



# Optimization of Crossing Vessel Scheduling on The Rupert-Dumai Trail, Bengkalis District, Riau Province

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**Abstract.** The Tanjung Kapal Ferry Port is located in Bengkalis Regency, Riau Province. This port serves the Rupert - Dumai crossing. As a port that operates for 12 hours with 13 trips/day, setting a schedule at this time is very important. Based on the results of a survey conducted by the author, there is no ship schedule. To be able to maximize ship loads, it needs to be supported by ship schedules that are in accordance with the implementation of current health protocols in order to create a balance between the number of ships and the existing ship load. Data collection was carried out using the observation method. The data that must be collected is passenger and vehicle productivity, ship characteristics and ship operational time. Institutional methods and literature data were taken from BPTD Class II Riau.

**Keywords:** Transportation, Port of Ferry, Ship Scheduling.

## 1 Introduction

Transportation has a very important role, both in rural areas or semi-urban or urban areas in developing countries, because it provides access for people to meet their daily needs for goods and services, as well as improving socio-economic life, according to Salim (2000 ) transportation is the activity of moving goods (cargo) and passengers from one place to another. Transportation quoted from (Sugiharto, 2020) as the business and activity of transporting or carrying goods and/or passengers from one place to another, accessed on 21 January 2023) because Indonesia is divided into many islands. Therefore, we need a bridge that can connect these islands. Apart from bridges, we have another alternative, namely crossing transportation

The absence of scheduling makes many service users ask when the departure time is and the insufficient number of ships is one of the factors causing not optimal ship services on the Rupert – Dumai route.

## 2 Research Methodology

The type of research used in this research is quantitative research. According to Sugiyono (2018; 13) quantitative data is a research method based on positivistic (concrete data), research data in the form of numbers that will be measured using statistics as a calculation test tool, related to the problem being studied to produce a conclusion

Quantitative research also involves determining subjects supported by data collection and analyzing data before making decisions. The analysis used is in the form of evaluation and analysis regarding load factor, productivity for the last 5 years, number of frequencies, and number of fleets.

This research is focused on optimizing the implementation of the Rupert - Dumai crossing ship schedule, to find out how the Rupert - Dumai crossing ship schedule can be optimal to meet transportation needs and to find out whether the ships operating are in accordance with the Rupert - Dumai crossing transportation needs.

## 3 Result and Discussion

### 3.1 Data Presentation

This research is focused on optimizing the implementation of the Rupert - Dumai crossing ship schedule, to find out how the Rupert - Dumai crossing ship schedule can be optimal to meet transportation needs and to find out whether the ships operating are in accordance with the Rupert - Dumai crossing transportation needs

### 3.2 Data Analysis

#### 1) Calculation of Passenger Growth Predictions for the Next 5 Years

No	Year	Passenger (Y)	Pre-diction (x)	X2	XY
1	2019	213,731	-2	4	- 427,462
2	2020	189,712	-1	1	- 189,712
3	2021	188,085	1	1	188,085
4	2022	284,003	2	4	568,006

Total	4	875,531	0	10	142.167
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$$a = \frac{875.531}{4}$$

$$a = 218.882$$

$$b = \frac{142.167}{10}$$

$$b = 14.217$$

The Regression Equation:

$$Y = 218,882 + 14,217 x$$

$$Y (2023) = 218,882 + 14,217(3) = 261,533$$

By entering the value X, you will get the number of passengers departing for the next 5 years, which can be seen in the following table.

No	Year	x	a	b	Total passenger
1	2023	3	218,882	42651	261,533
2	2024	4	218,882	56868	275,750
3	2025	5	218,882	71085	289,967
4	2026	6	218,882	85302	304,184
5	2027	7	218,882	99519	318,401
<b>Total</b>		<b>25</b>	<b>1,005,330</b>	<b>355,425</b>	<b>1,449,835</b>

From the forecast results above, passenger productivity for the next 5 years can be seen.

2) Calculation of Vehicle Growth Predictions for the Next 5 Years

VEHICLE				
GROUP	2019	2020	2021	2022
GOAL I	0	0	0	0
GOAL II	152071	156089	146291	171909
GOAL III	3437	3494	4708	6907
GOAL IV A	26781	28724	33781	30742
GOAL IV B	19052	16816	23832	31345
VA GOAL	440	20	0	1536
VB GOAL	25459	27008	33621	34437
GOAL VI A	0	0	0	0
GOAL VI B	0	0	0	0
GOAL VII	0	0	0	0
GOAL VIII	0	0	0	0
GOAL IX	0	0	0	0
NUMBER OF GROUPS	227,240	232.151	242,233	276,876

GROUP 2				
Year	Number of vehicles	X	XY	X <sup>2</sup>
2019	227240	-2	-454480	4
2020	232151	-1	-232151	1
2021	242233	1	242233	1
2022	276876	2	553752	4
TOTAL	978500	0	109354	10

$$a = \frac{978.500 - (0)(94.060)}{4 - 0}$$

$$a = 195,700$$

$$b = \frac{109.354}{40}$$

$$b = 2,734$$

$$Y = 109,354 + 2,734(X)$$

GROUP 2					
No	Year	x	A	B	Number of vehicles
1	2023	3	109,354	8,202	117,556
2	2024	4	109,354	10,936	120,290
3	2025	5	109,354	13,670	123,024
4	2026	6	109,354	16,404	125,758
5	2027	7	109,354	19,138	128,492
<b>Total</b>		<b>25</b>	<b>546770</b>	<b>68350</b>	<b>615120</b>

By entering the value X, you will get the number of vehicles leaving for the next 5 years. It can be seen in the following table:

VEHICLE GOAL	YEAR				
	2023	2024	2025	2026	2027
GOAL I					
GOAL II	117,55	120,29	123,02	125,75	128,49
GOAL III	6	0	4	8	2
GOAL IV A	4,321	4,525	4,729	4,933	5,137
GOAL IV B	24,978	25,302	25,626	25,950	26,274
GOAL IV B	19,178	19,503	19,828	20,153	20,478

VA GOAL	10,996	12,541	14,086	15,631	17,176
VB GOAL	25,914	26,517	27,120	27,723	28,326
GOAL VI A	0	0	0	0	0
GOAL VI B	0	0	0	0	0
GOAL VII	0	0	0	0	0
GOAL VIII	0	0	0	0	0
AMOUNT	202,94 3	208,67 8	214,41 3	220,14 8	225,88 3

### 3) Ship Departure Frequency Analysis

This ship frequency calculation is carried out to determine the number of trips and ships needed, the results of the calculation can be seen as follows:

#### 1) By Passenger

Method to calculate frequency per day based on annual productivity:

$$F_p = \frac{261.533}{365 \times 0,9 \times 0,35 \times 168}$$

$$F_p = 13 \text{ round trips / day}$$

#### 2) By Vehicle

Method to calculate frequency per day based on annual productivity:

$$F_k = \frac{202.943}{365 \times 0,9 \times 0,68 \times 31}$$

$$F_k = 29 \text{ round trips / day}$$

## 4 Closing

### 4.1 Conclusion

Ship scheduling on the Rupert – Dumai route is not in accordance with service user requests, so rescheduling is needed to suit transportation demand.

BOAT	MEETING		BOAT	DUMAI	
	ARRIVE	LEAVE		ARRIVE	LEAVE
1	2	3	4	5	6
K1		07.00	K3		07.00
K2	07.00	07.49	K4	07.00	07.49
K3	07.42	08.31	K1	07.42	08.31
K4	08.31	09.20	K2	08.31	09.20
K1	09.13	10.02	K3	09.13	10.02
K2	10.02	10.51	K4	10.02	10.51
K3	10.44	11.33	K1	10.44	11.33
K4	11.33	12.22	K2	11.33	12.22
K1	12.25	13.24	K3	12.25	13.24
K2	13.24	14.13	K4	13.24	14.13
K3	14.06	14.55	K1	14.06	14.55
K4	14.55	15.44	K2	14.55	15.44
K1	15.37	16.26	K3	15.37	16.26
K2	16.26	17.15	K4	16.26	17.15
K3	17.08	17.57	K1	17.08	17.57
K4	17.57	18.46	K2	17.57	18.46

## 4.2 Suggestion

It is necessary to rearrange ship schedules so that they can be optimal and ship arrival and departure schedules are in accordance with service users' requests, so that service users feel comfortable when using crossing transportation.

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