Assessment Of The Crossing Route Ship Operational Patterns Gilimanuk-Ketapang East Java Province

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Ketapang Port, which links the islands of Java and Bali, is a strategically important port with a heavy traffic volume of cars and passengers. Among the issues were the high load factor of the ship as a result of the rise in the quantity of automobiles and the use of subpar information technology for vehicle weighing, which allowed ships to operate at a carrying capacity greater than 100%. Therefore, the purpose of this study is to ascertain the load factor-based operational pattern of ships, ascertain the frequency of ship departures and schedule planning in accordance with the high demand for service users, and use descriptive quantitative research methods to analyze the weighbridge system's utilization at Ketapang Port. The average load factor for vehicle departure is 131% and for passengers is 28%, while the average load factor for vehicle arrival is 138% and for passengers is 31%, according to the computation analysis results. The schedule of ships serving the Ketapang-Gilimanuk route is not in line with the high volume of vehicles, as there are 28 ships operating daily and 224 departures per day. Therefore, it is planned to reschedule and increase the frequency of departures to 242 trips per day with 30 ships per day. The addition of a Weight in Motion (WIM) system integrated with the operator's dashboard and the enhancement and use of the weighbridge system can provide real-time data on vehicle load weight and vehicle class, enabling more precise operational decisions to avoid overload and guarantee shipping safety..

Keyword: *Vehicle Weighbridge, Ship Operational Pattern, and Load Factor*

1. INTRODUCTION

A key port on the Ketapang to Gilimanuk route, Ketapang Crossing Port links Java and Bali Island. 54 Ro-Ro ships support this port, which is open twenty-four hours a day. There are now 28 ships operating daily at Ketapang Port, with 224 departures each day. Ketapang Port faces a number of difficulties as a result of the volume of car and passenger flows that are growing annually, particularly during periods of high passenger and vehicle flow that result in a high loading factor of operating ships. In addition, inclement weather frequently happens, which causes long lines of vehicles because crossing services are closed, and improperly arranged vehicle loads on board the ship cause the ship transport vehicles to exceed the operational ship's maximum carrying capacity. Consequently, research was carried out to examine the ship's

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operational pattern in relation to the transportation mobility circumstances at Ketapang Port.

2. METHODOLOGY

Quantitative descriptive research is the methodology employed. While secondary data was gathered from associated organizations, including PT and BPTD Class II East Java, primary data was gathered at Ketapang Port through observation, survey, and documentation. Ferry (Ketapang Branch) of ASDP Indonesia. The load factor, ship departure frequency, operating schedules, and vehicle weighbridge usage were all examined in this study.

3. DISCUSSION

3.1. Presentation of Data

The following are some of the primary and secondary data that were gathered for this study:

a. March 2025 Transportation Productivity Data (for 20 days)
b. Data on Operating Vessels
c. Operational Ship Transport Capacity.

3.2. Data Analysis

3.2.1. An Examination of the Load Factor

According to the Minister of Transportation's Regulation Number 66 of 2019, daily transportation productivity data is used to calculate the load factor of both passengers and vehicles. This data is then translated into Production Units (SUP) for each group. This seeks to ascertain the area that the vehicle occupies in order to employ volume dimensions in the computation to offer a more equitable and balanced load for each class or kind of vehicle on board.

TABLE 1. VEHICLE CLASS TYPE AND SUP AMOUNT

Classifications of Vehicles	SOUP
I	2,23
II	4,02
III	8,67
IV A	32,09
IV B	33,26
V A	60,48
V B	61,55
VI A	100,51
VI B	103,19

Classifications of Vehicles	SOUP
VII	135,21
VIII	188,75
IX	272,74

According to the analysis of passenger and vehicle productivity data from March 01–20, 2025, which was converted using Production Unit (SUP), the load factor of passengers upon arrival was 31%, and the load factor of vehicles was 138%. On the other hand, the load factor of passengers upon departure was 28%, and the load factor of vehicles was 131%. This indicates that the load factor has surpassed the ship's maximum loading capacity.

3.2.1. Evaluation of the Optimal Operational Pattern Schedules and the Number of Ship Departure Frequencies

a. Frequency of Ship Departures by Passenger Count

$$Fp = \frac{Np}{(20 \times K \times LF \times M)}$$

$$Fp = \frac{274.383}{(20 \times 0{,}9 \times 1 \times 218)}$$

$$Fp = \frac{274.383}{3.924}$$

$$Fp = 69{,}9 \approx 70 \text{ RTT/Day}$$

Detail :

Fp = Frequency of Ship Departures required by passengers (RTT/Day)

For example = Number of passengers for 20 days

K = Ship's operational time coefficient (0.9)

LF = Plan Ship Load Factor (1 or 100%)

M = Average Ship Load Capacity

b. Frequency of Ship Departures by Vehicle Count

$$Fk = \frac{Nk}{(20 \times K \times LF \times M)}$$

$$Fk = \frac{5.294.943{,}57}{(20 \times 0{,}9 \times 1 \times 1215)}$$

$$Fk = \frac{5.294.943{,}57}{21.870}$$

$$Fk = 242{,}10 \approx 242 \text{ RTT/Day}$$

Detail :

Fk = Frequency of Ship Departure required by vehicle (RTT/Day)

Nk = Number of vehicles for 20 days
K = Ship's operational time coefficient (0.9)
LF = Plan Ship Load Factor (1 or 100%)
M = Average - Average Ship Load Capacity

c. Quantity of Ship Needs

1) Time of Round Trip (RTT)

The time it takes a ship to make a round trip, or go from point A to point B and back, is known as the round trip time (RTT).

According to the survey results, the 36-minute Lay Over Time (LOT) at Ketapang Port at the Moveable Bridge pier includes 20 minutes for vehicle loading, 5 minutes for entry and exit maneuvers, and 6 minutes for vehicle unloading. In the meantime, the Landing Craft Machine (LCM) and Pier IV have a 38-minute layover time (LOT), which is divided into 12 minutes for vehicle unloading, 16 minutes for vehicle loading, and 5 minutes for maneuvering in and out.

For ships using Ketapang Port, the Round Trip Time (RTT) is as follows:

TABLE 2. DOCK MOVEABLE BRIDGE ROUND TRIP TIME

Lintasan	*Sailing Time* (Minutes)	*LOT* (Minutes)	*RTT* (Minutes)
The Beatles - The Beatles	45	36	162

TABLE 3. LANDING CRAFT MACHINE (LCM) AND ROUND TRIP TIME PIER IV

Lintasan	*Sailing Time* (Minutes)	*LOT* (Minutes)	*RTT* (Minutes)
The Beatles - The Beatles	45	38	166

2) Capabilities for Boat Trips

Ship voyages are able to operate at Ketapang Port throughout the port's 24-hour operating hours, which is 1,440 minutes. The ability of ship trips at Ketapang Port is determined by dividing the duration of the port's operational hours by the ship's Round Trip Time (RTT). This yields the result that the ability of ship trips that run daily is 8-9 RTT/ship.

3) The quantity of appropriate vessels

An equation is used to calculate the number of ships, and the following computation results are obtained:

$$Jumlah\ Kapal = \frac{Frekuensi\ Kapal}{Kemampuan\ Trip}$$

$$Jumlah\ Kapal = \frac{242}{8}$$

$Jumlah\ Kapal = 30{,}20$ or 30 ships/day

3.2.3. An examination of how digital weighbridge systems and artificial intelligence (AI)-based cameras are used in information technology

Vehicle total weight data is crucial for determining the ship's overall load and its equitable distribution in the context of shipping operations and safety. Failure to do so results in inaccurate ship load factor calculations, a high risk of overload, and challenges in organizing and managing ship operations. To avoid ODOL (Over Dimension Over Loading), it is crucial to classify the different types of vehicle classes in addition to knowing the weight of the vehicle's load. This is because excess load is determined by the dimensions of each vehicle class, beginning with the vehicle's length, width, and height. To make it simpler for operators to distribute goods, a system that can recognize vehicle dimensions and class is also required. The addition of weighbridges to the motor vehicle and small vehicle (KK) toll gate, which are connected to port information systems or operator dashboards enabled with Weight In Motion (WIM) and AI-based cameras (Artificial Intelligence) that can determine the vehicle's dimensions starting from the vehicle plate, length, width, and height, is one suggested solution to this issue.

4. CONCLUSION

The author makes the following deductions based on the research mentioned above:

a. On the Ketapang-Gilimanuk route, the average load factor of vehicles boarding the ship has surpassed the operating ships' maximum loading capacity, which is 131% when vehicles depart and 138% when they arrive.
b. The huge number of cars at Ketapang Port is not compatible with the number of departure frequencies that are currently available.
c. Information technology utilization via Ketapang Port's weighbridge is not at its best.

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