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Overview Of The Condition Of The Dock Facilities At Kuala Tungkal Ferry Port

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Abstract

Kuala Tungkal crossing port is a crossing Port located in Tanjung Jabung Barat regency, Jambi province, with crossings Kuala Tungkal - Dabo Singkep and Kuala Tungkal - Telaga Punggur. The port is operated by the Department of transportation of West Tanjung Jabung regency and supervised by BPTD Region V Jambi province. The condition of the facilities at the port is very important to review and make periodic repairs so as not to interfere with port operations.

This study aims to determine the condition of the dock facilities in the form of fenders, Bolders, catwalks and various efforts to solve problems related to the condition of the dock facilities in accordance with the provisions. The method of analysis used in the form of observation, measurement of the dimensions of facilities and tides as well as, interviews to the ship operator.

Based on the results it can be concluded that the condition of the dock facilities in a damaged condition and the absence of repair and maintenance of the port operator. Thus, it is necessary to plan the dock facilities in accordance with the needs and periodic maintenance so that the dock facilities are always durable.

Keywords: Overview, Dock, Fender, Bolder, Catwalk

1. Introduction

Transport Crossing serves as a bridge connecting the road network and/or a network of railway lines separated by water to transport passengers and vehicles and their cargo. Freight crossings provide services for passengers and vehicles going to the surrounding area or between islands.

The port itself has 2 kinds of facilities. That is, land-side facilities and water-side facilities. Landside facilities serve to support services to passengers and vehicles at the Port. While the waterside facilities or berfubgsi dock to support the activities of berthing and loading and unloading at the Port.

In addition to land facilities, dock-side facilities must also be considered in order to function properly in accordance with the decree of the Minister of Transportation No. 52 of 2004 on the implementation of the crossing Port.

2. Research Methodology

The research was conducted in the form of descriptive quantitative methods, where the authors conducted a review and analysis of the condition of water facilities in the Port of Kuala Tungkal crossing. Primary Data obtained in the field in the form of tidal data at the port, the dimensions of the dock, the position of the draft, and the speed of the ship at the time will dock at the dock. Secondary Data obtained in the form of Port productivity data for the last 5 years, the geographical condition of the research location (West Tanjung Jabung regency), the

Inland Waterways Journal
Overview Of The Condition ... (Kodrat Alam,et.al)
Volume 4 Issue 1, October 2022, 41-48
ISSN 2723-3642

characteristics of the ships operating, and the layout of the Kuala Tungkal crossing Port.
The data collection methods used are direct observation of the condition of water facilities, measurement of the dimensions of facilities and changes in the tide at the port, as well as interviews with port operators and ships regarding the condition and importance of maintenance of water facilities (fender, bolder, and catwalk).

3. Results and Discussion

a. Result

1) Ship Characteristic Data

Table 1. Characteristics of KMP. Satria Pratama

Explanation	Description
Ship Name	KMP SATRIA PRATAMA
Owner Ship	PT. Jembatan Nusantara
LOA	49,85 M
LWL	46,53 M
Width	13,20 M
Depth	3,8 M
Draft	2,51 M
Gross Tonage	1026/308

2) Ship Berthing Speed Data

Table 2. Ship Berthing Speed Survey

No	Ship Name	Speed (knots)	Berthing Speed(m/s)
1	Satria Pratama	0,7	0,359
2	Sembilang	0,5	0,257
3	Senangin	0,5	0,257

3) Block Coefficient Data

Table 3.Values Of The Ship Block Coefficient In General

Container vessels	0,6 - 0,8
General Cargo and Bulk Carriers	0,72 – 0,85
Tanker	0,85
Ferrie	0,55 – 0,65
RoRo vessel	0,7 – 0,8

4) High Water Loaded Data

Table 4. Data Of High Water Load Of Kuala Tungkal Ferry Port For 15 Days

TIME	DATE (14 - 28 March 2022)														
	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1:00	3,2	3,1	2,9	2,6	2,3	2,0	1,8	1,7	1,8	2,0	2,3	2,6	3,0	3,2	3,4
2:00	3,2	3,2	3,2	3,1	2,3	2,6	2,4	2,2	2,1	2,2	2,3	2,6	2,8	3,1	3,3

Inland Waterways Journal

Overview Of The Condition ... (Kodrat Alam,et.al) Volume 4 Issue 1, October 2022, 41-48

ISSN 2723-3642

3:00	3,3	3,3	3,3	3,3	3,3	3,2	3,0	2,8	2,6	2,5	2,5	2,6	2,8	3,0	3,2
4:00	3,3	3,4	3,3	3,4	3,4	3,4	3,4	3,3	3,2	3,0	2,9	2,9	2,9	3,0	3,2
5:00	3,4	3,4	3,3	3,3	3,4	3,4	3,5	3,6	3,6	3,5	3,4	3,2	3,1	3,1	3,1
6:00	3,4	3,4	3,3	3,3	3,3	3,3	3,4	3,6	3,7	3,8	3,7	3,6	3,4	3,3	3,2
7:00	3,4	3,4	3,3	3,2	3,0	3,0	3,1	3,2	3,5	3,7	3,8	3,8	3,6	3,4	3,3
8:00	3,4	3,4	3,3	3,1	2,8	2,8	2,7	2,8	3,0	3,3	3,6	3,7	3,7	3,6	3,4
9:00	3,4	3,3	3,2	3,0	2,5	2,5	2,4	2,4	2,5	2,7	3,1	3,4	3,6	3,6	3,4
10:00	3,4	3,3	3,2	2,9	2,4	2,4	2,1	2,4	2,0	2,2	2,5	2,9	3,2	3,4	3,5
11:00	3,3	3,3	3,2	3,0	2,3	2,3	2,0	2,0	1,6	1,7	1,9	2,3	2,7	3,1	3,3
12:00	3,2	3,3	3,3	3,1	2,4	2,4	2,0	1,7	1,4	1,3	1,4	1,7	2,1	2,6	3,1
13:00	2,0	3,2	3,3	3,3	2,7	2,7	2,2	1,6	1,3	1,1	1,0	1,2	1,6	2,1	2,6
14:00	2,4	2,9	3,2	3,4	3,1	3,1	2,7	1,7	1,6	1,1	0,9	0,9	1,1	1,6	2,1
15:00	2,0	2,4	2,9	3,3	3,5	3,5	3,2	2,1	2,1	1,5	1,0	0,8	0,9	1,1	1,6
16:00	1,6	1,3	2,4	3,0	3,6	3,6	3,6	2,7	2,7	2,1	1,5	1,0	0,8	0,9	1,2
17:00	1,3	1,6	2,0	2,5	3,5	3,5	3,7	3,3	3,3	2,7	2,1	1,5	1,0	0,9	1,0
18:00	1,2	1,3	1,6	2,0	3,1	3,1	3,5	3,6	3,6	3,3	2,7	2,0	1,4	1,1	0,9
19:00	1,1	1,2	1,3	1,7	2,6	2,6	3,1	3,7	3,6	3,6	3,2	2,6	2,0	1,4	1,1
20:00	1,2	1,1	1,2	1,4	2,1	2,1	2,6	3,5	3,4	3,3	3,4	3,1	2,5	1,9	1,4
21:00	1,5	1,2	1,1	1,2	1,8	1,8	2,2	3,0	3,0	3,3	3,5	3,3	3,0	2,4	1,8
22:00	1,8	1,4	1,2	1,2	1,5	1,5	1,8	2,6	2,6	3,0	3,3	3,4	3,2	2,9	2,4
23:00	2,3	1,9	1,9	1,3	1,4	1,4	1,6	2,2	2,3	2,7	3,1	3,3	3,4	3,2	2,9
0:00	2,7	2,4	2,4	1,9	1,4	1,4	1,6	1,9	2,1	2,5	2,8	3,1	3,3	3,4	3,3
MAX	3,4	3,4	3,3	3,4	3,6	3,6	3,7	3,7	3,7	3,8	3,8	3,8	3,7	3,6	3,5
AVERAGE	2,5	2,6	2,6	2,6	2,7	2,7	2,7	2,7	2,6	2,6	2,6	2,6	2,5	2,6	2,6
MIN	1,1	1,1	1,1	1,2	1,4	1,4	1,6	1,6	1,3	1,1	0,9	0,8	0,8	0,9	0,9

5) Data Specification Fender

Table 5. Capacitance Fender Type Cell (Deflection 45 %)

Type	Energy (ton meter)	Reaction(ton)	Deflection(m)
KCEF 400H	11,00	1,70	0,1800
KCEF 500H	31,80	4,20	0,2250
KCEF 630H	34,40	7,10	0,2835
KCEF 800H	47,30	14,40	0,3600
KCEF 1000H	75,20	33,50	0,4500
KCEF 1150H	99,50	50,20	0,5175
KCEF 1250H	117,60	64,50	0,5625
KCEF 1450H	158,20	108,56	0,6525
KCEF 1600H	192,60	135,30	0,7200
KCEF 1700H	217,40	162,30	0,7650
KCEF 2000H	300,00	264,40	0,9000
KCEF 2250H	422,80	417,70	1,0125

Inland Waterways Journal

Overview Of The Condition ... (Kodrat Alam,et.al)

Volume 4 Issue 1, October 2022, 41-48

ISSN 2723-3642

KCEF 2500H	522,00	573,00	1,1250

b. Discussion

1) Pier Length Analysis

Based on the decree of the Minister of Transportation No. 52 of 2004 on the implementation of the ferry port in the Annex to the determination of land and water needs in the Master Plan of the ferry port that the condition of the length of the dock must be in accordance with the size of the longest ship in the :

$A \geq 1.3 \times LOA$

$A \geq 1.3 \times 49.85$ m

$A \geq 64{,}805$ m

$A \geq 65$ m

2) Port Pool Depth Analysis

In accordance with KM 52 of 2004 concerning the implementation of the crossing Port on the port pool the minimum depth of the Port Pool can be found by the formula, namely :

Pool depth = largest vessel Draft + 1 m

= 2.51 m + 1 m

= 3.51 m

3) Analysis Of Tide Rides

From the data in Table4. , then it will be processed by the least square method in microsoft excel to obtain tidal data at the Port of Kuala Tungkal crossing with 9 components as follows :

Table 6. Amplitude Components

Symbol	Aplitudo Meter
S0	2,602
M2	0,718
S2	0,281
N2	0,066
K2	0,170
K1	0,648
O1	0,597
P1	0,157
M4	0,062
MS4	0,055

From **table 6.** above, the values obtained to find the tidal calculation data on the Kuala Tungkal crossing Port Pool, are as follows:

Zo = 1.2 (M2 + S2 + K2)

= 1,2 (0,718 + 0,281 + 0,170)

= 1,402 m

MSL = Zo + 1.1 (M2 + S2)

Inland Waterways Journal

Overview Of The Condition ... (Kodrat Alam,et.al)

Volume 4 Issue 1, October 2022, 41-48

ISSN 2723-3642

= 1,402 + 1,1 (0,718 + 0,281)
= 2.501 m

HHWL = Zo + (M2 + S2) + (K1 + O1)
= 1,402 + (0,718 + 0,281) + (0,648 + 0,597)
= 3.646 m
LLWL = Zo - (M2 + S2) - (K1 + O1)
= 1,402 - (0,718 + 0,281) – (0,648 + 0,597)
= 0.841 m
From the above calculation results obtained hhwl value, which is 3.646 meters LLWL value of 0.841 meters, so as to find the average water level as follows :
MHWL= MSL + Zo
= 2,501 + 1,402
= 3.904 m
Mount Mount = HHWL-LLWL
= 3,646 – 0,841
= 2.615 m

4) Fender Requirement Analysis
The initial step is to measure the berth speed measured by the way when the ship entered the harbor pool with a distance of ±20 m from the harbor pool to the edge of the dock.
The berthing speed taken for the calculation of the fender is the largest ship speed when the ship is berthing or docked at the dock, because the faster the ship docked at the dock, the impact force charged by the ship is greater.
From table 2. we can know the berthing speed of the ship at the Port of Kuala Tungkal at a distance of 20 meters. The distance is taken from the GPS on the ship that will lean. And the time obtained when the ship will dock is measured through a stopwatch. So it is known that the largest berthing speed (v) is (0.359 m/s).
In addition, it must also be known the amount of displacement of the ship (the mass of the ship is equal to the volume of water moved)
To find the maximum ship weight used length, width and maximum draft of the largest ship of the ship operating on the dock, where according to Triatmodjo, 2003, the formula displasment:
Δ = Lpp . B. dmax . Cb . ρ
Where:
Lpp = length of the ship's waterline (46.33 m) B = width of the largest ship (13.20 m)
d max = 2.51 m
Cb = Block Coefficient (0.7)
Δ = density of water (sea water = 1028 kg / m^3) then for the crossing ship displasment is:
Δ = Lpp.B.dmax.Cb.ρ
Δ = 46.33 m x 13.20 m x 2.51 m x 0.7 x 1.028 tons / m^3
Δ = 1,104. 59 tons

Having obtained the displacement we have to find DWT (Dead Weight Tonnage) ship can be searched by the formula, as follows :

Inland Waterways Journal
Overview Of The Condition ... (Kodrat Alam,et.al)
Volume 4 Issue 1, October 2022, 41-48
ISSN 2723-3642

Δ = LWT + DWT (4.5)
Description :
Δ = Displasment
LWT = Light weight Tonnage
DWT = Dead Weight Tonnage
Here there is no ship LWT data, therefore we must find the ship LWT first in order to find the ship DWT, to find the LWT can be searched by the formula, as follows
LWT = Lpp.B.dmin.Cb.ρ
Description :
Lpp = length of the ship's waterline (46.33 m) B = width of the largest ship (13.20 m)
dmin = lowest Draft (0.8 m)
Cb = Block Coefficient (0.7)
P = density of seawater (1028 kg/m3)
LWT = L.B.dmin.Cb.ρ
LWT = 46,33 m x 13,20 m x 0,8 m x 0,7 x 1.028 tons/m3
LWT = 352,06 tons
Then DWT can be searched, namely :
DWT = Δ - LWT
DWT = 1.104, 59 tons – 352,06 tons
DWT = 752,53 tons
After determining the displasment, then next we must find the value of the block coefficient of the largest vessel surveyed by the formula
Cb = Δ / (Lpp B d)
Cb = (1.104,59)/(46,33×13,20×2,51×1,028)
Cb = 0,7
To find the impact energy caused by the ship with the above formula, it is necessary to know several components. Here's how to look for some components that affect the impact power of the ship
Looking For Cm
Cm = 1 + π /2cb x "d" / "B"
Cm = 1 + 3,14/(2(0,7)) x 2.51/13,20
Cm = 1,43
Looking For Ce
Ce = 1/(1+(l/r^2))
description
L = 1/4 LOA
= 1/4 (49,85 m) = 12,46 m
R = 0,24 LOA
= 0,24 (49,85 m)
= 11,97
So,
Ce = 1/(1+12,46/ 〖(11,97)〗 ^2)
Ce = 1/1,086
Ce = 0,92

Then obtained:
W = 1.104,59 tons

Inland Waterways Journal
Overview Of The Condition ... (Kodrat Alam,et.al) Volume 4 Issue 1, October 2022, 41-48
ISSN 2723-3642

Cm = 1,43
Ce = 0,92
Cs = 1
Cc = 1
Find V (speed component in the direction perpendicular to the dock side / speed of the ship at the time of Berthing (m/s))
V = v.sin 10º
= 0.359 x sin 10º
= 0.0623 m/s
then obtained :
$E = \frac{wv2}{2g}$Cm.Cs.Cc.Ce
$$E = \frac{1.104{,}59 \text{ x } 0{,}0623\text{^}2}{2(9{,}8)}\ 1{,}43\ x\ 1\ x\ 1\ x\ 0{,}92$$
E = 0,284 $ton/\ meter$
Because the fender can absorb half of the impact energy, the energy that hits the fender is :
E fender = $\frac{0{,}284 \text{ ton/m}}{2}$
E fender = 0,142 ton/m
Based on the analysis results obtained above, it is known that the impact energy absorbed by the fender system is 0.142 tons/meter. Based on the classification of fender types in Table 3.5, the type of fender that is suitable for use is the kcef 400H cell fender.plus a frontal frame in front of the fender.

5) Bolder Requirement Analysis
To find the distance between the bolder can use the following formula : distance between bolder = 1/3 x the length of the ship
Distance between Bolders = 1/3 x 49.85 m
= 16 meters
From the above calculation obtained 16 meters for the distance between the bolder. The situation is not in accordance with current conditions with a distance in the field sebesat 15.7 meters. Then it is necessary to repair the distance and repaint to avoid rusting.
To find out the number of Bolders corresponding to the dimensions of the pier is used the following formula :
Number of Bolders = (dock length)/(distance between Bolders)
= (54 meters)/(16 meters)
= 4 bolder
6) Catwalk Needs Analysis
The Catwalk at the Kuala Tungkal crossing Port is already available, but it needs maintenance and repair of floors and guardrails.

4. Closing

a. Conclusions

1) Based on the analysis, the condition of fender, bolder, and catwalk as follows :.
   a) The current condition of the fender in terms of the number is in accordance with the results of the analysis, which is as much as 4 pieces. But in terms of current conditions, the fender is not feasible to function because it is damaged and left

Inland Waterways Journal
Overview Of The Condition ... (Kodrat Alam,et.al) Volume 4 Issue 1, October 2022, 41-48
ISSN 2723-3642

hanging on the dolphin.so that it can interfere with the ship when docked or when there is bad weather.

b) The current condition of the bolder in terms of the number is in accordance with the results of the analysis, which is as much as 4 pieces. However, in the current conditions, the bolder is rusty and the distance between the Bolders is not yet in accordance with the analysis that adjusts the dimensions of the largest ship. That is still 14 meters between Bolders.

c) The condition of the catwalk in terms of length is appropriate and does not undergo perubhan. However, in terms of conditions it is not feasible because it has corrosion (rusting), and there is damage to the guardrail.

2) Efforts that can be made related to fender, bolder, and catwalk problems, namely

a) For fender, no additional number of facilities is required. However, it only requires the installation of new fenders with the type of cell KCEF 400H with additional frontal frame in front.

b) To bolder. Does not require the addition of amenities. However, it is necessary to increase the distance between the Bolders according to the analysis of 16 meters between the Bolders. Then dismantling and re-casting of the bolder is required.

c) For the length of the catwalk has not undergone changes. However, only necessary repairs to floors and guardrails that have been broken and rusted due to corrosion. By welding the catwalk and repainting with anti-rust paint.

b. Suggestions

1) The need for repairs to the fender, bolder, and catwalk.
2) The need for periodic maintenance of dock facilities in order to last a long time and facilitate operations at the port.
3) The need for affirmation from the port operator so that no one enters the vital port facilities other than officers and ensures that the area is always sterile in order to maintain existing facilities in the port.

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