THE EFFECTIVENESS OF VARIOUS TYPE RETAINING WALL TO CONTROL COASTAL EROSION

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRACT

Coastal erosion can be defined as the loss of the sand along the coastal area because of the action of waves, current or tides in a long duration of time. Coastal erosion happened when the water waves, currents or tides removed a portion of sand from the coastal area. When the water waves went to the coastal area, a portion of the number of the sand will be carried along from the coastal area when the waves return back to the sea, depositing and storing the sand in the formed of large sandbars. In a long duration of times following the water waves, the sand will return back to the coastal area. Due to the different in volume of the sand that was carried from the coastal area and the sand that are returned back to the coastal area in a repeated cycle caused the coastal erosion to happened. The main objective of this study is to identify the effectiveness of the various types retaining wall that are used for coastal protection today. The study was conducted in laboratory with four different types of retaining walls; vertical type, slope type, stairs type and curved type. The lab scale model is developed and constructed for the study in order to achieve the objective of the study by using the scale of 1:60 with assumption of the prototype retaining wall that has the height of 3 m. Among of the four types of retaining wall model that are used in this study, it found that the curved type is the most effective retaining wall model which it only allowed the lowest volume of water to pass through with an average rate overtopping volume of 1.67 ml/min. The result clearly showed that curved type retaining wall effectively able to protect the coastal area from wave attack. The less effective retaining wall from the study is sloped type which is indicated the highest volume of passing water over the walls with an average rate overtopping volume of 28 ml/min.

ABSTRAK

Hakisan pantai boleh didefinasikan sebagai kehilangan pasir di sepanjang kawasan pantai berpunca daripada tindakan ombak, arus atau pasang surut air laut dalam satu jangka masa yang panjang. Hakisan pantai berlaku apabila ombak, arus atau pasang surut air laut bertindak mengeluarkan sebahagian daripada pasir dari kawasan pantai dalam satu jangka masa yang panjang. Apabila ombak menuju ke kawasan pantai, sebahagian daripada pasir akan dibawa apabila ombak kembali ke laut, pasir ini kemudiannya akan dikumpulkan dan dipulangkan semula ke kawasan pantai melalui tindakan ombak dalam satu jangka masa yang panjang. Disebabkan perbezaan dalam jumlah pasir yang dibawa oleh ombak dan jumlah pasir yang dipulangkan semula ke kawasan pantai secara berulang-ulang menyebabkan hakisan pantai terbentuk. Objektif yang terlibat dalam kajian ini ialah mengenalpasti keberkesanan pelbagai bentuk dinding penahan iaitu dinding penahan berbentuk menegak, dinding penahan berbentuk tangga, dinding penahan perbentuk sudut dan dinding penahan berbentukmelengkung yang digunakan dalam mengawal hakisan pantai. Satu skala makmal model untuk digunakan didalam eksperimen telah dibina dan dihasilkan demi mencapai objektif kajian berpandukan skala 1:60 dengan dinding penahan ombak yang sebenar berketinggian 3 m. Di antara empat jenis model yang digunakan dalam kajian ini, model dinding penahan ombak berbentuk melengkung adalah yang paling berkesan kerana membenarkan jumlah air yang melepasinya yang paling sedikit iaitu 1.67 ml/min secara purata. Ini menunjukkan bahawa dinding penahan berbentuk melengkung sangat effektif melindungi kawasan pandai dari serangan ombak. Dinding penahan yang paling kurang keberkesanannya ialah dinding penahan berbentuk sudut kerana membenarkan jumlah air yang paling banyak melepasinya iaitu sebanyak 28 ml/min secara purata.

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LIST OF SYMBOLS

V_r	Rate of volume overtopping water
V_{total}	Total volume of overtopping water
T_{total}	Total time taken for one test
C	Celerity
G	Gravity
L	Wave length
D	Depth
T	Time period

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Wave is one of the most common phenomena that happened at the ocean. The wave that is commonly see happened at the coastal area is originally produced by the movement of the winds at a very long distance before they arrived at the seashore. In fact, in Malaysia waves commonly generated by the movement of the annual monsoon wind from north east (Nov-Feb) and southwest (May-Sept).

Open ocean waves can be explained as a curve that has a smooth repeating pattern that is superimposed to produce a realistic ocean as shown in Figure 1.1. Waves arriving at the coastal shore have their own period that ranging from two seconds to 20 seconds depending of the speed of the waves and the pattern of the winds (Holman, 2001). Based on this, the wave energy is being transferred to the seashores. Although the energy seems small but if the energy is being transferred to the seashores repeatedly at a period of two second to 20 seconds it will results in the coastal erosion.

Figure 1.1 Formation of Waves

Source : James and Stull (2016)

At present, erosion and flood are serious threats for coastal areas and the set-up of defense technologies able to cope with sea level rise and increased storminess induced by climate change represents a great challenge (Zanuttigh, 2011). Coastal erosion is a major problem that caused the consent of much country around the world as shown in Figure 1.2.

Figure 1.2 Coastal erosion at Butterworth Outer Ring Road, Penang

Source : Sahabat Alam Malaysia (2016)

This is because coastal are an important assets to the country which focusing on coastal tourism industry. Coastal also protect important coastal economic assets to the country. Coastal erosion is the reduction of the coastline area by the act of wave energy. There are many current practices to reduce and avoiding the coastal erosion and the most commonly used is by using retaining wall or sea wall to act as shield against wave's energy at shown in Figure 1.3.

Figure 1.3 Example of Retaining Wall at Pantai Morib, Selangor

Source : Cari Desinasi (2017)

Retaining wall consists of much type such as concrete retaining wall or retaining wall made of stone. Retaining wall also consists of different shape which can be used as a shield of wave energy. The shape that commonly used is stairs shape retaining wall, curved shaped retaining wall, and vertical shape retaining wall and slope shape retaining wall. All the shape can be used but the dispersion of the wave energy is different between the different shapes of the retaining wall.

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