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## Hybrid engineering on permeable groins to reduce the longshore current

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## Hybrid engineering on permeable groins to reduce the longshore current

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**Abstract.** This study aims to determine the effectiveness of hybrid engineering technology to be applied to the groin to reduce longshore currents. The application of hybrid engineering as a breakwater and sediment trap in coastal areas has given good results so that it can be developed in permeable groin structures. The research method used is laboratory experimental with physical modeling to make prototypes and conduct tests on the wave flume to determine changes in current velocity against the existence of a hybrid engineering structure with several model scenarios by changing the characteristics of brushwood groin such as length and distance between groin to surface height. The expected result of this study is an engineering model of the permeable groin that can function as an efficient and effective hybrid engineering in reducing longshore currents.

### 1. Introduction

The handling of coastal problems by using large investments or hard structures is carried out in response to changes that occur on the coast. Traditional hard and massive infrastructure, still like a breakwater, is one solution that is often used to solve problems. However, these structures are expensive and often prove counterproductive on muddy beaches. Also, handling using a hard structure cannot restore the lost mangrove belt.

To protect the coastline from erosion caused by longshore currents, a mangrove buffer zone must be created. The first step required is to stop the erosion process by restoring the lost sediment to obtain a stable shoreline. This approach is called hybrid engineering, in this case, engineering techniques are combined with existing processes in nature and available resources, producing dynamic solutions that can adapt to changing circumstances. The hybrid engineering approach can be applied in various situations and ecosystems [1]. The hybrid engineering in the form of Permeable Breakwater is carried out by utilizing natural resources around the coast using materials such as twigs or branches from mangroves which are cut and arranged to form a breakwater. In addition to using mangrove twigs or branches material, materials such as bamboo, which is an industrial plant that can be cultivated, can be used so that there are quite a lot of them when applied in coastal areas.

### 2. Methodology plan

This research was conducted at the Coastal Engineering Laboratory of the Department of Ocean Engineering, Faculty of Engineering, Hasanuddin University, with a length of research of 6 months.



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### 2.1. Main equipment needs

The wave flume with dimension length 15 m width 10 m with a two-wave generator parallel. The wave flume is shown in figure 1 and figure 2.



**Figure 1.** Wave flume (10 x 15 m)



**Figure 2.** Wave generator

### 2.2. Model design

A Hybrid Engineering structure is a technology that is applied to repair eroded beaches. This system is to build a kind of sediment trap or sediment trap that will improve the condition of an abrasion coastal

by using natural materials from around the coast such as bamboo and tied branches [2]. In the design of the model, it still uses natural materials, only the size is different or given a scale model so that it can be examined in the channel pool. The groin model is made of bamboo and tree branches with dimensions of 100, 150, 200 mm in length, 20 mm in width, and 40 mm in height, as in figure 3.

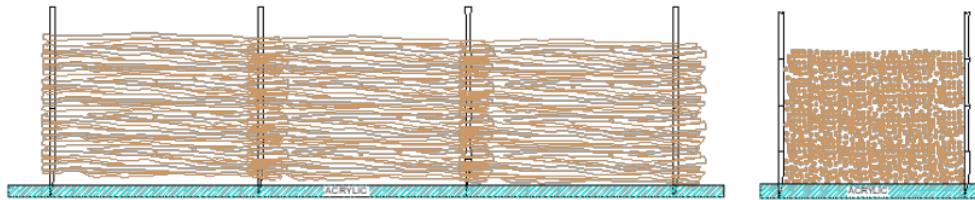


Figure 3. Groin model

### 2.3. Research Simulation

The research method is used by doing a physical model, in the test pool (flume). Physical modeling is done to solve problems because of the limitations of a prototype, such as limitations in accuracy between the prototype and the physical model to obtain more accurate and accurate results physical modeling is carried out [3].

Physical modeling is carried out to determine changes in flow patterns to the hybrid engineering structure [4]. Changes in velocity were arranged in several model scenarios in the form of schematic by changing the characteristics of the groin brushwood (width and distance between groin) to the water level. The modifier to be observed is the velocity of flow or flow to the shape of the groin structure. Model scenarios with variations in width and distance between structures, water level, and slope, see figure 4.

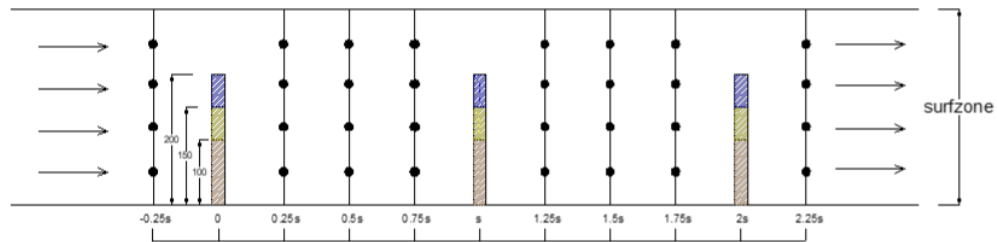


Figure 4. Flow velocity measurement points

### 2.4. Research flowchart

The research implementation with the hybrid engineering on permeable groin has a research mechanism by the research framework in figure 5.

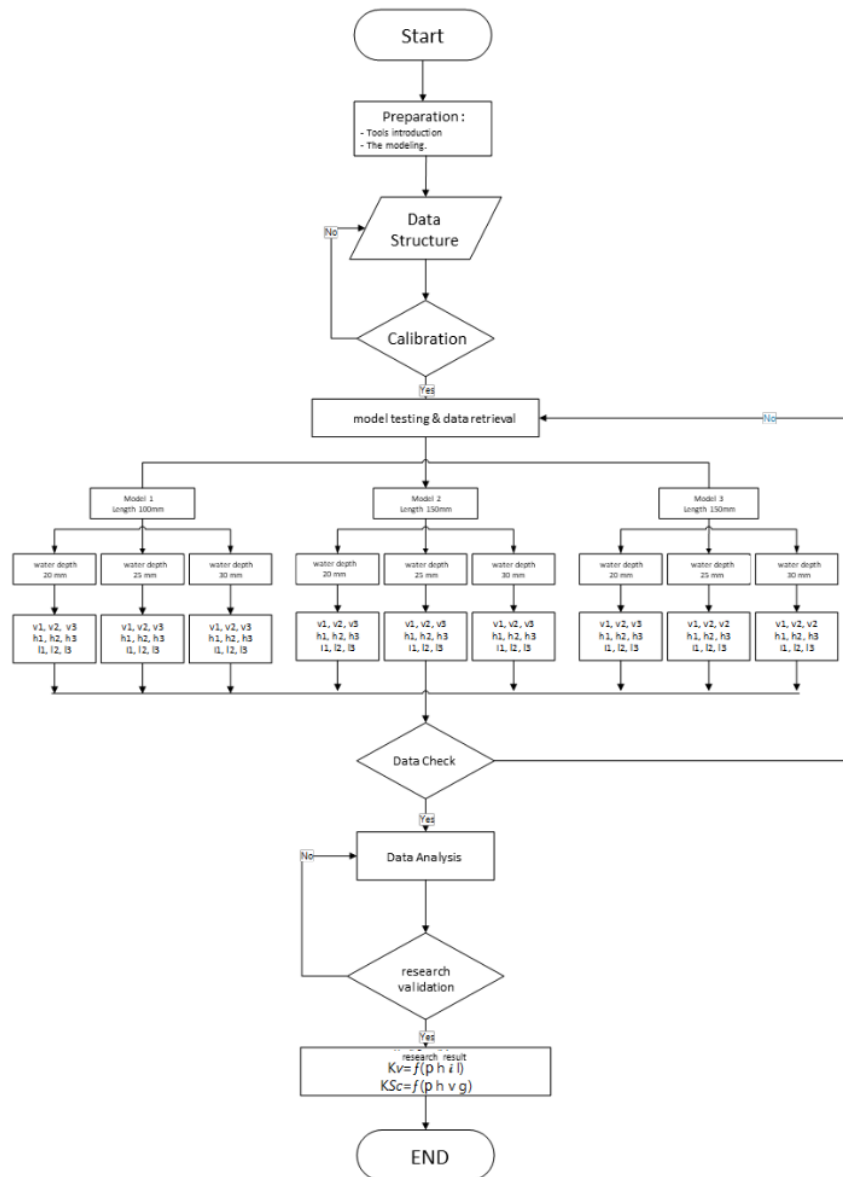


Figure 5. Research flowchart

### 3. Conclusions

From the simulation design of this model, it is expected that the equation of the length and density brushwood of groin will be formulated in the form of dimensionless parameter relationships, as in equation 1.

$$Kv = f(p h i t) \quad (1)$$

Where :

Kv: velocity coefficient

f: function

p: length of groin

h: height water level

I: coefficient

i: slope

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