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Barge Planning for Covid-19 Patient Isolation

Atok Wijaya[1)], Ali Azhar[1,*)], Maha Rizqi [1)]

[1)] Department of Naval Architecture, Faculty of Engineering and Marine Sciences, Universitas Hang Tuah, Surabaya 60111, Indonesia

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Correspondence Author:
Ali Azhar
ali.azhar@hangtuah.ac.id

ABSTRACT

The ship is a means of water transportation that is widely used, one of its functions is to transport passengers. Barge is a type of ship with a flat hull or a large floating box, barges generally do not have a propulsion system but nowadays many barges have a propulsion system which is usually called a Self-Propelled Barge. While barges are usually used to transport dry bulk goods or liquid bulk or recently also used to transport containers in connection with short sea shipping. So that in this study the aim is to design a general plan for room arrangement for the isolation room for COVID-19 patients. the need to design a room arrangement for the isolation room for covid-19 patients and the need to know the number of patients that can be brought. Equipped with several safety components, medical equipment, hospital facilities or a preventive measure that must exist in an emergency condition. The safety components on board must be managed as well as possible and must go through inspection procedures before being installed on the ship. This serves to ensure that everything is in good and optimal condition. This research will provide methods of data collection, design of plain lines and general plans, determination of load space capacity. The results obtained are barges with a capacity Alternative 1 patients amounted to 32 people and alternative 2 amounted to 48 people. From this capacity, the stability of the ship has met the requirements.

Keywords: *Barge*, covid-19, *General Arrangement.*

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1. INTRODUCTION

At the beginning of 2020, the spread of a new virus is taking the world by storm. The new virus is a new corona virus (SARS-CoV-2). This virus then spread throughout China and quickly spread to almost all countries in the world (Laksana et al, 2021). The virus originally came from Wuhan, China and was only discovered at the end of December 2019 (Parwanto, 2020). WHO declared Covid-19 a global pandemic. Recently, Indonesia has been experiencing an increase in patients affected by Covid-19 (WHO, 2020). The impact of the Covid-19 outbreak can be seen in almost all sectors of people's lives. Due to the increasing number of Covid patients, availability cannot accommodate patients. Therefore, one of the options that can be used is by planning a barge for a temporary place to isolate Covid-19 patients from the many barges that are not operating optimally due to this pandemic so that it can help as barge owners to continue to earn income. This concept is expected to help accommodate Covid patients due to limited patient isolation places. The author plans to operate the ship on the edge of the beach. So that patients who are being isolated do not feel bored with the atmosphere around the beach, also have good air. The author needs to provide a general design plan for planning a barge for the isolation of Covid-19 patients.

2. METHOD

In carrying out this research there are several sequences of work processes that must be completed. The first stage is to identify the right problem to provide a solution where the main problem of this research is to help provide a place for Covid-19 patients who are experiencing full isolation referral places in Surabaya. The second stage was data collection where the data related to this research were both from primary data and from secondary data which could assist in carrying out this research. The stages in designing a ship to design isolation of COVID 19 patients and the main size of the ship then plan a general arrangement that is used to design accommodation rooms and isolation places for COVID 19 patients. The final stage is to draw conclusions whether the formulation of the research problem can be answered or not.

3. RESULT AND DISCUSSION

3.1. Ship Main Size Data

The main size data is obtained from company x, the data obtained is a ship in the form of a barge. After searching and collecting data that will be needed in conducting this research so that the main ship size data is obtained which can be seen in Table 1 as follows:

Table 1. Main ship size

Details	Size	Unit
Length Over All (LOA)	76.20	m
Breadth	24.38	m
Height	4.87	m
Depth	2.50	m
Coefficients Block	0.909	

3.2. General Plan Design

3.2.1. Program for buildings and rooms

Limitations in providing COVID-19 isolation facilities at hospitals have forced many patients who have contracted COVID-19 to self-isolate in their homes. Therefore, this research is expected to be able to help with the problem of the lack of places for isolation of Covid-19 by designing a special ship that is used as a place for isolating Covid-19 patients. In designing this ship there is a technical analysis of the size of the room that will be used as an isolation place where the standard size of the room and the distance between the beds of isolated patients refer to the standards set by the ministry of health. The following is an example of a standard analysis for dividing room sizes (Ministry of Health, 2020).

The isolation patient treatment room is a room with more negative air pressure than the room next to it. For patients who suspected of being infected and confirmed infected, then one room for one patient. Patients who are confirmed to be infected if it is not possible to be placed in one room for more than one patient must pay attention to the distance between patient beds of at least 2.4 m. Modular minimum 3 x 3 m^2. The anteroom (airlock) and room pressure are made -5 pa against the corridor, while the patient isolation treatment room includes a toilet with a pressure of -15 pa. The corridor is recommended to have positive pressure, because it functions as a second airlock, and as an area where health workers monitor patients so that it is hoped that the air conditioning system in the corridor can reduce contaminants carried by health workers after leaving the patient's room. Place the supply air diffuser on the ceiling near the door in line with the patient's bed, while the exhaust diffuser is located on the lower wall near the head of the bed.

The medical device/linen/pharmaceutical storage room is placed on the supply air diffuser on the ceiling near the door in line with the patient's bed, while the exhaust diffuser is located on the lower wall near the head of the bed. Room size as needed. A separate room is provided for

Mobile X-ray storage. To access medical equipment/linens/pharmaceuticals into the storage room, it is recommended to use a hospital-passed box.

Changing room for medical officers, consisting of changing rooms for medical officers entering/exiting. Changing rooms are separated for male and female officers, each room consists of a PPE/PPE changing area equipped with lockers, a shower room and closet room as well as a PPE/PPE placement area/container and equipped with a handwashing tub.

Mechanical and electrical rooms are used as the placement of electrical panels, isolation transformers, UPS for the needs of service electric utilities and can function as the placement of HVAC system machines such as AHUs as well as rooms for medical gas manifolds and medical vacuums. There are other rooms that have important functions include the UPS (Uninterruptible Power Supply) room where this room has a function as a container for storing electricity, of course the UPS has functions for example: providing temporary electricity, without pause when there is a main power failure, especially for critical equipment such as Operation theater or operating room. The second function can overcome other electrical problems, such as current fluctuations, overvoltage, undervoltage, and others, the third function can protect the computer system from various electrical disturbances that can disrupt the computer system. The fourth function can secure radiology systems such as MRI, CT Scan, Cath lab from various electrical disturbances that can reduce the performance and life of the equipment, and the fifth function of the UPS room can perform voltage stabilization automatically when there is a change in input voltage. Apart from the UPS room, there is another room, namely the Air Handling Unit (AHU) room which is placed on each floor. One AHU can be used for several floors. After obtaining the room standard, then the application of making rooms on the barge will be designed.

In the standards that have been previously set, the size of the isolation area for Covid-19 patients will be designed with an area of 4 m x 7.5 m one bed one room. If in one isolation room the patient wants to be occupied by more than 1 person, it is required that each patient's bed is at least 2 m to 2.5 m apart, this has been determined according to regulations by the previous government. There are several alternative options in determining the capacity of the isolation room for Covid-19 patients with an isolation room measuring 4 m x 7.5 m where in alternative 1 as many as 2 patients can be provided, it can be seen in Figure 1 where the design of the isolation room with alternative 1. alternative 2 can provide as many as 3 covid-19 patients with a distance of 2.5 m between beds. So, for the isolation place there are 16 isolation rooms in each room there are 2 patients in alternative 1, so a total of 16 isolation rooms x 2 patients per room with a total of 32 patients can be accommodated.

In alternative 2 there are 16 isolation rooms in each room where there are 3 patients, so there are 16 isolation rooms x 3 patients per room with a total of 48 people that can be accommodated. The patient room is equipped with an exhaust to regulate air circulation in and out through the airlock and also a toilet with a size of 3m x 3m. Facilities in the patient room are beds, air conditioning, tables, chairs, sockets, emergency bells and medical devices. Room used to store spare medical gas cylinders used in the isolation room. The medical gas storage room has a size of 3.5 m x 4 m. the medical device storage room functions as storage for medical equipment that is needed at any time and has not been used. The tools stored in this room include infusion pumps, personal protective equipment (PPE), medicines etc. The medical device storage room measures 4m x 4m.

The doctor's rest room measures 4.5 m x 3.5 m. The break room is equipped with a sofa, washbasin, air conditioner (AC) and toilet. While the nurse's break room has a size of 6m x 5m. This room is equipped with a bed, table, chair, air conditioner and etc. The corridor has a size of 3.5 m which serves to pass patient beds and medical devices to facilitate movement without any obstacles. The nurse's post is a place to monitor developments/observe patients in the isolation room for 24 hours so that if an emergency occurs in a patient, it is immediately identified and appropriate action can be taken against the patient. The nurse's post provides a direct communication system between the nurse's post and the patient in the room.

The air handling unit (AHU) room has a size of 3.5 m x 7 m. The AHU room serves as the AHU operational and maintenance area. Filters that are connected in each of the rooms have a function to regulate the air. The function of the blue filter is to provide clean air in the patient room so that the air in the room is always in good condition, while the red filter is to filter dirty air. The UPS (Power Supply Unit) room measures 3.5m x 4m. The UPS (Power Supply Unit) room functions to provide temporary electricity when there is a main power failure, especially for critical equipment such as operating rooms.

The principles of clean water infrastructure need to be provided with a separate roof tank, which can be equipped with a booster pump including a pressure tank which directly distributes water to sanitary equipment. The types of outlets used are sinks, sloop sinks, service sinks, showers, faucets, toilets and urinals. The required clean water capacity is 500 liters/day x the total amount. Waste treatment before being distributed to the IPAL network, sewage and sewage must be disinfected using a chlorine-containing disinfectant. Make sure the disinfection time is at least 1.5 hours. All waste generated from patients must be disposed of as medical waste, put medical waste in a double-layer medical waste bag, close the bag with cable ties. Procedures to be followed before entering the room to get an explanation and equipment that may be needed while being treated in the isolation room (e.g. change packs, trash bags, linen bags and others). Do not carry out unnecessary activities or movements. We recommend that before entering and leaving the room wash your hands using alcohol-based ingredients according to the guidelines, use gloves or other necessary personal protective equipment. It can be seen in Table 2 where the comparison between the standard sizes that have been previously set with the room design sizes on the barge which is planned to be modified to become a place for isolating Covid-19 patients.

Table 2. Room design standards

Details	Standard Size	Design Size
Isolation Room	3 m x 3m	4 m x 7.5 m
Corridor	2.4 m	3.5 m
Airlocks	3 m x 2.5 m	3 m x 4.5 m
Oops	3 m x 4 m	3.5 m x 4 m
AHU	3 m x 4 m	3.5 m x 7 m
Doctor's Rest Room	4 m x 3 m	4.5 m x 3.5 m
Medical gas chamber	3 m x 4 m	3.5 m x 4 m
Nurse break room	4 m x 4 m	6 m x 5 m
Medical device room	4 m x 4 m	4 m x 4 m

3.3. Room Discussion

In the main deck view alternative 1 there are several rooms available such as isolation room, airlock, room for removing PPE, female nurse's room, male nurse's room, dirty warehouse, UPS room, medical gas manifold room, air handling unit room, bathroom, room mobile X-ray, doctor's room, patient reception room. It can be seen in the image below where the design of the rooms that meet the standards is applied to the barge which will be modified to become a place for Covid-19 isolation. There are 2 alternatives in determining the number of patients in one room. In the top view there is an isolation room, airlock, dirty warehouse, isolation transformer room, doctor's room, medical device and pharmacy room, mobile x-ray room, PPE release room, men's and women's changing rooms.

Previous research entitled "Conversion of Ro-Ro Vessels into Hospital Vessels for Handling Covid 19 in the City of Surabaya" (Fairuz et al, 2022). This research aims to produce a hospital ship design that can handle COVID-19 patients and at the same time can be used to address prevention in handling COVID-19. The design process begins with obtaining the General Arrangement of the ship to be converted. Hospital ships for handling COVID-19 with Ro-Ro hulls and floating on the pier with main dimensions Loa = 56.7 m, Lpp = 48.8 m, B = 14 m, H = 3.8 m, T = 2 .7 m. After conducting experiments and research results, the results of this thesis are that

the Hospital Ship Facility consists of five isolation rooms for people without symptoms (OTG) VIP class for 20 people, three isolation rooms for people with symptoms in economy class for 10 people, and eight isolation rooms for people with symptoms. 8 people. The medical facilities on the Hospital Ship consist of two Medical Laboratories, a Pharmacy, an Emergency Room and a High Intensive Care Unit. There are advantages to the research conducted, namely: having a VIP class isolation room. While there are deficiencies in this study, namely: it does not have a VIP isolation room.

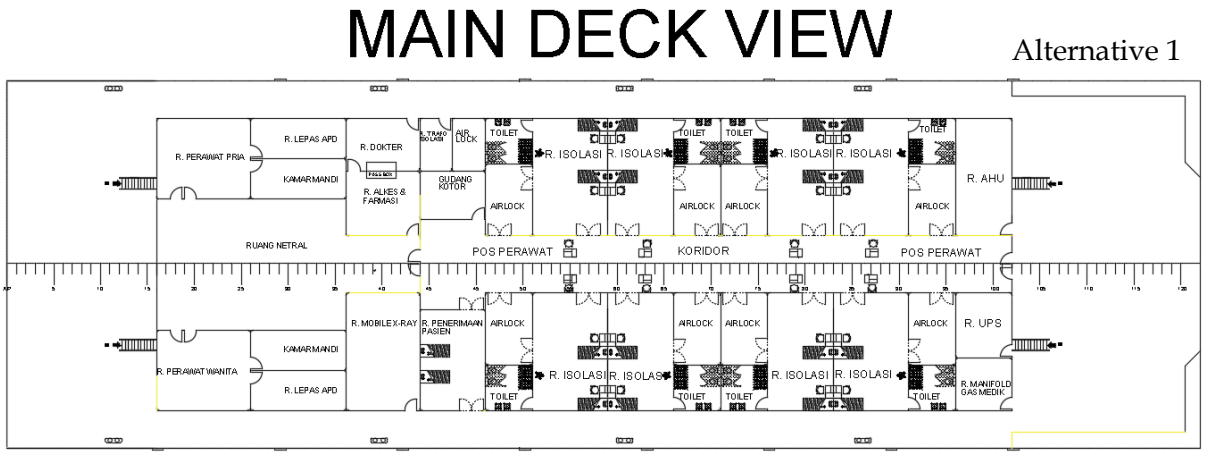

Figure 1. Main deck view alternative 1

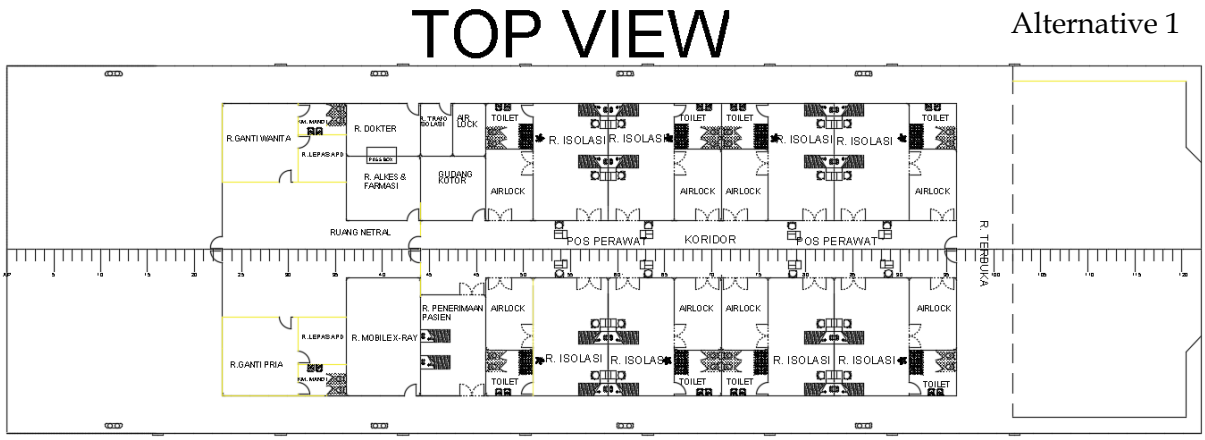

Figure 2. Top view alternative 1

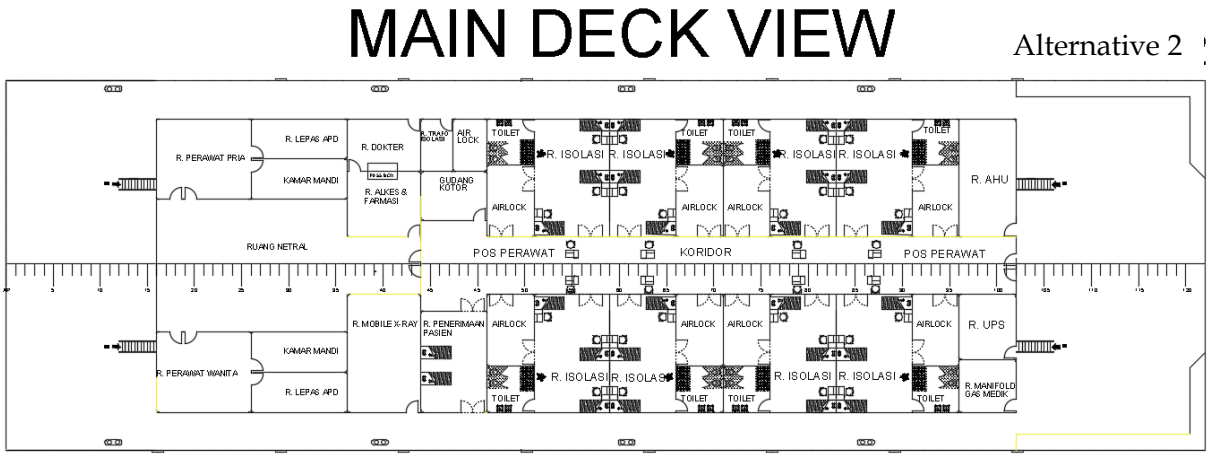

Figure 3. Main deck view alternative 2

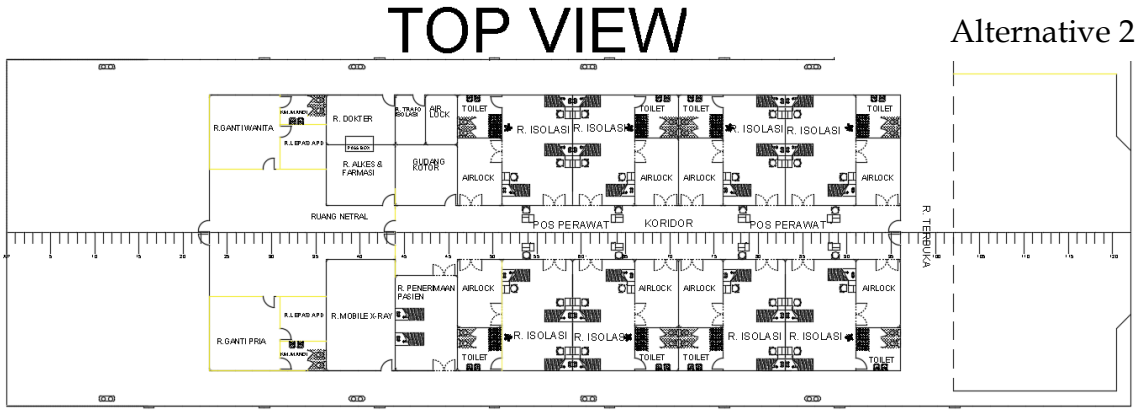

Figure 4. Top view alternative 2

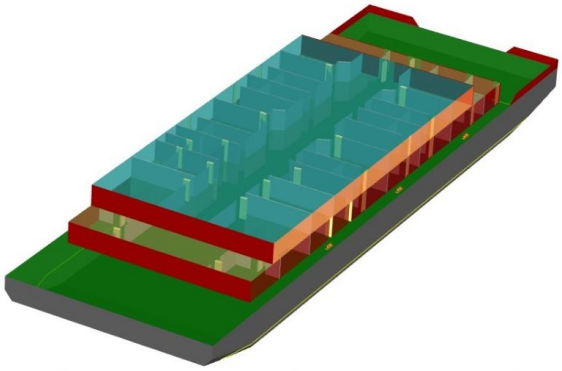

Figure 6. Model 3D barge

4. CONCLUSION

Based on the discussion that has been explained, it can be concluded that the type of ship used is a barge with a length of Lpp 73.15 m, a waterline length of Lwl 76.2 m, a width of 24.38 m, a height of 4.87 m, and a draft of 2.5 m. The purpose of this study is to design a general arrangement on a barge by providing space as an alternative place for isolating Covid-19 patients. The available capacity for the patient isolation room is able to accommodate a total of 32 patients in alternative 1, for the alternative 2 patient isolation room it can accommodate a total of 48 patients.

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