullus). Detached breakwaters systems with different parameters were selected to examine the shoreline changes.

Chapter Five presents a second case study which is located in northern coast of Egypt (West El Burullus) and presents the effect of different parameters on the shoreline changes at this study area.

Chapter Six resents a third case study which is located in Marina El Amlamein (Northern Coast o Egypt).

Chapter Seven presents general conclusions and further recommendations are presented. The study introduced the effect of different parameter of detached breakwater on shoreline changes.

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