

The Traffic Jam Phenomenon at Traditional Village: A Case of User Perception in Batam, Indonesia

Tria Resinta¹, Andri Irfan Rifa'i²

^{1,2}Faculty of Civil Engineering and Planning, Universitas Internasional Batam, Indonesia

E-Corresponding: 2111005.triaresinta@uib.edu

ARTICLE INFO	ABSTRACT
Keywords Transportation, Congestion, Jl. Simpang Mangsang	The development of transportation is increasing day by day. Increased transportation can cause a problem, especially land transportation; the problem is traffic congestion. The road in Simpang Mangsang, Tanjung Piayu, Batam City, is clear proof of the traffic congestion caused by the problem of lousy intersection direction. This is done research related to the problems that occur. This study was conducted by distributing a 100-form questionnaire that will be responded to by motorists passing through the road. The purpose of this study is to find out the condition of the road when there is a traffic jam. The results of this study obtained an excellent average score on the importance assessment, which was 3.90. This value is the primary interest that results from the driver's response. Furthermore, it needs even better improvement and obtained the average score of the satisfaction assessment when there is a traffic jam, which is 2.18. This is a slightly weak satisfaction score due to the problem's congestion.

Introduction

The current era of development of science and technology is increasingly developing, for example, the development of the world of transportation in urban areas. Even so, the deeper the development, the more problems that may have been unthinkable before problems that are rampant. For now, the issue of congestion has worried all road riders. The problem of congestion makes transportation delayed. This serious occurrence can result in the disposal of time and fuel (Mohanty et al., 2022). The problem of congestion is becoming commonplace in Indonesia. Therefore, transportation problems and congestion problems always exist in Indonesia.

Transportation is widely used almost all over the world. Transportation can facilitate all activities. The existence of transportation is also able to solve the problem immediately. Road transport is one of the primary sources of atmospheric pollution in urban areas. The volume of emissions from road transport has increased. This is primarily due to the condition of the transport infrastructure and control system. (Mavrin et al., 2020). Highways are one of the facilities and infrastructure in transportation that have important uses. The use of transportation is that it can connect regions to support distance and mobility and also facilitate activities (Kesuma et al., 2019). The road is a critical necessity that must be maintained because the road becomes an essential foundation in life. (Isradi et al., 2022). The road in the Tanjung Piayu area, precisely intersected by Mangsang, is a road that is usually passed to go to various activities. This road is used, for example, to go to school, go to work, go to the market, and go to other public places.

Traffic congestion is an ongoing problem in large cities. Transportation is getting more and more users every day and makes traffic disrupted a lot. City dwellers widely use transportation and causes traffic

jams. Traffic congestion often spreads between road locations on urban road networks. It is causing delayed waves (Xiong et al., 2018). With so much progress in urban development, the amount of input for the creation of urban traffic roads is getting higher and higher; it is because traffic congestion in big cities is becoming more and more serious, especially during the morning and evening hours (Zhu et al., 2021).

Very severe traffic congestion can cause extra carbon emissions and reduce the efficiency of the transport network; it can also cause substantial economic losses. Therefore, traffic congestion is often said to be a problem that must be found out the cause and managed all problems (Zhou et al., 2022). also has a minus effect on traffic, eventually the emergence of various problems such as congestion, a lot of air pollution, excessive fuel use, and reduced comfort on the way (Rifai & Arifin, 2020). The existence of this traffic jam is to be a way to reduce the impact. The government must make road widening repair potholes because many potholes can cause traffic jams. Moreover, the government must increase cooperation with the communitarian to maintain traffic order (Yusuf et al., 2021). The purpose of this study is to find out the condition of the road when traffic jams occur.

Literature Review

Traffic congestion is a problem that occurs in the sustainability of transportation development. Traffic jams can cause delays, inconvenience, as well as economic losses to motorists, and give rise to air pollution. Therefore, the steps and ways of traffic congestion are essential to decide how to resolve and improve the sustainability of the transportation system. (Afrin & Yodo, 2020).

The location of traffic jams causes many researchers to want to develop related problems. The location of this study has expanded widely. Traffic congestion, especially short-term Traffic congestion predictions, are made by fixing with additional traffic. Much of the research focused on data that historically estimated traffic congestion. However, some articles predict traffic congestion directly. Traffic jams have an impact on the Quality of each one. Many feel the loss of time during rush hour, mental stress, and additional pollution to global warming are also important factors caused by traffic jams. (Akhtar & Moridpour, 2021) .

Transportation has a significant impact on human activities. Even so, transportation can also provide many adverse events in road traffic. Such a traffic jam can occur accidents. Traffic congestion in urban areas remains an ongoing problem. Congestion can remain continuous if steps are not taken appropriately (Caban, 2021).

Traffic in cities continues to grow, especially in major cities of developing countries, based on high economic and population growth. This increasingly clearly requires serious transportation of goods and passengers. The increasing demand for private vehicle ownership, which over the past few years has seen growth around the world. However, the many failures in the construction of infrastructure that are fast enough to meet this growing traffic often lead to the failure of urban transport systems, resulting in traffic congestion. (Jain et al., 2017).

Road congestion is a problem that is increasing globally. Traffic congestion has a negative impact and affects economic production and the Quality of life in various cities. (Bokaba et al., 2022). The negative impact makes that Quality very bad and is disturbed by this congestion activity. In addition, congestion can damage the environment in various cities.

Congestion is a frequent traffic problem. This problem occurs in urban areas increasingly. Traffic congestion not only brings inconvenience to travel as well as life and causes fuel consumption to

increase, wasted gas emissions, noise pollution, and severe economic losses. All problems that occur due to traffic jams can be detrimental. (Pei et al., 2021).

Traffic jams are road delays. This road delay occurs due to interchange delays due to lane collisions and causing traffic jams. (Aleko & Djahel, 2020). This problem often occurs in various regions—especially the problem of crossing. There must always be lanes colliding and making one road two-way.

Traffic congestion is a problem that affects the sustainable development of urban traffic (Mohammed Almatar, 2022). This problem is already persistent and affects various activities. Therefore, traffic jams are essential to find out the cause and what are the ways to solve them. This traffic jam resolves to make the future, especially traffic, no longer a problem.

The problem of congestion occurs due to many factors. In this world, the problem of congestion is very accustomed and often occurs in countries that are still experiencing development. Traffic congestion problems can occur caused by changing the turning direction of vehicles not considered in the previous. Also, the faster and most extended arrival of vehicles on narrow road sections caused by misestimates can undermine congestion control. (Huang et al., 2021).

A large number of vehicle owners and the increasing economic growth at its geographical level. This leads to limited traffic access and high demand for further development. Multiple vehicle activities and ownership and limited access can lead to traffic congestion. It can also affect the economy and the surrounding environment. (Busari et al., 2021).

Congestion problems can also occur due to insufficient capacity or density and unmet demand. These are interrelated, but delays are hard-coded and do not depend on the amount of traffic congestion. Finally, there needs to be a way of optimizing traffic. This is all to be controlled by making it more suitable to support traffic density. (Mandhare et al., 2018)

The problem of congestion occurs in irregular road intersections that create traffic jams. Because this problem can be financially detrimental and reduce working hours caused by traffic jams, this problem is a problem for us to find out the current and its causes. We can also look at the flow to control traffic jams. (Jayaweera, 2017).

Method

This study uses qualitative research. The qualitative method is a research procedure that produces descriptive data in the form of written or spoken words from people or observed behavior using descriptive research. Data collection techniques using interviews, observation, and documentation. Methods of data analysis of data collection, data reduction, data presentation, and conclusion drawing and data verification. The hypothesis of the problem of traffic congestion often occurs in areas with high activity intensity and land use, such as traditional villages in Batam. In addition, traffic jams occur due to high traffic volumes caused by the mixing of through traffic, regional and local traffic. If the nature of the traffic jam is a routine occurrence, the consequences will not only affect the inefficient use of resources. However, they can also disrupt activities in the existing environment. In addition, it also has a broad impact on the smooth running of the socio-economic activities of the city.

Data is one of the main strengths for preparing scientific research and modeling (Rifai, Hadiwardoyo, Correia, Pereira, & Cortez, 2015). Systematic scientific research must begin with identifying appropriate problems (Rifai, Hadiwardoyo, Correia, & Pereira, 2016). This research is carried out at the location of Jl. Simpang Mangsang which is in Tanjung Piayu, Batam City. This location is one of the highways that often occurs congestion. Congestion can be interpreted as one of the conditions that cannot run well, is disturbed, messy, stuck, and can be said to be not smooth (Andika et al., 2022).



Figure 1. The situation of traffic jam condition

Calculate using the IPA (Importance Performance Analysis) method for the continuation. IPA is data that will be processed and then produced in the location of coordinate points (Irawan, 2022). This research was conducted by distributing a questionnaire containing questions about traffic congestion. This questionnaire aims to find out what results respondents responded to—furthermore, the results of respondents who filled out the questionnaire, as many as 100 respondents.

Result And Discussion

The respondents who filled out the answers to this questionnaire were generally people living in Tanjung Piayu, Batam City. This data was collected by filling out a questionnaire form assisted by sources that the author had distributed. The following parameters are used: Power Availability, Travel safety, Travel comfort, Traffic sign availability, Ease of access to roads, Use of much fuel, Availability of traffic road control officers, Surrounding circumstances, and Accessible at high speed.

Table 1. Importance Performance Analysis (IPA)

No.	Question	Average Performance	Average Importance	Gap
1	Availability of Manpower	2.37	3.92	-1.55
2	Travel Safety	1.17	4.80	-3.63
3	Travel Comfort	1.05	4.79	-3.92
4	Availability of Traffic Signs	3.25	2.99	0.26
5	Easy Access to Roads	1.19	4.80	-3.61
6	Fuel Use	3.33	2.35	0.98
7	State of the Riders	2.26	3.82	-1.56
8	Traffic Officer Availability	4.88	3.41	1.47
9	Surrounding Conditions	1.26	4.81	-3.55
10	Easily Accessible with High Speed	1.06	3.26	-2.20
Average		2.18	3.90	-1.73

The above value was obtained from filling out a questionnaire of 100 respondents. The calculation obtained can be seen that the average value of performance obtained, 2.18, is used as (X), while the average value of importance obtained, 3.90, is used as (Y). Both results become a reference for making axis points in the IPA diagram method. Moreover, there is also an average of the gaps obtained -1,731.

In Figure 3. It can be explained from the diagram of the IPA method.

1. Quadrant A (Top Priority). In this section, there are numbers 2, 3, 5, and 9, which can be explained that the information there can be considered very important, only that it is less for motorists. This is influenced by safety, comfort, ease of traffic access, and surrounding conditions during traffic jams.

2. Quadrant C (Low Priority). In this section, there is number 10; it can be explained that the information there can be judged less necessary and unsatisfactory by the rider; this is also the part that is less assessed as useful.
3. Quadrant D (Redundant). In this quadrant, there are numbers 1, 4, 7, 6, and 8, which can be explained that the information there can be overrated for the rider.

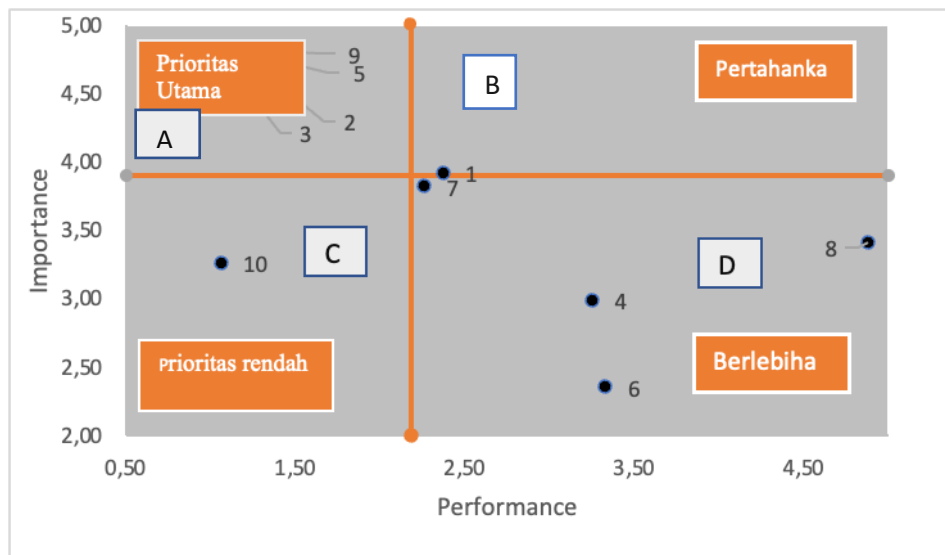


Figure 3. Diagram of Importance Performance Analysis of Congestion at Simpang Mangsang Tg.Piayu, Batam City.

The traffic jam in the center of this traditional village can be considered quite severe. From the results of an interview with one of the traffic police officers, it was found that the average speed of vehicles in the area is between 20-40 kilometers per hour. On an international scale, the speed of these vehicles is classified as a stuck category. Traffic jams that occur, not without cause. The roads in the area are wide when scaled with roads in other areas. The road has become the standard regional road lane in Batam. However, in reality, there is still a buildup of vehicles. According to observations that have been made, congestion that occurs in the area is due to the accumulation of two-wheeled and four-wheeled private vehicles.

Not entirely the cause of congestion is private vehicles. Behind the many private vehicles circulating today, there is a reason why people prefer to use private vehicles. The results of observations in the area, with the assumption that public transport users have opinions that can corroborate the data obtained from the previous police. From the informants' statements, it can be concluded that the background of the community prefers to use private vehicles rather than public transportation because 1) it takes a long time and is inefficient, 2) uncomfortable passengers, and 3) the majority of public transportation is not well maintained.

Conclusion

The results were obtained to analyze congestion in Jalan Simpang Mangsang, Tanjung Piayu, Batam City. Obtained an average score of 3.90; this figure can trigger an increase in importance in each problem and get a good importance value for the rider and obtained an average score of 2.18. This number is a slight level of satisfaction due to the congestion that occurs. Furthermore, there is an average result of a gap of -1,731. Variables in the top priority for motorists must be further improved because these things are significant to create good conditions when traveling for each rider. Such as security, comfort, ease of

traffic access, and surrounding conditions must be made the top priority in driving transportation. It is an essential foundation for motorists and the surrounding environment.

Bibliography

- Afrin, T., & Yodo, N. (2020). A survey of road traffic congestion measures towards a sustainable and resilient transportation system. *Sustainability (Switzerland)*, 12(11), 1–23. <https://doi.org/10.3390/su12114660>
- Akhtar, M., & Moridpour, S. (2021). A Review of Traffic Congestion Prediction Using Artificial Intelligence. *Journal of Advanced Transportation*, 2021. <https://doi.org/10.1155/2021/8878011>
- Aleko, D. R., & Djahel, S. (2020). An efficient adaptive traffic light control system for urban road traffic congestion reduction in smart cities. *Information (Switzerland)*, 11(2), 1–20. <https://doi.org/10.3390/info11020119>
- Andika, I., Rifai, A. I., Isradi, M., & Prasetijo, J. (2022). A Traffic Management System for Minimization of Intersection Traffic Congestion : Case Bengkong Junction , Batam. 05(05).
- Angkoso, G. S. (2021). Performance Analysis Of Roads Using The Indonesian Road Capacity Manual Method (MKJI) 1997 On The Jepara-Kudus Road Km 11 To Km 15. *Jurnal Civil Engineering Study*, 1(01), 19-25.
- Assalam, M. F., Rifai, A. I., & Taufik, M. (2022). The Effectiveness Analysis of Frontage Road on Jalan Margonda Raya, Depok. *Indonesian Journal of Multidisciplinary Science*, 1(1), 383-396.
- Bokaba, T., Doorsamy, W., & Paul, B. S. (2022). A Comparative Study of Ensemble Models for Predicting Road Traffic Congestion. *Applied Sciences (Switzerland)*, 12(3). <https://doi.org/10.3390/app12031337>
- Busari, A. , Loto, R. T., Ajayi, S. , Odunlami, O., Folake, A., Kehinde, O., & Olawuyi, O. (2021). Ameliorating Urban Traffic Congestion for Sustainable Transportation. *IOP Conference Series: Materials Science and Engineering*, 1107(1), 012102. <https://doi.org/10.1088/1757-899x/1107/1/012102>
- Caban, J. (2021). Traffic congestion level in 10 selected cities of Poland. *Scientific Journal of the Silesian University of Technology. Series Transport*, 112(February), 17–31. <https://doi.org/10.20858/sjsutst.2021.112.2>
- Gultom, D. A., Rifai, A. I., & Isradi, M. (2022). The Community Satisfaction of Transportation Facility Service: A Case of Bengkong Area, Batam. *Indonesian Journal of Multidisciplinary Science*, 1(1), 81-91.
- Hafram, S. M., & Asrib, A. R. (2022). Traffic Conditions and Characteristics: Investigation of Road Segment Performance. *International Journal of Environment, Engineering and Education*, 4(3), 108-114.
- Huang, C. J., Hu, K. W., Ho, H. Y., Xie, B. Z., Feng, C. C., & Chuang, H. W. (2021). A distributed urban traffic congestion prevention mechanism for mixed flow of human-driven and autonomous electric vehicles. *International Journal of Computational Intelligence Systems*, 14(1), 1714–1727. <https://doi.org/10.2991/IJCIS.D.210608.001>
- Irawan, B. (2022). Analysis of Higher Education Academic Service Satisfaction Levels using the Service Quality and Importance-Performance Analysis methods. *Infokum*, 10(02), 769–780.
- Isradi, M., Rachmansyah, L., Rifai, A. I., & Mufhidin, A. (2022). Analysis of Damage For Flexible and Rigid Pavement Using Pavement Condition Index (PCI) and Bina Marga Methods (Case Study : Narogong Cileungsi – Bantar Gebang Highway). *IJTI (International Journal Of Transportation And Infrastructure)*, 6(1), 30–37.
- Jain, S., Jain, S. S., & Jain, G. (2017). Traffic Congestion Modelling Based on Origin and Destination. *Procedia Engineering*, 187, 442–450. <https://doi.org/10.1016/j.proeng.2017.04.398>

- Jayaweera, I. M. L. N. (2017). Centrality Measures to Identify Traffic Congestion on Road Networks: A Case Study of Sri Lanka. *IOSR Journal of Mathematics*, 13(02), 13-19. <https://doi.org/10.9790/5728-1302011319>
- Kesuma, P. A., Rohman, M. A., & Prastyanto, C. A. (2019). Risk analysis of traffic congestion due to problem in heavy vehicles: A concept. *IOP Conference Series: Materials Science and Engineering*, 650(1). <https://doi.org/10.1088/1757-899X/650/1/012011>
- Maharani, N. A., Rifai, A. I., & Prasetijo, J. (2022). The Performance Analysis of Jalan Tengku Sulung in Botania, Batam Indonesia. *Indonesian Journal of Multidisciplinary Science*, 1(1), 129-139.
- Mandhare, P. A., Kharat, V., & Patil, C. Y. (2018). Intelligent Road Traffic Control System for Traffic Congestion A Perspective. *International Journal of Computer Sciences and Engineering*, 6(7), 908-915. <https://doi.org/10.26438/ijcse/v6i7.908915>
- Mavrin, V., Magdin, K., Shepelev, V., & Danilov, I. (2020). Reduction of environmental impact from road transport using analysis and simulation methods. *Transportation Research Procedia*, 50(2019), 451-457. <https://doi.org/10.1016/j.trpro.2020.10.053>
- Mohammed Almatar, K. (2022). Traffic congestion patterns in the urban road network: (Dammam metropolitan area). *Ain Shams Engineering Journal*, xxxx, 101886. <https://doi.org/10.1016/j.asej.2022.101886>
- Mohanty, A., Mohanty, S. K., Jena, B., Mohapatra, A. G., Rashid, A. N., Khanna, A., & Gupta, D. (2022). Identification and evaluation of the effective criteria for detection of congestion in a smart city. *IET Communications*, 16(5), 560-570. <https://doi.org/10.1049/cmu2.12344>
- Oktobrianto, A., Rifai, A. I., & Akhir, A. F. (2022). The Traffic Characteristic Analysis of Jalan Ciater Raya South Tangerang, Indonesia. *Indonesian Journal of Multidisciplinary Science*, 1(1), 437-450.
- Pei, Y., Cai, X., Li, J., Song, K., & Liu, R. (2021). Method for identifying the traffic congestion situation of the main road in cold-climate cities based on the clustering analysis algorithm. *Sustainability (Switzerland)*, 13(17). <https://doi.org/10.3390/su13179741>
- Purnama, E., Rifai, A. I., & Nasrun, N. (2022). Analysis of Road Performance Used Indonesian Highway Capacity Manual 1997: A Case Jalan KH Abdul Halim Majalengka-Indonesia. *Citizen: Jurnal Ilmiah Multidisiplin Indonesia*, 2(5), 888-895.
- Rifai, A. I. (2015). The data mining was applied for the prediction of highway roughness due to overloaded trucks. *International Journal of Technology*, 751-761.
- Rifai, A. I., & Arifin, F. (2020). Analysis of The Level of Passenger Satisfaction With Services And Transport Facilities-Based Integration in Jakarta. *Journal of World Conference (JWC)*, 2(2), 66-73. <https://doi.org/10.29138/prd.v2i2.211>
- Rifai, A. I., & Handayani, S. (2016). Pengembangan Model Interface Decision Support System Manajemen Pemeliharaan Jalan Berbasis Data Mining. *Rekayasa Sipil*, 5(1), 17-23.
- Rifai, A. I., Hadiwardoyo, S. P., Correia, A. G., & Pereira, P. A. (2016). Genetic Algorithm Applied for Optimization of Pavement Maintenance under Overload Traffic: Case Study Indonesia National Highway. *Applied Mechanics and Materials (Vol. 845)* (pp. 369-378). Trans Tech Publications Ltd.
- Vendhy, V., Rifai, A. I., & Isradi, M. (2022). The Analysis of Road Performance on Jalan Gajah Mada Batam, Indonesia. *Indonesian Journal of Multidisciplinary Science*, 1(1), 49-58.
- Wahyudi, M. A., Rifai, A. I., & Prasetijo, J. (2022). Analysis of the Effectiveness of Traffic Flow Diversion on Road Performance: A Case of Jalan Gajah Mada Development Project, Batam. *Indonesian Journal of Multidisciplinary Science*, 1(1), 92-102.
- Wincent, W., Rifai, A. I., & Isradi, M. (2022). The Road Performance Analysis in Jalan Ahmad Yani Batam Using IHCM 1997. *Indonesian Journal of Multidisciplinary Science*, 1(1), 103-116.
- Xiong, H., Vahedian, A., Zhou, X., Li, Y., & Luo, J. (2018). Predicting traffic congestion propagation patterns: A propagation graph approach. *IWCTS 2018 - Proceedings of the 11th ACM*

SIGSPATIAL International Workshop on Computational Transportation Science, 60–69.
<https://doi.org/10.1145/3283207.3283213>

Yusuf, I. M., Astuti, R. S., Kismartini, Afrizal, D., & Saputra, J. (2021). The Role of Collaborative E-Government in Surabaya Intelligent Traffic System: A Case Study of Surabaya, Indonesia. *Proceedings of the International Conference on Industrial Engineering and Operations Management*, 2472–2479.

Zhou, B., Liu, J., Cui, S., & Zhao, Y. (2022). Large-Scale Traffic Congestion Prediction based on Multimodal Fusion and Representation Mapping. <http://arxiv.org/abs/2208.11061>

Zhu, Q., Liu, Y., Liu, M., Zhang, S., Chen, G., & Meng, H. (2021). Intelligent planning and research on urban traffic congestion. *Future Internet*, 13(11), 1–17. <https://doi.org/10.3390/fi13110284>