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Cover Page Footnote

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EVALUATION OF COAL TRANSPORT ROUTE IN JAMBI CITY (TALANG DUKU PORT-EAST RING ROAD II)

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ABSTRACT

In its implementation, the role of coal transportation infrastructure is important in supporting the mining industry in Jambi City. However, it also causes various complex problems, one of them is traffic congestion on Arterial Roads in Jambi City. In May 2023, the Jambi Regional Police of the Republic of Indonesia issued a notification letter to stop the mobilization of coal transportation in Jambi Province. The policy caused several coal companies to switch their transportation method to shipping in order to continue operating, while several other companies stopped operating until an indeterminate time. Therefore, this study aims to seeks the comparison of traffic performance before and after the implementation of the policy on Jambi City arterial roads, especially on Talang Duku Port Road and East Ring Road II. The method used was a comparative analysis of the degree of saturation before and after the enactment of regulations on the prohibition of coal truck operations. The results of this study show the importance of traffic management as one of the solutions to reduce traffic congestion. Nevertheless, other alternatives are still needed to support the smooth operation of coal transportation activities.

Keywords: *Coal transportation trucks; Road Evaluation; Transport route.*

INTRODUCTION

The mining sector is one of the superior commodities because it contribute as a source of regional income. Jambi Province is one of the provinces in Indonesia that has a wealth of coal natural resources. The Jambi Province Energy and Mineral Resources (ESDM) Office during the year, January to November 2018, recorded that the total coal production from the mining sector in Jambi Province reached 9.3 million Metric Tons (MT) (Darminto et al., 2021).

However, behind the financial contribution to the region, the transportation of coal from the mine mouth to the stockpile has caused complex problems in Jambi Province (Subhan, 2015). In its implementation, coal transportation infrastructure has an important role in supporting the mining industry in Jambi City. Transportation infrastructure is one of the most important factors to ensure the smoothness of coal transportation activities. (redaktur, 2019). According to Subhan (2015), since 2009 there have been road problems as an impact of coal transportation with several impacts that arise, including damaged road conditions due to overloading, financial losses for local governments to repair damaged road conditions, traffic accidents, and the foundations of residents' houses that have fallen due to coal truck transportation exceeding capacity.

Therefore, to overcome these problems, the purpose of this research is to evaluate the existing conditions of the route used for coal trucks in 2024, then compare it with the conditions in the previous year. That way, a comparison can be made of the road conditions traveled by Coal trucks for several years, and determine the next policy. Recommendations and suggestions for improvement generated by this evaluation will serve as guidelines for researchers and other stakeholders to plan and implement policies that suit the needs and conditions of Jambi City. Thus, this evaluation is expected to make a positive contribution in advancing the coal transportation sector in Jambi City.

METHODS

To obtain the research results, direct interviews and surveys were conducted with Coal truck drivers, as well as stakeholders in the Department of Transportation and Police in Jambi City. The survey was conducted by directly observing the geometric conditions on the Arterial Road used by coal trucks. Interviews were conducted to understand the traffic policy conditions implemented in Jambi City regarding coal trucks. Then to find out the existing conditions of the current Coal transportation route, the method used was vehicle observation using CCTV on the Talang Duku Port Road and the East Ring Road II.

Using digital recording data (CCTV) from 5-7 April 2024 for 24 hours on Talang Duku Port Road and East Ring Road II, an analysis was carried out to determine the Degree of Saturation in April 2024 on the relevant road sections. The analysis was conducted using an analysis form in accordance with tables based on the Indonesian Road Capacity Guidelines (PKJI) (Direktorat Jenderal Bina Marga et al., 2023).

A comparative analysis of the degree of saturation in 2021 and 2024 was conducted with these data. The comparative analysis of road section conditions was carried out using literature analysis from previous studies, because the unavailability of CCTV data in the previous year. In previous research, which was conducted by one of the Batanghari University students in 2022 (Mu'izzu, 2022), it was found that the Degree of Saturation in December 2021 for Talang Duku Port Road and East Ring Road II.

RESULTS AND DISCUSSION

Based on surveys and direct observations on arterial road sections traversed by coal trucks in Jambi City, namely on the Talang Duku Port Road and East Ring Road II, the following data on the characteristics of these road sections were obtained:

1. The geometric conditions of the Talang Duku Port Road section and East Ring Road II with the 2/2 UD road type are as follows:

Table 1. Geometric Condition of Talang Duku Port Road and East Ring Road II

Data	Queue Area	
	East Ring Road II	Talang Duku Port Road
Road Width	6 m	6 m
Total Route	2	2
Total Lane	1	1
Queue Area Width	3 m	4 m

2. Flow composition and flow separation, i.e. urban roads with no flow separation.
3. Roadside activities traveled by coal hauling trucks, which are very high due to various activities on the road shoulder with various commercial activities and very high roadside market activities in the area.

Since October 2023, coal trucks have been suspended from operating by land to the port. So, the route used is the River route using a barge. Coal trucks transport coal from the stockpile then carry out loading and unloading at the Special Terminal (TERSUS) and Terminal for Own Use (TUKS) to the next stopping point.

In previous research (Mu'izzu, 2022), it was found that the Degree of Saturation in December 2021 for Talang Duku Port Road was 0.891 and East Ring Road II was 0.756. The Degree of Saturation in the study is the degree of saturation on the road section when coal trucks are still operating. Based on these findings, a comparison analysis of the degree of saturation in 2021 and 2024 was conducted.

The traffic data analysis utilized CCTV data from April 6 in 2024, because there was a peak traffic density. On that date, it was the peak of the Eid al-Fitr exodus (mudik) in Indonesia. The results of the analysis are as follows:

Table 2. Traffic Volume Data of Talang Duku Port Road Section

Time (Hour)	MC		LV		HV	
	Right	Left	Right	Left	Right	Left
20.00 - 21.00	244	234	50	63	51	64
21.00 - 22.00	222	183	39	55	19	38
22.00 - 23.00	139	119	42	39	9	17
23.00 - 00.00	105	96	23	31	16	12
00.00 - 01.00	34	35	13	24	13	20
01.00 - 02.00	15	16	4	16	8	9
02.00 - 03.00	16	12	8	6	9	3
03.00 - 04.00	6	11	5	6	8	5
04.00 - 05.00	25	15	4	7	23	11
05.00 - 06.00	40	36	9	11	27	17
06.00 - 07.00	236	269	21	24	56	15
07.00 - 08.00	571	469	37	46	89	30

Time (Hour)	MC		LV		HV	
	Right	Left	Right	Left	Right	Left
08.00 - 09.00	286	291	47	64	76	83
09.00 - 10.00	256	255	73	114	168	154
10.00 - 11.00	267	301	72	108	174	195
11.00 - 12.00	292	285	77	114	166	188
12.00 - 13.00	305	305	68	106	139	117
13.00 - 14.00	277	303	93	130	138	121
14.00 - 15.00	330	371	97	150	152	164
15.00 - 16.00	412	467	81	110	132	143
16.00 - 17.00	608	683	109	144	108	146
17.00 - 18.00	825	819	117	139	82	115
18.00 - 19.00	361	315	46	55	48	47
19.00 - 20.00	356	377	53	87	33	61
Total	6228	6267	1188	1649	1744	1775

Table 3. Traffic Volume Data of East Ring Road II

Time (Hour)	MC		LV		HV	
	Right	Left	Right	Left	Right	Left
20.00 - 21.00	107	622	22	90	34	26
21.00 - 22.00	69	605	16	108	12	12
22.00 - 23.00	50	506	15	111	4	9
23.00 - 00.00	35	307	5	58	5	11
00.00 - 01.00	13	85	6	30	4	8
01.00 - 02.00	6	38	1	11	0	10
02.00 - 03.00	6	36	5	19	0	10
03.00 - 04.00	2	25	3	17	4	8
04.00 - 05.00	6	62	1	25	9	20
05.00 - 06.00	18	109	3	21	8	31
06.00 - 07.00	117	350	8	31	5	60
07.00 - 08.00	227	905	11	103	7	99
08.00 - 09.00	104	595	10	81	25	68
09.00 - 10.00	119	507	31	100	79	123
10.00 - 11.00	116	525	27	121	93	152
11.00 - 12.00	124	589	28	125	113	83
12.00 - 13.00	121	618	26	125	62	106
13.00 - 14.00	131	561	32	131	56	103
14.00 - 15.00	162	573	35	157	94	82
15.00 - 16.00	189	621	24	121	91	57
16.00 - 17.00	286	852	38	169	76	51
17.00 - 18.00	323	1349	34	197	50	40
18.00 - 19.00	141	596	9	89	24	25
19.00 - 20.00	191	544	23	97	20	20
Total	2663	11580	413	2137	875	1214

The observations were conducted for 24 hours, but for further analysis, only peak hours were taken into account, namely from 07:00 to 09:00, 11:00 to 13:00, and 16:00 to 18:00. The road capacity (C) value for undivided road type, 2/2-UD is determined for a total traffic volume of 2 (two) directions.

- Base Capacity

  C_0 = 2.800 pcu/hour

- Capacity Correction Factor Due to Lane Width Differences

  FC_{LJ} = 0,87

- Capacity Correction Factor due to PA on Undivided Road Types

  PA (%-%) amounted 50%-50%

  FC_{PA} = 1,00

- Capacity Correction Factor Due to KHS on Roads

  Given a 2/2 UD road with a very high KHS and an effective shoulder width (LBE) of ≤ 0.5 meters, then based on the table in PKJI 2023, the FC_{HS} value is obtained.

  FC_{HS} = 0,73

- Capacity Correction Factor for City Size

  The value of the capacity correction factor for city size with the total population of Jambi City in 2023 amounted to 627.8 million people. Then, including the class / medium category (medium city) obtained the value of FC_{UK}. FC_{UK} = 0.94

Based on these data, capacity calculations can be carried out for undivided road types, 2/2UD on the Talang Duku Port Road and East Ring Road II which are passed by coal transport vehicles.

$$C = C_0 \times FC_{LJ} \times FC_{PA} \times FC_{HS} \times FC_{UK}$$

$$C = 2.800 \times 0,87 \times 1,00 \times 0,73 \times 0.94$$

$$C = 1.671,58 \text{ pcu/hour}$$

Using the known peak hours, the total number of vehicles during peak hours is summed up and then divided by the total number of peak hours.

Table 4. LHR (Vehicles/hour) at Peak Hour on Talang Duku Port Road

Time (Hour)	MC		LV		HV		LHR (vehicle/hour)	
	Right	Left	Right	Left	Right	Left	Right	Left
07.00 - 08.00	571	469	37	46	89	30	697	545
08.00 - 09.00	286	291	47	64	76	83	409	438
11.00 - 12.00	292	285	77	114	166	188	535	587
12.00 - 13.00	305	305	68	106	139	117	512	528
16.00 - 17.00	608	683	109	144	108	146	825	973
17.00 - 18.00	825	819	117	139	82	115	1024	1073
Total	2887	2852	455	613	660	679	4002	4144
Total / 6 Hours (vehicles/hour)	481	475	76	102	110	113	667	691

Table 5. LHR (Vehicles/hour) at Peak Hour on East Ring Road II

Time (Hour)	MC		LV		HV		LHR (vehicle/hour)	
	Right	Left	Right	Left	Right	Left	Right	Left
07.00 - 08.00	227	905	11	103	7	99	245	1107
08.00 - 09.00	104	595	10	81	25	68	139	744
11.00 - 12.00	124	589	28	125	113	83	265	797
12.00 - 13.00	121	618	26	125	62	106	209	849
16.00 - 17.00	286	852	38	169	76	51	400	1072
17.00 - 18.00	323	1349	34	197	50	40	407	1586
Total	1185	4908	147	800	333	447	1665	6155
Total / 6 Hours (vehicles/hour)	198	818	25	133	56	75	278	1026

The traffic volume (Q) for each movement is converted from vehicle units per hour to passenger car units (pcu) per hour using the passenger vehicle equivalent (pve) for 2/2 UD road types with vehicle/hour volumes less than 1800 for routes ≤ 6 meters is:

HV = 1,3

LV = 1,0

MC = 0,5

Using the emp, the value of traffic volume (Q) can be calculated. The following is an example of calculating the value of traffic volume (Q).

Known:

- Light Vehicle (LV), emp value 1.0 and total LV on the right side of Talang Duku Port Road is 76 vehicles/hour.
- Heavy Vehicle (HV), emp value 1.3 and total HV on the right side of Talang Duku Port Road is 110 vehicles/hour.
- Motorcycle (MC), emp value 0.5 and total MC on the right side of Talang Duku Port Road is 481 vehicles/hour.

So,

$$Q = Q_{LV} + (Q_{HV} \text{ x } emp_{HV}) + (Q_{MC} \text{ x } emp_{MC})$$

$$Q = 76 + (110 \text{ x } 1,3) + (418 \text{ x } 0,5)$$

$$Q = 448 \text{ pcu/hour}$$

The analysis of total Q and degree of saturation can be seen in the following table:

Table 6. Total Q analysis on Talang Duku Port Road

No.	Vehicle type	LV		HV		MC				
1.1	EMP Direction 1	1		1.2		0.5		Q_{TOT}		
1.2	EMP Direction 2	1		1.2		0.5				
2	Directions	Vehicles/ hour	PCU/hour	Vehicles/ hour	PCU/hour	Vehicles/ hour	PCU/hour	Directions,%	Vehicles/ hour	PCU/hour
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
3	Right	76	76	110	132	481	241	49%	667	448

4	Left	102	102	113	136	475	238	51%	691	476
5	Total	178	178	223	268	957	478	100%	1358	924
6					Separation, PA=q1/(q1+q2)				49%	[redacted]
7					PCU factors, FSMP					0.681

Table 7. Saturation Degree Analysis of Talang Duku Port Road

Arah	Base capacity (C0) (pcu/hour)	Adjustment factor for capacity				Capacity (C) [2] x [3] x [4] x[5] x [6] (pcu/hour)	Traffic Flow (Q) pcu/vehicles	Degree of Saturation [8] / [7]
		Route width (FC_{LJ})	Directional separation (FC_{PA})	Side Barriers (FC_{HS})	City Size (FC_{UK})			
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Total	2800	0.87	1	0.73	0.94	1671.5832	924	0.553

Table 8. Analysis of total Q on East Ring Road II

No.	Vehicle type	LV		HV		MC				
1.1	EMP Direction 1	1		1.2		0.5			Q_{TOT}	
1.2	EMP Direction 2	1		1.2		0.5				
2	Directions	Vehicles/ hour	PCU/hour	Vehicles/ hour	PCU/ hour	Vehicles/ hour	PCU/hour	Directions,%	Vehicles/ hour	PCU/hour
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
3	Right	25	25	56	67	198	99	23%	278	190
4	Left	133	133	75	89	818	409	77%	1026	632
5	Total	158	158	130	156	1016	508	100%	1303	822
6					Separation, PA=q1/(q1+q2)				23%	[redacted]
7					PCU factors, FSMP					0.630

Table 9. Degree Saturation Analysis of East Ring Road II

Arah	Base capacity (C0) (pcu/hour)	Adjustment factor for capacity				Capacity (C) [2] x [3] x [4] x[5] x [6] (pcu/hour)	Traffic Flow (Q) pcu/vehicles	Degree of Saturation [8] / [7]
		Route width (FC_{LJ})	Directional separation (FC_{PA})	Side Barriers (FC_{HS})	City Size (FC_{UK})			
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Total	2800	0.87	1	0.73	0.94	1671.5832	822	0.492

The degree of saturation on a road section is an important parameter in evaluating traffic density. In research conducted by one of the Batanghari University students in 2022, it was found that the degree of saturation in December 2021 for Talang Duku Port Road was 0.891 and East Ring Road II was 0.756. The degree of saturation describes how full the capacity of a road section is at a certain time. The higher the degree of saturation, the more congested the traffic, and the lower the efficiency of vehicle movement.

In the range of degree of saturation > 0.75, traffic is already congested, and congestion often occurs, especially during peak hours. Planning should focus more on strategies to address traffic congestion, such as building new roads, improving public transportation, restricting vehicle access, and adjusting travel schedules. Thus, the Government issued a policy of limiting coal truck vehicle operations by setting a schedule, leading to a complete shutdown on arterial roads.

In 2024, without coal truck operations, there is a significant decrease in the degree of saturation. The degree of saturation decreased to 0.553 on Talang Duku Port Road and 0.492 on East Ring Road II. This indicates that without coal truck operations, the capacity of the road section can be utilized more efficiently by other vehicles, which in turn can reduce traffic congestion and increase the rate of vehicle movement.

CONCLUSION

This decrease in degree of saturation can also have a positive impact on traffic safety and the surrounding environment, as it reduces the likelihood of congestion and air pollution due to the reduced number of slow-moving or stopped vehicles. This is due to the regulation on the prohibition of coal hauling truck operations, which can demonstrate the importance of traffic management and control of activities that have the potential to disrupt the smooth flow of traffic, such as coal truck operations, as an effort to improve urban transportation conditions.

This study indicates that the absence of coal trucks on arterial routes reduces the degree of saturation and congestion levels. The problem of congestion on arterial roads, especially on Talang Duku Port Road and East Ring Road II, has been resolved due to the absence of coal trucks passing through, but coal loading and unloading operations are hampered and require other alternatives to continue operating. However, a policy for alternative coal transport needs to be implemented to address coal transport issues. Further analysis regarding dedicated coal transportation routes also needs to be conducted.

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