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A Study of One-Way Road Implementation To Improve Performance In The City of Pagar Alam

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Abstract: This study aims to improve the traffic performance of Major Ruslan Street in Pagar Alam City by implementing a one-way system. The context of this research is the congestion problem caused by secondary obstacles such as illegal, unscheduled loading and unloading and the presence of street vendors that reduce the effective width of the road. This research focuses on the Major Ruslan Road section, which is part of the Central Business District (CBD) area of Pagar Alam City. This study used the VISSIM analysis method to simulate traffic conditions before and after implementing the one-way system. The data was collected through field surveys, including speed, parking, and pedestrian volume surveys. The results show that implementing a one-way system can increase traffic, reduce traffic congestion, and improve road service. In conclusion, implementing effective structured traffic management, such as the one-way system, can be an essential solution to overcome traffic problems in urban areas, especially in Mayor Ruslan Street. This research recommends that the Government of Pagar Alam consider implementing a one-way system as part of more traffic management efforts to improve travel convenience and efficiency.

Keyword: One-Way Street, Performance, Vissim Analysis Method

INTRODUCTION

Transportation is vital in supporting a region's economic, social, and cultural development (Karim & Lesmini, 2023). Providing effective and efficient transportation is becoming increasingly important with increased community activities. One-way System (SSA) is one traffic management system that creates one-way roads on several interconnected roads to surround an area (Stevia & Elda, 2023). With the One Direction System (SSA), vehicle conflicts at intersections are expected to be reduced so that the movement of traffic flows becomes smoother (Nugraha, 2023).

Pagar Alam City, located in the south, is one of the areas experiencing rapid development, both in terms of population and economic activities. As a tourist center with great potential, Pagar Alam is the destination of many tourists and international travelers. In

addition to this, the city is also a traffic route for vehicles from various regions, such as Palembang, Lampung, and Bengkulu. This causes a significant increase in volume in the city. One area highlighted in the transportation management in the city of Pagar Alam is the section of Jalan Mayor Ruslan. This area is part of the city's central business district, which is the center of various social and transportation activities. This section of Major Ruslan Road is the main route for private vehicles and freight companies that distribute various goods to nearby traders and markets.

However, the high activity in this area needs to be improved due to adequate traffic management, causing traffic problems such as traffic congestion, parking, and high side obstacles. Based on data obtained from field surveys, the capacity of the Major Ruslan Road Section was recorded at 1861.97 SMP/hour, with traffic volumes reaching 867.4 SMP/hour. The volume-to-capacity ratio (V/C ratio) obtained is 0.47, which indicates that this road is in a non-optimal condition. The average speed of vehicles crossing this road only reached 22 km/h, with the road's service level at level C, indicating a significant decline in road performance. The problems encountered in Jalan Walikota Ruslan require effective traffic management. One of the proposed solutions is implementing a one-way system on the road. Implementing a one-way system reduces side obstacles caused by illegal parking and unplanned loading and unloading activities, increases travel speed, and improves road safety levels.

In addition, space rearrangement and restrictions on loading time are also part of the traffic management strategy to overcome the existing problems. This study aims to determine the traffic performance of Jalan Walikota Ruslan before and after the implementation of a single system and provide recommendations that might improve the road.

The method used in this research is traffic analysis using VISSIM software.

Simulations were conducted to simulate the existing conditions and several scenarios of one-way system implementation. The results will be analyzed to see changes in average vehicle speed, traffic volume, and road service level after the one-way system is implemented.

The theory underlying this research is the concept of traffic management and engineering, which aims to optimize the utilization of the road network to improve security, safety, order, and smooth transportation. According to the Law of the Republic of Indonesia, Number 22 of 2009, concerning Road Traffic and Transportation, traffic engineering is an effort to regulate traffic movements efficiently to reduce congestion and improve road performance (Risdiyanto, 2014). In addition (GOVERNMENT REGULATION OF THE REPUBLIC OF INDONESIA NUMBER 32 OF 2011, 2011), Traffic Management and Engineering is also the legal basis for the implementation of traffic management strategies, such as the implementation of one-way systems and efficient parking arrangements.

Research (Greenshields, 1935) explains how vehicles move on roads and how traffic flow is affected by various factors such as speed, density, and traffic volume.

The operational definitions used in this study include several essential concepts, such as side barriers, V/C ratio, and road level of service. Side barriers refer to any activity around the road that can disrupt the smooth traffic flow, such as illegal parking and unscheduled loading and unloading activities. The V/C ratio is a crucial indicator in assessing road performance, calculated by comparing traffic volume to road capacity. Road level of service is a qualitative measure that describes the condition of traffic flow based on travel speed, comfort, and ease of movement (Priyambodo, 2015). This research collects data through field surveys, which include direct measurement of traffic volume, vehicle speed, and obstacles on Jalan Walikota Ruslan. The data obtained was then processed and analyzed using VISSIM software to evaluate road performance in existing conditions and after implementing the one-way system.

The results of this research are expected to make a real contribution to efforts to improve traffic conditions in Pagar Alam city and become a reference for local governments in policy formulation. More effective and efficient circulation. This research should also provide new knowledge in traffic management and engineering, as well as in applying one-way systems in dense urban areas.

This study will use data and simulation approaches to provide a more accurate picture of the various traffic management scenarios' on-road performance.

The results obtained are expected to be used as a reference for further research aimed at developing innovative solutions in dealing with traffic problems in major cities in Indonesia. The references used in this research include various sources of relevant literature and regulations, such as Law No. 22 of 2009 on Road Traffic and Transportation, Government Regulation No. 32 of 2011 on Traffic Management and Engineering, as well as various other related studies that provide a theoretical and methodological foundation for this research (Arisandi, 2020). Thus, this research not only answers the specific problems faced on Major Ruslan Road but also contributes to developing traffic management and engineering science.

METHOD

This research uses descriptive quantitative research with a case study approach. This case study focused on evaluating traffic performance on Major Ruslan Road, Pagar Alam City, with the implementation of a one-way system as an effort to improve traffic performance. This research aims to identify problems, analyze traffic performance before and after implementing the one-way system, and provide recommendations for solutions based on the analysis conducted.

This study's population included all vehicles and road users traveling on Major Ruslan Road during the study period. Because the population was huge, this study used a simple random sampling technique with specific observation times on weekdays and weekends. The samples taken are data on traffic volume, vehicle speed, and road service level at certain times representing critical conditions.

This research was conducted for two weeks, collecting data on weekdays and weekends. The research site was Major Ruslan Road in Pagar Alam City, one of the dense business centers (CBD). Data was collected at peak activity times to get an accurate picture of traffic conditions at the location.

This study used speed-measuring devices, automatic traffic counters, and road geometry maps. In addition, VISSIM traffic simulation software was used to analyze and model road performance based on data obtained from the field.

The research procedure began with primary and secondary data collection. Primary data was obtained through field surveys that included direct measurements of traffic volume, vehicle speed, and side obstacles on the Major Ruslan Road Section. Secondary data was obtained from relevant agencies such as the Department of Transportation and the Regional Development Planning Agency (BAPPEDA) of Pagar Alam City, which included road network maps, demographic data, and historical traffic data.

After the data is collected, the next step is to collect it using VISSIM software. Simulations were conducted to evaluate traffic performance under existing conditions and one-way system implementation scenarios. The simulation results are then analyzed for changes in traffic performance, such as changes in average speed, traffic volume, and road service level.

The data collected was analyzed using a quantitative approach. The analysis included calculating the volume/capacity ratio, average, and level of service. In addition, benchmarking techniques were utilized for traffic performance before and after implementing the one-way system. The analysis results were used to draw conclusions and provide recommendations regarding the management of Jalan Walikota Ruslan.

This research also takes into account external factors such as weather conditions, the economy, and local activities that may affect the research results. In addition, the validation of simulation results involves comparing actual data with simulation results to ensure the accuracy and reliability of the research.

This research is expected to make a real contribution to traffic management in Pagar Alam City, significantly improving road performance by implementing an effective one-way system.

Table 1. Research Stage

Step	Description	Output
Problem Identification	Identification of traffic problems in Pagar Alam. Research objectives to improve traffic performance	Explanation of traffic problems. - Research objectives.
Literature Review	Review studies and theories related to the implementation of one-way streets in other cities. Review basic traffic management theories and principles.	Summary of previous studies. - Relevant theory.
Study Design	Determine the research method: case study, data analysis, survey, or simulation. Identify the data needed.	Research methodology plan. List of required data.
Data Collection	Data collection in the form of secondary data and primary data obtained.	Primary data in the form of Section and Intersection geometric data, Section and Intersection Volume Data, Speed Data, Parking Data, Pedestrian Data and Secondary data in the form of Land Use Maps, Road Network Maps, Pagar Alam City Administration Maps, 2022 Pagar Alam City PKL Data.
Data Analysis	The collected data was processed using VISSIM software	Then the research results from VISSIM were validated.
Conclusions and Recommendations	Draw conclusions on the effectiveness of the one-way street system. Provide recommendations for further development.	The results of the analysis are used to draw conclusions and provide recommendations regarding the management of Jalan Walikota Ruslan.

RESULTS AND DISCUSSION

This study's data obtained through field analysis and VISSIM software show that implementing one-way streets on Major Ruslan Street in Pagar Alam significantly improves traffic performance. The following are the results of the data analysis, along with interpretations that answer the previously formulated problems.

1. Existing Condition Data

Before implementing the one-way system, several main factors affected traffic performance in Jalan Walikota Ruslan. Based on the survey, the road capacity was recorded at 1861.97 SMP/hr, with the volume reaching 867.4 SMP/hr. The volume/capacity ratio value is 0.47, which indicates that this lane is close to saturation. The average speed of vehicles crossing this road is 22 km/h, with a road service level of C.

Table 2. Existing condition of Major Ruslan road

No.	Street Name	Road Length (m)	Capacity (smp/hr)
1	Major Ruslan Street 1	160	1861,97
2	Major Ruslan Street 2	450	1861,97
3	Major Ruslan Street 3	600	1861,97
4	Major Ruslan Street 4	339	1861,97
5	Trip Yunus Road	300	2867,87
6	Jalan Koprul Abdullah	200	1344,67
7	Jalan Lettu Syarif	107	1256,98
8	Lt. A. Rahman Street	604	1344,67
9	Jalan Lieutenant Muda Nur Majais	700	1905,30
10	Jalan Pratu Bahmin	600	1198,51
11	Jalan Lettu Hamid 1	450	1905,30
12	Jalan Lettu Hamid 2	120	1905,30

Source: 2023 Survey Results

This shows that the traffic on this road section has experienced a significant decline in performance. This is due to various secondary factors such as illegal parking, unscheduled loading and unloading of goods, and trade activities on the road section.

2. Performance Analysis After Implementation of One-Way System

After implementing the one-way system, the traffic performance in Jalan Mayor was analyzed using VISSIM software. The simulation results showed a significant improvement in traffic performance compared to the existing conditions. In the first scenario, when the arranged on-street parking and loading and unloading times were adhered to, the average speed of vehicles increased by 28 km/h, the level of service B. The V/C ratio also decreased, indicating a decrease in congestion.

Table 3. Road network performance Scenario I

No.	Road Segment	Segment Type	V/C Ratio	LOS	Density (SMP/Km)	Speed (km/h)
1	Major Ruslan Street 1	2/2 UD	0,33	B	22,95	28
2	Major Ruslan Street 2	2/1 UD	0,40	B	30,43	25
3	Major Ruslan Street 3	2/2 UD	0,36	B	29,87	24
4	Major Ruslan Street 4	2/2 UD	0,22	B	9,63	42

5	Trip Yunus Road	2/2 UD	0,26	B	22,78	35
6	Jalan Kopral Abdullah	2/1 UD	0,48	C	33,71	14
7	Jalan Lettu Syarif	2/2 UD	0,27	B	10,30	38
8	Lt. A. Rahman Street	2/2 UD	0,30	B	13,93	33
9	Jalan Lieutenant Muda Nur Majais	2/2 UD	0,26	B	14,64	34
10	Jalan Pratu Bahmin	2/2 UD	0,08	A	1,76	58
11	Jalan Lettu Hamid 1	2/1 UD	0,30	B	24,72	30
12	Jalan Lettu Hamid 2	2/1 UD	0,23	B	10,33	42

Source: Analysis Results

In the second scenario, where the implementation of the one-way system was combined with the optimization of traffic management, the average vehicle speed increased further to 31.75 km/hour. The road level of service reached level B, with the average vehicle delay reduced to 18.64 seconds or a 51% reduction. This shows that implementing a one-way system, accompanied by good traffic management, can significantly reduce congestion and improve the efficiency of traffic movements on Major Ruslan Road.

Table 4. Road network performance Scenario II

No.	Parameters	Performance
1	Average Delay (seconds)	18,64
2	Network Speed (km/h)	31,75
3	Total Trip Distance (kend/km)	9,23
4	Total Travel Time (kend/hr)	258,31

Source: Analysis Results

3. Interpretation of Results

Based on the data analysis results, the implementation of the one-way system on Major Ruslan Road has a significant positive impact on improving traffic performance. The increase in average vehicle speed and the decrease in V/C ratio values indicate that the one-way system has successfully reduced traffic congestion, which was previously one of the leading causes of congestion in the area.

In addition, parking rearrangements and scheduling of loading and unloading times have proven effective in reducing side obstacles, which have been a significant factor in reducing road performance. By reducing these obstacles, road space can be utilized more optimally, increasing travel speed and user comfort.

In a broader context, this research demonstrates that data-driven and simulation-based traffic management and engineering approaches can effectively solve urban traffic problems. Local governments can also use the results to formulate effective and efficient traffic policies, especially in big cities with similar traffic problems.

Overall, implementing a one-door system on Ruslan Mayor Street in Pagar Alam significantly improved traffic flow. The results of this study are expected to contribute significantly to efforts aimed at improving transportation in Pagar Alam city, thus serving as a model for similar efforts in other cities facing similar traffic problems.

CONCLUSION

This study aims to evaluate the traffic performance of Major Ruslan Street in Pagar Alam City, focusing on implementing a one-way system as a solution to overcome the problem of congestion and decreased road performance. Based on the results of the analysis conducted using VISSIM software, this study succeeded in answering the proposed problem formulation, namely how the performance conditions of the road section before and after the implementation of the one-way system, as well as the impact of parking arrangements and loading and unloading activities on the effective width of the road. The results showed that implementing a one-way system on Jalan Mayor can significantly improve road performance.

Before the implementation of the one-way system, traffic conditions on this road section were congested. With a volume/capacity ratio of 0.47, the average vehicle speed was less than 22 km/h, and the road service was at level C. After implementing the one-way system, the average vehicle speed increased to 31.75 km/h, the V/C ratio decreased to 0.39, and the road service level increased to level B. These improvements show that the one-way system effectively reduces congestion and improves traffic flow.

In addition, the study also revealed that more organized parking arrangements and planned loading and unloading activities could alleviate the side obstacles that were previously the leading cause of road performance degradation. It was proven that high lateral resistance, illegal parking, and unplanned loading and unloading activities significantly reduce the effective width of the road and impede traffic flow. By reorganizing parking lots and limiting loading and unloading times, these constraints can be minimized, which in turn has a positive impact on improving road performance.

The improvements made as part of this research provide short-term solutions to the traffic problems on Major Ruslan Road and offer ones that can be applied in other areas facing similar traffic problems. In a broader context, this research contributes to traffic management and engineering techniques based on data analysis and simulation, which can serve as a reference for future research and transportation development.

This research proves that traffic simulation approaches, such as VISSIM, are practical tools for evaluating and planning traffic management strategies. With accurate and detailed results, this approach allows transportation planners to make more informed decisions based on data, ultimately improving the quality and efficiency of transportation in cities.

The research also opens up opportunities for further development in traffic management, particularly in the context of applying simulation technology to traffic scenarios. As urban transportation challenges become increasingly complex, innovative approaches such as this are becoming increasingly important to ensure that the solutions implemented are not only technically efficient but also for the people and tailored to the region's specific needs.

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