

Analysis of Road Network Performance in Universitas Islam Negeri Raden Intan Area using Microsimulation PTV VISSIM

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Article Information	ABSTRACT
Article History Received : September 19, 2025 Revised : October 15, 2025 Published : October 26, 2025	The road network in the area of the Raden Intan State Islamic University in Lampung often experiences congestion due to heavy traffic, resulting in a decline in road performance. The objective of this study is to analyze existing performance, implement improvement scenarios, and evaluate the impact of improvement scenarios. A descriptive quantitative method was used, involving field surveys covering traffic volume, vehicle speed, and side obstacles. Traffic simulation modeling was conducted using PTV VISSIM software, calibrated by adjusting microscopic traffic parameters and validated through GEH and MAPE tests, ensuring the modeling results accurately represent actual traffic conditions on-site. The results showed the performance of the existing road network, with an average speed of 25.13 km/h, an average queue length of 16.3 m, and an average delay of 73.84 seconds. Three improvement scenarios were conducted using a one-way system and the use of the right lane. All three improvement scenarios showed improvements, with the most significant improvement using scenario 1, which had an average speed of 26.69 km/h, an average queue length of 2.18 m, and an average delay time of 10.13 seconds.
Keywords: <i>Road Network; VISSIM; GEH; Performance; One-way.</i>	

INTRODUCTION

Bandar Lampung is a city located in Lampung Province with 169,2 km² area, which concludes it as the biggest city in the specific province. According to Indonesia Central Bureau of Statistics (2023), the total population in Bandar Lampung city is 1.100.109 people. As well as any developing cities, Bandar Lampung is developing physically and economically. Its developing is in line with the need of infrastructures, such as housing, road network, schools and universities, and so on. The specific situation causes land use switching, for instance conservation area to developed area, particularly to housing area (Yuniasa et al., 2023). The switching land use causes the change of movement pattern, which impacts to the increase of traffic in several road network covered by the land use switching. If this condition is intact, the traffic becomes congested. Since road is the vital infrastructure (Udiana et al., 2014), the congested needs to be managed to generate the better traffic.

Congested area, such as UIN Raden Intan Lampung that located in Bandar Lampung city, has a specific characteristic of land use switching by students activities (Fernanda et al., 2021) who contribute to the increase of mobility in the area, particularly on Jalan Letnan Kolonel H. Endri Suratmin, Jalan Prof. Dr. Hamka, and Jalan Pulau Sebesi. The traffic in this area is influenced by the activity of the students of Institut Teknologi Sumatera, which is nearby. The critical point of

The analysis of road network traffic can be conducted by simulation, such as using PTV VISSIM. The specific software is a discrete-time-based traffic microsimulation that is developed by PTV Group. The software can simulate the traffic behaviour in the specific road network. Furthermore, the performance of each road can be analysed in detail with several constraints, such as vehicles interaction, traffic signals, and scenarios in of traffic planning and management (Irenita et al., 2022; Juwita, 2021; Karunia et al., 2021; Senna et al., 2020). VISSIM is commonly used by researchers and traffic engineers to evaluate level of service, delay, queue length and scenarios effectiveness of road infrastructures improvement and management (Romadhona et al., 2019). Thus, this study aims to analyse the road network performance of the area of UIN Raden Intan Lampung comprehensively using PTV VISSIM microsimulation approach which generate a network with its traffic that needs to be calibrated by traffic behaviour and validated by traffic volume and speed.

The study of road network performance in the area of UIN Raden Intan Lampung is conducted using quantitative and descriptive approaches to analyse related issues through theoretical and mathematical approaches. In order to conduct the study, data collection is carried by traffic counting at several location within the network. The counting is conducted on Monday at 16.30-18.00 (Arianto, 2023) with 5 minutes interval at 29 locations within the road network. The locations are showed on Figure 1. The survei needed 52 persons as traffic counters and 2 cameras to help the counters.

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All data is analysed using Microsoft Excel and PTV VISSIM following this specific steps:

1. Traffic data, which is obtained by traffic counting, then is processed and simplified using Microsoft Excel
2. The processed data is analysed using microscopic simulation on VISSIM to evaluate the performance of the existing road network. Before the model is obtained to the next management process, the model is constructed by several parameters, including:
 - a. Background map: adjusting the location map and road geometry according to the data
 - b. Road Network: constructing link as the representative of road
 - c. Connector: added to connect road sections at intersections
 - d. Vehicle Routes, Types, Volume, and Speed: determining traffic flow on model based on collected data
 - e. Calibration: adjusting the driving behaviour of the simulation to the real condition. The calibration is finished by confirming the output of the model through GEH and MAPE value (Ahmad et al., 2023; Faizurrahim, 2025; Nindita, 2021; Rizqiah et al., 2021).

RESULTS AND DISCUSSION

Geometric Data of Road Network

Tabel 1. Geometric Data of Roads

Road Name	Numb. Of Segment	Traffic Direction	Segment Width (metre)
Jalan Letkol H. Endro Suratmin	ES 1	West to East	3,3
		East to West	3,2
	ES 2	West to East	3,3
		East to West	3,8
	ES 3	West to East	3,5
		East to West	3,8
	ES 4	West to East	3,8
		East to West	4
	ES 5	West to East	3,5
		East to West	4
	ES 6	West to East	3,6
		East to West	3,7
	ES 7	West to East	3,4
		East to West	3,8
	ES 8	West to East	3,5
		East to West	3,9
Jalan Pulau Sebesi	PS 1	West to East	3,4
		East to West	3
	PS 2	West to East	3,3
		East to West	3,3
	PS 3	West to East	3
		East to West	3
	PS 4	West to East	3
		East to West	3
	PS 5	West to East	3,1
		East to West	2,8
Jalan Pulau Bawean	PS 6	West to East	2,8
		East to West	2,9
	PB 1	South to North	2,1
		North to South	2,1

Road Name	Numb. Of Segment	Traffic Direction	Segment Width (metre)
Jalan Pandawa Raya	PB 2	South to North	1,9
		North to South	1,9
Jalan Pulau Pisang	PR	South to North	2,5
		North to South	2,5
Stasiun Pengisian Bahan Bakar Umum	PP	South to North	3,2
		North to South	2,9
Gerbang <i>Ball Room</i> UIN RIL	SPBU	South to North	10
		North to South	15,7
Jalan Nusa Jaya	GBR	South to North	4,6
		North to South	4,6
Gerbang Masuk 2 UIN RIL	NJ	South to North	2,6
		North to South	2,6
Gerbang <i>Sport Center</i> UIN RIL	GM2	North to South	4,7
		South to North	4
Gerbang Dinas PU	GSC	North to South	3,7
		South to North	2,9
Gerbang Belakang	PUPR	South to North	2,9
		North to South	2,9
Jalan H. Madang	GB	North to South	3,4
		South to North	2,1
Jalan Prof. Dr. Hamka	HM	North to South	2,2
		South to North	4,1
	PDH	South to North	4,1
		North to South	4,2

Traffic Volume Data

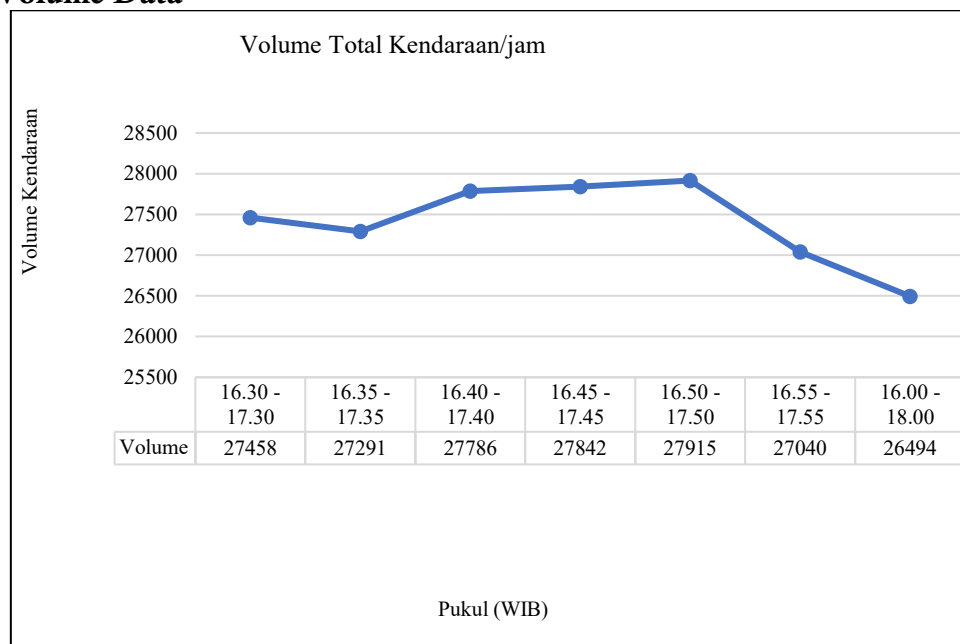


Figure 2. Traffic Volume

Vehicles Speed Data

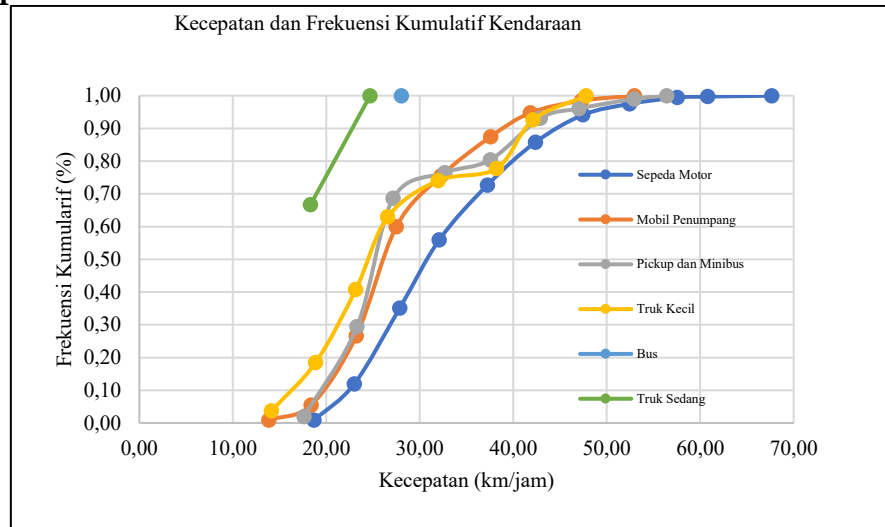


Figure 3. Speed Data

Tabel 2. Space-Mean Speed

Ruas Jalan	All Vehicle	MC	PC	Pick-Up	Minibus	Small Truck	Bus	Medium Truck
Jalan Endro Suratmin B-T	24.0	26.2	24.3	24.0	24.0	21.7		
Jalan Endro Suratmin T-B	26.2	28.7	26.3	25.5	25.5	25.0		
Jalan Pulau Sebesi B-T	40.3	42.9	37.2	43.3	43.3	34.9		
Jalan Pulau Sebesi T-B	33.0	39.8	31.6	31.1	31.1	31.5		
Jalan Prof. Dr. Hamka S-U	25.2	32.8	25.6	26.6	26.6	19.2	28.0	17.5
Jalan Prof. Dr. Hamka U-S	26.8	31.7	27.7	28.7	28.7	22.5		21.5

Side Frictions Data

Tabel 3. Side Frictions Data

Road Name	PK 0.5	KB 1	K K/M 0.7	KBL 0.4	Occurrence Value
Jalan Letkol. H. Endro Suratmin	327	92	1127	97	1084
Jalan Pulau Sebesi	159	63	1283	59	1066
Jalan Prof. Dr. Hamka	9	5	0	4	12

Notes: PK: Pedestrian, KB: Stop Vehicles, KK/M: Entering-Exiting Vehicles, KBL: Slow Vehicles

Existing Analysis

Traffic simulation of UIN Raden Intan Road Network is conducted using PTV VISSIM. The output of the model is traffic volume, speed, queue length, and delay time. In order to collect the output from the model, data collection points, vehicle travel time and queue counters are put on the network, similar position as the surveyor of the survey location.

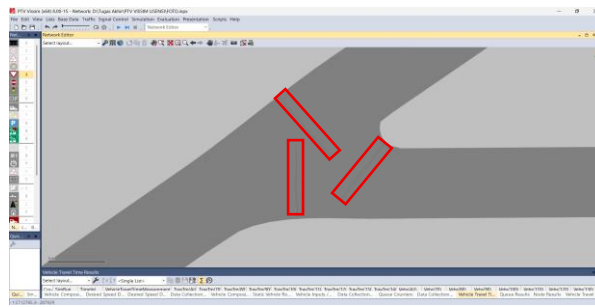


Figure 4. DCP

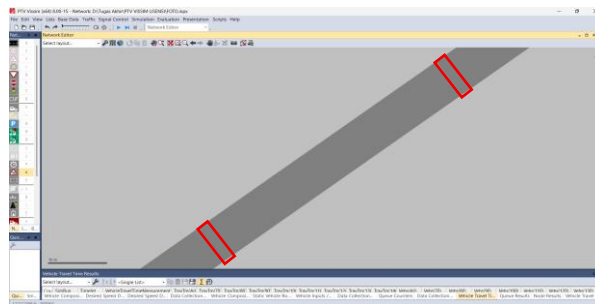


Figure 5. VTT

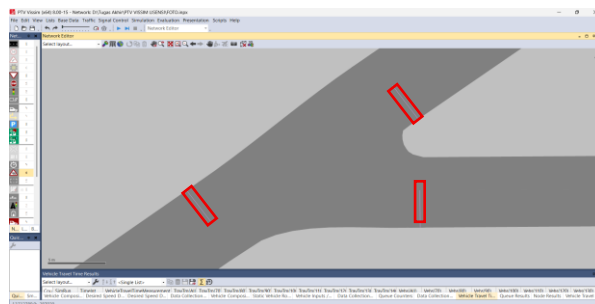


Figure 6. QC

The default setting of VISSIM needs to be calibrated by adjusting driving behaviour until it is matched to the traffic of the road network. The calibration process is conducted iteratively until the simulation matched the real condition. The calibration of driving behaviour parameters is shown on Table 4.

Tabel 4. Driving Parameters Calibration

Parameter Kalibrasi	Kondisi	
	Default	Kalibrasi
Parameter Following		
- Car following model type	Wiedeman 99	Wiedeman 74
- Look ahead distance minimum	0 m	0 m
- Look ahead distance maximum	250 m	200 m
- Observed vehicle	4 kendaraan	8 kendaraan
- Look back distance minimum	0 m	15 m
- Look back distance maximum	150 m	100 m
- Smooth closeup behaviour	✓	✓
- Average standstill distance	2 m	0,2 m
- Additive part of safety distance	2 m	0,3 m

Parameter Kalibrasi	Kondisi	
	Default	Kalibrasi
- Multiplicative part of safety distance	3 m	0,4 m
Parameter Lane Change		
- General behaviour	Free Lane Selection	Free Lane Selection
- Overtake reduce speed areas	-	✓
- Waiting time before diffusion	60 detik	180 detik
- Minimum headway	0,5 m	0,3 m
- Safety distance reduction factor	0,6 m	0,6 m
Parameter Lateral		
- Desired position at free flow	Middle	Any
- Consider next turning direction	-	✓
- Overtake left	-	✓
- Overtake right	-	✓
- Minimum distance standing	0,2 m	0,2 m
- Minimum distance driving	1 m	0,3 m

After the model is calibrated, the simulation is validated by 2 tests which are GEH and MAPE. The results are shown on Table 5. The model is valid if the value of $GEH < 5$ and $MAPE < 50\%$ (Romadhona et al., 2019), therefore the model is reliable to be used for further analysis.

Tabel 5. Space-Mean Speed

Test	Volume	Speed
GEH	2.61	0.49
MAPE	0.12%	1.43%

Network Improvement Scenarios Analysis

The improvement scenario is applying one-way traffic to several segments of the network, which are Segment 2-7 of Jalan Letkol. H. Endro Suratmin and Segment 1-5 of Jalan Pulau Sebesi. Then, scenario is illustrated on Figure 7. The implementation of the scenario to the network aims to decrease the number of conflict points, specifically at intersections, which are dominated on the network (Susilo & Imanuel, 2018). Since the area of the network is commercial and populated area, hence the management of traffic direction is quite suitable (Senna et al., 2020).

The result of the scenario simulation shows that the number of congested and conflicted points are reduced, furthermore the vehicle speed increases, the delay time and queue length decrease. The results of the improvement are proven by presented data on Figure 8-10.

The implementation of one-way system to several segment contributes to the change of volume distribution in the network. There are several significant escalations of volume, such as the volume on Jalan Prof. Dr. Hamka (N-S) increases to 4019 vehicles/hour. Oppositely, the volume of access link to Ball Room UIN Raden Intan decreases to 97 vehicles/hour. The trend showed that the scenario significantly and substantially impacted the traffic patterns in the network.

The change of the traffic pattern through this simulation scenario could improve 6.21% the speed averagely, from 25.13 km/h to 26.69 km/h. The improvement could be seen specifically on segments that the condition of traffic is poor on the former simulation. Furthermore, the increase of speed contributes to the decrease of conflict points which make the traffic smoother (Susilo & Imanuel, 2018). However, the positive impact is not on every observed conflict-points (Figure 9).

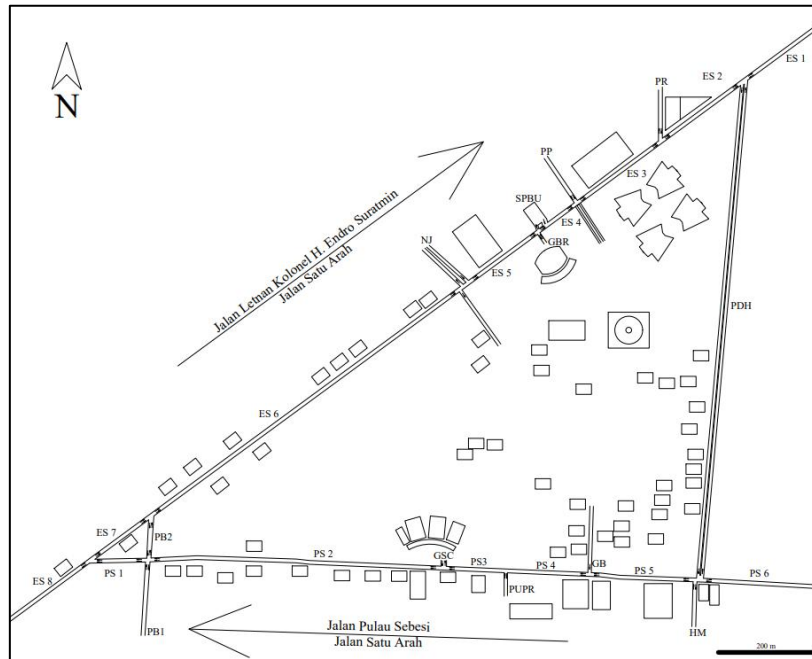


Figure 7. Traffic Management Scenario

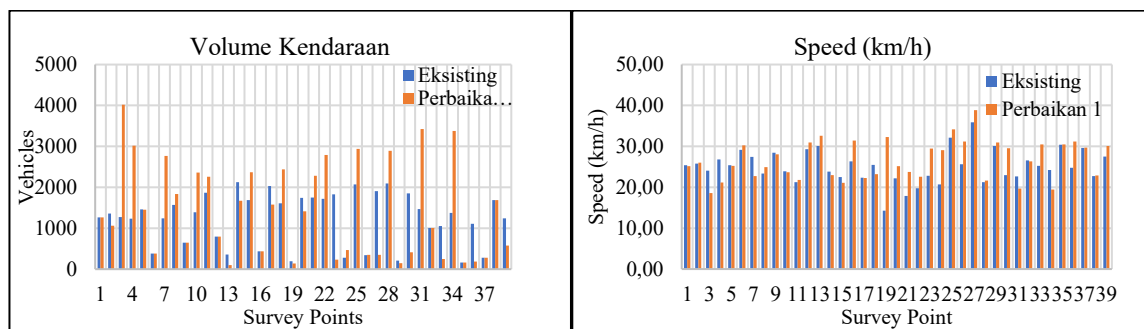


Figure 8. Traffic Volume and Speed Simulation

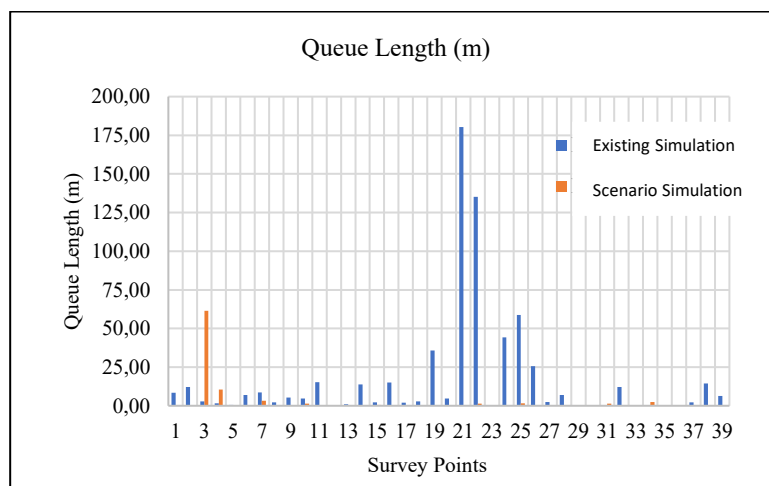


Figure 9. Queue Length

As well as the traffic distribution and the speed increase, the parameters of queue length and delay time are also improved. The queue length decreased significantly 86,6%, with the average of queue length 16.3 m on the existing condition to 2.18 m on scenario simulation. The most decrease is on Segment 8 of Jalan Letkol. Endro Suratmin from 180.39 m to 0.01 m. The

phenomenon occurs because there are conflict points elimination through the scenario. Furthermore, the delay is also decrease significantly 86,3%, with the average of delay 73.84 seconds on the existing condition to 10.13 seconds on the scenario simulation.

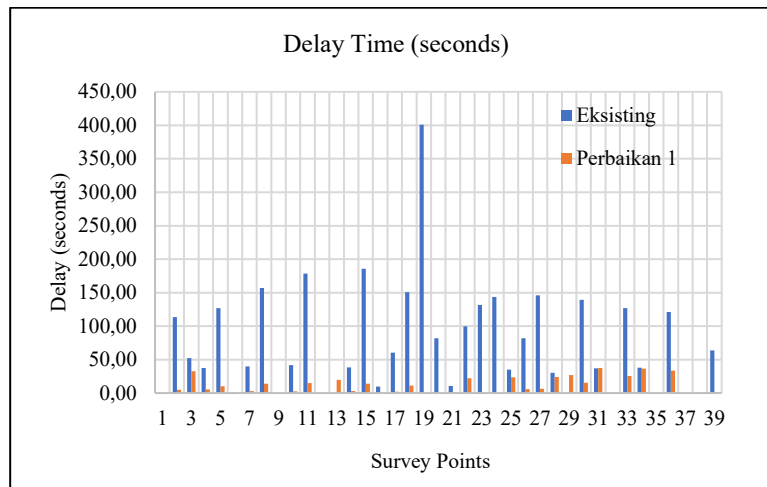


Figure 10. Delay Time

CONCLUSION

The traffic condition of UIN Raden Intan Lampung Road Network showed the most congested road is on Jalan Letkol. H. Endro Suratmin and Jalan Pulau Sebesi, while the traffic on Jalan Prof. Dr. Hamka runs relatively smooth. The poorest segmen is on Jalan Letkol. H. Endro Suratmin, Jalan Pulau Sebesi and Jalan Pulau Bawean. The improvement scenario of one-way system to Jalan Letkol Endro Suratmin and Jalan Pulau Sebesi of the network successfully enhances the efficiency of the overall traffic. The improvement scenario also contributes to the change of traffic pattern which shown by lesser queue length and delay time compare to the existing.

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