

PREDICTION OF PASSENGER PRODUCTIVITY AT THE KUALA TUNGKAL RO-RO FERRY PORT ON THE KUALA TUNGKAL – TELAGA PUNGUR LINE

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ABSTRACT

Passenger productivity at the port plays a crucial role in supporting the sustainability of port operations. Predicting the number of passengers at the port can be used as a reference for preparing port service readiness. The Kuala Tungkal Ferry Port, on the Kuala Tungkal – Telaga Punggur route, connects Jambi Province with the Riau Islands Province. The purpose of this study is to predict the number of passengers on Eid transportation in 2026. The historical data used is data from 14 days before Eid al-Fitr until 7 days of Eid al-Fitr from 2020 to 2025. The analysis method used is the FORECAS.ETS method, the application of which is carried out in Excel.

After conducting the analysis, the prediction was that the highest number of passengers would be seven days after Eid al-Fitr, with 882 people. This prediction was used as a reference for evaluating the port's service readiness. The evaluation, based on Ministerial Decree No. 52 of 2004, determined that the existing waiting area was inadequate to accommodate the number of passengers expected for the 2026 Eid al-Fitr holiday.

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1. INTRODUCTION

A port is a place consisting of land and surrounding waters with certain boundaries as a place for government activities and economic activities. (Sasono, 2021) Ports play a vital role as a vital driving force for the Indonesian economy, serving as hubs in transportation networks and supporting industrial and trade activities (Communication Bureau, 2022). Ports are complex systems, with many interrelated variables, such as passenger numbers, facility capacity, and operational schedules.

Passenger productivity at ports plays a crucial role in supporting the sustainability of port operations. This relates to the efficiency, effectiveness, and socio-economic impact of port activities. The challenge is how to predict future transportation needs, as measured by passenger numbers and public enthusiasm for using transportation (Alydrus, 2024).

Prediction is a process of systematically estimating something that is most likely to happen in the future based on past and present information available, so that the error (the difference between something that happens and the estimated result) can be minimized (Setyo, 2014). Prediction does not have to provide a definite answer to the event that will occur, but rather tries to find an answer that is as close as possible to what will happen (Herdianto, 2013: 8) in (Setyo, 2014).

One method that can be used to find accurate predictive data is forecasting. Forecasting is a crucial element in the decision-making process (Sri, 2021). Forecasting methods have been developed by various experts and organizations gradually through various research and research. Research on passenger productivity predictions is useful in addressing the dynamics of port operations.

As is the case during the Eid al-Fitr holiday, the surge in departing passengers can exceed existing port facilities. Every year, leading up to Eid al-Fitr, there is a significant increase in public mobility, known as the Eid homecoming and return journey. This phenomenon causes a surge in passengers and vehicles using various modes of transportation, including sea transportation, at major ports in Indonesia, including Kuala Tungkal Ferry Port. Port authorities should plan additional facilities for the Eid al-Fitr holiday.

2. METHOD

The type of research used is quantitative research. According to Siyoto & Sodik (2015), quantitative research is research that uses numerical data, from collecting and interpreting to presenting the results. This research calculated the effective area plan for the main land facilities at the Sikakap Ferry Port. The methods used to collect research data are:

a. Observation Method

Observation method is a method of collecting data by directly observing the object or phenomenon being studied in the field. The researcher is present at the research location and records everything relevant to the research objectives.

b. Library Method

In this study, the author obtained accurate data from the literature in the library of the River, Lake and Ferry Transportation Polytechnic, thus the author also used modules that were directly related to the topic of discussion.

c. Institutional Method

According to Soemardjan, institutionalism comes from the word "institution." Broadly speaking, institutionalism originates from societal institutions (Darono, 2012). Research using institutional methods originates from various related agencies, namely:

- 1) Jambi Class 2 BPTD
- 2) Kuala Tungkal Crossing Executing Unit

3. RESULTS AND DISCUSSION

3.1 Passenger Departure Productivity Data Prediction for Eid Transportation in 2026

Based on the results of passenger data predictions using 2020-2025 data, the predicted results for Eid transportation in 2026 are as follows:

Table 3.1 Predicted Departure Passengers in 2026

Year	H-14	H-13	H-12	H-11	H-10	H-9	H-8	H-7
2026	120	96	90	135	124	101	151	82
Year	H-6	H-5	D-4	H-3	H-2	H-1	H-0	H-0
2026	133	194	251	224	167	108	55	213
Year	H+1	H+2	H+3	H+4	H+5	H+6	H+7	Total
2026	268	761	853	729	881	812	882	7,431

Based on the prediction results in table 4.14, the number of departing passengers will increase on D+3 of the 2026 Eid al-Fitr Transportation and D+7 of the 2026 Eid al-Fitr Transportation. The highest number of passengers is predicted to be on D+7 of Eid al-Fitr 2026 with 882 passengers, or it is predicted that the number of passengers will increase from the previous year. The factor causing the increase in the number of passengers is the holiday period, where many ship passengers return to their hometowns, go on vacation or go or return to their respective hometowns via the Kuala Tungkal route. Meanwhile, the least number of passengers is on D-0 of the Eid al-Fitr Transportation with 55 people or it is predicted that the number of passengers will increase slightly from the previous year. The factor causing the small number of passengers is due to D-0 of Eid or service users usually have arrived at their respective destinations, so that only a few passengers use the ferry transportation service.

Thus, developing a passenger productivity prediction system is not merely an option, but rather an important strategic step to address overcapacity, improve services, and support investment decisions at Kuala Tungkal Ferry Port, as well as improve the port's overall operational performance.

3.2 Historical Patterns of Eid al-Fitr Transportation Over the Past 6 Years

To identify and visualize historical passenger numbers during the Eid al-Fitr holiday period over the past six years at the Kuala Tungkal Ro-Ro Ferry Port, the following passenger productivity data is available for the 14 days before and 7 days after Eid al-Fitr from 2020 to 2025:

Table 3.2 Passenger Departures for Eid Transportation in the Last 6 Years

Year	2020	2021	2022	2023	2024	2025
H-14	0	22	49	63	57	117
H-13	0	0	27	78	84	51
H-12	20	51	0	77	75	112
H-11	10	0	70	74	85	86
H-10	16	0	51	70	63	107
H-9	0	34	80	49	55	104
H-8	32	0	50	91	77	135
H-7	0	2	71	85	57	59
H-6	0	0	44	108	48	112
H-5	30	0	0	133	186	83
D-4	14	0	137	123	182	143
H-3	4	0	126	161	212	132
H-2	0	0	61	149	169	80
H-1	26	0	44	120	60	66

Table 3.3 Arrival of Eid
Passengers in the Last 6

H-0	6	0	34	66	20	46
H-0	0	0	92	0	142	144
H+1	0	0	0	0	243	191
H+2	2	0	366	0	651	341
H+3	0	0	390	312	628	507
H+4	0	41	741	459	496	624
H+5	26	16	327	432	432	782
H+6	0	100	561	775	498	619
H+7	0	39	414	340	594	576
Total	186	305	3,735	3,765	5,114	5,217
Year	2020	2021	2022	2023	2024	2025
H-14	0	176	108	126	108	179
H-13	0	0	129	171	122	156
H-12	26	259	0	117	160	214
H-11	20	0	268	210	240	186
H-10	16	0	198	191	246	107
H-9	0	373	275	110	296	258
H-8	30	0	349	361	634	206
H-7	0	20	473	359	422	277
H-6	0	0	550	429	568	189
H-5	14	18	0	450	702	322
D-4	4	0	671	880	939	388
H-3	34	11	719	1,139	2,260	506
H-2	0	0	709	769	1,120	250
H-1	32	0	734	1,564	810	326
H-0	0	0	195	535	266	215
H-0	0	0	233	78	173	180
H+1	2	0	0	182	192	215
H+2	6	0	300	240	250	207
H+3	0	0	264	298	363	114
H+4	0	18	275	182	332	234
H+5	12	73	217	272	537	139
H+6	0	147	191	256	286	448
H+7	0	55	352	330	222	132
Total	196	1,150	7,210	9,249	11,248	5,448

Transportation
Years

Based on data from the past five years, the historical pattern of Eid al-Fitr passenger traffic shows a significant upward trend each year, particularly in the periods before and after the holiday. In 2020 and 2021, passenger numbers remained very low due to mobility restrictions caused by the COVID-19 pandemic. However, from 2022 to 2024, there was a sharp spike, with the highest peak in 2024, when total departure and arrival passengers reached over 16,000. Figures for 2025 also remained high, although slightly lower than the previous year, likely due to incomplete data collection. Peak departure traffic generally occurs three to one days before the holiday, while the highest return traffic is recorded between three and six days after the holiday. This increase in passenger numbers is influenced by the relaxation of travel policies, increased public mobility

during Eid al-Fitr, and other seasonal factors. Therefore, this increase requires attention in port operational planning, particularly in providing facilities and managing passenger flows more optimally.

3.3 Waiting Room Facilities Analysis

Calculate the area of the waiting room using KM 52 of 2004 in attachment II (two) using the following formula:

$$A = \alpha \cdot n \cdot N \cdot x \cdot y \quad (4.1)$$

Information :

A1 : Waiting room area (m2)

A: The area required for one person (1.2 m2 per person)

n : Number of passengers on one ship (data taken according to largest passenger carrying capacity)

N : Number of ships arriving/departing at the same time

x : Concentration Ratio (1.0-1.6)

y : Concentration Ratio (1,2)

To calculate the waiting room concentration ratio, the following formula is used:

$$X = (4.2) \frac{\text{Jumlah penumpang terbanyak perhari/kapal}}{\text{kapasitas pnp dalam satu kapal x trip}}$$

The number of passengers per ship is determined based on the characteristics of ships operating at the Kuala Tungkal Ro-Ro Ferry Port. This passenger count is based on the largest passenger capacity, the KMP Citra Nusantara, for the Kuala Tungkal-Telaga Punggur route, with a capacity of 333 passengers.

Based on passenger departure productivity data, the highest number of passengers on the Kuala Tungkal – Telaga Punggur route at the time of departure was 7 days (H+7) after Eid al-Fitr in 2026, with 882 passengers, with 1 trip. Therefore, the following formula can be used:

$$\text{Concentration ratio (X)} = (4.3) \frac{\text{Jumlah penumpang terbanyak perhari/kapal}}{\text{kapasitas pnp dalam satu kapal x trip}} = \frac{882 \text{ penumpang}}{333 \text{ penumpang x 1 trip}}$$

$$=2,6$$

So, the concentration ratio (x) is 2.6 ~ 1.6

So from the data above we get:

$$A1 = \alpha n N x y \quad (4.4)$$

$$A1 = 1.2 \text{m}^2/\text{person} \cdot 333 \text{ passengers/ship} \cdot 1 \text{ ship} \cdot 2.6 \cdot 1.2$$

$$A1 = 1,246.752 \text{ m}^2 \text{ (1,247 m}^2\text{)}$$

Based on the calculation of the area required for the waiting room, the passenger waiting room required for the Kuala Tungkal – Telaga Punggur route is 1,246 m2, while the area of the waiting room currently available is 222 m2, so an expansion of around 1,024 m2 is required.

Based on observations at Kuala Tungkal Ferry Port, the large number of passengers resulted in passengers not being in their designated waiting areas and waiting in inappropriate areas, leading to a disorganized waiting environment. Implementing a forecasting model combined with data-driven management will help reduce pressure on waiting area facilities.

Therefore, it is hoped that port management can utilize the ready-to-load parking area and the drop-off and pick-up parking area for passengers as additional waiting areas with additional facilities such as tents and chairs, in order to reduce the risk of accidents that may occur and provide a sense of comfort and security to service users.

4. CONCLUSION

From the results of the analysis described previously, it can be concluded that:

1. The historical pattern of Eid al-Fitr passenger traffic over the past five years has generally shown an increase in passenger numbers since 2020. Influencing factors include the increased capacity of operating vessels and

the increasing familiarity of the Kuala Tungkal Ferry Port among the Jambi community and surrounding areas for mobility from Jambi Province to the Riau Islands Province.

2. The results of the implementation of the Forecast.ETS method obtained the highest number of transportation on the 7th day after Eid al-Fitr with a total of 882 passengers in the predicted productivity of departure passengers and the highest predicted productivity of arrival passengers on the 3 days before Eid al-Fitr with a total of 2037 passengers.
3. Kuala Tungkal Ferry Port often experiences overcapacity, especially during Eid al-Fitr. This results in the existing waiting room being inadequate to comfortably accommodate the number of passengers. The lack of waiting room capacity impacts user satisfaction, passenger flow efficiency, and potential safety and comfort risks. The waiting room facilities at Kuala Tungkal Ferry Port are not in accordance with KM 52 of 2004 where the lack of waiting room area is inadequate, so it is necessary to add a temporary waiting room area for the 2026 Eid al-Fitr transportation of 1024 m2.

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