Mud Coastal Protection Using Triangular Modules of Breakwater made of Bamboo

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ABSTRACT

The objective of this study is to investigate the efficiency of triangular breakwater modules made of bamboo. Each module is triangular in shape with dimensions of 2 m wide and 2.5 m high. Wave characteristics were measured in front of and behind the breakwater, which was constructed on a mild-slope mud coast in the Upper Gulf of Thailand. Water level time series were recorded at the breakwater while the offshore wave height was measured. The triangular breakwater modules made of bamboo have a wave energy dissipation efficiency of more than 10% especially when the water level is high in the period of spring tide.

KEY WORDS: Coastal erosion; breakwater; energy dissipation; mud coastal.

INTRODUCTION

Coastal erosion is one of the most important socio-economic problems around the world. Most coastal protection concepts are based on attenuating the incoming wave energy before it approaches the beach using hard or soft measures (Reeve et al., 2004).

The most important forces for sediment erosion and transport are from waves, because they introduce energy to the coast, and series of currents that move sediment along the shore and normal to the shore. Therefore, it is important to understand the movement of wave forms and their interaction with coastal structures (Kamphuis, 1999).

Extreme weather events and projected sea level rise have led to increasing interest in and research on wave attenuation. The latest trends in coastal engineering focus on less intrusive forms of shore protection, which provides a natural habitat while protecting shorelines (Augustin et al., 2009).

Previously, a few researchers studied the interaction between waves and some types of coastal protections. For example, applications of vegetation for wave attenuation were presented by Wayne (1976), Knutson et al. (1982), Kobayashi et al. (1993), Mazda et al. (1997), Møller and Spencer (2002), Quartel et al. (2004), Burger (2005), and Chen and Zhao (2011). Examples of applications of vertical cylinders for wave transformation were given by Herbich and Douglas (1988), Kakuno et al. (1996), and Silva et al. (2003).

Other types of breakwater were found, for examples, the applications of geotextile tubes (Oh and Shin, 2006), bamboo breakwater (Halide et al. 2004, Thanh, 2006), and rubber tires (McCartney, 1995) were reported for shore protection.

In Thailand, efforts to protect shorelines have been made by government agencies, the private sectors, and local communities during the last three decades. However, the effectiveness of coastal structures is still in questions among engineers, scientists, and communities. Some coastlines were protected using hard structures and some using soft structures. For mud coastal areas, hard structures are not appropriate due to high rate of settlement on soft ground while vegetation like mangroves need time for growing and its roots cannot remain in place if severe erosion or large soil loss occurs.

The objective of this study is to investigate the efficiency of a set of triangular breakwater modules made of bamboo for energy dissipation in a selected mud flat area.

STUDY AREA

Bang Khun Thian shoreline is located in southern Bangkok in the Upper Gulf of Thailand as shown in Fig. 1. This area is coastal mudflats, fringed by thin band of mangroves along the coastline as shown in Fig. 2 (Kamphuis, 1999). The mangrove forest has been destroyed to make way for shrimp farming for a few decades, and therefore most of the eroded areas have increased, with shrimp farms taking up larger areas. After farming was stopped, sea water was pumped out the shrimp farms, and some surface soil was removed and sold for other infrastructure construction (Ekphisutsuntorn et al. 2010; Department of Ocean and Coastal Natural Resources, 2008).

The concept of the triangular breakwater made of bamboo arose from the claim of a local community in a district of Samutsakorn province, next to Bang Khun Thain district, that a few layers of triangular breakwaters made of bamboo constructed on the Samutsakorn coastline were effective and could reduce the wave energy very well. Accretion of deposition of mud was found behind the breakwater, and so the lost seashore was reclaimed.

In the present study, only one layer of triangular breakwater made of bamboo is studied. The module is triangular in shape, 2.0 m wide, and 2.5 m high, as shown in Fig. 3.