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THE EFFECT OF STRUCTURE SUBMERGED UNSYMMETRIC TO THE SEMI CIRCLE MODEL AGAINST REFLECTION OF WAVES

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Abstract

A reflection of a wave is a reflection of a wave that occurs when a wave is coming against a wall or a barrier. The problem of wave reflection is very important in coastal building planning especially port. The water in the harbor pool should be calm so the ship can dock. To get the calm in the harbor pool, then must be made buildings that can absorb energy or destroy wave energy. Breakwaters are buildings that serve to absorb or destroy wave energy. One form of the breakwater is a sinking wave breaker. The wave breaker is a wave breaker in which the muted wave is permitted to crush over the construction. The purpose of this research is to understand wave reflection with unsymmetrical sink structure. This research is done with a wave breaker model that is semicircle model. The model will be arranged asymmetrically to see the effect of wave reflection changes across the model. The results of this study indicate that the reflection coefficient value with a density of 4 x 6 cm, 6 x 9 cm and 8 x 12 cm is inversely proportional to the wave steepness value (Hi / L). The larger the density of the model, the greater the reflection coefficient.

Keywords— Submerged Breakwater, the arrangement is not symmetrical, the reflection coefficient

I. INTRODUCTION

Various activities in coastal areas such as settlement, industry, port, agriculture / fishery, tourism and so on can cause problems in coastal areas such as coastline changes. The coastline changes caused by human factor that can be port development activities. Port Development activities conducted continuously is expected by negative effect against nature conservation. Negative impacts can be a situation on the harbor pond due to sedimentation. To overcome the negative impact of erosion or coastal abrasion or sedimentation problem, it can be made a breakwater construction to reduce wave energy. The reduction of wave energy depends on the magnitude of the reflection coefficient. The reflection coefficient of the sink tends to increase as the slope gradient of the steeper sink. Another investigation is conducted by ArkalVittal et al (2013) on the influence of a quarter-circle submersed wave with several variations of a radius results in the addition of a reflection coefficient proportional to the steepness of the waves and also to the radius of the increasingly enlarged model. From the previous research, it was developed again in terms of arrangement of models that are made

II. LITERATURE REVIEW

A. Reflection Wave

A reflection of wave is a reflection of a wave that occurs when a wave is coming to hit wall or barrier. The phenomenon of reflection can be found in the harbor pool. The reflection of waves is determined by different coefficients for different types of building. The great ability of a building reflects that the wave given by the reflection coefficient, i.e. the comparison between the wave height of Hr reflection and the high of coming wave Hi:

$X = Hr/Hi$ …………………………………..1

Where :
X = reflection coefficient
Hr = reflection wave height (m)
Hi = wave height coming (m)

The building reflection coefficient is estimated based on the model tested. The reflection coefficients for various building types are presented in Table 1 below

Table 1. Reflection Coeficient

Building Type	Reflection Coefficient (X)
Vertical walls with tops above water	0.7 - 1.0
Vertical walls with submerged peaks	0.5 - 0.7
Pile of oblique side stones	0.3 - 0.6
Pile of concrete blocks	0.3 - 0.5
Vertical building with energy damper (given aperture)	0.05 - 0.2

(Source : Triatmojo, 1996)

The vertical and non-permeable walls reflect most of the wave energy. In such buildings the reflection coefficient is X = 1 and the reflected wave height is equal to the coming wave height

B. *Breakwater*

The breakwater is a building that serves to break the waves of sea water so as to reduce energy in the waves of sea water. The structure of breakwaters can be made of massive or rigid structures and flexible structures of life, rubblemount and floating plants. During this time the breakwaters can be used as a tool in maintaining coastal damage. The form of the breakwater is divided into 4 parts, namely:

1. The tilted sidewall
2. Up right side wave breaker
3.Mixed breakwaters
4.Submerged breakwater

The breakwater as an energy damper is essentially composed of four kinds:
a. Submerged breakwaters are breakwaters where muted waves are permitted to crush over construction.
b. Non-submerged breakwaters are breakwaters that are frontally hit by waves in construction so that the waves break directly during construction
c. Floating breakwaters are breakwaters that are floated above the water surface so that kinetic and dynamic energies are muted together by construction (Harms, 1979).
d. Submerged (submerged horizontal plate) is a built float breakwater in the form of a plate-shaped construction (Xiping, 2004).

The submerged breakwater can serve to direct the movement of wave propagation as desired (Herbich, 2000). If the shape of the contours of the sea floor is convex in the direction of the coming wave, then the wave will be centered (converging) and cause the wave will rise. Similarly, when the seabed is concave in the direction of the coming wave, then the wave will be widened (divergent) and the wave height becomes lower. This theory shows that when the shape of the sinking construction is concave curved with the direction of the coming wave, then the wave will widen (divergent) and the wave height becomes lower. This theory shows if the form of sunken concave-shaped construction concave with the direction of the arrival of the wave will cause a refraction effect (widening of the wave behind the construction)

C. *Wave Theory*

Waves can occur due to wind, ups and downs, artificial disturbances such as ship movement and earthquakes. The effect of the wave on port planning is:

1. The size of the waves determines the dimensions and the depth of the building breakwater.

2. Waves create additional forces that must be accepted by ships and dock buildings.

Waves are a major factor in the determination of port layouts, shipping lanes and coastal building planning (Triatmojo, 1996).
waves can be classified into three parts based on the water depth of shallow water waves, transitional water waves and deep water waves (Triatmojo, 2011). Based on the water depth, the three types of waves can be differentiated according to the following limits:

Table 2. Types of Waves Based on the Water Depth

wave category	d/L	2πd/L	Tanh 2πd/L
shallow water waves	> 0.5	> π	1
transitional water waves,	0.05 – 0.5	0.25 - π	Tanh 2πd/L
deep water waves	< 0.05	< 0.25	2πd/L

(Source :Triatmojo, 2011)

D. *WAVE CHARACTERISTICS*

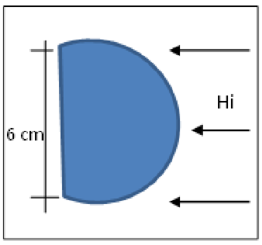
Waves arising on the surface are one form of energy transfer caused by the wind that blows on the surface of the ocean. The characteristics of the waves leading to the coast are strongly influenced by the water depth, the shape of the beach profile and the wave character itself. Parameters to consider in explaining waves are wavelength, wave height, and water depth. These parameters can be explained as follows:

a. Wavelength (L) is the horizontal distance between two peaks or the highest point of successive waves
b. The wave period (T) is the time required by two successive wave peaks / passes through a given point
c. The wave propagation velocity (C) is the ratio between the wavelength (L / T) when the water waves propagate at speed, the water particle does not move toward the wave propagation
d. Amplitude (a) is the vertical distance between the peak / highest point of the wave or valley / lowest point of a wave with calm water level (H / 2)

III. METHOD RESEARCH

Material collection of modeling, model will be adjusted to channel size, calibration of laboratory apparatus, determine wavelength according to wave period, no model test to determine the wavelength, model test with three unsymmetrical arrangement to determine wave height and transmission height.

A. Type Model



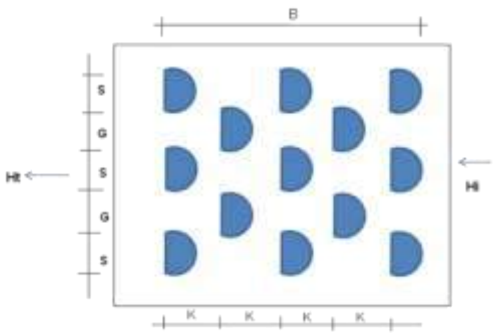


Figure 1.examples of unsymmetrical arrangement

The place of research was conducted at Hasanuddin University Hydrolical and Engineering Laboratory.

B. Research Implementation

Standard testing is done by calibrating the probe. The probe calibration aims to get the actual wave height by using Eagle software for readability. The readings obtained are wave amplitude. By entering the wave amplitude value of the probe calibration equation, it will be obtained by the coming wave height and the transmission height

C. Testing without model

The Model testing was performed at the Laboratory to determine the wavelengths with two different depths of 12 cm depth and 16 cm depth, then with three periods and three strokes. The wavelength to be obtained is then used as a standard for subsequent tests

D. Testing with a model for three unsymmetrical arrangements

The semicircle-test was performed with three density variations for each depth of 12 cm and 16 cm. Three variations of density are 4 cm x 6 cm, 6 cm x 9 cm and 8 cm x 12 cm. The density in question is the horizontal and vertical distance between the asymmetrically arranged models. This test is done to see the effect of reflection coefficient on the model which is arranged asymmetrically.

E. Implementation Walk

After obtaining the wave amplitude value for each density variation through the aid of the Eagle program, the subsequent wave amplitude values are substituted into the probe calibration equation to obtain readings of wave height and transmission wave height. After that the wave height data comes and the transmission wave height data are processed by using the reference to get the reflection coefficient value

IV. RESULT AND DISCUSSION

A. Semi circle model for density 4 cm x 6 cm

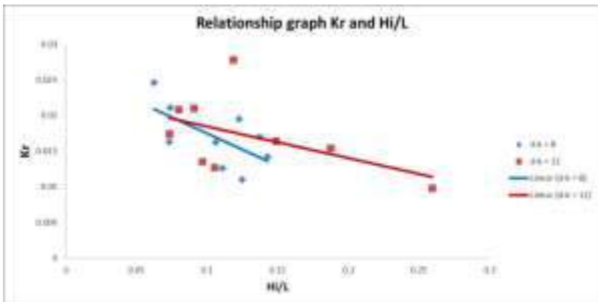


Figure 2.Relationships Kr and Hi / L for Density
4 cm x 6 cm

Figure 2 shows the reflection coefficient value to the steepness of the wave (Hi / L) decreased significantly. The greater the value of Hi / L, the reflection coefficient is smaller. The reflection coefficient value in Figure 2 at 16 cm depth for a density of 4 cm x 6 cm decreased from 1.8% to 1.2%, while for depth 12 cm decreased from 2.2% to 1.4%.

B. Semi circle model for density 6 cm x 9 cm

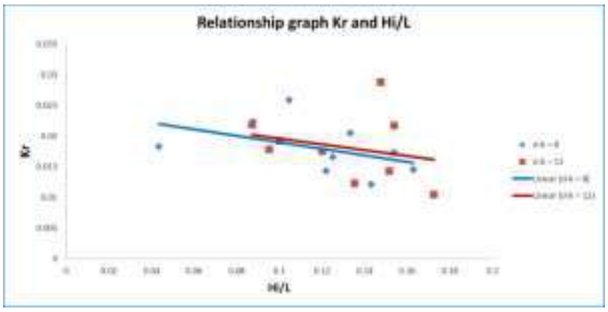


Figure 3.Relationships Kr and Hi / L for Density
6 cm x 9 cm

Figure 3 shows the reflection coefficient value to the steepness of wave (Hi / L) decreased significantly. The greater the value of Hi / L, the reflection coefficient is smaller. The reflection coefficient value of Figure 3 at a depth of 16 cm for a density of 6 cm x 9 cm decreased from 2.0% to 1.6% while for depth 12 cm decreased from 2.4% to 1.5%.

C. Semi circle model for density 8 cm x 12 cm

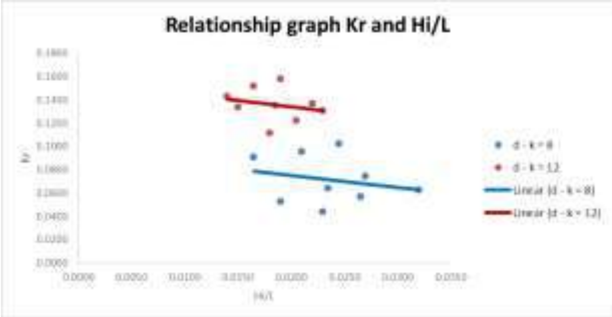


Figure 4.Relationships Kr and Hi / L for Density 8 cm x 12 cm

Figure 4 shows the reflection coefficient value to the steepness of wave (Hi / L) decreased significantly. The greater the value of Hi / L, the reflection coefficient is smaller. The reflection coefficient value of Figure 4 at a depth of 16 cm for a density of 8 cm x 12 cm decreased from 14 % to 13 % while for depth 16 cm decreased from 8 % to 6 %.

D. Percentage Reflection Coefficient

Table 2.Percentage Reflection Coefficient

Density Semi Circle Model					
4 cm x 6 cm		6 cm x 9 cm		8 cm x 12 cm	
Depth		Depth		Depth	
12 cm	16 cm	12 cm	16 cm	12 cm	16 cm
2.2 % - 1.4 %	1.8 % - 1.2 %	2.4 % - 1.5 %	2.0 % - 1.6 %	14 % - 13 %	8 % - 6 %

From the percentage value of the reflection coefficient, it found that for the density of 4 cm x 6 cm, 6 cm x 9 cm and 8 cm x 12 cm, the reflection coefficient is inversely proportional to the steepness of the wave (Hi / L). the greater the density of the model, the smaller the reflection coefficient value

V. Conclusion.

From the results of research and analysis can be drawn conclusions as follows;

1. The density of the model affects the value of the reflection coefficient
2. The greater the density of the model, the smaller the reflection coefficient value

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