Rehabilitation Planning Breakwater Construction at Labuan Fishing Port Labuan Subdistrict

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***Abstract*—Fisheries Port (PP) Labuan is located in Teluk Village, Labuan District, Pandeglang District, BantenProvince. Fisheries Port (PP) Labuan has a land area of 8,500 m2, overlooking the Indian Ocean Sea west of Sumatra and Sunda Strait with the coordinates of location: 060 24 '30 "LS and 1050 49' 15" BT. Labuan fishery harbor, there are some problems between other, brekwater buildings that need to be repaired, and siltations that occur in the pond labuh. The breakwaters, also known as waves breakers, are infrastructures built to break the waves, by absorbing some of the wave energy. The breakwaters are used to control the abrasion that undermines the shoreline and to calm the dip in the harbor so that the vessel can dock at the port more easily and quickly. Determining and designing breakwater is extremely difficult. The approach should be through field surveillance levels (Survey), Calculations / assumptions, laboratory investigations with the model and adapted to the field experience.**

Keywords: fisheries port, breakwater, siltation

I. INTRODUCTION

Indonesia as an archipelago / maritime, the role of shipping is very important for social life, economy, government, defense / security and so on. The field of shipping activities is very broad which includes passenger and goods transportation, coast guard, hydrography, and many other types of shipping. Indonesia is an archipelago, has more than 13,000 islands and has a coastline of 80,000 km [1]. The coastal area is a very effective area for the utilization of various economic activities. It is proven that 75% of big cities in Indonesia are located on the coast with high population density.

Beach abrasion is the retreat of the coastline from its original position [1]. Labuan Fishing Port is a port located in Pandeglang Regency, more precisely the area of the Village of the Bay, District of Labuan. In daily activities, Labuan Fishing Port as a place for loading and unloading of goods and the ups and downs of passengers. Abrasion that occurs at Labuan Beach causes various damages, namely damage to the building breakwater (breakwater), so that with the addition or patching of breakwaters at the Labuan Fishing Port of Labuan, Pandeglang Regency is expected to calm the wave currents, it is expected that fishing boats can dock at the Port Labuan Fisheries in Pandeglang Regency.

II. METHOD

The methods used are derived from primary data, secondary data, observation data, literature data. Where all is collected in the writing of the report. Data processing is based on preparatory work, data inventory, data selection and reporting.If checking is not appropriate, then the data is repeated, but if it is appropriate, the data is continued until it is finished

III. ANALYSIS AND DISCUSSION

Analysis of wave refraction is known a series of waves propagating from the sea to the coast which has a straight seabed contour and parallel in the west-east direction. At sea in wave height is 0.66m; the wave period is 4.7 seconds and the direction of the wave is from the northwest ($\alpha_0 = 45^0$). Determine the height and angle of the incident wave at a depth of 2 m. The direction the waves come in at depth 2,00 m : Koefisien refraksi = 22,93, Kr = 0,87.
To calculate the superficial coefficient, look for the value of n by using the appendix function table based on the value d / L0 above, obtained $n_1 = 0.8848$.
At sea in seabed contour values see Figure 2.2 Wave Refraction $n_0 = 0.5$; So the superficial coefficient **is**:

$$Ks = \sqrt{\frac{n_0 L_0}{n_1 L_1}} = \sqrt{\frac{0{,}5 \, . \, 34{,}46}{0{,}8848 \, . \, 19{,}54}} = 0{,}9982$$

Wave height at a depth of 2.00 m is: $H_1 = K_S\, K_r\, H_0 = 0{,}9982 \times 0{,}87 \times 2 = 1{,}73$ m

Labuan fisheries with a slope of the seabed 1: 50. The height of the planned wave at the planned breakwater 1.73 m as above. Wave period of 4.7 seconds. on the breakwater location plan. From the tidal data we get HWL = 1.5 m; MWL = 0.7 m; LWL = 0.25 m. The depth of water at the building site based on HWL, LWL and MWL is: High water level depth dHWL = 3.5 m, Low Water Depth d_{LWL} = 2,25 m, The average depth of water d_{MWL} = 2,7 m

It is investigated the condition of the waves at the depth of the water in the planned breakwater location, i.e. whether the waves break or not. Calculated the height and depth of the breaking waves by using Figure 2.4 breaking wave height from iversen, [2], and Figure 2.5 Wiegel breaking wave depth. For the slope of the seabed 1:50. Wavelength $L_0 = 1{,}56\ T^2 = 1{,}56\ .4{,}7^2 = 34{,}46$ m. From the attachment of the function d / l to the value added d / L_0 and Fundamental Coefficient (Ks). Because there is no value in the table, it must be interpolated linearly.

TABEL.I.LINEAR INTERPOLATION TO DETERMINE D / L AND KS OR H / H_0

d / L_o	**d / L**	**Ks / H/ H_0**
0.0720	*0.11582*	0,968
0.0725	…….	…………..
0.0730	*0.11675*	0,966

Source: Analysis of value added d / L_0. d / L = 0.12258

Silting coefficient Ks = (0,968) + (0,968 0,966) = 0,969

$\frac{H_b}{H'_0}$ Obtained a value = 0,12258 ; and K_s = 0,969

$$\frac{H_1}{K_S.K_r} = \frac{1{,}73}{0{,}969 \times 0{,}87} = 2{,}05\ m$$

Equivalent wave height: : $H'_0 = K_r . H_0$ = 0,87 x 2,05 = 1,78 *m*

From Figure 2.5. Wave height From [2], obtained:

Figure 2.6 The depth of the breaking wave Wiegel, obtained:

$\frac{d_b}{H'_b}$ → 0,9 The depth of the water when the wave breaks d_b = 0,9 x 1,78 = 1,602 *m*

So the breaking wave will occur at a depth of 1,602 m. Because db <dLWL (2.25 m) and dHWL (3.5), it means that at the building site at a depth of - 2 m the wave does not break. The height of the breakwater is calculated based on the height of the runup. The slope of the breakwater is fixed at 1: 2.

Wave height in deep sea :

$L_0 = 1{,}56\ T^2 = 1{,}56 \times 4{,}7^2$
$= 34{,}46$ m

So the wavelength in the deep sea is 34.46 m

To determine the wave runup magnitude in buildings with sloping surfaces for various types of materials can be used using the formula by Irribaren as below:

Figure 2.14 Wave Runup can be seen in chapter II p.29. The curve in Figure 2.13 has a dimensionless form for the relative runup of Ru / H or Rd / H as a function of the irribaren number, where Ru and Rd are runup and rundown calculated from the mean sea level.

By using the graph in Figure 2.13. the calculated runup value for the quarry stone

$\frac{R_y}{H} = 1{,}0 \longrightarrow R_u = 1{,}0 \ .\ 1{,}73 = 1{,}73$ m

Runup R_u 1,73 m

Elevation of the peak of the breakwater by calculating the height of freedom of 0.5 m

$El_{pem.Gel}$ = HWL + R_u + high freedom
= 1.5 + 1,73 + 0,5 = 3,73 m

For protection from tetrapod: $\frac{R_y}{H} = 0{,}7$ R_y = 0,7 . 1,73 = 1,211 m

Elevation of the peak of the breakwater by calculating the height of freedom of 0.5 m :

$El_{pem.Gel}$ = HWL + R_u + high freedom 1.5 + 1,211 + 0,5 = 3,211 m

Breakwater height :

With a broken stone ;Freedom height 0.5 m\ Breakwater peak width.

$$H_{Pem.Gel} = 3{,}73 - (-2) =$$

$$3{,}3 + 2 = 5{,}73\ m\ \ (batu)$$

$$B = nk_\Delta \left[\frac{W}{\gamma_r}\right]^{1/3}$$

In the tilted side breakwater planning the weight of the protective stone is determined, which can be calculated using the hudson formula as below.

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

The weight of the protected layer rock is calculated by the formula Hudson follows:

For the protected layer of broken stone (KD = 4) obtained:

With $\cot\theta$ = 2

For Tier I :

$$W1 = \frac{\gamma_r H^3}{K_D (S_r - 1)^3\ \cot\theta} = \frac{2{,}65 \times 1{,}73^3}{4\left(\frac{2{,}65}{1{,}03} - 1\right)^3 2} = 0{,}440\ ton$$

or the equivalent of 440 kg

for Tier II:

$$W2 = \frac{W1}{10} = \frac{440}{10} = 44\ k$$
$$W3 = \frac{}{200} = \frac{}{200} = 2{,}2$$

For the protective layer from tetrapod (KD = 8) obtained:

With $\cot\theta$ = 2

For Tier I :

$$W = \frac{2{,}4 \times 1{,}73^3}{8\left(\frac{2{,}4}{1{,}03} - 1\right)^3 2} = 0.190 \text{ or equivalent}$$

0.330 or equivalent to 330 kg

Arrangement of stone size in several layers can be followed in Figure 2.15 tilted breakwater See in chapter II p.31

In the review of the construction of the breakwater (breakwater) at the top of the breakwater (breakwater) a pile of stones made walls and layers of concrete casted in place. This concrete layer has a function, namely: Strengthen the tops of buildings, Increase height of building tops, As a way to car Protection layer thickness The thickness of the protected layer is calculated as the formula below then see table 2.4 layer coefficients in chapter 2:

Protect layer thickness 2 For broken stone :

$$t = nk_\Delta \left[\frac{W}{\gamma_r}\right]^{1/3} = 3 \times 1{,}10 \left[\frac{0{,}440}{2.65}\right]^{1/3} = 1{,}8m$$

Protection layer thickness 1 For tetrapod

The number of protective stones

The number of protective stone grains per unit area (10 m2) is calculated by the following formula:

For broken stone:

$$N = Ank_\Delta \left[1 - \frac{P}{100}\right]\left[\frac{\gamma_r}{W}\right]^{2/3}$$

For Tier 1 per 10 m2

$$N = Ank_\Delta \left[1 - \frac{P}{100}\right]\left[\frac{\gamma_r}{W}\right]^{2/3} =$$

$$10 \times 2 \times 1{,}10 \left[1 - \frac{40}{100}\right]\left[\frac{2{,}65}{0{,}440}\right]^{2/3} = 43$$

For Tier 2 per 10 m2

$$N = Ank_\Delta \left[1 - \frac{P}{100}\right]\left[\frac{\gamma_r}{W}\right]^{2/3} =$$

$$10 \times 3 \times 1{,}10 \left[1 - \frac{40}{100}\right]\left[\frac{2{,}65}{0{,}0440}\right]^{2/3} =$$

$$304$$

For tetrapod:

For Tier 1 per 10 m2

$$N = Ank_\Delta \left[1 - \frac{P}{100}\right]\left[\frac{\gamma_r}{W}\right]^{2/3} =$$

$$10 \times 2 \times 1{,}04 \left[1 - \frac{50}{100}\right]\left[\frac{2{,}4}{0{,}330}\right]^{2/3} =$$

$$39$$

From the above calculation, the results can be from:

With a Broken Stone : Breakwater height = 5.73 m The peak of the breakwater El = 3.3 m Peak width of the breakwater = 3.02 m, Side slope ctg = 2 or slope tg = ½ (m = 2),Thickness of the first Layer of Protection = 1.8 m, Second Layer Thickness = 0.84 m, The weight of the first Protected Lapis Stone = 440 kg, The weight of the second Protected Stone = 44 kg, Weight of the third Protection Stone = 2.2 kg.

With Tetrapod : Breakwater height = 5.21 m, The peak of the breakwater El = 2.79 m, The width of the breakwater peak = 1.07 m, Side slope ctg = 2 or slope tg = ½ (m = 2), Thick First Layer of Protection = 0.07 m, Weight of the Lapis Protection Stone = 330

IV. CONCLUSION

Breakwater is something of a marine structure that functions specifically to protect the beach or the area around the coast against the effects of ocean waves. So, it is necessary to build a breakwater in the Labuan coastal area in order to avoid large wave capacity. In general the most dominant factors that cause breakwater structures damage are abrasion and wave height increase. Breakwater suffered damage due to settlement and armor leyer instability due to the impact of broken waves and the inadequate dimensions of the broken rock. After calculated using the Airy wave formula (d / L) and the Refraction Coefficient (Cr), the wave height is 1.73 m from a depth of 2 m.

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