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Traffic Flow and Simulation at the Jalan Kebudayaan 28 (Junction of Jalan Pendidikan – Jalan Kebudayaan) in Skudai, Johor

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Abstract: The increase in populations in Skudai, Johor Bahru causing an increase in the number of vehicles which lead to traffic congestion. There is congestion issue at Jalan Kebudayaan 28 (Junction of Jalan Pendidikan – Jalan Kebudayaan) in Skudai. This study aims to evaluate the traffic parameter such as traffic volume, traffic density and traffic speed at the selected area and simulate traffic flow at the case study location based on the data obtained by using VISSIM Software (student version 2021). The manual count method was used in collecting data for 3 days with 3 sessions at a particular time. The obtained data were used to simulate the traffic flow by using VISSIM Software to determine the LOS in every session including before and after mitigation action was proposed. LOS F was obtained in every session before appropriate mitigation strategies have been proposed. To improve the delay of service and traffic movement, the appropriate design traffic signal timing at the intersection is proposed with the combination between the law of enforcement and enlarge lane shows a positive result which obtained above LOS C which is considered as acceptable vehicle delay.

Keywords: Traffic Congestion, Level Of Service, VISSIM, Traffic Flow, Johor Bahru

1. Introduction

Traffic congestion is important externality created by road users which is mostly happened due to the slow-moving of vehicles travel because there is too much traffic on the road. Traffic congestion produces a lot of bad impacts not only for individuals but also on property and society. It was found that traffic congestion produced an increased travel of time that can cause a cost increase to road users in terms of economic loss and reduced quality of life and mobility [1].

Traffic Congestion are not only occur in city centres but also can occur in outskirt of cities such as Taman Universiti in Skudai, Johor. There is a need to understand the factor of congested happened and have to find out how to control the severity. Physical parameters such as volume was the main

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importance of a particular route with respect to the other routes, the distribution of traffic on road and fluctuation inflow followed by speed of vehicles [2].

1.1 Problem and Objective

Jalan Kebudayaan 28 was selected due to the location provide two public buildings that are very popular among the citizen. The best part is that the location only provide one-way lane and along the roadside between those two buildings and, there is only several parking provided. Instead of that, Jalan Kebudayaan 28 is located in a residential area, which means that the lane was designed based on the common housing road designed. Supposedly before the construction of those public building was held, the road between those buildings must be redesigned to avoid problem happened which contributes to traffic congestion. Instead of those public buildings that causing the traffic congested, actually that road also is also used by parents who lived nearby to fetch their kids from school since at the end of the Jalan Kebudayaan 28 there is a primary school. This is also can cause the traffic congestion at the location of study.

This study was done in order to improve the traffic condition in the case study location. Therefore the following objectives have been developed to achieve the aim which are to evaluate the traffic parameter such as traffic volume, traffic density and traffic speed at the study location. Secondly, simulate traffic flow of study location based on the data obtained by using VISSIM Software (student version 2021) and recommend a proper mitigation action to reduce or control traffic congestions at a particular location also using VISSIM Software.

1.2 Scope of study

The scope of this study are more on research, observations, collecting data, analyzed data and design available traffic flow of the study area to overcome the traffic congestion problem. Manual handling was used to conduct this study instead of using laboratory equipment. Video cameras and handphones were used in order to collect the data. Traffic parameter flow of the vehicles were determined based on peak hours chosen.VISSIM Software as used to approach a suitable traffic design to overcome the traffic congestion at Jalan Kebudayaan 28.

2. Literature Review

Traffic congestion is a condition of the transport movement in a certain location and time. There are two types of traffic congestion which are recurring and non–recurring [3]. A common impact of the traffic congestion that can be seen including air quality due to extra vehicles at a certain location, personal satisfaction that caused by the delay that took too much time and felt tired as soon as arrived the destination and for the business activities that can cause late to work and late delivery to the client. Instead of bad impact, traffic congestion also produces a good impact at a certain location [4].

Traffic parameters help to detect any variation in flow characteristic by obtaining the information regarding the natural traffic flow. The parameter can be classified into two types which are the measurement of quantitative and measurement of qualitative [5]. The quantitative measure is using for modelling while for the qualitative measure is using for evaluation. Level of services (LOS) is used to relate the traffic service quality to a given flow rate of traffic.

After the level of service at the selected location was determine, it continues with proposed the suitable traffic modelling. Where traffic modelling is used to plan and manage the traffic within certain road networks such as lowering the traffic congestion and smooth the traffic at an intersection [6]. There are several traffic modelling software that already used in the market such as VISSIM Traffic Software, Sidra Intersection Software and Paramics Microsimulation. The application of each model and select the right model according to finding the solution for the traffic problem and aim of the study to be conducted.

There are several mitigation actions that can be used to reduce traffic congestion such as expanding roadway capacity, use CCTV to monitor road conditions and enforce existing road traffic laws if the road user obey the instructions that already put along the roadside [7].

3. Methodology

The methodology of this study illustrates a brief overview of the overall process and workflow involved in the study.

3.1 Case Study Location

This study location (Figure 1) was chosen because the area is severely congested in the morning and evening due to many visitors and patients go to Klinik Kesihatan Taman University since that area just has one government health clinic for the community who live nearby and also students who frequently go to the public library that opposite of the clinic building. The objective of this study can be achieved such as reduce congestion by designing and coordinating road movement system at that area and delays since the study location was lack in the parking area and controlling the signal light system.

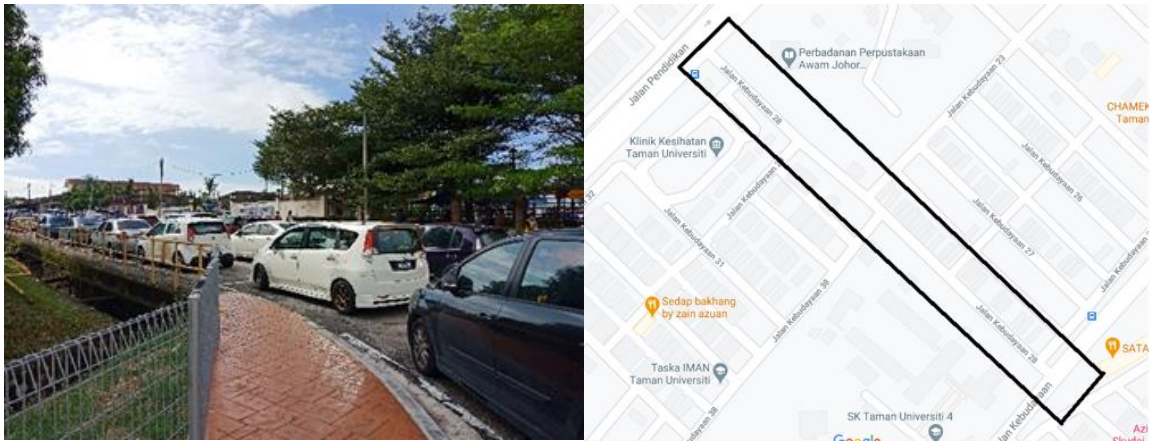

Figure 1: Case Study Location

3.2 Equipment

For this study, the manual count method more particular since it just requires small samples of data at the selected location and manual counts are usually used for a period of less than one day. Other than that, automatic equipment is not available due to expensive in terms of manpower and inappropriate (Figure 2).

Figure 2: Research Equipment

3.3 Data Collection Process

Data wias collected on 3 working days with 3 sessions per day which were was between 7.00 a.m to 9.00 a.m, 1.00 p.m to 3.00 p.m and 5.00 p.m to 7.00 p.m. Every vehicle was counted manuallying and recorded in form. This form is made according to the class of vehicles passing through at the intersection. It was divided into four classes which are:

- Class 1: Motorcycles
- Class 2: Cars
- Class 3: Vans and Medium Trucks
- Class 4: Heavy vehicles

3.4 Traffic Simulation Procedure

The speed and volume of vehicles that were obtained from the data were key in using VISSIM Software. The case study location must be determined and design the lane by using links at the provided network objects.

Select the data based on the interval time such as 7.00 a.m to 9.00 a.m that the vehicle's mean speed was tabulated. The data can be assigned as stochastic value or exact values for accuracy and the vehicles will start the journey on the network by selecting the vehicle routing decision [6].

Since the major problems of traffic congestion happened at the case study location was illegal parking and double parking. Instead of that, vehicle classes also provided to noticed the only available vehicles that used to parking at that area since not all of the vehicles are available to park at the case study location.

In order to add the new links, highway or road, the adding symbol object was provided in the software. The proposed links can be determined either it was necessary or not by selecting and run the procedure sequence then the error will occur if the proposed links is not suitable.

4. Results and Discussion

Method of data analysis is performed by using Microsoft Excel and VISSIM Software. This chapter was discussed the volume of vehicles on peak hours based on the selected day and time.

4.1 Traffic Volume Assessment

The data was analyzed to identify the trend of traffic volume for 3 sessions which are in the morning, afternoon and evening.

Based on the bar chart in Figure 3 for the overall results, shows that the morning session was the most congested than the other session which is afternoon and evening since about 38% around 303 people (1st day), 35% around 237 people (2nd day) and 36% around 244 people (3rd day) used that road in order to go work or other matters. The most number of vehicles used at that location in every session was the car as the same in the first and second day since car was the most convenient vehicle than the other type of vehicles including the safety and body size to go through the congested area [7]. While the least number of vehicles that can be seen at that location was heavy vehicles especially in the evening.

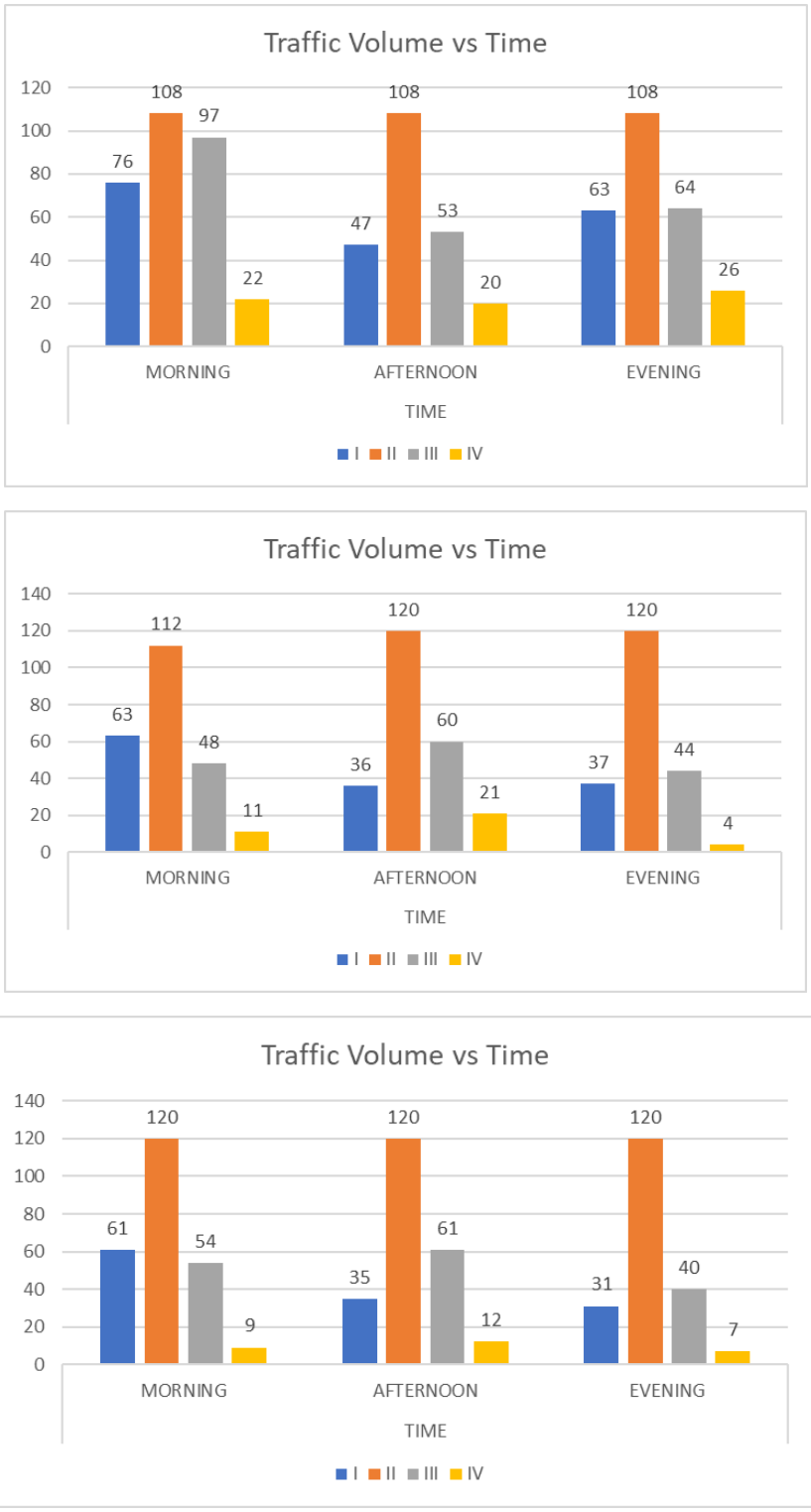

Figure 3: Traffic Volume for 3 days

4.2 Simulation of Traffic Flow and Level of Service

VISSIM Software was used in order to identify the level of service at that area and the vehicle delay in 3 sessions based on the data obtained during the observation (Figure 4).

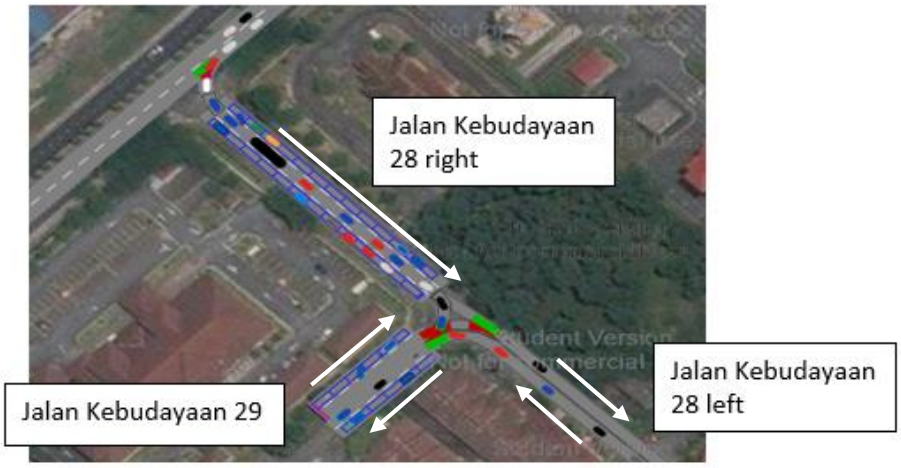

Figure 4: Example of Simulation Model

Table 1: Overall result of LOS for 3 sessions

Simulation	LOS Results
Morning	From Jalan Kebudayaan 29 — F, F, E, F — From Jalan Pendidikan — From Jalan Kebudayaan
Afternoon	From Jalan Kebudayaan 29 — C, F, E, F — From Jalan Pendidikan — From Jalan Kebudayaan
Evening	From Jalan Kebudayaan 29 — C, E, E, F — From Jalan Pendidikan — From Jalan Kebudayaan

Based on the Table 1, it shows that traffic volume from Jalan Pendidikan constantly at LOS F in every session due to the problem of not enough space which one lane one way. Adding illegal parking at that area and Jalan Kebudayaan 29 made that location as the most congested area at Skudai, Johor. Based on the observation, the mean speed on every session and class can be classified as 15km/hr which is the 3rd traffic speed level.

4.3 Suggestion of Mitigation Action to Control Traffic Congestions

Mitigation action that including in order to control the traffic congestion at the specific location such as the law of enforcement to prevent the illegal parking along the roadside of Jalan Kebudayaan

28 and enlarge lane by adding the new lane at specific area due to limited road space as in Figure 5. Both mitigation actions that was proposed will be upgrade using VISSIM Software. Roundabout was added in order to avoid the blind spot between Jalan Kebudayaan 29 and 28 in every mitigation action that was proposed.

Figure 5: Example of Simulation Model for Mitigation Action

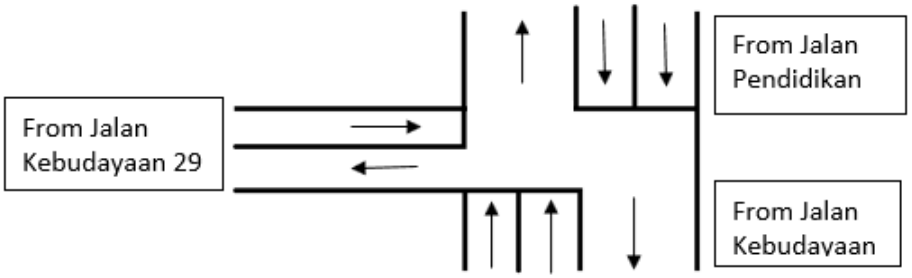

Figure 6: Before the Enlarge Lane

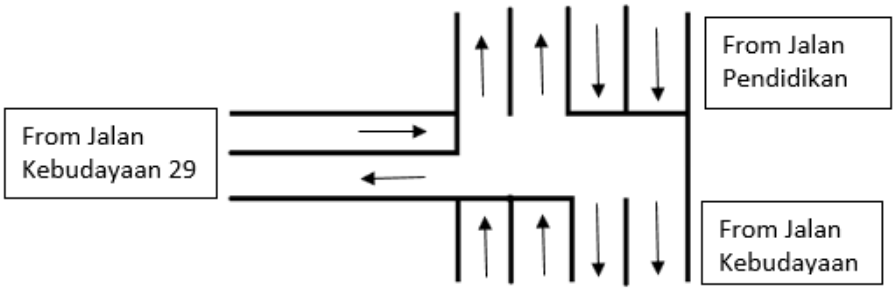

Figure 7: After Enlarge Lane

Unbalance road design can be the main reason cut queue between road user happened in that area. Cut queue made the lane getting crowded beside the illegal parking made the flow vehicle decreased [7]. Expanding the roadway is a simple response to the problems that will not only traffic congestion can be reduced but time travel of road users also can be reduced as in Figure 6 and 7.

Table 2: Overall result of LOS for 3 mitigation action

Count	Movement	Level of Service for mitigation action		
		Law Enforcement Action	Enlarge Lane	Combination
1	Jalan Kebudayaan 29 enter Jalan Kebudayaan	B	B	B
2	Jalan Kebudayaan 29 enter Jalan Pendidikan	A	A	A
3	Jalan Kebudayaan 28 right enter Jalan Kebudayaan 29	A	A	C
4	Jalan Kebudayaan 28 left enter Jalan Pendidikan	D	D	A
5	Jalan Kebudayaan 28 left enter Jalan Kebudayaan 29	D	D	B
6	Jalan Kebudayaan 28 right enter Jalan Kebudayaan	C	C	A

Based on the results in Table 2, mitigation proposed which is law enforcement and enlarge lane shows the same results which is the level of service shows positivity where it was above D that can be categorized as tolerable delay than before the mitigation was proposed which in LOS F. While the combination of both mitigation action shows that LOS above C that can be described as an acceptable delay.

Jalan Kebudayaan 28 can be announced as stable traffic flow with a medium degree of freedom speed and operating conditions but there is still significant interactions and influences with other users in-front of Klinik Kesihatan and public library. The speed of transport can return to normal speed based on vehicle class. Even it may costly on handling the mitigation action but it still gives a benefit to the society and the economic since it for long term effects.

5. Conclusion

The evaluation of traffic parameter such as traffic volume, traffic density and traffic speed has been conducted by doing fieldwork such as capturing traffic flow for three days Sunday, Monday and Tuesday and three sessions at peak hour that is in the morning, at afternoon and in the evening. From this study, it was found that the maximum number of vehicles was in the morning at 7.00 a.m to 9.00 a.m with 789 vehicles and on Monday with 793 vehicles. While the minimum number of vehicles was in the evening at 5.00 p.m to 7.00 p.m with 664 vehicles and on Sunday with 676 vehicles.

Simulation of traffic flow of the case study location based on the data obtained by using VISSIM Software. The results of the analysis found that the LOS varies in every session which is LOS F. Morning session the most critical delay which between 53-68 seconds at LOS F from every direction except from Jalan Kebudayaan 29. Other than that, the movement of the vehicle can be seen in 3D mode and the mistake can be noticed immediately.

After all the analysis has been done, the recommended of suitable mitigation action in control traffic congestion has been done using the VISSIM Software to obtain the best LOS corresponding to the volume of the vehicle at peak hour and the mean speed obtain. Moreover, modifications to road design

has been made to facilitate the movement of vehicles at Jalan Kebudayaan 28 with having roundabout and two way. Law of enforcement and enlarge lane was selected as mitigation action that shows an improvement the level of services from F to C at the case study location by using VISSIM Software. The speed of transport returns to normal speed based on vehicle class.

The recommendations are aimed at improving road and future studies such as improvement physical field work at study location, make allowed vehicles sign that can enter Jalan Kebudayaan 28 and make allowed speed limit sign.

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