

## Road Performance Analysis of Jalan Laksamana Bintan at Hijrah Industrial Complex, Batam

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ARTICLE INFO	ABSTRACT
<p><b>Keywords:</b></p> <p>Road performance, industrial complex, traffic volume</p>	<p><i>Jalan Lakshmana Bintan, which is precisely in front of the primary school and the Hijrah industrial complex, is currently a hot topic of conversation for the people living in the area. The intersections in front of the exit of the site are often congested. This happened because the road section shrank from 2 lanes to 1 lane when passing through the site. Intersections in the right area must be equipped with signs so they are dangerous for passing people. This research uses guidelines from MKJI 1997. Data were obtained from the volume of traffic that occurs within 1 hour from 12.00-13.00 on Saturday 12,11,2022 at Jalan Laksamana Bintan, Batam, Indonesia. From the analysis, we find out that the level of services (LOS) in Jalan Laksamana Bintan road is C, so from this research, it can be concluded that Jalan Laksamana Bintan is still relatively stable during busy vehicle times.</i></p>

### INTRODUCTION

The world's streets are also growing along with the increasing population. This is also a concern in various worlds. Therefore, technological developments in the field of road transportation need to be improved. Transportation is critical to the economy and society since a good transport infrastructure helps improve people's mobility and the flow of goods. Today, road transport safety is a primary concern (Gnap et al., 2021). Transportation is the lifeline of any country around the world for familiar reasons. Especially when road transport cases are highlighted and safety factors are observed (Jha, Tiwari, & Chatterjee, 2020). that is, road accidents or accidents, and different countries face challenges due to deaths and associated injuries apart from the loss of other resources.

Indonesia has many areas for improvement in terms of transportation between provinces, cities, and cities. Road vehicles are currently the most efficient means of passenger and freight transportation (Kuric et al., 2018). However, individual travel still has much work to address from all sectors. One of the efforts that must be made is to reduce the number of accidents that occur when passing by. Indonesia faces serious challenges in improving road traffic safety. Efforts to improve road safety have begun through roadworthiness testing. However, the results are generally accepted, and the facts on the ground show that the accident rate is still high (Tjahjono, 2016). There are many things that make the accident rate in Indonesia very high. Many things cause accidents, one of which is the community's behavior in traffic. In Indonesia, traffic accidents, especially those involving motorcyclists, are relatively high, even if there are 1 million incidents in one day (Kulsum, 2022). Of the hundreds of thousands of kilometers of roads in Indonesia, on the contrary, only 60-70% of the roads are in good condition (Muslihudin, Susanti, Maseleno, & Pringsewu, 2018).

Batam City has a population of 1,283,196 people and continues to increase until now, also directly proportional to the increase in vehicles. An increase in the number of vehicles that is not matched by the growth of road area is one of the causes of road Traffic congestion in Batam City (Andika, Rifai, Isradi, & Prasetyo, 2022). Therefore, the government needs to improve and develop sector transportation and infrastructure. Smooth transportation conditions can improve population mobility services and other

resources supporting economic growth (Darmawan, Ginting, & Umar, 2022). In this modern era, it is also undeniable that the transportation system improves human living standards and contributes to the economic growth of an area (Ashraf, Hur, Shafiq, & Park, 2019). Therefore, the development of roads in Batam has also increased very significantly. It can be seen in the construction of roads and the widening of roads everywhere. Currently, the streets in the city have extensive lanes at several points in the city center because a good road will accelerate the flow of goods and people. The road was a means of land transport is very important to social relations and economic goods and services, and with a population that is increasing every year to year, increasing the number of vehicles passing on the road that there is, therefore, in need of planning a safe way according to the function, volume, and nature of traffic (Abiansyah & Rifai, 2020). The results reveal that the perceived impact of road and transport infrastructure is positively related to community support for tourism. Tourism's perceived benefits and community satisfaction mediate this relationship (Kanwal, Rasheed, Pitafi, Pitafi, & Ren, 2020). Being blessed with good roads can improve the economy in Batam City.

Jalan Lakshmana Bintan, which is precisely in front of the basic school and the Hijrah industrial complex, is currently a hot topic of conversation for the people living in the area. Intersections in front of the exit of the area are often congested. This happened because the road section shrank from 2 lanes to 1 lane when passing through the area. Intersections in the right area need to be equipped with signs, so they are quite dangerous for passing people. The high intensity of road users also further aggravates this. Traffic jams are a common sight that can be seen in almost all major cities in Indonesia. This happens because the number of vehicles continues to grow (Karyaningsih & Rizky, 2020). Many people complain when passing through the road, especially when it is time to get off work; the road is getting denser due to the volume of vehicles passing by.

This study aimed to find out road users' opinions regarding road performance in the Panasonic Interchange area, Jalan Laksamana Bintan. It is hoped that this research can help solve problems in the area. So that people can enjoy comfortable and safe roads when driving, accident victims can be reduced, especially in urban areas such as Batam. The experience gained reveals several important deaths from accidents on urban branch roads (Demasi, Loprencipe, & Moretti, 2018). Therefore, we also urge people passing the road to be more careful. We also hope for improvements on the road soon.

### Literature Review

Road performance in the world still has a lot to improve. Many roads still need to be equipped with signs or lack street lighting. That makes road performance became unsafe for road users. Road transport safety should be one of the main concerns right now. Road accidents must be appropriately addressed so as not to cause many casualties. All countries face challenges due to deaths and associated injuries, apart from losing other resources (Jha, Tiwari, & Chatterjee, 2020). Roads are a very important land transportation infrastructure in supporting public activities to provide easy mobility and land use access. The increase in population has increased the use of land transportation. So that the capacity and performance of roads are reduced (Kurniawan & Sriharyani, 2019). Therefore, the development of transportation must also develop. Do not let road performance become unfulfilled because of the absence of developments or innovations in the field of transportation.

The current road performance is very influenced by the infrastructure available on the road. Sensor-monitored indicators generally measure road performance, and the ability of monitored indicators to reveal actual performance is generally determined by decision-makers and road users (Song, Thatcher, Li, McHugh, & Wu, 2021). One of the facilities that must exist is traffic signs. In general, the definition of traffic signs is signs, tools, or objects used to convey messages as a means of regulating road traffic. Signs

can be in the form of instructions, prohibitions, and orders. With the existing signs, it can remind the community of the regulations on the road.

Road performance can run well if, in passing, the public complies with the signs on the road. An effort to reduce the number of accidents is installing traffic signs on roads prone to injury (Kusuma, Sumarna, Mustika, & Demar, 2019). Therefore, the signs must be followed as well as possible. Because the signs on the road really help us in driving. With signs, we can discover the obstacles ahead, such as the existence of derivatives, turns, or intersections.

One common goal in different countries is to make roads safer and reduce road deaths, currently estimated by the World Health Organization (WHO) at more than 1.35 million per year (Van den Berghe, Schachner, Sgarra, & Christie, 2020). The mortality rate is very high, and it will be a task for the country of the world. Reducing traffic accidents is an increasingly important priority in many countries today (Zahran et al., 2021). Especially in Europe, the safety of vulnerable road users is a serious concern because they comprise more than half of all victims of road accidents in the European Union (Olszewski, Szagała, P., & Zielińska, 2019). Innovation in the field of transportation technology must also be balanced with safety. Because with transportation that develops but endangers users, of course, it is highly not recommended. Safety riding is the number one thing to pay attention to before innovating. Therefore, it is hoped that the innovations being implemented can reduce the driving accident rate.

Unsupportive road performance can also affect the high safety of driving. There are still many founded roads that still need to be equipped with signs or lack street lighting. Road transport safety has one of the main concerns, which is accidents on the road, and all countries face challenges due to deaths and associated injuries apart from the loss of other resources (Jha, Tiwari, & Chatterjee, 2020). Accidents can lead to loss of life and are undesirable events that can lead to lifelong injuries (Ikram & Mahajan, 2016).

Given the increasing motorization rate, driving safety has become a priority issue in developing countries (Kaateba, R., Amoh, & Gyimah, 2013). At the same time, Indonesia, which now still has a high accident rate. Even in Indonesia, land traffic accidents reached 103,645 cases in 2021. This number is up 3.62% compared to the previous year, which was 100,028 cases. This illustrates that Indonesia still needs to be ready regarding driving safety. Of course, this is not only a job for the government or aparat, but also for the public, so that they still pay attention to driving safety.

Although interdisciplinary research on traffic safety so far has revealed many possible risk factors and safety challenges in road transport (Bergland & Pedersen, 2019). There are still many people who often violate the rules that apply in traffic. For example, it is still common to find that people do not use seat belts or helmets when driving. This is the biggest factor in frequent traffic accidents. We recommend the mandatory use of seat belts in vehicles and creating new databases to collect, store and analyze information relating to road traffic accidents (Ansari, Akhdar, Mandoorah, & Moutaery, 2000).

Road transport safety is a main concern today (Gnap et al., 2021). however, driving comfort is no less important than driving safety. Driving comfort can allow road users to enjoy the benefits of the road itself. One of the things that affects the comfort of driving is good roads. Good and smooth roads will make the trip faster and more efficient. Road surface roughness is an important indicator for evaluating the quality of service and pavement performance.

Driving comfort is also influenced by the environment around the road. Changes in environmental conditions have been felt to make comfort in activities many people complain, especially regarding environmental temperatures that continue to increase every year (Sazali, Zulpa, Kusuma, & Pane, 2019). Because of the increase in temperature, it is necessary to tree trees around the road area so that the

road remains shady and comfortable to walk. In addition, residents should maintain road trees adjacent to their neighborhoods as they can increase benefits in urban green spaces (Marshall, Grose, & Williams, 2019). In addition to being comfortable, planting trees also makes the air cooler and makes more oxygen.

Driving comfort can also be seen from the supporting facilities. What we often encounter, for example, is the bus stop. The existing conventional bus transport system is difficult to meet the increasing travel needs of the people (Wang, Ye, Zhu, & Gu, 2022). There are still many bus stops in Indonesia that can be said to need to be fixed. Because providing the right bus stop can make public transportation users more comfortable, users of general transportation, if set up correctly, will make the transportation users comfortable. In addition, being able to stay and return home can be on time if the bus stop is equipped with an organized schedule.

Comfort must also be considered at airports, ports, and train stations. The airport has grown into a significant business hub in the last four decades, serving a variety of business models in addition to providing transportation infrastructure (Bakır, Özdemir, Akan, & Atalık, 2022). It is hoped that the many developments and development of cranes can make the community comfortable. In addition to a comfortable infrastructure, it also needs to be improved in other services—comfort when driving can also be seen from the vehicles on the road. Vehicles on the road must be suitable for use; there are still many vehicles that are not suitable for use. Even in some countries, it is rigorous to crack down on vehicles that are not suitable for use. One of them is Romania. Uniquely in this country, dirty vehicles found on the road will be subject to fines. It is hoped that more and more regulations will make road users more comfortable driving.

## Method

Data is one of the main strengths in compiling scientific research and modeling (Rifai, Hadiwardoyo, Correia, Pereira, & Cortez, 2015). The systematic scientific research process must begin with identifying the right (Rifai, Hadiwardoyo, Correia, & Pereira, 2016). The method uses a cumulative method; this time, the study will be carried out on the road of the Jalan Laksamana Bintan, precisely in front of the primary school and industrial hijra, which will be carried out during the day when returning from work on Saturdays at 12.00-13.00, the study uses how to calculate passing vehicles in intervals of 15 minutes per 1 hour of observation or commonly called peak hour factor (PHV). This research will be converted into a table to find out the results.

This research uses guidelines from MKJI 1997, which defines urban roads as roads with permanent and continuous development along all or almost all the roads, at least on one side of the road (MKJI 1997).



Figure 1. Research Location on Jalan Laksamana Bintan

A road is a 2-lane road divided into (2/2 D). Data obtained using the emoji 1997 guide listed in the table above, the volume of traffic that occurs within 1 hour from 12.00-13.00 on Saturday 12,11,2022 on Jalan Laksamana Bintan, Batam, Indonesia. The research location can be seen in Figure 1 and Figure 2 below.



Figure 2. Road situation

## Result and Discussion

The data used in this study consisted of primary data and secondary data. The primary data used includes road geometric data and the amount of traffic flow. The secondary data is in the form of data on the number of motorized vehicles in the Batam area. The geometric road in Jalan Laksamana Bintan is a 2-lane undivided road (2/2 UD).

In road volume analysis, we can find out by measuring passing vehicles on that road (LV) we must measure the light vehicle, (HV) heavy vehicle, (MC) motorcycle, and (UM) non-motorized vehicles so that we can find the (Q) volume of that road. Therefore, data on the traffic flow is obtained by conducting a survey calculating the number of vehicles passing through this road section. The survey was conducted for two days, from 06.00 – 18.00, on Monday and Saturday. From the survey results of traffic volume during peak hours that occurred can be seen in Table 1.

Table 1. Data analysis

Time	Vehicle	Number	Q
12.00-12.15	LV	426	426
	HV	5	6
	MC	410	102.5
	UM	0	0
	TOTAL	841	528.5
12.15-12.30	LV	428	428
	HV	1	1.2
	MC	433	108.25
	UM	0	0
	TOTAL	862	537.45
12.30-12.45	LV	428	428
	HV	1	1.2
	MC	390	97.5
	UM	0	0
	TOTAL	819	526.7
12.45-13.00	LV	361	361

	HV	1	1,2
	MC	484	121
	UM	0	0
	TOTAL	846	483.2
TOTAL		3368	2075.85

The capacity of a road segment is the maximum amount of traffic that can pass through that road segment per unit of time. On divided roads, capacity calculations are carried out per direction. The capacity determination contained in Form UR-3 of the MKJI can be seen in Table 1. The highest traffic volume (Q) is 12.15-12.30,  $Q = 537.45$  pcu/hour.

From the results of observations in the field that have been carried out, the conditions of land use on the sides of the road are in the form of shopping centers and culinary centers. The class of side resistance for urban roads that suit these conditions is included in the class of medium side resistance.

Road capacity We can find out by using the guide of MJKI 1997,  $C =$  capacity,  $CO =$  base capacity  $FCw =$  Traffic lane width adjustment factor  $FCsp =$  direction splitting adjustment factor,  $FCsf =$  side resistance adjustment factor, and  $FCcs =$  city size adjustment factor.

$$C = CO \times FCw \times FCsp \times FCsf \times FCcs$$

$$C = 2900 \times 1.00 \times 1.00 \times 0.98 \times 1.00$$

$$C = 2,842 \text{ SMP / hour}$$

$$DS = Q/C$$

$$DS = 2075.85 / 2842 = 0.73$$

Level of Services obtained C from a reference from US-HCM 1985 because the number of degrees of saturation was 0.73, which received a value of C.

## Conclusion

The Jalan Laksanama Bintan is a road type with 2-lane undivided road (2/2 UD)—the highest traffic volume of 537.45 pcu/hour. Q total is 2075.85 pcu/hour, and the road capacity obtained was 2,842 pcu/hour. The degree saturation is 0.73, so the level of services is C. From this research, it can be concluded that Laksamana Bintan Road, Batam, Indonesia is still relatively stable during busy vehicle times.

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