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Evaluation Of The Scheduling Of Padangbai-Lembar Ships During The Pandemic Period In Bali Province

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Abstract

The Padangbai Ferry Port is located in Padangbai Village, Karangasem Regency. This port serves crossings between districts/cities, namely the Padangbai-Nusa Penida cross and between provinces, namely the Padangbai-Lembar cross. As a port that operates 24 hours with 13 trips/day, the current schedule arrangement is very important. Based on the results of a survey conducted by the author, there is a mismatch of the schedule compiled by the Land Transportation Management Center (BPTD) with its implementation, namely the ship's departure time with the existing schedule is not appropriate because the ship is waiting for a full load to depart. To be able to maximize the ship's load, it needs to be supported by a ship schedule that is in accordance with the implementation of the current health protocol in order to create a balance between the number of ships and the existing shipload.

Data collection was carried out using the observation method. The data that must be collected are passenger and vehicle productivity, ship characteristics and ship operational time. Institutional methods and library data are taken from the Regional BPTD. XII Province of Bali & NTB. The analysis is carried out by evaluating schedules that are not in accordance with field conditions, and making an appropriate schedule so that no ships still have to wait for passenger and vehicle loads.

Keywords: Load Factor, Departure Frequency, Scheduling

1. Introduction

Karangasem Regency is located on the eastern tip of the island of Bali, which is very strategically located because this district is the central link between the island of Bali and the island of Lombok. There are several kelurahan/villages among 8 sub-districts in Karangasem Regency, one of which is Padangbai Village in Manggis District. In this sub-district/village area, there is a Padangbai Ferry Port which is managed by the Land Transportation Management Center for area XII of Bali and West Nusa Tenggara Provinces. This ferry port is operated to serve crossings between districts, namely the Padangbai - Nusa Penida cross and between provinces, namely the Padangbai - Sheet crossing.

The current state of thepandemic Covid-19 has greatly affected the number of passengers who use crossing services at the Padangbai Ferry Port. At the Padangbai Ferry Port, especially the Padangbai – Lembar must follow health protocols on board, one of which is maintainingdistance between passengersroute, youphysical. In addition, it is only allowed to cross for passengers who have a negative Covid 19 certificate.

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Since the enactment of this policy, the productivity of passengers and vehicles during thepandemic Covid-19 has greatly decreased and greatly affects the load factor of passengers and vehicles.

As a port that operates 24 hours with 13 trips/day, the current schedule arrangement is very important. Based on the results of a survey conducted by the author, there is a mismatch of the schedule compiled by the Land Transportation Management Center (BPTD) with its implementation, namely the ship's departure time with the existing schedule is not appropriate because the ship is waiting for a full load to depart. To be able to maximize the ship's load, it needs to be supported by a ship schedule that is in accordance with the implementation of the current health protocol in order to create a balance between the number of ships and the existing shipload.

In accordance with the Director General of Land Transportation Regulation Number: SK. 2681/AP.005/DRJD/2006 concerning the Operation of Ferry Ports, to meet transportation needs, it is possible to increase the ferry port service capacity. This can be done by increasing the number of ship trips, proposals to replace / increase the number of ships, increase the operating time of the ferry port or propose to increase the number of piers.

2. Research Methods

Methods used in this study are:

a. Observation Method

Conducting direct observation of the actual conditions in the field regarding the condition of the Padangbai Ferry Port. The data that has been obtained is then recorded so that it can be used as data to analyze existing problems precisely, accurately and definitely

b. Literature

Method This method is done by searching for literature or documentation from various existing sources regarding theories and related data in solving problems in this Compulsory Working Paper (KKW).

c. Institutional Method

Data collected from various related agencies, namely:

1) PT. ASDP Indonesia Ferry (Persero) Padangbai Branch
2) Land Transportation Management Center Region XII Bali & West Nusa Tenggara Province
3) Central Statistics Agency (BPS) Karangasem Regency

3. Results and Discussion

a. Load Factor Analysis

To determine the load factor of the ferry on the Padangbai-Lembar crossing, the thing that must be considered is the number of passengers and vehicles as well as the available capacity of the operating ferry. Load factor is divided into two: the load factor of passengers and vehicles that each component in load factor thehas its own calculations.

1) Passenger Load Factor

In calculating the load factor the formula used is as follows:

$$\text{Load Factor} = \frac{\text{Capacity Used}}{\text{Capacity Available}} \times 100\%$$

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Table 3.1 Load Factor Passengers
During The Last 6 Months On The Padangbai-Lembar Track

DEPARTURE					
No	**Month**	**Trip**	**Capacity Used**	**Capacity Available**	**Load Factor**
1	January	384	1620	97300	1,66%
2	February	338	1278	84195	1,52%
3	March	328	1820	81589	2,23%
4	April	376	2934	102889	2,85%
5	May	376	2865	104893	2,73%
6	June	370	2884	104749	2,75%
Average					**2,29%**
ARRIVAL					
No	**Month**	**Trip**	**Capacity Used**	**Capacity Available**	**Load Factor**
1	January	393	1138	102437	1,11%
2	February	346	682	87893	0,78%
3	March	365	795	91215	0,87%
4	April	381	1018	105099	0,97%
5	May	396	968	112533	0,86%
6	June	385	1758	110447	1,59%
Average					**1,03%**

Source: Analysis Result, 2021

2) Vehicle Load Factor

Table 3.2 Vehicle Load Factor
During The Last 6 Months On The Padangbai-Lembar Track

DEPARTURE																
No	**Month**	**Trip**	**Vehicle Class**												**Capacity Used**	**Capacity Available**	**Load Factor**
			I	**II**	**III**	**IV A**	**IV B**	**V A**	**V B**	**VI A**	**VI B**	**VII**	**VIII**	**IX**			
1	January	384	2	3489	2	562	489	1	880	79	382	156	15	0	173853,66	365054,04	47,62
2	Februar y	338	1	2849	11	462	511	3	942	82	219	147	8	0	153759,86	318779,51	48,23
3	March	328	7	3666	24	561	543	5	613	75	211	98	9	0	133316,90	305944,27	43,58
4	April	376	1	2792	35	685	638	5	836	107	264	159	4	0	166739,37	364933,29	45,69
5	May	376	9	2734	32	556	563	2	1059	81	278	137	2	1	169160,16	366363,76	46,17
6	June	370	11	2563	21	851	613	3	739	149	214	157	11	0	164236,59	368612,41	44,56
Average																	**45,98%**

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ARRIVAL																
No	Month	Trip	Vehicle Class											Capacity Used	Capacity Available	Load Factor
			I	II	III	IV A	IV B	V A	V B	VI A	VI B	VII	VIII	IX			
1	January	393	0	1647	1	382	364	9	1463	67	229	157	13	0	175633,00	376733,54	46,62
2	Februar y	346	0	1014	0	280	332	6	926	59	314	144	5	0	140207,72	329612,73	42,54
3	March	365	0	1192	1	360	353	6	1027	52	208	103	3	0	132851,34	338289,32	39,27
4	April	381	0	1237	1	411	461	3	1276	95	236	154	2	0	167323,63	369251,49	45,31
5	May	396	10	3074	0	825	980	9	3043	113	664	293	4	0	379537,12	387872,42	97,85
6	June	385	0	4311	0	1136	918	8	3217	137	918	427	2	0	449417,79	383728,81	117,12
Average																	64,79%

Source: Analysis Result, 2021

Analysis of Passenger and Vehicle Growth Predictions

In this calculation, it is predicted that the growth or demand for passenger and vehicle transportation by class is based on the realization of transportation productivity in the last 6 months. To determine the growth of passengers and vehicles per class, a simple linear regression method is used, namely:

Regression Equation: $Y = a + bX$

The results of predictions of passenger and vehicle growth can use the Microsoft Excel program so that the following results are obtained:

1) Calculation of Passenger Growth Prediction in the Next 6 Months

Table 3.3 Predicted Results of Passenger Growth at Padangbai Ferry Port in the Next 6 Months

No	Month	x	a	b	Total Passengers
1	January	6	1362,42	348,42	3453
2	February	7	1362,42	348,42	3801
3	March	8	1362,42	348,42	4150
4	April	9	1362,42	348,42	4498
5	May	10	1362,42	348,42	4847
6	June	11	1362,42	348,42	5195
Total		**51**	**8174,57**	**2090,57**	**25944**

Source : Analysis Result, 2021

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2) Calculation of Vehicle Growth Predictions for the Next 6 Months

Table 3.4 Prediction Results of Vehicle Growth at Padangbai Ferry Port in the Next 6 Months

No	Month	x	a	b	Total Vehicles
1	January	6	157925,04	901,08	163331,55
2	February	7	157925,04	901,08	164232,64
3	March	8	157925,04	901,08	165133,73
4	April	9	157925,04	901,08	166034,81
5	May	10	157925,04	901,08	166935,90
6	June	11	157925,04	901,08	167836,99
Total		**51**	**947550,24**	**5406,51**	**993505,64**

Source : Analysis Result, 2021

a. Analysis of The Ship Departure Frequency

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

1) By Passenger

$$Fp = \frac{Np}{30 \text{ x } K \text{ x } LF \text{ x } M}$$

$$Fp = \frac{3453}{30\text{x } 0{,}9 \text{ x } 0{,}65 \text{ x } 272}$$

$$Fp = 0{,}72 \text{ round trip/day} = 1 \text{ round trip/day}$$

2) By Vehicle

$$Fk = \frac{Nk}{30 \text{ x } K \text{ x } LF \text{ x } M}$$

$$Fk = \frac{163332}{30\text{x } 0{,}9 \text{ x } 0{,}65 \text{ x } 974{,}38}$$

$$Fk = 9{,}55 \text{ round trip/day} = 10 \text{ round trip/day}$$

b. Analysis of the Total of Ships Needs

In analyzing the total of ships needed to cover the needs of service users, it is necessary to analyze the number of ships needed according to the average loading factor, it is necessary to analyze the ideal number of ships according to the requests of service users:

1) RTT (Round Trip Time)

a) Sailing Time

Distance trajectory Padangbai - Sheets is 38 miles away, while the ship speed average - average of 10 knots so that the travel time of the ship can be seen in the following table:

$$t = \frac{s}{v} = \frac{38 \text{ miles}}{10 \text{ knots}} = 3 \text{ hours } 48 \text{ minutes}$$

Table 3.5 Sailing Time at Padangbai Ferry Port

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Tracks	Distance Trails	Speed Average	Sailing Time
Padangbai - Lembar	38 miles	10 knots	228 minutes

Source : Analysis Result, 2021

b) Layover Time

Based on a survey carried out for 15 days at the Padangbai Ferry Port on the Padangbai-Lembar track, sheet average unloading time is for 108,7 minutes.

c) Round Trip Time

After knowing the sailing time and layover time, it can be seen the Round Trip Time (RTT) or the time the ship travels on the Padangbai-Lembar trajectory, which can be seen in the following table:

Table 3.6 Round Trip Time Ship

Tracks	Sailing Time	Lay Over Time Average	RTT = 2 (ST + LOT)
Padangbai - Lembar	228 minutes	108,7 minutes	673 minutes

Source : Analysis Result, 2021

2) Ship Trip

Capability the ship's current trip capability uses a port operating time of 24 hours or 1440 minutes. The ship's trip capability can be calculated using the formula:

$$\text{KT} = \frac{\text{Ship Operating Hours in Port}}{\text{RTT time}}$$

$$\text{KT} = \frac{1.440 \text{ minutes}}{673 \text{ RTT}}$$

$$\text{KT} = 2{,}1 \text{ Trip/ship}$$

$$\text{KT} = 2 \text{ Trip/ship}$$

3) Total of Ships Needed Required

$$\text{Total of Ship Needed Required} = \frac{\text{Total of Frequencies}}{\text{Trip Capability}}$$

$$\text{Total of Ship Needed Required} = \frac{10}{2}$$

Total of Ship Needed Required = 5 ships

Based on the above calculation results, the number of ships that are suitable is 5 ships. While the current condition of the number of ships on the Padangbai-Lembar trajectory is 13 ships that operate every day. So based on the calculation results, the current amount already meets the needs. However, the implementation is still not optimal because many ships often load empty cargoes because the current port productivity is affected by the condition Covid-19 so that the implementation has not run optimally.

For the required number of 5 ships in order to achieve a balance between the number of ships and service users in order to achieve the load factor planned of 65%, it is necessary to regularly use ships and make a more effective schedule.

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c. Analysis of Ship Schedules

Before determining the departure and arrival schedules of ships, themust be determined in advance headway (the ship's departure time range) using the formula:

$$\text{Headway Time} = \frac{\text{Ship Operating Hours in Port}}{\text{Frequencies}}$$

$$\text{Headway Time} = \frac{1440 \text{ minutes}}{10 \text{ round trip/day}}$$

$$\text{Headway Time} = 144 \text{ minutes}$$

Based on the calculation results, the data is headway 144 minutes. Scheduling can be done by considering the port operating time with current conditions.

Based on the results of the analysis above, it is known that:

RTT	= 673 minutes	= 11 hours 13 minutes
Layover Time	= 108 minutes	= 1 hours 48 minutes
Headway	= 144 minutes	= 2 hours 24 minutes
Ship Operating Hours in Port	= 1440 minutes	= 24 hours
Sailing Time	= 228 minutes	= 3 hours 48 minutes

Based on the results of the analysis, the schedule can be made by considering the port operating time and current conditions. By using the same formula and the same calculations, the schedule can be arranged, so the preparation of departure and arrival schedules on the Padangbai – Lembar track. The following is a planned schedule at Padangbai Port:

Table 3.7 Ship Departure Planned Schedule

MONTH		SEPTEMBER																			
DATE		1		2		3		4		5		6		7		8		9		10	
ARRIVAL	DEPARTURE	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB
21.36	00.00	Z	O	X	F	C	N	K	E	T	G	J	Q	P	A	V	D	H	B	R	I
00.00	02.24	M	W	L	U	Y	Z	O	X	F	C	N	K	E	T	G	J	Q	P	A	V
02.24	04.48	H	B	R	I	S	M	W	L	U	Y	Z	O	X	F	C	N	K	E	T	G
04.48	07.12	Q	P	A	V	D	H	B	R	I	S	M	W	L	U	Y	Z	O	X	F	C
07.12	09.36	K	E	T	G	J	Q	P	A	V	D	H	B	R	I	S	M	W	L	U	Y
09.36	12.00	O	Z	F	X	N	C	E	K	G	T	Q	J	A	P	D	V	B	H	I	R
12.00	14.24	W	M	U	L	Z	Y	X	O	C	F	K	N	T	E	J	G	P	Q	V	A
14.24	16.48	B	H	I	R	M	S	L	W	Y	U	O	Z	F	X	N	C	E	K	G	T
16.48	19.12	P	Q	V	A	H	D	R	B	S	I	W	M	U	L	Z	Y	X	O	C	F
19.12	21.36	E	K	G	T	Q	J	A	P	D	V	B	H	I	R	M	S	L	W	Y	U

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MONTH		SEPTEMBER																			
DATE		11		12		13		14		15		16		17		18		19		20	
ARRIVAL	DEPARTURE	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB
21.36	00.00	S	M	W	L	U	Y	Z	O	X	F	C	N	K	E	T	G	J	Q	P	A
00.00	02.24	D	H	B	R	I	S	M	W	L	U	Y	Z	O	X	F	C	N	K	E	T
02.24	04.48	J	Q	P	A	V	D	H	B	R	I	S	M	W	L	U	Y	Z	O	X	F
04.48	07.12	N	K	E	T	G	J	Q	P	A	V	D	H	B	R	I	S	M	W	L	U
07.12	09.36	Z	O	X	F	C	N	K	E	T	G	J	Q	P	A	V	D	H	B	R	I
09.36	12.00	M	S	L	W	Y	U	O	Z	F	X	N	C	E	K	G	T	Q	J	A	P
12.00	14.24	H	D	R	B	S	I	W	M	U	L	Z	Y	X	O	C	F	K	N	T	E
14.24	16.48	Q	J	A	P	D	V	B	H	I	R	M	S	L	W	Y	U	O	Z	F	X
16.48	19.12	K	N	T	E	J	G	P	Q	V	A	H	D	R	B	S	I	W	M	U	L
19.12	21.36	O	Z	F	X	N	C	E	K	G	T	Q	J	A	P	D	V	B	H	I	R

MONTH		SEPTEMBER																			
DATE		21		22		23		24		25		26		27		28		29		30	
Arr	Dept	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB	LBR	PDB
21.36	00.00	V	D	H	B	R	I	S	M	W	L	U	Y	Z	O	X	F	Z	O	X	F
00.00	02.24	G	J	Q	P	A	V	D	H	B	R	I	S	M	W	L	U	M	W	L	U
02.24	04.48	C	N	K	E	T	G	J	Q	P	A	V	D	H	B	R	I	H	B	R	I
04.48	07.12	Y	Z	O	X	F	C	N	K	E	T	G	J	Q	P	A	V	Q	P	A	V
07.12	09.36	S	M	W	L	U	Y	Z	O	X	F	C	N	K	E	T	G	K	E	T	G
09.36	12.00	D	V	B	H	I	R	M	S	L	W	Y	U	O	Z	F	X	O	Z	F	X
12.00	14.24	J	G	P	Q	V	A	H	D	R	B	S	I	W	M	U	L	W	M	U	L
14.24	16.48	N	C	E	K	G	T	Q	J	A	P	D	V	B	H	I	R	B	H	I	R
16.48	19.12	Z	Y	X	O	C	F	K	N	T	E	J	G	P	Q	V	A	P	Q	V	A
19.12	21.36	M	S	L	W	Y	U	O	Z	F	X	N	C	E	K	G	T	E	K	G	T

Source : Analysis Result, 2021

Descriptions :

A = KMP. Roditha
B = KMP. Port Link II
C = KMP. Prima Nusantara
D = KMP. Gading Nusantara
E = KMP. Citra Nusantara
F = KMP. Marina Primera
G = KMP. Marina Segunda
H = KMP. Swarna Kartika
I = KMP. Nusa Sakti
J = KMP. Nusa Bhakti
K = KMP. Nusa Penida
L = KMP. Dharma Ferry VIII
M = KMP. Putri Yasmin
O = KMP. Sindu Tritama
P = KMP.Sindu Dwitama
Q = KMP. Shita Giri Nusa
R = KMP. Rama Giri Nusa
S = KMP. Gemilang VIII
T = KMP. Wihan Bahari
U = KMP. PBK. Muryati
V = KMP. Gerbang Samudera 3
W = KMP.Salindo Mutiara I
X = KMP. Munic III
Y = KMP. Munic XI
Z = KMP. Dharma Kencana IX
N = KMP. Naraya

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After the ship scheduling is planned, the average departure for each ship within 1 month is as follows:

Table 3.8 Total of Planned Ship Departure Trips

No	Name Ship	Trip	No	Name Ship	Trip
1	KMP. Roditha	22	14	KMP. Putri Yasmin	25
2	KMP. Port Link II	24	15	KMP. Naraya	21
3	KMP. Prima Nusantara	21	16	KMP. Sindu Tritama	25
4	KMP. Gading Nusantara	21	17	KMP. Sindu Dwitama	23
5	KMP. Citra Nusantara	23	18	KMP. Shita Giri Nusa	23
6	KMP. Marina Primera	24	19	KMP. Rama Giri Nusa	24
7	KMP. Marina Segunda	25	20	KMP. Gemilang VIII	21
8	KMP. Swarna Kartika	24	21	KMP. Wihan Bahari	24
9	KMP. Nusa Sakti	24	22	KMP. PBK. Muryati	24
10	KMP. Nusa Bhakti	21	23	KMP. Gerbang Samudra 3	25
11	KMP. Nusa Penida	24	24	KMP. Salindo Mutiara I	24
12	KMP. Dharma Kencana IX	25	25	KMP. Munic III	24
13	KMP. Dharma Ferry VIII	24	25	KMP. Munic XI	21
Average					**23**

Source : Analysis Result, 2021

4. Closing

a. Conclusion

Based on the results of data analysis and discussion in the previous chapter, the following conclusions can be drawn:

1) Knowing the predictions of future passenger and vehicle growth using productivity data for the last 6 months. For passengers, it is 25.944 people and for vehicles, it is 993.505 vehicles.
2) The average loading factor of the Padangbai-Lembar trajectory based on a survey from 21 April 2021 to 5 May 2021 is 1,92% of passengers and 39,48% of vehicles.
3) The number of ship frequency requirements for July – December 2021 uses the planned ship departure frequency of 10 trips/day.
4) The planned schedule is based on service time and uses the frequency of ship departures, namely sailing time of 228 minutes with headways from 1,5 hours to 2,24 hours, so as to extend the time for ships to dock from the existing conditions, the number of operating vessels is 13 ships/day to 5 ships/day.
5) The schedule of ships serving the Padangbai-Lembar route is still not in accordance with the requests of service users to meet transportation needs. So it is necessary to reschedule to suit the demand for ferry transportation more optimally to the needs of the cargo that will cross, namely by reducing the number of trips that exist today and also reducing the number of operating vessels. This is done to maximize the current shipload in accordance with the implementation of health protocols in order to create a balance between the number of ships and the existing shipload.

b. Suggestions

From the conclusions above, the authors provide suggestions on the problems that occur, namely:

1) The need for future forecasts in order to further increase the load factor in the next 6 months, trip planning can be carried out in accordance with the ship's operational and trip capabilities that have been analyzed.
2) Improving services to service users, by reviewing the ship loading factor in order to achieve a balance between the need for ferry transportation and the transportation provided and more efficient crossing activities.
3) We recommend that the number of ships operating is adjusted to the conditions in the field so that it can achieve the ideal ship departure frequency according to the loading factor.
4) It is necessary to reduce the number of operating vessels so that crossing transportation activities are balanced with the needs of service users.
5) The need to re-schedule the ship so that it can be optimal and the ship's arrival and departure schedule is in accordance with the request of service users to feel comfortable when using crossing transportation.

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