

# A Seawall Design with a Revetment and the Wave Reflector to Protect Coast and Maintain the Position of Maron Coast Line Semarang

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**Abstract.** Coastal areas is a very strategic location and has a high economic value due to the transition between land and water. However, it also causes a lot of problems. Semarang is a city in Indonesia, located on the north coast of Java. This research was conducted in Maron Beach as the location of the research object. Longshore sediment transport the which cause silting, sedimenttaion, abrasion and erosion can change the coastline. Therefore, the main reason being to conduct research on coastal protection. This study is a sea wall design using water depth 40 cm, 30 ° slope of the sea wall, curved reflector Compared with two different wave is 1Hd and 1.5 Hd on it. The result of the selection of materials between wood and concrete, concrete is more stable against big waves used. Test results on a slope of 30 ° curved 10cm (model A ) and a slope of 30 ° curved 15cm (model B ), that is capable of reducing the model B is evidenced by the large wave reflection coefficient ( Kr ) is smaller than the model A is 0.199.

**Keywords:** Wave, Seawall, Curve.

## 1. Introduction

Maron beach is the location of the research in Semarang, Central Java, Indonesia. The existence reclamation around the coast, making high tides so the impact on coastal protection facilities and tourist facilities around it.

Coastal abrasion, longshore sediment transport caused the shallowing the river inflow Silandak because material deposition of sediment transport, shoreline changes around Maron beach, jetty indicated the cause to the flow in the river Silandak, and the presence of the wave character of Maron Beach is located on the ocean waves shallow with a wave period of 5-6 seconds Leonardus Loan Rah Utomo and Muflikhudin [1].



Fig. 1. Design a model the laying of on the beach Maron Semarang

Previous research by Yowono Nur, Bobby Primatama [2] is very supportive of this the research, which is a model of innovative and economical revetment, slope of a model experiment carried out with the use of wood and multiplexes, curved angles below 40 ° and 60 ° angle equivalent, on the slope of the given block of wood to obtain the reflection and run-up smallest angle but based on the model used only one kind of placement of block and only one formation of.

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Based on that, the need to protect the coast of the optimal form of protective and economical buildings, such as modifying the shape of a sea wall to reflect waves occur, without prejudice to the existence of these waves. Design of coastal protection function properly need to make the construction of the prototype in the form of construction of the corresponding waves (sea wall reflector) as blue sketch placed at the edge of the breakwater there is shown in Fig. 1.

## 2. Literature Review

Reference visible indicates that this research is to understand and obtain the optimal seawall that has the smallest wave refleksi. Some of previous the research have sloping seawall be used as a reference. If the protection of the natural beach does not exist, then it can be done in an artificial coastal protection (artificial), to protect the artificial beach can be done through the five ways one of them is the retrofitting of the beach with a seawall or revetment so resistant to wave action, Nur Yowono [3].

The amount of the effectiveness of a seawall is shown the resulting reflection coefficient is small, which the large reflection coefficient ( $K_r$ ) is the parameter of the reflection wave is defined as the ratio of the reflected wave height ( $H_r$ ) and high wave comes ( $H_i$ ) according to the precepts of Dharma, IGB [4].

$$K_r = \frac{H_r}{H_i} = \frac{H_{maks} - H_{min}}{H_{max} + H_{min}} \quad (4)$$

By Triatmodjo B [5], the wave will be reflected on an barrier partially or completely. A building that has sloping sides and is made of rubble mount can absorb wave energy mount more than erect buildings and massive. In building a vertical, smooth, and impermeable wall, the wave will be reflected entirely. Based on the model test, the reflection coefficient for various building types are shown in Table 1.

Table 1: Coefficient of reflection

No	Building type	Coefficient of reflection ( $K_r$ )
1	Vertical wall with a peak on the water	0,70 – 1,00
2	Vertical wall with the top of the submerged	0,50 – 0,70
3	Piles of stone hypotenuse	0,30 – 0,50
4	Piles of concrete blocks	0,30 – 0,50
5	Vertical buildings with damper	0,05 – 0,20

So that made the research was based on a survey of the literature, found that there are no search results conducted on the use of wave reflection from sloping seawall revetment block and head curved the same as the model of this the research, both the size mapun variables.

## 3. Experimental Set-Up, Procedure and Test Programme

Seawall design that made the first stage using wood, multiplex and aluminum compared with a mixture of sand stone bricks and cast composite curved to fit the diameter used is 10 cm and 12.5 cm. On the slope field given the size of the block of wood 4,8cm x4,8cmx 4,8cm. Assuming srtuktur stable slope. Probe used is 7, put right in front of the seawall models probes 6 and 7, the next 1m probes 4 and 5, the next 4m, probe 3, the next 6m and 15m probe 2 probe 1.

Experimental research carried in a wave flume Assessment Institute for Dynamics of Yogyakarta, Indonesia. Dimensions and characteristics of the wave flume used for this study are and the picture of flume at Fig. 2 :

- a. Flume length 50 m
- b. Flume width 2 m
- c. Flume depth 1.6 m
- d. Water depth,  $d$  0.4 m
- e. Waves used in this study Regular wave
- f. Incident wave height  $H_i$  0.05–0.30 m

- g. Wave period ( $T$ ) 1–3 s
- h. Type of seawall Impermeable and block revetment
- i. Dimension of the seawall 1.85 m width  $\times$ H 2.50 m height seawall
- j. Dimension of the structure seawall 0.10 m  $\times$ H 0.05 m  $\times$ L0.05 m
- k. Type of wave generator Piston type generator
- l. Angle between seawall surface  $30^\circ$

Some of the range of normalized hydrodynamic parameters obtained are:

- Incident wave steepness,  $H_i / L_0$ , 0,006-0,11
- Relative water depth,  $d / L_0$ , 0,09-0,45
- Relative wave height,  $H_i / d$ , 0,07-0,54

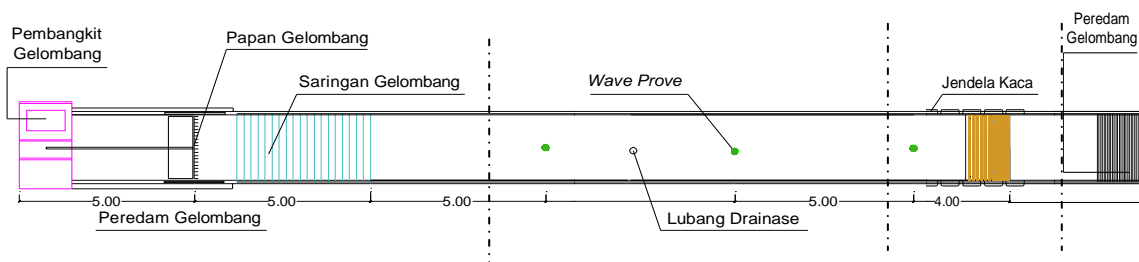


Fig. 2. Layout Wave Sensor Model

A total of 2390 data is taken to carried a regular wave with the same wave height, wave period and slope walls. Seven probes were be used to measure the wave and the reflected wave profiles. Mike uses software to analyze the wave profile to obtain the reflected wave height. Intake number of probes is basically using the theory that the use of probes described by Goda and Suzuki [6], seven probes better of the two probes in improving the resolution of the wave. First, the waves generated without running the sea wall in the flume. History wave measured in this situation be used as an incident wave field.

## 4. Results and Discussions

### 4.1. Experimental Design Material Selection

Seawall research conducted at an angle of  $30^\circ$ , and 35 in a wave conditions Maron Beach then used Curves (R) 1 is 10 cm and Curves (R) 2 is 12.5 cm at Fig. 3.

#### 4.1.1. Experiments on smooth condition with wood, large angle of $30^\circ$ , curved 10 cm

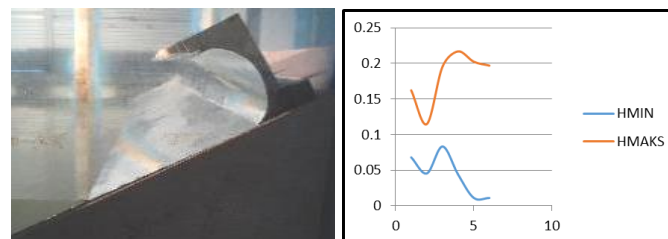


Fig. 3. Experimental 1a models

#### 4.1.2. Experiments on the material conditions of smooth concrete, large angle of $30^\circ$ , curved 10 cm

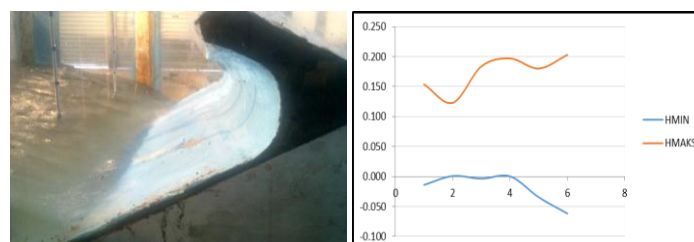


Fig. 4. Experiment 1b models

Based on the experimental material selection, shown in Fig. 3 and Fig. 4 that the wave line graph formed between wood and concrete material, which is produced between the minimum and the maximum is more stable in the concrete material experiment, so that in future experiments using concrete materials.

## 4.2. Eksperimen Design

### 4.2.1. Model Test A, results at water depth of 40 cm, at an angle of 30, curved 1 Hd = 10 cm as in Table 2.

Table 2: Calculation coefficient of reflection model test A

Model A	Front of Probe		Behind of the Probe		Hi	Hr	Kr
	Hmaks	Hmin	Hmaks	Hmin			
	m	m	m	m			
experiment 1	0.475	0.057	0.375	0.165	0.5035	0.105	0.395
experiment 2	0.475	0.057	0.375	0.165	0.5035	0.105	0.395
experiment 3	0.475	0.057	0.375	0.165	0.5035	0.105	0.395
experiment 4	0.475	0.057	0.375	0.165	0.5035	0.105	0.395
experiment 5	0.475	0.057	0.375	0.165	0.5035	0.105	0.395
average of Kr							0.395



(a) Sea waves in stable condition (b) High sea wave conditions

Fig. 5. Model Test Results 30 angle, curved 1 Hd

Experimental results of A model, when the waves come crashing condition of the sea wall at an inclination of 30 ° and 10 cm curved reflection occurs and some of the water in a large structure with wave reflection 0.395, shown in the wave line in Fig. 5 (a). Then the image (b) the conditions Maron Beach wave after reflection, water back sliding on the structure that forms the greater pressure in front of the building, so that the structure is said to be able to reduce wave.

### 4.2.2. Model Test B, results at water depth of 40 cm, at an angle of 30, curved 1.5 Hd = 15 cm as in Table 3.

Table 3: Calculation coefficient of reflection model test B

Model B	Front of Probe		Behind of the Probe		Hi	Hr	Kr
	Hmaks	Hmin	Hmaks	Hmin			
	m	m	m	m			
experiment 1	0.166	0.00056	0.21525	0.0901	0.16628	0.16572	0.996632
experiment 2	0.167	0.00056	0.21525	0.0901	0.167282	0.1667178	0.996626
experiment 3	0.168	0.00056	0.21525	0.0901	0.168282	0.1677179	0.996647
experiment 4	0.166	0.00056	0.21525	0.0901	0.166282	0.1657178	0.996606
experiment 5	0.167	0.00056	0.21525	0.0901	0.167282	0.16671785	0.996627
average of Kr							0.199326

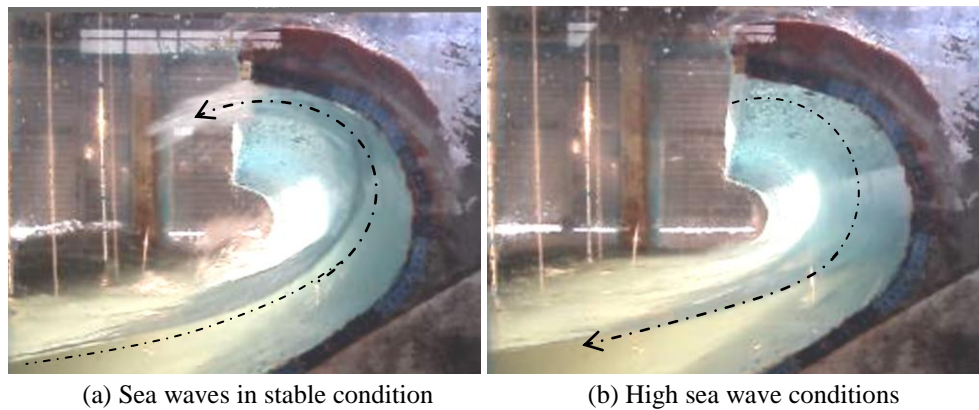


Fig. 6. Model Test Results at 30 angles, curved Hd 1:25

The experiment model B, in Fig. 6 (a) the conditions of pliers wave crashing into the sea wall at an inclination of  $30^\circ$  and 15 cm curved occur reflection and continued on (b) the condition of the entire water back down the structure with large wave reflection 0.199.

Based on the experimental model of a reflection coefficient of 0.395 and model B produces the reflection coefficient of 0.199, can be concluded that the model B is able to reduce wave. Results of experiments conducted several models when looking at research Triatmodjo B, large coefficient based on the types of buildings ranging from the state of the oblique using a block on top and use a silencer, the large reflection coefficient generated from this study that limit the entry of 0.199 is smaller than research Triatmodjo B.

## 5. Conclusions

Implementation research to this stage, the conclusion can be made include:

1. Results for the selection of material test model is refined with concrete material material 2 is more stable models of wood.
2. A Model Experiment results reflection coefficient of 0.395 and model B produces the reflection coefficient of 0.199, it can be concluded that the model B is able to reduce wave.

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