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EFFECT STRENGTH AT ARMOR LAYER BREAKWATER CONTAIN WITH SAND

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ABSTRACT

Planning for coastal protection structures requires a good of security and can be economical, so in the planning of structures for coastal protection needs to be well planned by making construction materials availability is good. Coastal protection buildings using Tetrapod, Dolos, X-Blocks are excellent buildings to be used for coastal protection in a region, but at the some areas natural resources are not available to make they are expensive, so a method is needed to reduce the the concrete by filling with material sand in the concrete without reducing the strength of the existing protective layer of concrete. Because the sandbag is made of bunny or plastic sack so it is often destroyed by sunlight, and sandbag damage is the beginning of the damaged construction, by it we wrap sandbag with concrete is a solution to combine armorlayer with sandbag by maintaining tetrapod, dolos and X- Blocks will create interlocking between stones.

Keywords: construction, economic, breakwater, local material.

INTRODUCTION

For to meet human needs for transportation and for support of tourism and residential in coastal area, the humans need a method to cope with the wave-related beach issues, because these problems often they faced. One of buildings in the development of coastal area that could cost pretty high fee is the breakwater; the building was constructed to provide protection against the shore from wave attack, so the beach can be safe from abrasion.

Planning of coastal structures must have a high level of security and is economical. So in planning coastal structures must be aware of is the availability of sufficient material for construction, so construction could stand strong and economical. At the first time people thought that the stone breakwater constituent layers of protection should be using a large rock but with decreasing stone size then the construction of the breakwater and eventually switched to an artificial stone made of concrete and is formed in accordance with the concept of the author who finally discovered new facts that breakwater stability is not only determined by the weight of the stone but also largely determined by the interlocking of the rock, some rock layers progress protected latter include tetra pod, pod hex, dolos, A-Jack and many others. One type of protective construction layer currently developing is the X-Block stone protective layer Produced by Marine Consultant in Europe, and has considerable weight so that the interlocking value is high enough, so the stability of X-Blocks construction is very good. But in areas where natural resources are lacking, the use of this type of protection layer is quite difficult, because the manufacture of high quality concrete is very difficult to do primarily in remote areas, and one of the areas that does not have adequate concrete material resources is East Kalimantan, so that all materials to load the concrete must be imported from outside East Kalimantan, if the source of the stock is reduced, then it can raise the material price in East Kalimantan. This led to the selection of X-Block in coastal protection construction will be difficult to implement because it will cost a very large, so that in this research need to do further research in order to use local materials for the manufacture of concrete and the use of sand in layers of protective layer for Reduce implementation costs.

Some previous researchers have developed the application of sand bags as coastal structures with ease Implementation considerations and reduce cost. Some researchers that have conducted on coastal protection with sandbags is (Silvesterdan @1992, Restall, @2002; Hornsey, @2003; Zhu., @2004; Shin @2007 ;), then continued research about the use of the material is on site work (Yuwono, @1992, Black, @2001) and in 2011 was publication by Ferry Fatnanta, with the tittle "Assessment transmission behavior and stability of the breakwater and sand bags emerged type". and construction has been implemented in some areas such as in the coastal district Handil, Samboja, Kutai Kertanegara regency in East Kalimantan. Handling the construction of coastal erosion using sacks filled with soil, which aims to reduces abrasion apparently, did not live long, then a few years later construction was damaged due the sacks that used is weathering and eventual construction of this no longer works optimally. Based on this, the authors are interested to develop a protected layer breakwater with concrete blocks serrated filled with sand. In this research, the authors developed protected layered concrete called beam-serrated, with this shape allows materials to enter the ground while casting before concrete casting execution, and use of formwork can be carried out repeatedly cause the formwork opening not need to distort the shape of the formwork.

METHODOLOGY

Concept of the layer stone

The concept of stone breakwaters have been developed since World War II, there are several factors that affect the development include the size and the interlocking, then after developed further apparently other factors affecting stability are the placement and number of

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layers. Some rock layers are developing today as can be seen in the following Figure:

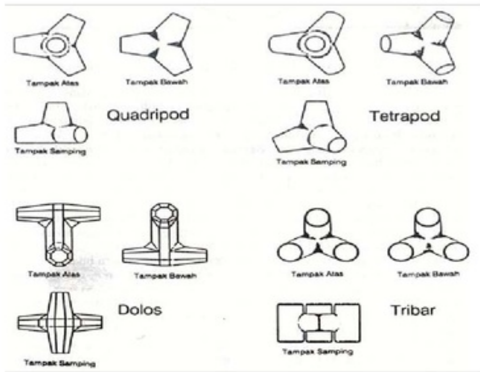

Figure-1. Shape layers of protection are widely used.

In Figure-1 above all forms of Armor Layer Breakwater has a different KD value depending on the system, and the installation position. The placement of stone protection layer is divided into two ways, uniform and random. Uniform placement is generally used for the area that does not used feet construction or the construction isn't under water. Generally this placement is done near the coast and form homogeneous. While random placement is generally used in offshore waters that have influence of deep waters. Types of protective stone that is usually used on a random method must have a high value of interlocking so can be locked as soon as the stone placed.

In generally the construction of breakwater has Armor Layer Breakwater as a protective of layer filter (filter layer) or other fine material, and serves to reduce the run-up and reflection on the waves. This protective stone usually consists of one or two layers, but Armor Layer Breakwater with serrated beam just have one layer, has advantages over the two layers, of which in addition to saving the cost and use of stone, it also saves the location of placement, mobilization and can avoid collapse due to overload.

The stability of the Armor Layer Breakwater of Breakwater can be achieved by making the Armor Layer Breakwater of breakwater remains in place although it has been hit by a wave, the factors affecting the stability of stone such a protective stone is heavy of rock, but the rock in the large size will lead to higher costs due to the need to create a concrete that has a large volume, and the second is the interlocking factors, that Armor Layer Breakwater of breakwater are locked to each other so became a single entity and this condition can defend itself from attack wave. Figure-2 illustrates the shape and breakwater protection layer that is commonly used in the construction of breakwater construction.

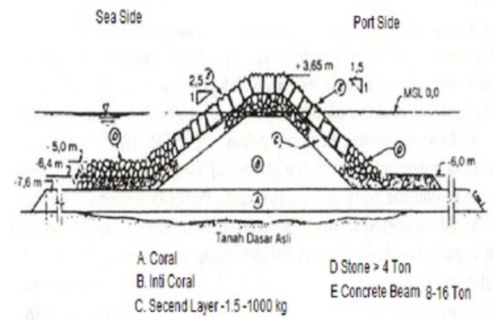

Figure-2. Shape of protective layers of breakwater.

Heavy stone as a protection layer is calculated by the following Hudson formula:

$$W = \frac{\gamma_r H^3}{K_D(S_r - 1)Cot\theta}$$

Were:

$$W = \frac{\gamma_r (Berat.Jenis.Batu.2{,}6t/m^3)}{\gamma_a (Bera.Jenis.Air.Laut.1{,}02.t/m^3)}$$

$$K_D = Stability.of.Coefisient$$

Concept of the sandbag protection

A sandbag is a bag or sack made of hessian (burlap), polypropylene or other sturdy materials that is filled with sand or soil and used for such purposes as flood control, military fortification in trenches and bunkers, shielding glass windows in war zones, ballast, counterweight, and in other applications requiring mobile fortification, such as adding improvised additional protection to armoured vehicles or tanks.

The advantages are that the bags and sand are inexpensive. When empty, the bags are compact and lightweight for easy storage and transportation. They can be brought to a site empty and filled with local sand or soil. Disadvantages are that filling bags is labor-intensive. Without proper training, sandbag walls can be constructed improperly causing them to fail at a lower height than expected, when used in flood-control purposes. They can degrade prematurely in the sun and elements once deployed. They can also become contaminated by sewage in flood waters making them difficult to deal with after flood waters recede. In a military context, improvised up-armouring of tanks or armoured personnel carriers with sandbags is not effective against cannons (though it may offer protection against some small arms).

Bags are made from various materials, but the most common is woven polypropylene. They usually measure about 14 inches wide and 24 to 26 inches long. Other sizes of bags also are available, but bags are easier to handle if their weight with filling in them is limited to 35 to 40 pounds. Sand is the easiest material for filling and shaping sandbags. Silt and clay in bags will form a good

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dike, but working with those materials is more difficult. Fill sandbags slightly more than one-half full. Contact your county emergency management office for information on where to obtain and bags

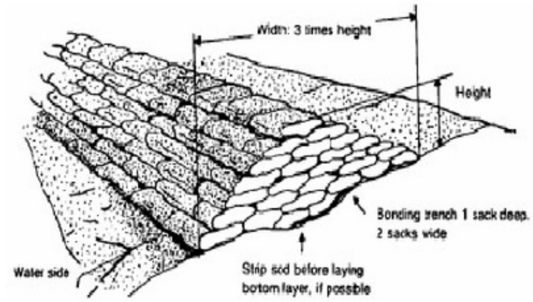

Figure-3. Sandbag protection model.

Concept of contain sand in the Armor

Armor layer break water content sand is combination between sandbag method and armor layer block method where the concrete to be cover for the sand, and block always have interlocking same as the tetrapod and dolos in generally. This method is very easy to implement and easy to achieve the level of stability because it can quickly occur interlocking well same as with original armor layer, as like tetrapod and dolos. Judging from the breakwater foot automatically can binding randomly and the implementation system is faster.

Armor layer break water content sand is expected to be used on offshore protection, which focused on the placement of random and also structured, requires only a single layer of protective stone, it makes this Armor Layer Breakwater is similar to the protective layers stone with one layer protection which in general is very popular usage, remind it can make the construction costs down and still have the interlocking factors and believed to be economical implementation.

DISCUSSIONS

Job mix design

This concrete using a local material, where sand we take in Mahakam and coral from Long Iram, this is the result from Job mix laboratory

In order to make use of local materials for the manufacture of Armor Layer Breakwater has been performed testing the concrete forming material with local-based and tested East Kalimantan do use sand and coral of East Kalimantan by using sand from the Mahakam and coral from Long Iram with compressive strength on plan K225 in 2012 by author *et al*, and the results of K250 concrete design using local materials were obtained composition East Kalimantan weight materials used for the manufacture of concrete as follows: water = 12,41; cement = 1.00, sand = 1.75, and coral = 3.83. To manufacture the concrete of serrated beam has done experimental research method that is made in scale 1:10 to see the resilience of Armor Layer Breakwater due to the influence of sand content there in. And after the completion of casting done it hopes can be developed to test for assessing wave pool interlocking between the concrete blocks. In this study created a form of serrated beam with the advanced possibilities entering sand material into the layer of concrete beams protected. These are presented in figure serrated blocks that contain mostly sand.

Table-1. Output job mix laboratory.

No	Description	Information	Formula	Simbol	Unit	Value
1	2	3	4	5	6	7
1	Strengh	Setting		f'c	Mpa	18,68
2	Deviation Standard	Setting		S	Mpa	7
3	Free Value		1.64xS	m	Mpa	11,48
4	Strengh average			f'cr	Mpa	30,16
5	Semen type	Type I				
6	Agregat:					
	Coral	Natural			Long Iram	
	Sand	Natural			Mahakam	
7	Water Cement Factor			FAS		0.59
8	FAS Maximum					0.60
9	Slump	Setting			mm	60-180
10	Maximum Coral	Setting			mm	20
11	Water Free		2/3 Wh+ 1/3 Wk		Kg/m^3	195
12	Semen		(11)/(7)		Kg/m^2	330,51
13	Max Cement Level	Setting n				-
14	Kadar Semen Minimum	Setting			Kg/m3	275
15	FAS adjust					-
16	Sand Gradation	zona IV				
17	Proportion Aggregate	Sand			%	30
		Coral			%	70
18	BJ (SSD)					2,54
19	BJ concrete				Kg/m^3	2310
20	Sand volume				Kg/m^2	535,35
21	Coral volume				Kg/m^3	1249,14

Strength of serrated beam

In this study compared the ability of the Armor Layer Breakwater receives the load where the Armor Layer Breakwater without content of sand and Armor Layer Breakwater that are filled with sand can be seen in the following table and graph charts.

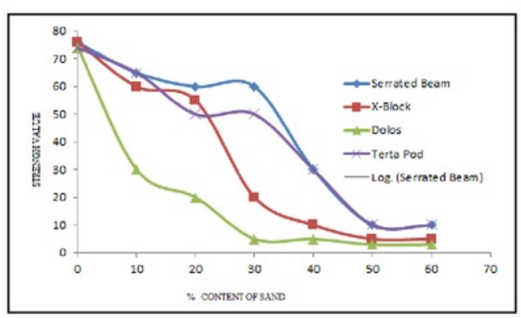

Figure-4. Relationship between compressive strength.

From the graph above is shown that more content of sand that is owned by concrete blocks the ability of concrete blocks will decrease, and when sand content of 30%, then the condition of concrete beam is relatively more stable for serrated beam block but another block not stabile, although shear strength of his arm has decreased, but the arm sliding events are also still relatively better than the Armor Layer Breakwater that more than 30%, so it can be concluded that the use of sand in the Armor Layer Breakwaters are advised not to exceed 30% of the total volume of concrete in the serrated beams.

CONCLUSIONS

a) The concept of serrated beam with serrated beam shape containing sandbag is essentially stronger with the form of tetrapod, Dolos X-Block containing Sandbag, so that this form can be developed to reduce the cost of implementation in areas that have coastal erosion problems while the source of concrete forming material inadequate.
b) With almost equal strength between non-sandbag and sandbag conditions, the 30% content of serrated beam still shows the same strength, but for other forms it is not certain that it can not contain sandbag serrated beam concept with sand content basically can be developed to reduce the cost of implementation in areas which have problems of coastal erosion while concrete forming material resources are inadequate.

REFERENCES

A. van den Berge, P. Bakker, M. Muttray, M. Klabbers, D. McAllister. 2006. Reconstruction of the Port Oriel Breakwater; First Xbloc application in Europe. International Conference on Coastal Engineering, San Diego.

B. Reedijk, M. Klabbers, A. van den Berge, R. Hakenberg. 2003. Development of the Xbloc® breakwater armour unit. 2nd International conference on Port & Maritime R&D and Technology.

Armono H.D., Hall K.R. 2002. Wave Transmission On Submerged Breakwaters Made Of Hollow Hemispherical Shape Artificial Reefs, Canadian Coastal Conference.

Andojo Wurjanto dkk. 2010. Pemodelan Fisik 2-D untuk Mengukur Tingkat Efektivitas Perforated Skirt Breakwater pada Kategori Gelombang Panjang. Jurnal Teoretis dan Terapan Bidang Rekayasa Sipil, Volume hal. 17, 211-216.

Bergmann H., Kudella M., Oumeraci H. 1998. Wave loads and pressure distribution on permeable vertical walls.

Bloxam M., Maxted G., Murray J. 2003. Wave Energy Dissipating Wharf: Raffles Marina Breakwater, Singapore, Coasts & Ports Australasian Conference Paper No. 95.

CIRIA CUR. 1991. Manual on the use of rock coastal and shoreline engineering. A.A Balkema Rotterdam. pp. 246-249.

Jaff. 2007. The effect of porosity of submerged breakwater structures on non-breaking wave transformations. Malaysian Journal of Civil Engineering. 19(1): 17-25.

Hagiwara K. 1984, Analysis of Upright Structure for Wave Dissipation Using Integral Equation, Proc. 19th Conf. on Coastal Engineering A.S.C.E. pp. 2810-2826.

Jarlan G.E. 1961. A Perforated Vertical Wall Break-water. Dock Harbour Auth. XII 486 (1961), pp. 394-398.

Kondo K. 1979. Analysis of Breakwaters Having Two Porus Walls, Proc. Coastal Structures '79.

P. Bakker, M.Klabbers, M. Muttray, A. van den Berge. 2005. Hydraulic Performance of Xbloc® Armour Units, 1st international conference on coastal zone management and engineering in the Middle East.

Shin, E.C. and Oh, Y.I. 2007. Coastal erosion prevention by geotextile tube technology. Geotextiles and Geomembranes. 25: 264-277.

Tamrin, Saleh pallu, Herman Parung, Arsyad thaha. 2014. The effect of hole size configuration towards wave reduced level of perforated concrete block breakwater. ISID 2014. pp. 85-92.

Tamrin, Saleh pallu, Herman Parung, Arsyad thaha. 2013. Strength test of Serrated Beam for Armor Layer Break Water, APAC. pp. 238-242.

Tamrin, Saleh pallu, Herman Parung, Arsyad thaha. 2014. The Reduction of Run-up and Run-dwn With Perporated Block Break Water, ARPN. 9(10).

Triadmodjo Bambang. 1999. Teknik Pantai, Yogyakarta : Penerbit Beta Offset.

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