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Supply System of Fresh Water for Passenger Ship at the Nusantara Port of Parepare City

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ABSTRACT: *The need for fresh water that meets the requirements is very necessary for passengers who sail ships, especially shipping, with a travel time of more than 24 hours. For this reason, the fresh water infrastructure and facilities on ship support the comfort of passengers on ship. The freshwater supply of the Local Water Company (LWC) to the port for the needs of passengers on ship is still limited. This study aims to analyze how the water needs of the ships anchored at the port wharf are associated with the supply of LWC. The analytical method used is based on information, data obtained from stakeholders with surveys and field observations. It can be explained that the need for fresh water in ships is far greater than the supply from the LWC.*

Keywords: *Port, fresh water, passenger ship, ship call*

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I. INTRODUCTION

Parepare City is a city in the southern Sulawesi province. The city has an area of 99.33 km^2 and has a population of approximately 140,000 people. Geographically, the city of Parepare is located in a bay overlooking the Makassar Strait. The northern part is bordered by Pinrang Regency, on the east bordering Sidenreng Rappang Regency and in the south bordering Barru Regency. Even though it is located on the edge of the sea, most of the area is hilly. The city of Parepare can be reached by land and sea transportation. Parepare is located on the main route of traffic to West Sulawesi, Tana Toraja and Palopo.

Nusantara Port is a Sea Transportation Sub System that connects Parepare with the coastal cities of Kalimantan, Surabaya and Port cities in Eastern Indonesia [1]. Nusantara port of Parepare is located in Mallusetasi Village, Ujung Subdistrict, Parepare City, South Sulawesi Province, at 03°57'39 " South Latitude - 119°43'40" East Longitude, in the middle of Parepare City which is ± 155 km from Makassar City capital of South Sulawesi Province. Nusantara Port of Parepare is a port that serves shipping on a Regional, National and International scale, especially tourist vessels. Along with the increase in the flow of passengers at Nusantara Port of Parepare, the need for fresh water during shipping and the level of comfort and safety of passengers must be a top priority.

In addition, ship wharf facilities also need to be refined and improved, analyzing the fresh water needs of LWC intended for seaports, in terms of the number of needs and quality of fresh water for ships, especially for ships that rely on the Nusantara Port of Parepare City. Based on [2] set the Nusantara Parepare Port as a port that is cultivated with wharf facilities for 80 meters of ship moorings with an area of 180 m^2 of work area which is called Nusantara wharf.

In 1972 [3] carried out the construction of rehabilitation of the wharf into a concrete wharf with a wharf length of 120 meters. From 1976 to 1978, additional wharf facilities were carried out with a length of 150 meters. In 1985 to 1986, the government had built a 200-meter long wharf and in 1993 the wharf length was 235 meters. Until 2018 the wharf length is 280 meters with a good condition of 95%, while the width is 15 meters, the construction of concrete is 5 tons/m^2 and with a depth of 9 to 14 meters.

Port entrance is asphalt construction, 77.00 meters long, and 28.00 meters wide in good condition (90%). The port pool is an area of 77,650 m^2, with a depth of 10 to 17 meters. Fresh water with a capacity of

220 m^3 and supply capacity of 65 m^3/hour by the Regional LWC [4,5]. The passenger terminal with a wall construction with an area of 640 square meters, with a capacity of 500 people, with good conditions. In addition there is a parking area with an area of 1205 m^2 in good condition and asphalt, Mushollah with an area of 95 m^2 in good condition. Electric power with 11.5 KVA from PLN, and Telephone 1 channel, from PT.TELKOM. The operational performance of a port should be managed optimally which is beneficial for the community, ship operators and port management [6]

II. MATERIALS AND METHODS

This research was carried out at the Nusantara Port of Parepare City in April to May 2019. The choice of location was carried out with the consideration that the Nusantara Port of Parepare was a port that served shipping on a Regional, National and even International scale, and as an exit gate the entry of ships is quite dense and is the center of the number of ships after Makassar City, where the system for the need for fresh water supply [7] for sea transportation needs in the Nusantara Port of Parepare today requires a planning stage in order to balance supply and demand.

The data used in this study consisted of primary data and secondary data [8]. Primary data is data obtained from the results of direct observation on the location of research and secondary data obtained from documents, agencies/institutions concerned and literature that are considered relevant to the problem under study. Secondary data consists of administrative boundary data, the number of ships, the size of the ship, the number of passenger ships, the geographical area of the research and data on the Supply of fresh water at the Parepare Nusantara Port. The data obtained from the survey results were analyzed in quantitative and qualitative forms [9], including the capacity of ship fresh water tanks, number of passengers, water requirements, and number of ship visits.

III. RESULTS AND DISCUSSION

The climatology condition of Parepare Nusantara Port based on the data of Meteorology and Geophysics Agency is included in the category of tropical climate with rainy and dry seasons, average temperature of 15°C-30°C. Effects of temperatures that occur are with winds and waters leading to land. Rainfall lasts between April to October as many as 247 days, where the lowest rainfall takes place in December; the condition of the waters of Nusantara Parepare Port is very strategic and safe. High wind speeds generally occur during the rainy season between September and January. The highest wave conditions reach a height of 1 to 2 meters towards the northwest and occur for 100 days. Nusantara Parepare Port is naturally protected by the mainland of Pinrang Regency.

In this study, to analyze the LWC service performance, the volume of supply of fresh water used for each ship anchored at the Nusantara Port of Parepare City was identified based on the number of passenger samples and the use of water while on the ship. The minimum water volume that should be fulfilled for each passenger per day for KM Umsini and the like [10] is 0.118 m^3, Lambelu KM is 0.173 m^3, KM Bukit Siguntang is 0.09 m^3, and KM Binaiya is 0.045 m^3. Then each passenger has an average of 2 family members. Based on the minimum needs of the average passenger of 0.150 m^3 per person per day, the maximum deficit can be seen on average for each vessel's water requirements not in accordance with the minimum requirements, resulting in a water shortage of around 30% of minimum water requirements.

The results of the analysis show that LWC water needs still need to be planned to increase the volume of water supply to be able to meet the water needs of passengers on ship.

Passenger ship traffic and fresh water needs

To find out the number of ship visits and number of passengers, as well as the capacity of fresh water needed at Nusantara Parepare port can be explained in Table 1.

Table 1. Movement of ships and passengers and the need for fresh water

No.	Ship Name	Ship GRT	Passenger Capacity	Supplied water capacity (m^3)	Backrest at the Port /month
1	KM.Bukit Siguntang	14.649	2.580	1000	4 times
2	KM. Lambelu	14.501	2.575	1000	4 times
3	KM. Binaiya	6.022	2.230	500	4 times
4	KM.Prince Soya	4.300	1.560	275	8 times
5	KM.Cattleya Express	3.017	1.540	220	4 times
6	KM. Umsini	12.987	2.465	1000	4 times
7	KM.Queen Soya	2.983	1.545	250	4 times
	Total		14.495	4245	32 times

Source: Parepare Port Office, 2019

The number of passenger ships leaning on the wharf to raise and lower passengers is a type of KM Bukit Siguntang and KM Lambellu ship with a capacity of 14,500 GRT, with 2,500 passengers per ship. The capacity of the fresh water supply tank is an average of 1000 m^3, the highest frequency of passenger ships (8 times) per month. KM Prince Soya with a capacity of 1,560 passengers and a fresh water supply tank is 275 m^3.

Table 2. Passengers go down and passengers go up

Month	Passenger ride (people)	Passengers down (people)	Number of Passengers (Up & Down)
January	11.665	7.799	19.464
February	22.024	15.297	37.321
March	28.156	27.342	55.498
April	17.428	16.397	33.825
May	21.136	15.735	36.871
June	22.213	17.213	39.426
July	16.504	13.979	20.483
August	32.633	30.156	62.789
September	11.637	14.332	25.969
October	39.918	25.563	65.481
November	29.938	9.172	39.110
Average/ month	23.023	18.453	39.658
	23.023	18.453	39.658

Source: Parepare Port Office

The average number of passengers going up in the Parepare port ranges from 23,000 people per month and Passengers drop by 18,500 people. The highest number of passengers occurred in October (40,000 passengers). And passengers dropped the highest in August (30,200 passengers). Overall the number of passengers was highest in August (62,800 passengers).

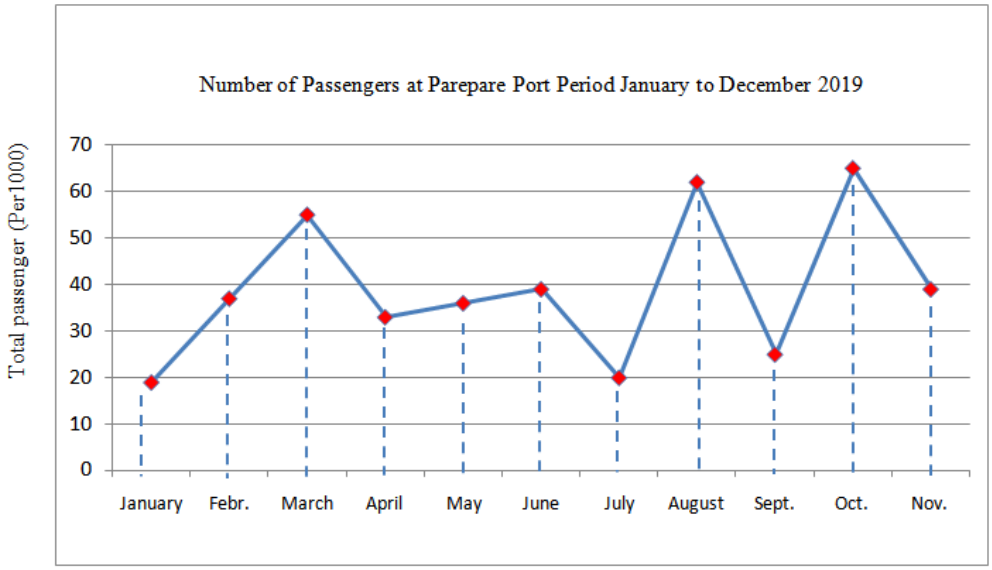

Figure 1. Fluctuations in passengers going down and boarding passenger ships

The highest passenger fluctuation in ups and downs occurred in March, August and October, whereas the lowest up and down passengers occurred in April to June and September.

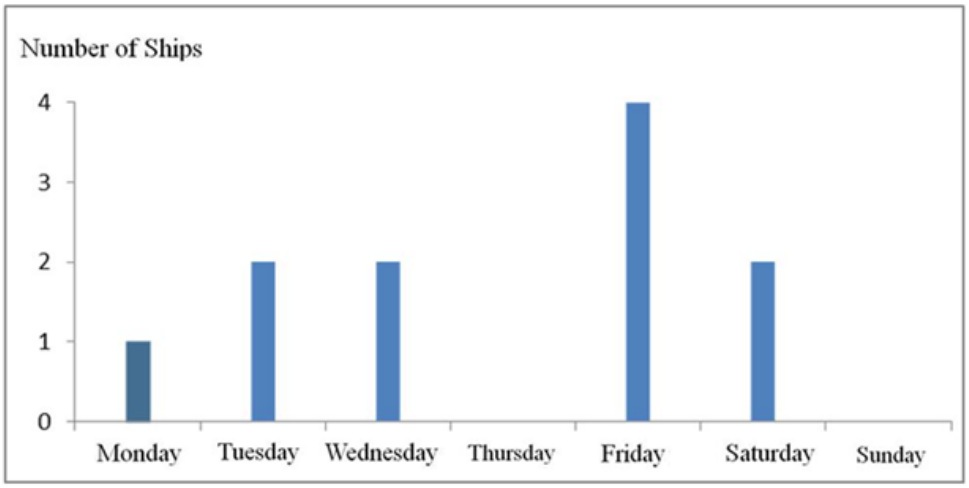

Figure 2. One week ship visit in Parepare Port

The ship's visit on Monday is one ship, which is KM. Cathalya, GRT 3,017 and the number of passengers is 1,540 people, the capacity of fresh water tanks is 220 m^3. On Tuesday there were two ships that were docked were Lambelu KM, 14,501 GRT and 2,575 passengers, 1,000 m^3 fresh water tank and KM Prince Soya ship 4,300 GRT, and 1,560 passengers, 275 m^3 fresh water tank capacity. Wednesday there were two ships docked at the port, KM Bukit Siguntang GRT 14,649, passengers 2580 people with a tank capacity of 1000 m^3 of fresh water and KM Binaiya GRT 6,022, passengers 2,230 people and a tank capacity of fresh water 500 m^3.

Then on Thursday there were no ships that docked at the Nusantara Port of Parepare. On Friday there were 4 ships leaning in, KM Binaiya GRT 6,022, passengers 2,230 people, with a capacity of 500 m^3 of fresh water, KM Prince Soya GRT 4,300 with passengers of 1,560 people and fresh water capacity of 275 m3, KM Umsini with GRT 12,987, 2,465 passengers, 1000 m^3 of fresh water tank capacity and 2,983 KM Queen Soya ship and 1,545 passengers and 250 m^3 of fresh water. On Saturday there were two ships that docked at the wharf, KM Bukit Sigigang GRT 14,649 and passengers 2,580 people and fresh water tank capacity of 1000 m^3 and KM Lambelu ships with GRT 14,501 and passengers 2,575 people with fresh water capacity of 1000 m^3. For Sundays there are no ships that wharf at the Parepare Nusantara port.

Table 3. Passenger ships that wharf on Friday

No.	Ship name	GRT (X_1)	Number of Passengers (X_2)
1	KM. Binaya	6.022	2.230
2	KM. Prince Soya	4.300	1.560
3	KM. Umsini	12.987	2.465
4	KM. Queen Soya	2.983	1.545
	Total	26.292	7.800

Prediction of fresh water needs in ship (Y) is determined by the amount of ship GRT (X_1) and Number of Passengers (X_2) [11].

The need for fresh water to serve 4 ships is docked by the Parepare Port, namely:

$$Y = -213.220 + 0.053(X1) + 0.181\ (X2\ )$$

$$Y = 1{,}605\ m^3$$

Fresh water needs of 1,605 m^3 are obtained, or the average minimum water supply requirement per vessel is around 450 m^3.

IV. CONCLUSIONS AND RECOMMENDATIONS

The capacity of the reservoir that holds fresh water from the PDAM is only 220 m^3 so that the water supply to the ship berthed at Nusantara Port of Parepare cannot be fulfilled, while the prediction of the number of ships berthing on Friday consists of 4 ships requiring average fresh water 450 m^3/per ship, meaning that the needs are greater than the supply.

It is necessary to increase the capacity of a larger reservoir and supply pumps with relatively large debits to be able to deliver fresh water to ships with a limited time of around 3 to 4 hours. For the long term, piping installation can be improved, and an alternative change of sea water into fresh water is also needed, namely Desalination.

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