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Feasibility Analysis of Dock Capacity in Tanjung Tembaga Port (Probolinggo, East Java)

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ABSTRACT

As a maritime country and also as an archipelago country, Indonesia has many ports spread troughout its region. This makes sea transportation become the community's choice, especially for shipping goods. This is because the load capacity is greater and the price is more efficient than land or air transportation. From time to time, sea transportation continous to grow. With an increase in the flow of ship visits and cargo flows, the port as a supporting facility for sea transportation is demanded to continue to be maximized in the services of these two things. This research aims to evaluate the feasibility of the dock capacity at the Tanjung Tembaga Port in Probolinggo, East Java. The evaluation process is carried out by processing ship visit data, then measuring the dimensions and capacity of dock, and finally looking for the value of Berth Occupancy Ratio (BOR). The result showed that ship visits in Tanjung Tembaga Port still tend to be low. Then for the BOR value, it is known that the level of dock usage in Tanjung Tembaga Port in 2021 is 68%. This value is still below the maximum BOR value, which means the addition of dock length is not needed.

Keywords: Dock Capacity, Sea Transportation, Tanjung Tembaga Port

1. INTRODUCTION

Indonesia is an archipelagic country as well as a maritime country whose territorial waters are wider than its land area. Therefore, territorial waters are very important in Indonesia. The territorial waters are one of the sources of livelihood for the Indonesian people, not to forget about what can be extracted from it, such as marine biota and oil sources. However, the main function of the territorial waters is to be used as a transportation route.

Water transportation, or rather sea transportation, has long been the choice among the people, where this mode of transportation promises more efficiency than land or air transportation. The very wide presence allows the movement of larger loads at a more efficient cost than other modes of transportation (Musriadi, 2016). To ensure smooth sea transportation, it is very necessary to pay more attention to ports as supporting facilities.

A port (or port) is a place where the transfer of cargo and passengers to and from waters and coasts takes place. Transfers are made to and from the ship. The port can be a cargo port (handling only cargo transfers), a passenger port (handling passenger transfers only), or a combination cargo/passenger port (handling both cargo and passenger transfers) (Talley, 2009).

Dock is a part of the port where ships dock and moor when carrying out loading and unloading activities. Dock is divided into three types, namely wharf, pier and jetty. Wharf is on the shoreline and parallel to the shoreline. Pier is perpendicular to the shoreline. Jetty has front side that parallel to the shoreline and it is connected to the mainland by a bridge perpendicular to the jetty. On cargo port, there must be a large enough yard to place the cargo containers while waiting for shipping or distributing to the land. This dock must also be equipped with a crane or other loading and unloading equipments to transport the cargo containers from or to the ship (Triadmodjo, 2010)

The wharf is an important aspect in port performance, because of its vital function as a place for ship activities to take place. Especially with the current situation where port activity continues to increase. With the continued increase in the volume of cargo, there must be an evaluation of the feasibility of the dock capacity at Tanjung Tembaga Port so that there is no overcrowding due to the increasing flow of ships and cargo flows.

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In addition to the demands of transportation development, the reason for the development is also based on the risk factors for accidents that often occur in the world of transportation. Various problems that occur become a challenge to increase accountability by increasing openness, responding quickly to problems in the field, handling problems effectively and efficiently (Tjendani et al., 2017). The main problem of transportation besides congestion is the high number of accidents that cause fatalities (Hartatik et al., 2021). Apart from that, there are several other reasons why development is necessary.

This research was conducted at the Port of Tanjung Tembaga, Probolinggo, East Java. The evaluation process is carried out by processing ship visit data, then measuring the dimensions and capacity of the pier, and finally finding the Berth Occupancy Ratio (BOR) value. The above stages can be called Port Performance Analysis.

2. LITERATURE REVIEW

Dock

A pier is a port building that is used to dock and moor ships that carry out loading and unloading of goods and boarding and dropping passengers. The dimensions of the pier are based on the type and size of the ship docked and moored at the pier.

The wharf was built for a specific need. The selection of wharf tips is greatly influenced by the needs to be served, the size of the ship, the direction of waves and winds, topography and seabed conditions, and the most important is an economic review to get the most economical building (Amiron, 2009). The dock is divided into 3 types, namely as follows:

1. Wharf
   Wharf is parallel to the beach and usually coincides with the shoreline. The wharf also functions as a retaining ground behind it. The illustration of wharf is shown in Figure 1 as follows:

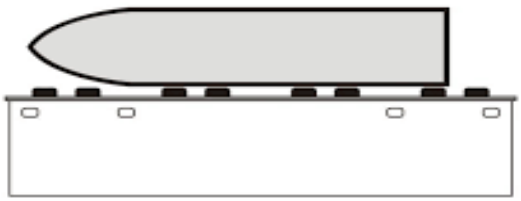

Figure 1. Wharf

2. Pier
   Pier is located on the shoreline and its position is perpendicular to the shoreline (finger shape). Unlike the wharf which is used to dock only on one side, the pier can be used on both sides so that it can accommodate many ships. The illustration of pier is shown in Figure 2 as follows:

Figure 2. Pier

3. Jetty
   Jetty is a pier that juts into the sea which aims to get a suitable sea depth for the ship to be docked. The front side of the jetty is parallel to the shoreline and is connected to the mainland by a bridge perpendicular to the jetty. The illustration of jetty is shown in Figure 3 as follows:

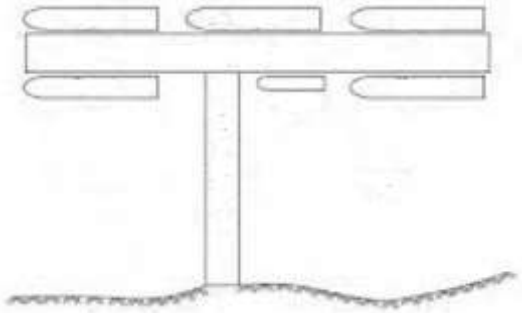

Figure 3. Jetty

Ship

Ship is a vehicle for transporting passengers and goods in the sea, rivers and other water areas. In all calculations related to ships, ships have their respective dimensions. The dimensions of the ship are needed as one of the factors that are directly related to port planning and the facilities that must be available at the port.

The length of the ship generally consists of Length Over All, Length on Designes Water Line and Length Beetwen Perpendicular, while the width and depth of the ship are other main measurements of the ship in determining ship sizes. For more details, it can be described as follows:

1. LOA (Length Over All)
   By definition LOA is the length of the ship measured from the bow of the leading ship to the stern of the ship at the rear. Is the main measure needed in relation to the length of the pier, cargo, the longer the LOA the bigger the ship means the greater the carrying capacity of the ship.
2. LWL (Lenght On Designes Water Line)
   Is the length of the ship measured from the bow of the ship at the waterline to the stern of the ship at the seawater line.
3. LBP (Length Between Perpendicular)
   Is the length of the ship measured from the bow of the ship at the waterline to the height of the rudder.

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4. Ship width (beam)
   The width of the ship is the maximum distance between the two sides of the ship.

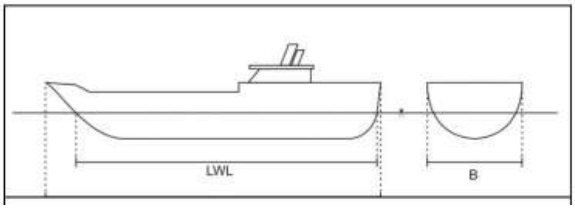

Figure 4. Ships Dimension

Port performance analysis

Port performance is a reference to see the level of port service to port service users. Good port performance indicates good port service quality for port service users. The performance of ship (when the ship is docked at the mooring) is the time calculated from the rope is tied at the mooring until the rope released, or the number of hours while the ship is at the mooring (Liberty & Azwansyah, 2019). The ship services served by the port are as follows:

1. Waiting Time (WT), namely the waiting time for ships waiting for the arrival of pilot ships and tugboats to enter port waters.
2. Approach Time (AT), i.e. the time it takes for the ship to start from anchoring in the open waters until the ship enters the port waters to moor and vice versa, ie from the ship releasing the mooring rope until the ship exits to the open waters.
3. Postpone Time (PT), namely the time delayed/wasted while the ship is in port waters calculated from before and after the ship carries out activities at the port.
4. Service time (ST), namely the service time of the ship when it is at the mooring. The ship's service time is divided into several parts, namely as follows:
   a. Berthing time, namely the total time used by the ship while at the mooring, berthing time consists of berth working time and not operation time, berthing time (BT) can be calculated by:
      $$BT = NOT + BWT$$
      Where:
      NOT : not operation time
      BWT : berth working time
   b. Berthing working time namely the planned time to carry out loading and unloading activities, which consists of effective time and idle time. Berthing working time can be calculated by:
      $$BWT = ET + IT$$
      or
      $$BWT = BT - NOT$$
      ET : effective time
      IT : idle time
      BT : berthing time
   c. Not operation time, namely the planned time not to work (not carrying out loading and unloading activities), such as resting time, which is 30 minutes per shift.
   d. Effective time, namely the time used to carry out loading and unloading activities effectively.
   e. Idle time, namely time that is not used for loading and unloading activities or idle time, such as time wasted when loading and unloading equipment is damaged.
5. Turn Round Time (TRT), i.e. the total service time of the ship at the port is calculated from the time the ship waits for the pilot ship and tugboat (Waiting Time) until the ship leaves the port.
6. Number of ship visits per day (SV), which is the number of ships mooring at the dock per day. It can be calculated using the following formula:
   $$SV = \frac{Number\ ship\ visits}{Number\ of\ day}$$

The service time of the ship at the pier has an influence on the indicator of the utilization of the pier (utility) which is known as the BOR (Berthing Occupancy Ratio) value. Overall, the service time indicator will be the basis for calculating the berthing occupancy ratio. The dock usage ratio expressed in percent (%) provides information on how dense the flow of ships mooring and carrying out loading and unloading activities at the port.

3. RESEARCH METHODOLOGY

This research requires data in the form of secondary data. The steps taken are as follows:

1. Collecting the data needed in the research consisting of the characteristics of the operating ship, the length of the current wharf, the land facilities used and the warehouse for stockpiling commodities.
2. Retrieval of the required data is by collecting secondary data from the relevant agencies.
3. Data processing by grouping the data to check the completeness of the data.
4. Analyze the data obtained. The analysis carried out includes:
   a. From the ship characteristics data obtained ship size, number of ships, frequency of trips and ship carrying capacity.
   b. From this ship characteristic data, it is determined how many ships are leaning, the average length of the ship and the average amount of cargo from the operating ship.

In a feasibility level study, related data are needed, which can be used for further analysis. The purpose of collecting data in this study is to obtain secondary data which is the object of research so that a clearer picture is obtained regarding the feasibility level of the Tanjung Tembaga Port.

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The secondary data needed in this study are the characteristics of the ship, the length of the pier, the facilities used and the warehouse for stockpiling commodities.

After the data obtained from the field, the data will be analyzed. The results of the analysis in this study are to find the volume of ship visits that dock which is then connected to the length of the pier and with the analysis of the Berth Occupation Ratio (BOR) it can be determined what percentage of the dock usage rate at the port.

The steps taken to get the results of the Berth Occupation Ratio (BOR) analysis or the level of use of the wharf :

1. Analyzing the number of ships that are leaning then classifying the size of the ship and the loading capacity of the ship. The equation used is equation 2.1 to calculate the BOR value. This equation can be seen in Chapter II Literature Review.
2. Calculate the loading and unloading capacity of the goods carried out.
3. Accumulating the average number of times the ship's service is moored, both working (productive) and idle (idle and not operating time) at mooring.

4. RESULT AND DISCUSSION

The data collection and survey conducted at the Tanjung Tembaga Port aims to obtain an analysis of the feasibility level of the dock every day in serving incoming/outgoing ships. Data collection is done by collecting secondary data from agencies related to research. The requested data concerns the selected parameters.

Dock capacity

Dock capacity (DC) is the ability of the dock to be able to accept loading and unloading flows. Dock capacity is also an indicator of the density level of a port in serving loading and unloading activities. Before calculating the Dock capacity value, it is necessary to calculate the Berth Throughput (BTP).

1. Berth Throughput (BTP)
   Berth Throughput (BTP) is an indicator of dock utilization which states the amount of goods that can be unloaded and loaded at Tanjung Tembaga Port to find out the capacity of a dock is. Berth Throughput (BTP) value can be calculated using the following formula:

$$BTP = \frac{Loading\ and\ Unloading\ Value}{Wharf\ length}$$

   Example of calculation:

$$BTP = \frac{Loading\ and\ Unloading\ Value}{Wharf\ length}$$

$$BTP = \frac{2145}{1024}$$

$$BTP = 2.09\ ton/m$$

The calculation of Berth Throughput (BTP) aims to determine the capacity of the dock, how much loading and unloading activities can be carried out at Tanjung Tembaga Port. Berth Throughput (BTP) at Tanjung Tembaga Port during the 2021 period is shown in Table 1 below:

Table 1. Berth Throughput (BTP) Value at Tanjung Tembaga Port in 2021

No	Month	Loading and unloading value (ton)	Wharf length (m)	BTP (ton/m)
1	January	2130	1024	2.08
2	February	2145	1024	2.09
3	March	1709	1024	1.67
4	April	1112	1024	1.09
5	May	2483	1024	2.42
6	June	3146	1024	3.07
7	July	2099	1024	2.05
8	August	2099	1024	2.05
9	September	1769	1024	1.73
10	October	2731	1024	2.67
11	November	3777	1024	3.69
12	December	1093	1024	1.07
Total		26293	12288	25.68
Average		2191.08	1024	2.14
Rounding		2191	1024	2

Based on the results of data analysis from Table 1, it is known that the average Berth Throughput (BTP) at Tanjung Tembaga Port is 2 ton/m/month. The highest Berth Throughput (BTP) at Tanjung Tembaga Port occurred in November reaching 3.69 ton/m/month, while the lowest Berthing Throughput (BTP) occurred in December at 1.07 ton/m/month. The Berth Throughput (BTP) value in 2021 is shown in Figure 5 below:

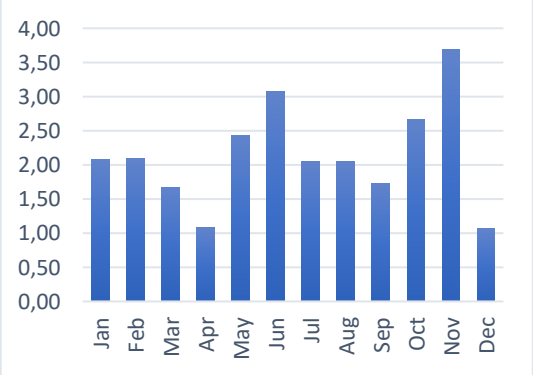

Figure 5. Berth Throughput (BTP) Value at Tanjung Tembaga Port in 2021

2. Dock Capacity (DC)
   As the indicator of the density level, Dock Capacity (DC) value can be calculated after calculating the Berth Throughput (BTP) first. Dock Capacity (DC) value can be calculated using the following formula:

$$DC = L \times BTP$$

   Example of calculation:

$$DC = L \times BTP$$

$$DC = 1024 \times 2.09$$

$$DC = 2145\ ton$$

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Calculation of Dock Capacity (DC) aims to find out how many loading and unloading activities can be carried out at Tanjung Tembaga Port. The Dock Capacity (DC) at Tanjung Tembaga Port during the 2021 period is shown in Table 2 below:

Table 2. Dock Capacity (DC) at Tanjung Tembaga Port in 2021

No	Month	Wharf length (m)	BTP (ton/m)	Dock capacity (ton)
1	January	1024	2.08	2130
2	February	1024	2.09	2145
3	March	1024	1.67	1709
4	April	1024	1.09	1112
5	May	1024	2.42	2483
6	June	1024	3.07	3146
7	July	1024	2.05	2099
8	August	1024	2.05	2099
9	September	1024	1.73	1769
10	October	1024	2.67	2731
11	November	1024	3.69	3777
12	December	1024	1.07	1093
Total		12288	25.68	26293
Average		1024	2.14	2191.08
Rounding		1024	2	2191

Based on the results of data analysis from Table 2, it is known that the average dock capacity at Tanjung Tembaga Port is 2191 ton. The highest dock capacity at Tanjung Tembaga Port occurred in November reaching 3777 ton, while the lowest dock capacity occurred in December at 1093 ton. The dock capacity (DC) in 2021 is shown in Figure 6 below:

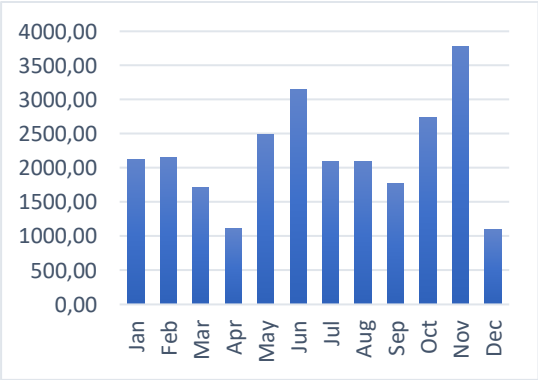

Figure 6. Dock Capacity (DC) Value at Tanjung Tembaga Port in 2021

Dock dimension

Tanjung Tembaga Port has an available wharf with the length of 1024 meters. This wharf is divided by some purpose and by its allotment. The overall condition of the wharf is in good condition, but some part of the wharf still in need of maintenance. Table 3 below describes the existing condition of the wharf at Tanjung Tembaga Port.

Table 3. Existing Data of Wharf at Tanjung Tembaga Port

No	Name of wharf	Length (m)	Width (m)	Area (m^2)	Pool depth (m lws)
1	West wharf	360	4	1440	1.5 m
2	East wharf	640	4	2560	2.5 m
3	Fringe wharf	337	1	337	1.5 m
4	Concrete wharf	20	6	120	2.5 m

Based on the Table 3 above, it is known that there are four parts of the wharf at Tanjung Tembaga Port. The four wharfs have its own respective uses. On every part of the wharf at Tanjung Tembaga Port there is a bollard, except for the fringe wharf. Because the actual fring wharf is only designated as an area for fishermen and not for cargo ships.

Estimates of the arrival of ships that may dock and moor at the Tanjung tembaga Port based on secondary data obtained from the origin of the destination, the volume of transportation is very helpful in dimensioning the length of the pier concerned so that facilities and infrastructure services can be effective, efficient, cheap and fast.

In general it can be said that the size of the pier is based on an estimate of the type of ship that will dock at the pier. In accordance with the shape of the mooring/wharf to be built, the planning of the dimensions of the pier must be based on the minimum size in order to keep the ship safely mooring/leaving the pier and loading and unloading its transportation.

$$L_D = Loa + 5$$

Example of calculation:
Taken from the size of the largest ship moored at Tanjung Tembaga Port
Ship name : Arum Manis
GRT : 497 ton
Loa : 43 meter
So, length of dock needed:
$L_D = Loa + 5$
$L_D = 43 + 5$
$L_D = 48\ meter$
The length of dock used is 48 meter, so 48 meter < 1024 meter. In other words, Arum Manis ships can be served at the Tanjung Tembaga Port, even up to 21 ships.

Ship visits

The level of usability of the wharf is influenced by several factors, one of which is ship visits. Ships moored at Tanjung Tembaga Harbor are divided into two types, namely local ships and people shipping's ships. Local ships are capable of carrying more cargo than people shipping's ships, which means that local ships tend to be larger than people shipping's ships. Below is the calculation of the visit of local ships and people shipping's ships at Tanjung Tembaga Port.

1. Local ship visits

$$LSV = \frac{Number\ of\ local\ ships}{Number\ of\ day}$$

Example of calculation:

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$$LSV = \frac{Number\ of\ local\ ships}{Number\ of\ day}$$
$$LSV = \frac{5}{31}$$
$$LSV = 0.161$$

The number of local ship visits is the number of ships served in a certain period of time to carry out loading and unloading activities. The number of local ship visits is one of the factors that affects the density level of the port, the more local ships that dock and carry out loading and unloading activities indicate that the increasing economic activity at Tanjung Tembaga Port. With the same formula, the intensity of local ship visits in 2021 is shown in Table 4 below:

Table 4. Average Local Ship Visits at Tanjung Tembaga Port in 2021

No	Month	Number of ship visits	Number of days	Average ship visits per day
1	January	4	31	0.129
2	February	4	28	0.143
3	March	5	31	0.161
4	April	4	30	0.133
5	May	4	31	0.129
6	June	5	30	0.167
7	July	3	31	0.097
8	August	4	31	0.129
9	September	5	30	0.167
10	October	5	31	0.161
11	November	1	30	0.033
12	December	8	31	0.258
Total		52	365	1.71
Average		4.33	30.41	0.142
Rounding		4	30	1

Based on the results of data analysis from Table 4, it is known that the average number of local ship visits at Tanjung Tembaga Port in 2021 is 0.142 ship per day. The highest number of local ship visits occurred in December 2021 reaching 0.258 ship per day and the lowest local ship visits occurred in November 2021 that just 0,033 ship per day.

2. People shipping's ship visits

$$PSV = \frac{Number\ of\ people\ shipping's\ ships}{Number\ of\ day}$$

Example of calculation:

$$PSV = \frac{Number\ of\ people\ shipping's\ ships}{Number\ of\ day}$$
$$PSV = \frac{9}{31}$$
$$PSV = 0.29$$

Total people shipping visits affect the density at the dock, as well as local ship visits, people shipping visits also affect the density level of the port. The more people shipping that dock and carry out loading and unloading activities indicate that there are more routes to remote areas are served at Tanjung Tembaga Port. The number of people shipping visits in 2021 is shown in Table 5 below:

Table 5. Average People Shipping Visits at Tanjung Tembaga Port in 2021

No	Month	Number of ship visits	Number of days	Average ship visits per day
1	January	0	31	0
2	February	6	28	0.214
3	March	9	31	0.29
4	April	8	30	0.267
5	May	4	31	0.129
6	June	5	30	0.167
7	July	7	31	0.226
8	August	3	31	0.097
9	September	4	30	0.133
10	October	6	31	0.194
11	November	8	30	0.267
12	December	6	31	0.194
Total		66	365	2.18
Average		5.5	30.42	0.181
Rounding		6	30	1

Based on the results of data analysis from Table 5, it is known that people shipping visits at Tanjung Tembaga Port in 2021 were quite stable. The average people shipping visit at Tanjung Tembaga Port is 0.181 ship per day. The highest number of people shipping visits occurred in March 2021 reaching 0.29 ships and the lowest people shipping arrivals occurred in January 2021 because there are no people shipping's ship visit in that period.

The total number of visits by ships, local ships and people shipping at Tanjung Tembaga Port was 118 ships in 2021. There were more people shipping visits at Tanjung Tembaga Port than local ship, 66 people shipping visited while local ships visited only 52 ships during 2021. The comparison of the intensity of local ship visits with people shipping is shown in Figure 7 below:

Figure 7. Comparison of Local Ship and People Shipping Visits at Tanjung Tembaga Port in 2021

The average intensity of daily local ship visits is 0.142 ship per day, while the average daily intensity of people shipping visits is 0.181 ship per day in 2021. The comparison of the average intensity of local ship visits with people shipping is shown in Figure 8 below:

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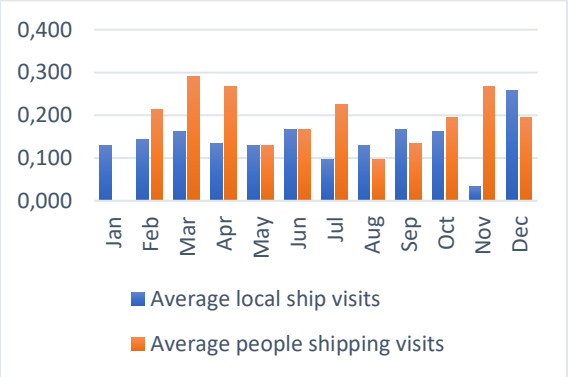

Figure 8. Comparison of Average Local Ship and People Shipping Visits at Tanjung Tembaga Port in 2021

Berth Occupancy Ratio (BOR)

The performance of the dock or Berthing Occupancy Ratio (BOR) is the ratio between the time of using the wharf and the time available (the wharf is ready for operation). By calculating the BOR (Berthing Occupancy Ratio) value, it can be seen the density level of a port. Before calculating the BOR (Berthing Occupancy Ratio) value, it is necessary to calculate the mooring use value for every ship while at Tanjung Tembaga Port with the following formula:

$$Mooring\ use = (Loa + 5) \times Mooring\ time\ value$$

Example of calculation:

$$Mooring\ use = (Loa + 5) \times Mooring\ time\ value$$
$$Mooring\ use = (26.17 + 5) \times 198$$
$$Mooring\ use = 6171.66\ hour$$

The calculation of mooring use value aims to calculate how long the ship moored at Tanjung Tembaga Port is as a whole. Mooring use value at Tanjung Tembaga Port during the 2021 period is shown in Table 6 below:

Table 6. Service Time Value at Tanjung Tembaga Port in 2021

No	Month	Loa (m)	Number of ship	Ships mooring time (hour)	Mooring use value (hour)
1	January	129.17	4	1147.98	45122.91
2	February	282.24	10	10735.82	324047.86
3	March	357.14	14	20810.28	545541.83
4	April	340.05	12	15094.83	458552.95
5	May	225.35	8	27963.48	689977.05
6	June	295.15	10	20207.48	580462.47
7	July	263.98	10	22490.4	638488.05
8	August	207.17	7	9007.98	266840.53
9	September	259.36	9	18088.48	558848.57
10	October	318.18	11	21645.18	646033.47
11	November	205.47	9	36935.8	1010077.37
12	December	448.73	14	9021.47	308948.39
Total		3331.99	118	213149.18	6072941.45
Average		277.66	9.83	17762.43	506078.45
Rounding		278	10	17762	506078

The BOR (Berthing Occupancy Ratio) value is also an indicator that determines whether a port still meets the requirements to serve ships and goods or requires development, and the BOR (Berthing Occupancy Ratio) value also describes the level of port productivity. Example of calculating the value of BOR (Berthing Occupancy Ratio) which is calculated using the following formula:

$$BOR = \frac{\sum Mooring\ Use\ Value}{Wharf\ Length \times Available\ Time} 100\%$$

Example of calculation:

$$BOR = \frac{\sum Mooring\ Use\ Value}{Wharf\ Length \times Available\ Time} 100\%$$
$$BOR = \frac{324047.86}{1024 \times (28 \times 24)} 100\%$$
$$BOR = 47.09\%$$

Calculation of the value of BOR (Berthing Occupancy Ratio) aims to determine the level of performance of the pier to determine the quality of port services at Tanjung Tembaga Port. The BOR (Berthing Occupancy Ratio) value at Tanjung Tembaga Port during the 2021 period is shown in Table 7 below:

Table 7. Berthing Occupancy Ratio (BOR) Value at Tanjung Tembaga Port in 2021

No	Month	Number of day	Wharf length (m)	Mooring use value (hour)	BOR (%)
1	January	31	1024	45122.91	5.92%
2	February	28	1024	324047.86	47.09%
3	March	31	1024	545541.83	71.61%
4	April	30	1024	458552.95	62.2%
5	May	31	1024	689977.05	90.57%
6	June	30	1024	580462.47	78.73%
7	July	31	1024	638488.05	83.81%
8	August	31	1024	266840.53	35.03%
9	September	30	1024	558848.57	75.8%
10	October	31	1024	646033.47	84.8%
11	November	30	1024	1010077.37	137%
12	December	31	1024	308948.39	40.55%
Total		365	12288	6072941.45	813.09%
Average		30	1024	506078.45	67.76%
Rounding		30	1024	506078	68%

Based on the results of data analysis from Table 7, the average Berthing Occupancy Ratio (BOR) at Tanjung Tembaga Port is 68%. This value is fulfilled the 70% limitation requirement from UNCTAD. The highest BOR (Berthing Occupancy Ratio) value at Tanjung Tembaga Port occurred in November, reaching 137%. while the lowest value of BOR (Berthing Occupancy Ratio) occurred in January at 5.92%. The BOR (Berthing Occupancy Ratio) value in 2021 is shown in Figure 9 below:

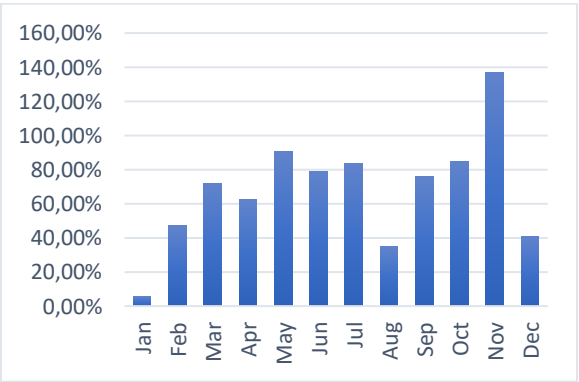

Figure 9. Berthing Occupancy Ratio (BOR) at Tanjung Tembaga Port in 2021

5. CONCLUSION

Dock capacity is the ability of the dock to be able to accept loading and unloading flows. The average dock capacity at Tanjung Tembaga Port in 2021 is 2191 tons. The available dock in Tanjung Tembaga Port is 1024 meter, it is more than enough to serve many ships.

The ship visits in Tanjung Tembaga Port is very low, which just around 1 ship per week for both local ship and people shipping's ship. Based on the BOR value obtained, the dock usage rate, which is 68%, is still below the maximum BOR value, meaning that there is no need to increase the length of the dock.

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