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Research Paper

Study Of Dock Construction In People's Fishery Port

(Case Study: Pancer Fishing Port Banyuwangi, Indonesia)

Noor Salim*)
*) *Civil Engineering, Faculty of Engineering, University of Muhammadiyah Jember*

ABSTRACT
The dock condition at the fishing port for the people of Pancer, Banyuwangi, Indonesia is less efficient. The berth place of the ship at the pier and fishermen's traffic when loading and unloading the fish is inadequate. This is due to the elevation of the dock floor with the less close and too low shoreline. From the aforementioned problems, it is necessary to study the dock construction in the Pancer fishery port of Banyuwangi Indonesia, so that it can work optimally and well. It is hoped that this study can provide input on the planning of the specific wharf and ports in general.
Based on the study of the port construction of the fishing port, the results obtained are: the size of the berths with a capacity of 10-30 GT with a total berth of 27 ships per day. For tides, the Formzahl F = 2.753. with the ebb and flow of a single daily tidal mix. The elevation of the wharf is 6.75 m, from the sea floor to the level of the pier floor. Dock dimensions with a length of 96 m and a width of 5 m with a depth of piling from the ground to below = 12 m. The beam dimensions for the pier are 50 x 60 cm larger than the dimensions of the existing pier. The Bollard pier facilities are planned according to the 10-30 GT ship pulling force of = 2.25 tons, and the CV4 "Hyper Ace Type" Fender with a maximum deflection of 47.50% of = 7.8 ton
It is recommended that port studies should be carried out comprehensively. The analysis covers all buildings in the port so that an integrated planning can be produced.
Keywords: *Construction, Pier, Ship, Port.*

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I. INTRODUCTION

The dock condition at the fishing port for the people of Pancer, Banyuwangi, Indonesia is less efficient. The berth place of the ship at the dock and fishermen's traffic when loading and unloading the fish is not sufficient. This is due to the elevation of the dock floor with the less close and too low shoreline.

The dock dimensions depend on the type and size of the vessels moored at the dock which are insufficient to anchor 27 ships per day according to data in the field obtained from the Pancer Marine and Fisheries Service (2017). For the dock construction at IPP Pancer which is damaged due to the collision force of the ship and the pulling force of the ship, it is also due to the shape or dimensions that are less efficient for the berthing of the ship.

According to Fajri et.al (2012), the breakdown of dock construction which is one of the coastal structures, can be caused by large flow and sea waves. This is in accordance with the BNPB document (2011) which defines the process of erosion of the coast by the power of ocean waves and destructive ocean flow. Abrasion is usually called beach erosion. The damage of the dock construction is also depend on the dock facilities such as existing bolders and fenders. The bolder is not strong enough to withstand the pulling force of the moored vessels due to the small dimensions of the bolder, while the existing fenders use wooden fenders, which are porous and broken due to ship collisions and are submerged by sea water during tides.

The dock must be planned in such a way that ships can dock and tie up, and carry out activities at the port safely, quickly and smoothly (Bambang Triatmodjo: 2009). With that it is necessary to evaluate the elevation, shape and dimensions of the dock so that the loading and unloading activities can be effective according to the type of ship anchored at the dock, and also construction damage due to the ship's pulling force on the bolder, a rather large size or dimension is made, then due to the horizontal collision of the ship with the dock that occurs on stronger fenders withstand collisions of ships and is not prone to damage.

From the description of the aforementioned problems, it is necessary to study the dock construction in the Pancer fishery port of Banyuwangi Indonesia, so that it can work optimally and well. It is hoped that this study can provide input on the planning of the wharf in particular and the port in general.

II. METHODOLOGY

The Research Location

The location of this research is on the beach of Pancer, Pesanggaran Subdistrict, Banyuwangi Regency, East Java, Indonesia, which is located 8 ° 35'34.06 "South Latitude and 113 ° 59'51.20" East Longitude.

Figure 1 Map of Research Location

Research Flowchart

The flow chart in this dock construction study is as follows.

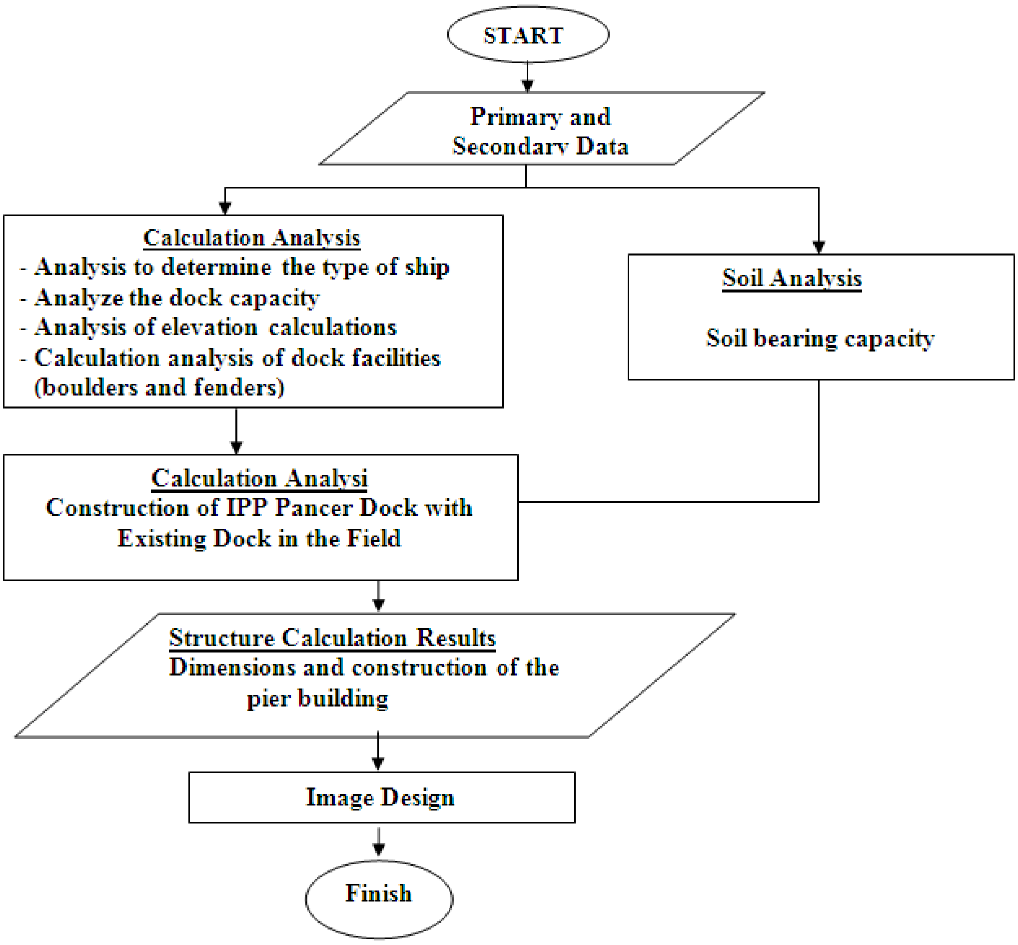

Figure 2. Research Flowchart

Types of Data and Data Sources

The data used are primary and secondary / indirect data.

1. Primary Data

This data is obtained from observations and direct measurements in the field of the condition of the dock building and its facilities. The primary data obtained consisted of: Documentation in the form of photos of conditions at the research location, namely images of existing docks in the fishing port of Pancer, Banyuwangi Regency.

2. Secomdary Data

Data obtained through written materials, as well as other information that is closely related to the object of research, namely:

a. Bathymetric data
b. Ship data
c. Soil data
d. Tidal Data

Data Processing Methods

The data that has been collected will be processed and analyzed which includes:

a. Presentation of design ship data
b. Topographic data presentation
c. Tidal
d. Determination of the elevation of the plan face
e. Bathymetry data presentation
f. Presentation of soil characteristics data

Analysis

The calculation analysis regarding the evaluation of this port includes:

a. Vessel Type Determination Calculations
b. Pier Capacity Calculation
c. Jetty elevation calculation
d. Bollard calculation
e. Fender calculation

III. RESULTS AND DISCUSSION

Ship Planning

The Pancer beach dock in Banyuwangi Regency serves 10-30 GT fishing boats, from the data that already exists in the field in a day there are 27 ships that dock at the Pancer fishing port, Banyuwangi Regency. The following is the ship data that will be used in the dock design process:

Tonnase : 30 GT
Length (LOA) : 18.50 m
Width (B) : 4.50 m
Draft : 1.5 m

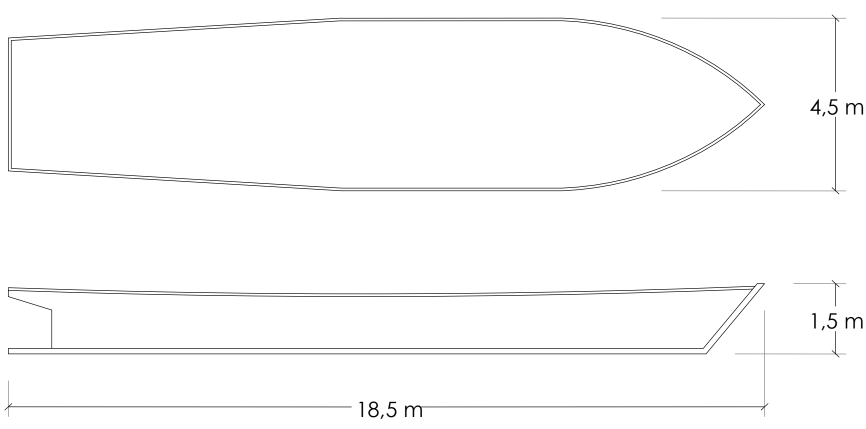

Figure 3. Size of the Planned Ship

Tidal Analysis

Tidal data is needed to determine the design water level, port pool depth and dock dimensions. So that it can be determined the placement of the dock and the elevation of the dock deck.

From the tidal data in the Banyuwangi area of the South Coast IPP Pancer research location, which is obtained from local data (Meteorology and Geophysics Agency of Banyuwangi Regency. 2017), the tidal graph is obtained as follows:

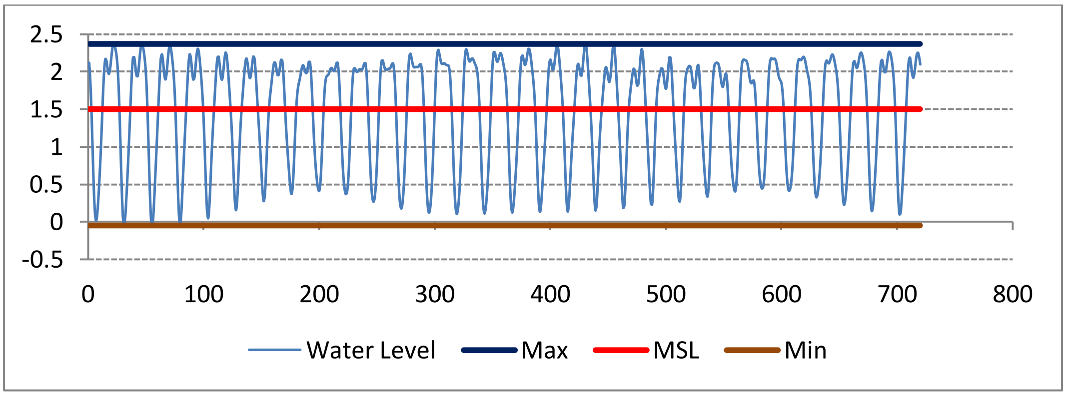

Figure 4. Graph of Pancer Beach Tide Kab. Banyuwangi

The results of tide data analysis get the amount of tides. This tidal constant generally determines the movement of water in the mid-daily to daily period, depending on the type of tide that occurs in these waters. In this analysis, the Admiralty method is used. The choice of this method is because it is relatively easy to use existing tables. The nine main components of the tidal constants obtained are M2, S2, N2, K1, O1, M4, MS4, K2, and P1.

Table 1. Results of tidal harmonic analysis at Pantai Pancer Kab. Banyuwangi

	S0	M2	S2	N2	K1	O1	M4	MS4	K2	P1
A (m)	1.50	0.04	0.26	0.08	0.70	0.11	0.02	0.08	0.13	0.23
g	0	11.1	87.5	18.0	311.8	143.4	207.8	347.8	87.5	311.8

(Source: the results of the admiralty method of ebb and flow calculations)
Once the tidal constants are known, the tidal types can be defined as follows:

$$F = \frac{A(O1) + A(K1)}{A(M2) + A(S2)}$$

$$F = \frac{0.70 + 0.12}{0.03 + 0.26} = 2.753$$

Using the formula above, the Formzahl F = 2.753 is obtained. Thus the tides are mixed tides with a single daily inclination, meaning that in one day there is 1 tide and 1 ebb at different heights, sometimes two tides and two low tides with differences in height and time.

Dock Type

The type of dock chosen is the form of a wharf. This dock was constructed when the depth line was close to shore and planners did not want the dredging of the large harbor pond. Between the pier and the beach are directly connected.

Wharf Deck Elevation Planning Based on Tidal Data

The difference in tide height from maximum = 2.37 m minus MSL = 1.5 m of 0.87 m is small so that it is profitable to determine the dock deck is planned to be: ± 1.00 m as the above guard, the elevation of the dock floor is obtained

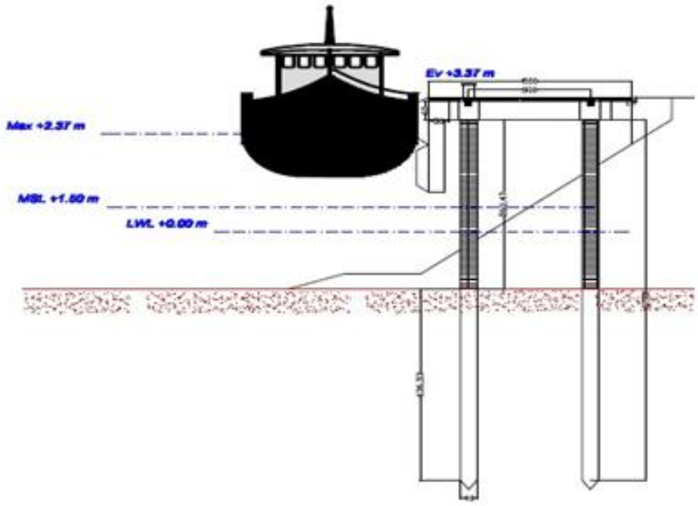

Figure 5. Dock Deck Elevation

Dock Dimensions

At this dock, it is planned that around 4-5 ships will dock, so that according to the size of the planned ship, the size of the dock is 96 meters long. As for the width according to pier traffic or existing activities on the pier, it is known that in the field there is not a lot of traffic such as people / fishermen activities assuming = 1 m and also fish carts with maneuvers = 3 m, plus the edge of the pier = 1 m, from that we know the width of the pier is 5 meters.

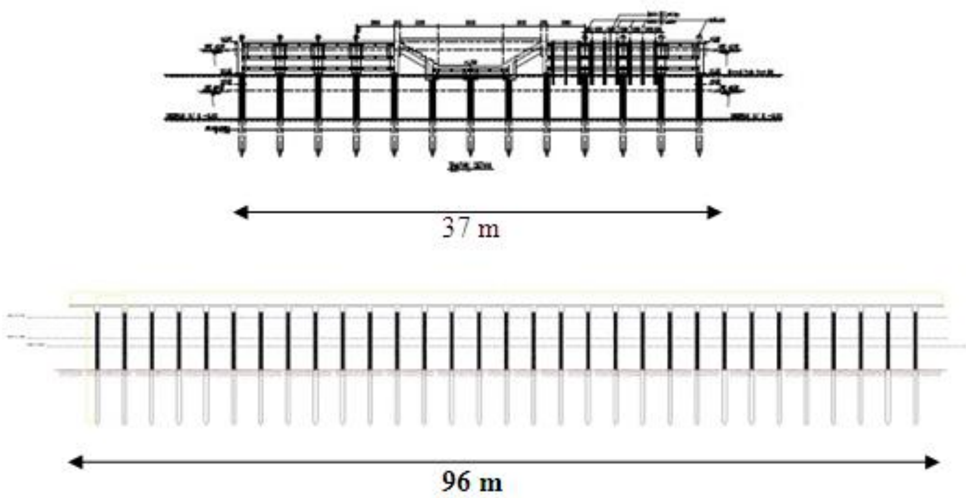

Figure 6 Existing wharves in the field and planning results

Loading on the dock

The following is general data that is used as a reference in calculating loading:

➢ Dock Size

- Length of Dock: 96 m
- The width of the dock: 5 m
- dock elevation: 3.37 m

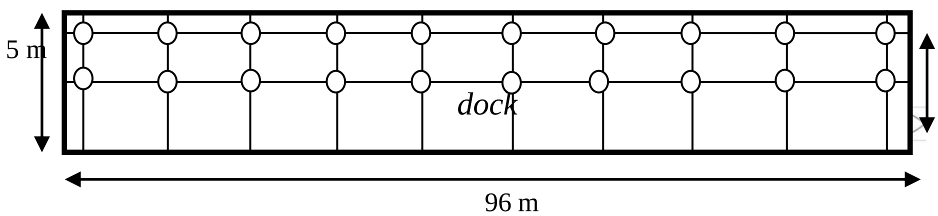

Figure 7. Dock wharf layout and berth capacity

➢ **Material parameters**

The material used is based on references from Concrete Construction. Jakarta: Jakarta State Polytechnic by Pratikto (2009) where in this case:

- Density of concrete = 2400 kg / m3

➢ **Earthquake Load**

- Earthquake areas in Indonesia are divided into 6 zones based on the peak acceleration of the base rock based on the rules for Earthquake Resistance Planning Standards for Building Structures. Jakarta: National Standardization Agency for SNI 1726 - 2002, this zone division can be seen in Figure 8. below.

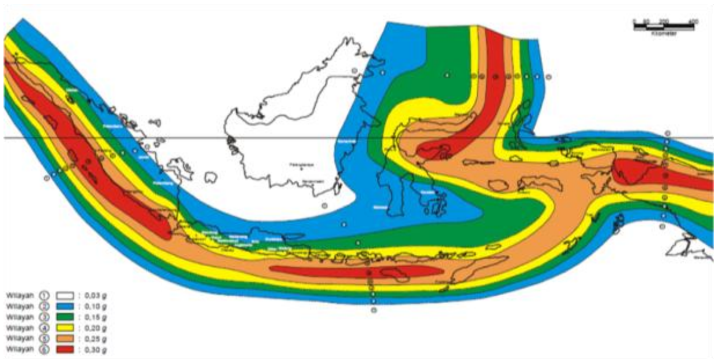

Figure 8. The area of the Indonesian earthquake with the peak acceleration of bedrock 500 year birthday period

- Based on the distribution of earthquake areas in Figure 8, it can be seen that the coast of Pancer Banyuwangi is included in the earthquake zone 4. The value of the earthquake response factor can be determined based on the following graph.
- The type of land for the pier location is soft soil based on the average N-SPT value at each depth. The value of the building vibration time Ta = 0.231 with the building height is 4.951 m. From the reading of the graph above, then for planning the basic earthquake coefficient value of Ci is 0.85 for the pier structure.
- Seismic resistance planning procedure "nominal basic shear force as the first variable response to the effect of the design earthquake according to the equation:

i = priority factor = 1

C = earthquake response factor = 0.85

Rt = ductility factor = 5.5

Total load (Wt) = WDL + WLL = 135720 kg

V = C x I / R x Wt = 20974.9 kg = 20.9749 tons

➢ **Dock beam size and reinforcement**

To calculate the dimensions of concrete blocks and their reinforcements, the book Basics of Reinforced Concrete Planning is used. written by Gideon H. Kusuma (1993), and to find the diameter of reinforcement used Graphs and Tables. Calculation of Reinforced Concrete based on SK SNI T-15-1991-03 also written by Gideon H. Kusuma. (1993), the calculation results are as follows

- Beam width: 50 cm
- Beam height: 60 cm
- Beam reinforcement can be shown in table 2 and an example of beam reinforcement A in Figure 9 below.

Table 2. Recapitulation of beam reinforcement

Beam	Balok A	Balok B	Balok C	Balok D	Balok E
Support	5 D 29 & 4 D 29	4 D 29	4 D 29	4 D 29	4 D 29
Field	4 D 29	4 D 29	4 D 29	4 D 29	4 D 29

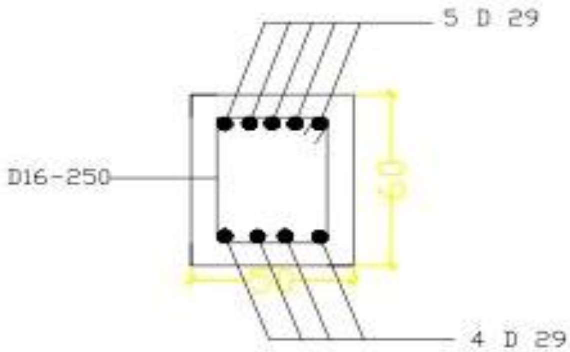

Figure 9. Beam Support Reinforcement A

➢ **Calculation of Plate Reinforcement**

To calculate the dimensions of the concrete plate and its reinforcement, the book Basics of Reinforced Concrete Planning is used. written by Gideon H. Kusuma (1993), and to find the diameter of reinforcement used Graphs and Tables. Calculation of Reinforced Concrete based on SK SNI T-15-1991-03 also written by Gideon H. Kusuma. (1993), the calculation results are as follows

- Plate thickness = h = 150 mm
- Thick concrete cover = p = 50 mm beam: 60 cm
- diameter of the design reinforcement Ø 10 mm for both directions
- Plate reinforcement can be seen in table 3 and figure 10 below.

Table 3 Results of Plate Reinforcement Recapitulation

	PLATE A	PLATE B	PLATE C
Field Moment X	Ø10 - 250	Ø10 - 250	Ø10 - 250
Field Moment Y	Ø10 - 250	Ø10 - 250	Ø10 - 250
Bearing Moment X	Ø10 - 125	Ø10 - 250	Ø10 - 250
Bearing Moment Y	Ø10 - 125	Ø10 - 250	Ø10 - 250

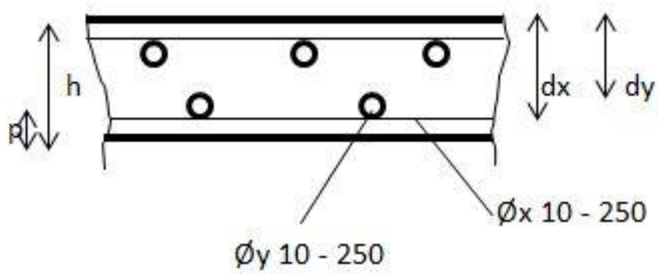

Figure 10 Plate cross section

➢ **Ukuran Tiang Pancang Dermaga**

- B / d = width of the pile (Diameter 0.5 m)
- L = distance from the base of the pile to the ground = 12 m
- e = distance from the top of the stake to the ground = 3.37 + 3.381 = 6.75 m

Selection of Bollards and Fenders

From the references obtained from OCDI (2009), the Bollard wharf facility is planned according to the 10-30 GT ship pull force of = 2.25 tonnes. For ships of the 10-30 GT bolder / bollard type, a cylindrical shape is planned with a height = 35 cm and a width = 20 cm.

The design of the fender for a dock is very much determined by the size of the ship and the speed of docking. In choosing the fender that will be used, first determine the energy that will work on the fender. The choice of fender is based on the amount of energy absorbed by the fender (Er) which must be greater than the collision energy of the ship. Er = 0.34> E = 0.0429 tm. Where the fenders at the port of Pancer harbor previously used a type of wood fender which has a weakness that is not strong enough to withstand the collision force of ships anchored at the pier and is easily brittle. In this planning, it is assumed that all berthing loads are received by the fender. The type of fender used is the Hyper Ace Type HA 150H CV4 rubber fender shown in Figure 9, with a maximum deflection of 47.50% = 7.8 tons. The rubber fender data was obtained from Sumitomo Rubber Industri, LTD. (Sumitomo, 2002).

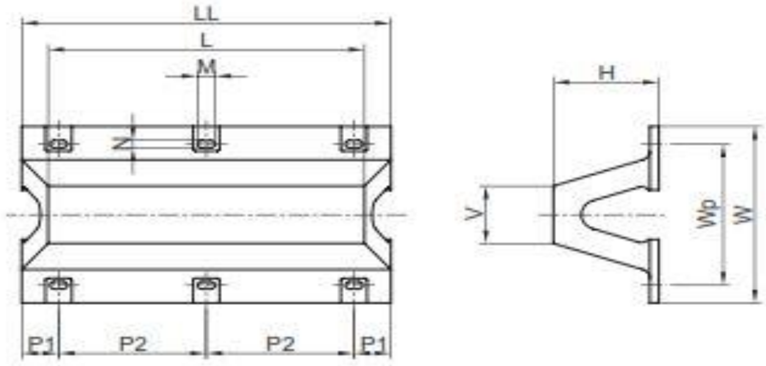

Figure 9. Hyper Ace Type HA 150H CV4

IV. CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the study of the construction of the Pancer fishing port pier in Banyuwangi Regency, it can be concluded as follows:

1. The size of ships with a berthing capacity of 10-30 GT with a total berth of 27 vessels per day
2. For Tides, the Formzahl value is F = 2.753. with the ebb and flow of a single daily tidal mix.
3. The wharf elevation is 6.75 m, from the seabed to the surface of the pier floor
4. Jetty dimensions with a length of 96 m and a width of 5 m with a depth of piling from the ground to below = 12 m
5. The beam dimensions for the pier are 50 x 60 cm larger than the dimensions of the existing pier.
6. Bollard dock facilities are planned in accordance with the 10-30 GT ship tensile strength = 2.25 tons, and CV4 "Hyper Ace Type" Fenders with a maximum deflection of 47.50% of = 7.8 tons.

Suggestion

For port studies it should be done comprehensively. The analysis covers all buildings in the port so that an integrated planning can be produced.

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