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Fixed Traffic and Intersection Simulation in Front of UTHM Pagoh

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Abstract

In Malaysia, traffic congestion is a common problem that often occur during rush hours that leading to adverse social, economic, and environmental issues. Pagoh Higher Education Hub, the place which boasts four esteemed educational institutions UTHM, UTM, Politeknik Tun Syed Nassir and UIA is also not spared from experiencing traffic congestion which might happen due to high traffic volume along the road itself especially at Persiaran Sarjana (In front of UTHM Pagoh main gate). Therefore, this study was conducted to determine the speed and traffic volume at the Persiaran Sarjana at Pagoh town in working days and non-working days, to develop traffic simulation of the case study location using PTV-VISSIM students' version 2023 to analyse the Level of Service (LOS) to reduce or control the congestion issues at the Persiaran Sarjana during the peak hour in the morning, afternoon and evening. After conducting the experiment, this study has collected all the data for optimization. The level of service of Persiaran Sarjana – UTHM intersection during working and non-working days is LOS D and LOS B, respectively. These results provide valuable insights for developing effective traffic management plans and infrastructure improvements to address congestion in the area, which could be implemented by relevant authorities such as JKR (Public Works Department) or Sime Darby.

1. Introduction

Traffic congestion is a phenomenon that happens as road usage increases, characterized by slower speeds, longer travel times and increased queuing [1]. As studied by [2], traffic congestion as the additional travel time or delays that occur beyond what is typically experienced under light or free-flowing conditions [3]. Traffic congestion occurs when the number of vehicles on a road networks exceeds its capacity [4]. Congestion is often exacerbated by factors such as accidents, adverse weather, and road construction [5].

To determine the traffic congestion, the Level of Service concept as adopted in Highway Capacity Manual 2000 (HCM) with represent a range of operating conditions. In HCM 2000, the Level of Service (LOS) of a facility assessed based on the traffic flow characteristics such as vehicle density, volume-to-capacity ratio, average speed, and intersection delay. These characteristics all vary depending on the type of facility. The LOS is then divided into 6 discrete classes ranging from A to F [6].

Persiaran Sarjana (in front of UTHM Pagoh main gate) was selected as the study location due to its critical role as the main intersection connecting the UTHM campus and residential college. It serves as a focal point for

students and staff, and its connection to Panchor town contributes to increased traffic volume. Congestion is particularly pronounced during peak hours. Previous studies have shown that traffic congestion can significantly impact economic growth, environmental quality, and public health [7].

Therefore, the following objective have been developed to analyse the traffic congestion at the study location. The first objective is to determine the traffic volume and speed at Persiaran Sarjana (In front of UTHM Pagoh main gate). This data will be used to develop traffic simulation of the case study location using PTV-VISSIM software and to propose an analysis to determine the Level of Service (LOS) for further research.

2. Research Methodology

The case study region that has been selected is at Persiaran Sarjana (In front of UTHM Edu Hub Pagoh main gate) as shown in Fig. 1 (a) and Fig. 1 (b) below**.** This four-lane road connecting Pagoh town and Panchor town which also leads to Bukit Gambir and Tangkak making the road congested with vehicles.

(a)

(b)

Fig. 1 *Side view of the study case(a); Plan view of the study case (b)*

Because the location of road is nearby the industrial area of Pagoh, Persiaran Sarjana was aimed on increasing of the vehicle volume over day and will be going more crowded and congestion problem will keep increasing. According to [3], there are two methods for collecting traffic volume data which is manual [3]. Manual method of traffic count was used in this study in order to collect the traffic volume data as shown in Fig. 2. Speed of the vehicle at the study location also will be conduct using manual method via pneumatic road tube method as shown in Fig. 2, scenario of spot speed manual data collection. The vehicle speed will take randomly at a selected study location.

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Fig. 2 *Count camera for traffic count method*

The volume of the vehicle at the Persiaran Sarjana are taken in 12 hours interval. The time of collection will start on the morning (07:30) until evening (19:30). Once the data is collected and simulated from the PTV-VISSIM software, total intersection delays will be translated from the Highway Capacity Manual (HCM) to a letter grade Level of Service (LOS). PTV-VISSIM Students' Version 2023 is used in this study, and it is a time step and behaviour-based simulation model developed to model urban traffic and public transport operations and flows of pedestrians as shown in Fig. 3. The mitigation action was identified and listed for the further study and adapted to the case study location at Persiaran Sarjana (in front of UTHM Edu Hub Pagoh) at Pagoh Town.

Fig. 3 Simulation model in PTV-VISSIM software

3. Result dan Discussion

Based on the objective of the study which is to assess the physical parameter of traffic at Persiaran Sarjana at Pagoh town such as traffic volume and speed had been completed, as part of typical data analysis, the following steps can be taken into consideration.

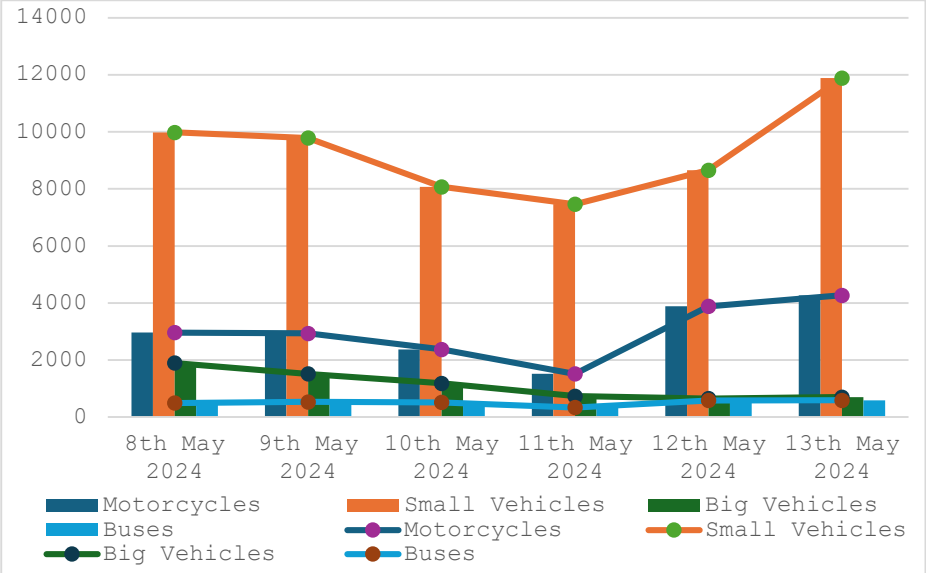
From the field observation consisting of traffic volume studies that had been done for six days which Monday, Wednesday, Thursday as weekdays and Friday, Saturday, Sunday as weekends. The data of the vehicle volume in 12 hours are analysed to achieve the first objective. The vehicle class are present based on the following classes, class 1 for motorcycle, class 2 for small vehicles such as cars, small lorries (with 2 axles), class 3 for vans, large lorries, heavy vehicles (with 3 axles and more) and class 4 for buses. Figure 4.1 show the distribution of the number of vehicles passing through Persiaran Sarjana from 8^{th} to 13^{th} May 2024.

According to Fig 4 (a), the graph illustrates the traffic volume for different vehicle types from May 2024 to May 2024. The traffic volume data reveal distinct patterns between working and non-working days. In the graph, small vehicles consistently dominate the traffic across all days, with a noticeable peak on working days, especially on the May 2024 reaching the highest volume of 11885. This indicates that small vehicles are the most common type on the roads. Motorcycles also shows a higher volume on working days than non-working days, suggesting the prominent use for commuting. In contrast, motorcycle numbers drop sharply on non-working days, with the lowest on the May 2024.

Big vehicles exhibit a gradual decline from the to the May, then increase again on the and , with the highest count on the May and the lowest on the May. This trend may reflect reduced commercial activities on non-working days. For buses, while maintaining a relatively low volume compared to other vehicle types, show slight fluctuations with the highest count on the May and the lowest on the May. Overall, the traffic volume for all vehicle types is generally higher on working days, highlighting the increased movement and activity during this period.

According to Figure 4 (b), the graph illustrates the frequency distribution curve for different vehicle types over the period from 8^th to 13^th May 2024. From the graph, the speed range (80-90) km/h from 10^th to 12^th May 2024 has more than the other three days 20 times. From the predictions, in non-working day, as traffic volume has more less than working day, the traffic speed will be increase. The predictions also can be used in Figure 4 (c).

Average speed is defined as the total distance travelled by the object in a particular time interval. During the analysis, it was found that the average speed of the vehicles was 76 km/h. The majority of vehicles travelled between 70-90 km/h, which higher than current speed limit in Persiaran Sarjana, which is 60 km/h. The study also calculated the percentile speed, which was found to be average 78.33 km/h, indicating that 85% of the vehicles were travelling at or below this speed. Additional descriptive statistics showed that the media speed was average 68.5km/h.



(a)

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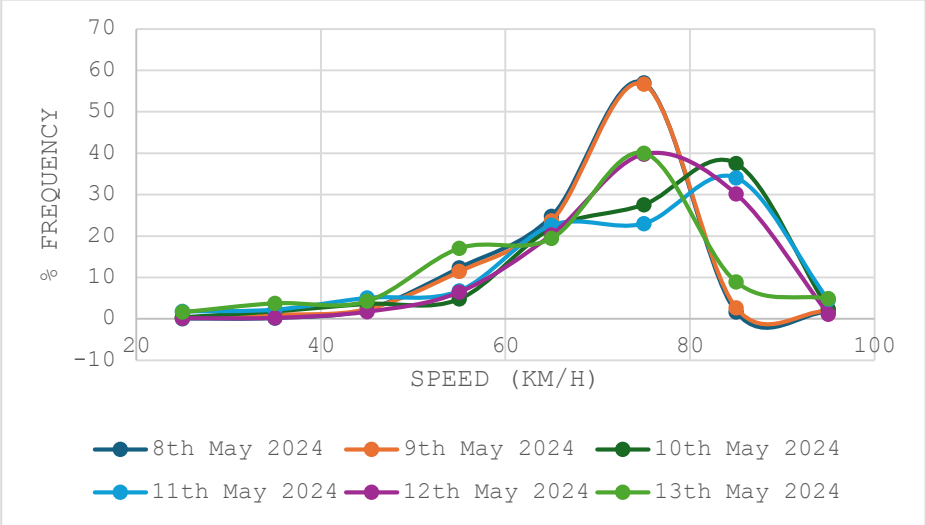
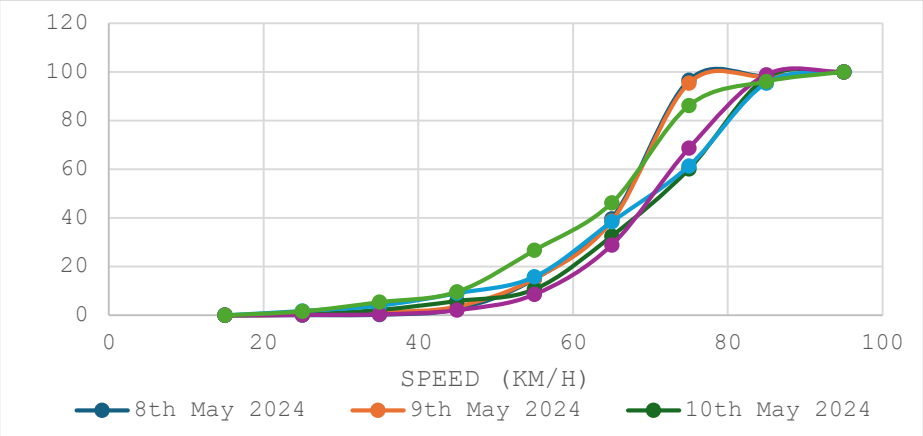


(b)



(c)

Fig. 4 Line chart of Persiaran Sarjana average traffic volume in 8^thMay 2024 to 13^thMay 2024 (a); Frequency Distribution of Persiaran Sarjana from 8^thMay 2024 to 13^thMay 2024 (b) ; Cumulative Frequency Distribution of Persiaran Sarjana from 8^thMay 2024 to 13^thMay 2024 (c)

4. Conclusion

This study has fulfilled the objectives of the study to identify the current situation of the traffic system on the overpass bridge between the University Tun Hussein Onn Campus, Pagoh and UTHM Student Residence College, Pagoh (KKKP). PTV-VISSIM is microscopic multi-model traffic flow simulation software for analysing and optimizing traffic flows and facilitating complex multimodal analysis. PTV-VISSIM has its own advantage in simulation software for analysing and optimizing traffic flows and facilitating complex multimodal analysis.

In this study, the traffic density that passes through the study area is collected. The types of vehicles were classified as motorcycles, small vehicles, large vehicles, and buses. To calculate the average traffic density/day, traffic volume data was collected over six days with 12-hours video each day, capturing three weekdays and three weekends. The results shows that the traffic volume on weekdays is higher than the traffic volume in weekends. On weekdays, traffic volume peaked around 9th May 2024, reaching approximately 12,000 vehicles. Weekend traffic volume appeared to be lower, with a peak of around 8,000 vehicles on 11th May 2024. This is because weekdays likely see a surge in traffic due to students, faculty, and staff commuting to and from the university campus. This influx of vehicles is absent on weekends, leading to a significant decrease in traffic volume.

In conclusion, due to various factors, weekdays tend to be more accident-prone than weekends. Increase traffic congestion during school drop-off and pick-up times the traffic volumes around will increase widely, which means that the increased of congestion level can lead to frustration and potentially causing accidents. Other than that, the presence of teenagers could also be factor during after-school time on weekdays. The contributes of less experienced drivers can contribute to a high percentage of accidents.

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Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

This journal requires that all authors take public responsibility for the content of the work submitted for review. The contributions of all authors must be described in the following manner:

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Goo Jun Hong, Seah Xiang Feng, Faiz Fahmi Bin Adnan, Nor Farah Atiqah Binti Ahmad;* ***data collection:*** *Goo Jun Hong, Seah Xiang Feng, Faiz Fahmi Bin Adnan;* ***analysis and interpretation of results:*** *Goo Jun Hong, Seah Xiang Feng, Faiz Fahmi Bin Adnan;* ***draft manuscript preparation:*** *Goo Jun Hong, Seah Xiang Feng, Faiz Fahmi Bin Adnan, Nor Farah Atiqah Binti Ahmad. All authors reviewed the results and approved the final version of the manuscript.*

References

[1] R. Chen, Y. Lin, H. Yan, J. Liu, Y. Liu and Y Li, "*Scaling law of real traffic jams under varying travel demand*," EPJ Data Science, vol. 1, no. 13, December 2024.
[2] S.T.T. Lomax, S. Turner, G. Shunk, H.S. Levinson, R.H. Pra, P.N. Bay and G.B. Douglas, "*Quantifying congestion, Transportation Research Board*, vol. 1, no. 108, 1997.
[3] M.A. Miller and K. Li, "*An Investigation Of The Costs Of Roadway Traffic Congestion: A Preparatory Step For IVHS Benefit's Evaluation,"* California Partners for Advanced Transportation Technology Journal, vol. 21-3, December 1989.
[4] A.M. Rao and K.R. Rao, "*Identification of traffic congestion on urban arterials for heterogeneous traffic*," Transport Problems, vol. 11, no. 3, pp. 131-142, 2016.
[5] M. Treiber and A. Kesting, "*Traffic flow dynamics. Traffic Flow Dynamics: Data, Models and Simulation*," Springer-Verlag Berlin Heidelberg, vol. 227, November 2013.
[6] H.C. Manual, "Highway capacity manual," Washington, DC, vol. 2, no. 1, 2000.
[7] H. Clarke & A. Hawkins, "Economic framework for Melbourne traffic planning. Agenda: A Journal of Policy Analysis and Reform, vol.1, no. 63-80, January, 2006. [Online serial]. Available: https://www.jstor.org/stable/43199367. [Accessed September 15, 2024].