



Traffic Congestion Effect on Socio-Economic of Road Users in Palembang City

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Abstract. Traffic Congestion is one of the common problems for road users found in almost all cities with high mobilization activities. Palembang is one of the capital cities in Indonesia that has been dealing with Traffic Congestion problems. It certainly has impacted road users, while one of the biggest ones is the socio-economic felt by road users. However, the magnitude of the loss of socio-economic impact caused can be in the form of reduced income from wasted fuel due to increased purchases of fuel (BBM) and a decrease in economic benefits in the form of wasted time due to traffic congestion.

This research aims to determine the impact that arises as a result of traffic congestion in Palembang city by distributing a questionnaire form with 114 respondents who are in Palembang city to find out the actual conditions in the field. This research result shows that three things are affected, there are economic, social, and environmental. The Linkert analysis score indicates that 92,84% of respondents agree and strongly agree that Traffic Congestion affects the economy, and 90,60% of respondents agree and strongly agree that traffic congestion also affects the social. The Linkert analysis results on the environmental impact of 91,84%, which means that Traffic Congestion is also Highly Impactful on the environment. Thus, traffic congestion will impact the social, economic, and environmental aspects.

Keywords: Traffic Congestion · Economic Impact · Socio-economic Impact · Transportation

1 Introduction

The growth of vehicle use in large cities has raised concerns about congestion, pollution, and negative environmental consequences [1]. Traffic Congestion is one of the major problems for road users found in almost all cities with high mobilization activities. However, the congestion peak always happens in the morning and evening. It is caused by the heading and returning from the activities traffic flow. It has been happening and become a more significant concern on highways compared to any type of roads, there are several factors causing traffic congestion, they are the transportation infrastructure has failed to meet city traffic demand, lack of public transport users, a high number of personal vehicles, lack of public transport users and insufficient street network to accommodate the current number of vehicles, and population vehicles growth [2].

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Palembang is one of the capital cities in Indonesia with a 369,22 km area, 16 subdistricts, a 1,8 million population, and a territory divided into two parts by the Musi River. Currently, these two parts have only been connected by a bridge called the Ampera Bridge, the traffic is concentrated on the major roads connected by the Ampera Bridge. However, this city has been dealing with Traffic Congestion problems that occur almost evenly in all parts, particularly at peak hours.

Spending time in traffic trapped is not a trivial thing, even for most of us it is a very wasting time and causes a delay in travel to reach the destination. Research showed that the cost of driving increases due to the congestion situation [3]. The traffic Congestion Problem impacts some factors, the several factors are social, economic, and environmental [4]. The negative impact such as an increase in rider stress and exhaustion which is an impact social factor, increasing fuel and time consumption which is part of the economic impact factor, and lastly an increase in pollution and noise which is an environmental impact factor. This research determines the impact that arises as a result of traffic congestion in Palembang city based on socioeconomic and environmental factors.

2 Literature Review

2.1 Social Impact

The Social Impact of Congestion is the impact that affects the users' mental health. It did happen due to the congestion situation, amount of car increase, and the time to reach the destination delay. Being in the situation of trap in a car and long queue movement to wait to move slowly with air pollution, noise, and tired feeling increase frustration, anger, and loss of focus [4].

2.2 Economic Impact

According to research, several economic factors due to vehicles are divided into private cost and public cost. A private cost is a cost issue according to some conditions, they are the cost that has to be spent when the vehicle move, the cost of losing time during driving, and the cost of vehicle service and maintenance. While public costs are some factors has to be spent due to cost accident issues, road facility maintenance, and many others [5].

The impact of congestion on the economy is shown by increasing privates cost than normal, it was proven by some studies that the congestion impact drivers' economic outcomes. Research in 423 urban areas in the US showed that the congestion increasing urban area problem, it represented that fuel consumption and wasting time waiting increased due to the congestion. The research in 2007 mentioned that the economic impact due to increasing fuel consumption increased up to \$87.2 in 439 urban areas per peak traveller for 36 h [6].

Furthermore, the research also did in Jakarta, Indonesia. it mentioned that in 2018 as the 10th most congested city in the world the situation comes from approximately 3.5 million cars and 14 million motorcycles on the roads each day, and it is about Rp100 trillion estimated as the economic loss due to vehicle operating costs and time value cost [7].

2.3 Environment Impact

The congestion also gives an impact on the environment, it is because of the increase in fuel consumption that air pollution and greenhouse emissions also increase. Air pollution occurs in the form of free radicals such as CO₂, CO, CH₄, NO_x, PM, SO₂, and HC which also have an impact on health. Research proved that air pollution is one of the causes of thousands of deaths every year [4].

Several studies above have shown that it is true that congestion impact social, economic, and environmental road users. This is evidenced by the increase in costs that must be incurred due to the increase in fuel consumption and the estimated time wasted when experiencing congestion, increased stress, fatigue, air pollution, and noise levels.

3 Research and Methodology

In this research, the method used by descriptive analysis technique with quantitative selection. The population chosen in this research is the rider who is in the city of Palembang and active in Palembang city or the rider who is outside Palembang city. As for the sample study, there are 114 respondents, obtained from a questionnaire spread via google forms. Furthermore, the Data analysis techniques used in a study is analysis Linkert technical, with data description as follows:

4 Result and Discussion

4.1 Social Impact

Research results of 114 respondents showed that congestion is a very detrimental situation that impacts society on riders. The impact of social problems caused by traffic jams on riders/drivers is described right in the Table 1.

Of the 114 respondents who gave answers about the social impacts caused by traffic congestion as shown in the table above, it is about 10.62% gave answers disagreed to strongly disagree, while it is around 90.61% of respondents who agreed or even strongly agree that the congestion in Palembang impacted on the drivers' social issue.

Based on Table 2, it can be seen from the first question that the drivers often experience fatigue caused by staying too long. Second, riders/drivers experience a loss of focus and concentration in driving due to congestion. Third, the driver experiences stress due to the non-conductive traffic due to congestion, from the results of the study the three statements obtained 177 responses agreeing, 133 responses strongly agree, then 8 responses strongly disagree and 28 responses giving answers disagreeing.

The number of answers to these 3 questions is 346 answers, which means that there are 4 double responses or slices of the answers between agreeing and disagree at the same time. However, this study only wants to see the social impact caused by congestion on drivers/riders in Palembang. So, with 90.61% of the responses indicating that respondents agree and strongly agree with these 3 questions, it is sufficient to show that the congestion in Palembang has impacted the society of road users.

Table 1. Data Description Respondent

Information	Amount Respondent		Total
Type Sex	Female = 76 people	Male = 38 People	114 people
Address	Palembang = 107 people	Outside Palembang = 7 people	114 people
Age	> 30 years old = 76 people	< 30 years old = 38 people	114 people
Education	<ul style="list-style-type: none"> - High school = 18 people - Diploma = 2 people - Bachelor = 53 people - Postgraduate = 41 people 		114 people
Work	<ul style="list-style-type: none"> - Student = 16 people - ASN = 34 people - Private = 54 people - Entrepreneur = 10 people 		114 people
Income	<ul style="list-style-type: none"> - 1–3 million Rupiah = 43 people - 4–5 million Rupiah = 37 people - > 5 million Rupiah = 34 people 		114 people
Type Vehicle	Car = 58 people	Motorcycle = 56 people	114 people
Fuel Type	<ul style="list-style-type: none"> - Peralite = 79 people - Pertamina = 25 people - Biosolar = 6 people - Despite = 4 people 		114 ople

4.2 Economic Impact

Below is the economic impact due to congestion on drivers or riders in Palembang:

The congestion phenomena very impact to economic of road users, it is impact travel for work and travel not for work. It will affect the movement of people and the flow of goods. Vehicles driving in normal traffic usually consume fuel following the efficiency of the vehicle's engine in consuming fuel, but when congestion, the vehicle spends more fuel so the driver has to spend extra money to pay to buy more fuel. Furthermore, the impact is also in the form of increased expenses for routine services due to overheated engines during congestion. The increase in costs that must be incurred by the driver is the impact of congestion from an economic point of view. Next, the driver also loses time during the congestion effect to being late for work and salary deductions as a penalty for delays, it also becomes an economic impact to drivers due to losses part of income. Last, the driver lost Opportunity for Other Activities during the congestion.

Based on Table 3, it can be seen from the first question that the driver loses time during the congestion and impact of being late for work so he loses some of his income due to being late and losing other opportunities for activities. Second, Increased Expenditure for Fuel Due to Congestion. Third, Increased Expenditures for Routine Service Due to Overheated Machines caused by Congestion, from the results of the study for the three statements obtained 171 responses agreed, 143 responses strongly agree, then 7 responses strongly disagree and 23 responses giving answers disagreeing.

Table 2. Response Respondent to Social Impact

No	Question	Response Respondent			
		Totally Disagree	Disagree	Agree	Totally Agree
1	Driver Experience Fatigue Consequence Wait for Congestion Too Long in The Vehicle	3	4	55	53
2	Driver Loss of Focus Due to Fatigue During Congestion	3	12	67	33
3	The Emergence of Stress Caused by Unconductive Traffic During Congestion	2	12	55	47
Amount		8	28	177	133
Average		2.7	9.4	59	44.3
Percentage		2.37%	8.25%	51.75%	38.86%
		10.62%		90.61%	

The number of answers to these 3 questions is 344 answers, which means that there are 2 double responses or slices of the answers between agreeing and disagree at the same time. However, this study only wants to see the economic impact caused by congestion on drivers/riders in Palembang. As shown in the Table 3, there are about 8.85% giving answers that disagree to strongly disagree, on the other hand, there are about 91,84% of the responses indicated that respondents agree and strongly agree with these 3 questions, which is sufficient to show that the congestion in Palembang has been impacted on the economics of road users.

The economic loss that is very obvious and can be directly measured is the Increased Expenditure for Fuel Due to Congestion, the below is the result of research on the estimated amount of fuel expenditure when there is no congestion felt by road users in litter/week, as shown seen in the Table 4.

From the Table 4, it can be seen that the most road users spend about 5–15 liters/week for activities with normal conditions, it indicated by 66 respondents giving the most answers to choose 5–15 liters/week, while the least answer is only 7 respondents who consuming > 35 liters/week. Furthermore, the use of fuel due to congestion has increased, while based on the results of the study it was found that the increase in fuel use due the congestion is seen in the Table 5.

Based on the research data that has been shown in the Table 5, it can be seen that 49 respondents gave the most answers to choosing about a 10% fuel consumption increase when experiencing congestion. While the least number of votes was the addition of fuel

Table 3. Respondents Response to Economic Impact

No	Questions	Respondents Response			
		Totally Disagree	Disagree	Agree	Totally Agree
1	The driver loses time during the congestion and impact to being late for work so that he loses some of his income due to being late, and losing other opportunities for activities	1	8	56	50
2	Increased Expenditure for Fuel Due to Congestion.	2	5	50	57
3	Increased Expenditures for Routine Service Due to Overheated Machines caused by the Congestion.	4	10	65	36
Amount		7	23	171	143
Average		2,4	7,7	57	47,7
Percentage		2,10%	6,75%	50%	41,84%
		8,85%		91,84%	

Table 4. Fuel Expenditure (Litter)

No Congestion	Respondent
5–15 litter/week	66
16–25 litter/week	27
26 - 35 litter/week	14
> 35 litter/week	7
Amount	114

use occurred at 5% with 16 the number of respondents, the rest were not much different for the addition of 15% to 20%. Although fuel consumption is very dependent and varies on the type of vehicle used, this study only wants to see the economic impact due to congestion overall. So, the increase in fuel consumption during congestion compared to

Table 5. Fuel consumption Increase during congestion

Increase in the use of fuel when experiencing traffic jams	Respondent
5%	16
10%	49
15%	22
20%	27
Amount	114

Table 6. Fuel Consumption Estimated

Fuel Consumption	Volume			cost (Rp)/Vehicle		
	litter/week	litter/month	litter/year	Rupiah/week	Rupiah /month	Rupiah/year
Normal	15	60	720	Rp.150.000	Rp.600.000	Rp.7.200.000
increasing	= 10% x 15 = 1,5 L	6	72	Rp.15.000	Rp.60.000	Rp.720.000
Due congestion	16,5	66	792	Rp.165.000	Rp.660.000	Rp.7.920.00

* Peralite cost Rp.10.000,- /September 2022

normal conditions has been used as a reference for the occurrence of economic impacts due to congestion on road users.

From the fuel consumption and fuel consumption increase data shown before, the Increased Expenditure for Fuel Due to Congestion is estimated as shown below:

Based on Palembang Average daily traffic data in 2021 by Sumatera Selatan Central Bureau of Statistics there are 141.18 cars and 377.908 motorcycles, so the total number is 519.097. So, the total expenditure when multiplied by the number of LHR for motorized vehicles in Palembang as follows:

From the results of the calculations above, it has been seen that the economic impact of congestion on the cost of spending on fuel consumption increases. It is multiplied by the difference against the number of motorized vehicles LHR registered so the total difference in expenditure is Rp. 7,786,455,000/day, or Rp. 31,145,820,000 /week or Rp. 373,749,840,000 rupiah/year.

However, in this study, it is assumed that the number of LHR experiences an increase in fuel consumption so the expenditure value is multiplied by the total number of LHRs for motorized vehicles in Palembang. Further research and calculations are needed to specific congestion roads in Palembang. Therefore, based on the calculations that have been carried out, it can be concluded that congestion had an impact on the economy in Palembang.

Table 7. Fuel Consumption Estimated against Average daily traffic

Fuel Consumption	cost (Rp)/Vehicle			Total Cost (Rp)		
	litter/week	litter/month	litter/year	Rupiah/week	Rupiah /month	Rupiah/year
Normal	Rp.150.000	Rp.600.000	Rp.7.200.000	Rp. 77.864.550.000	Rp. 311.458.200.000	Rp. 3.737.498.400.000
increasing	Rp.15.000	Rp.60.000	Rp.720.000	Rp. 7.786.455.000	Rp. 31.145.820.000	Rp. 373.749.840.000
Due congestion	Rp.165.000	Rp.660.000	Rp.7.920.000	Rp. 85.651.005.000	Rp. 342.604.020.000	Rp. 4.111.248.240.000

Table 8. Respondents Response to Economic Impact

No	Questions	Respondent Response			
		Totally Disagree	Disagree	Agree	Totally Agree
1	the occurrence of pollution that comes out of vehicles as a result of traffic jams.	3	4	55	53
2	The Driver Is Disturbed by The Presence of Beggars and Singers Around the Congestion Location	4	14	67	32
3	Increased Noise at Congestion Locations	2	5	58	49
Amount		9	23	180	134
Average		3	7,7	60	44,7
Percentage		2,64%	6,75%	52,63%	39,21%

4.3 Environment Impact

The below shows the environmental impact due to congestion on drivers or riders in Palembang.

The congestion phenomenon not only impacted the social and economic aspects but also the environment. As for the results of the study as shown in the Table 8 it is about 91.84% of respondents agree and strongly agree that congestion has an impact on the environment by looking at several factors such as the occurrence of pollution that comes out of vehicle fumes due to congestion, drivers are disturbed by the presence of beggars and buskers in the area, and noise Increase. All these factors cause disease due to pollution and free radicals that come out of vehicle fumes on drivers and the surrounding. However, further research needs to discuss the impact of air pollution, free radicals, and noise pollution due to congestion on drivers’ health and the surrounding.

5 Conclusion

Based on the results of the analysis conducted in the Result and Discussion chapter related, it can be concluded as follows:

In this research that has been conducted on 114 respondents; it was found that the congestion in Palembang had an impact on the social impacts felt by the drivers. There are drivers experiencing fatigue caused by staying too long waiting for congestion, experiencing loss of focus and concentration in driving due to congestion, and drivers

experiencing stress due to the non-conductive traffic due to congestion. The result of this study shows that 90.61% of the responses indicate agree and strongly agree that congestion has a social impact on drivers. Further research is needed on the social impacts caused by congestion due to several factors such as different educational backgrounds, different work pressures, and different health conditions affected to stress and fatigue levels or other social impacts vary and related to other things.

This research showed the economic impact due to congestion 91.84% of responses from 114 respondents agree that the congestion in Palembang City impacted the economy and some losses to drivers by this situation. However, the measured losses are carried out by the difference in the increase of fuel wasteful consumption due to congestion in liters and rupiah. From 114 respondents, it can be concluded that the average driver in Palembang spends about 5–15 L/week under normal conditions and it is increasing by around 10% of fuel consumption after experiencing congestion. This economic impact on the difference in fuel consumption can be measured, from the calculation, the difference in fuel consumption due to congestion is Rp. 15,000/week which will become Rp. 60,000/month and Rp. 720,000/year. The difference in losses achieved due to congestion in Palembang with the total number of LHR in 2021 will be Rp. 373,749,840,000/year. As for, this loss is only seen from the fuel consumption and a comprehensive calculation of the LHR total number for cars and motorcycles in Palembang, further research is needed to see the economic loss in terms of vehicle repair costs, the cost of increased fuel consumption by type of vehicle and fuel type, cost treatment due to congestion on health and the cost of fuel consumption in specific congestion road on congestion points in Palembang.

The results of the analysis conducted on 114 respondents concluded that congestion impacted the environment, the results showed about 91.84% of respondents agreed and strongly agreed that congestion has an impact on the environment based on several factors. However, further research is needed to discuss more the impact of air pollution, free radicals, and noise pollution due to congestion on drivers and their surroundings.

References

1. Salarvandian, F., Dijst, M., Helbich, M.: Impact of traffic zones on mobility behavior in Tehran, Iran. *Journal of transport and land use* 10(1), 965-982 (2017).
2. Almatar, K. M.: Traffic congestion patterns in the urban road network: (Dammam metropolitan area). *Ain Shams Engineering Journal*, 14(3), 101886 (2022).
3. Arnott, R., Small, K.: The Economics of Traffic Congestion Rush-hour driving strategies that maximize an individual driver's convenience may contribute to overall congestion. *American scientist* 82(5), 446-455 (1994).
4. Fattah, M. A., Morshed, S. R., Kafy, A. A.: Insights into the socio-economic impacts of traffic congestion in the port and industrial areas of Chittagong city, Bangladesh. *Transportation Engineering*, 9, 100122 (2022).
5. Roth, G. J.: *An Economic Approach to Traffic Congestion*. (2014)
6. Shunfeng, S.: Lincoln Institute of Land Policy Report Part Title: Congestion Pricing on State Route 91 in Southern California, USA Report Title: Congestion Pricing: Report Subtitle: How? (2012).
7. Kikuchi, T., Hayashi, S.: S. Rajaratnam School of International Studies Report Part Title: The State of Jakarta's Traffic Congestion Report Title: Traffic Congestion In Jakarta And The Japanese Experience Of Transit-Oriented Development. (2020).

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