



Traffic Management in Addressing Congestion in Commercial Areas: A Case Study on Jl. Karanggetas, Cirebon City

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ABSTRACT

Traffic congestion is a serious problem in commercial areas such as Jl. Karanggetas, Cirebon City, which affects the effectiveness of mobility, travel time, and community productivity. This study aims to identify the causes of traffic congestion and formulate traffic management solutions based on local needs. The method used is mixed-methods, combining secondary data such as Average Daily Traffic (LHR), road geometry, and side obstacles, as well as field surveys. The analysis was conducted based on the Indonesian Road Capacity Guidelines (PKJI) 2023, which is a national reference in evaluating road capacity and performance. The results showed that congestion is caused by illegal parking, loading and unloading activities during peak hours, and limited road capacity. The road level of service (LoS) is in the B and C categories, while the correlation between road user perception variables and congestion shows a weak relationship. Recommendations include the repositioning of parking zones, logistics timing, construction of angkot stops, and elimination of on-street parking to optimize traffic space capacity.

INTRODUCTION

Traffic congestion in commercial areas is a chronic problem that not only hampers the efficiency of urban mobility but also has economic, social and environmental impacts. Various cities in Indonesia have implemented traffic management approaches, such as traffic engineering, traffic light timing, and motor vehicle restrictions, but the effectiveness of implementation at the local level is often not systematically documented. The rapid growth in the number of private and public transport vehicles traveling on these main roads, while limited road capacity, exacerbates the congestion situation (Sarwandy et al., 2024; Widodo et al., 2024). In this context, research focusing on micro-level commercial areas such as Jl. Karanggetas in Cirebon City plays an important role in filling the literature gap and providing an empirical foundation that can be applied directly by policy makers.

Based on the Indonesian Road Capacity Guidelines (PKJI) 2023, an analysis of road conditions and congestion in this area shows that the main roads in this commercial area often experience saturation. Vehicle volumes exceeding road capacity, coupled with illegal parking and irregular loading and unloading activities, are the main factors causing congestion in this area (Alyani et al., 2025; Budiati et al., 2024). Ineffective traffic management in such areas, given the mismatch between road infrastructure and the number of vehicles, requires a more adaptive and locally context-based managerial approach.

This study is novel in three main aspects. First, it highlights secondary commercial areas in mid-tier cities that often escape macro-planning attention despite their central role in supporting urban economic activity. Jl. Karanggetas, as a commercial hub with mixed vehicle flows (city transport, private vehicles, and goods vehicles), provides a representative case study of traffic management challenges in the context of mid-sized urbanization. Most of the previous literature has focused on metropolitan cities such as Jakarta and Surabaya, while Cirebon with its rapid economic growth but inadequate infrastructure offers different dynamics and requires an adaptive management approach. Therefore, this study focuses on analyzing traffic congestion on Jl. Karanggetas, Cirebon City, to provide solutions that are more relevant and contextual to local conditions (Samal et al., 2022; Yamanari et al., 2022). Second, the approach used in this study combines spatial mapping, analysis of congestion time patterns, as well as the involvement of local stakeholders (road users, traders, and the Transportation Agency). This enabled a comprehensive understanding of the sources of congestion, including the contribution of illegal parking, peak hour goods distribution, and the imbalance between road capacity and vehicle volume. This interdisciplinary approach has not been widely adopted in similar studies that predominantly use quantitative approaches.

Third, this study offers a prototype of traffic management based on local needs and road user behavior. In most transportation policies, generic top-down solutions often fail to capture local complexities. This study, based on direct observation and field data on Jl. Karanggetas, produces more contextualized technical and policy recommendations, such as repositioning parking zones, providing dedicated lanes for goods vehicles, and regulating off-peak loading

and unloading times. These local data-based policy adjustments are a real contribution in streamlining the implementation of traffic management.

As urbanization is expected to reach 68.4% by 2050 (Yamanari et al., 2022), challenges related to traffic congestion in commercial areas are increasingly urgent. Therefore, this research is very relevant in formulating traffic management policies that can be adapted quickly to changing conditions and economic growth in medium urban areas such as Cirebon City.

LITERATURE REVIEW

Transportation Demand

Transportation demand describes the relationship between factors that influence travel decisions and the transportation patterns that occur in an area. In the context of traffic management, this theory highlights how travel demand is influenced by several variables, such as transportation prices, travel time, availability of transportation modes, and road user preferences.

Traffic demand is influenced by individual characteristics and external factors, including road capacity, congestion levels, and existing transportation policies. Litman (2022) in transportation demand theory explains that good traffic management focuses not only on improving road capacity, but also on managing travel demand, for example through policies such as limiting the use of private vehicles during peak hours or developing alternative modes of transportation (public transport, carpooling, bicycles, etc.) (Zhang et al., 2024). Therefore, traffic management in the commercial area of Jl. Karanggetas needs to consider these factors in order to reduce congestion caused by high travel demand.

Demand Theory Applications: In the context of Jl. Karanggetas, this theory can be applied to design policies that reduce the volume of vehicles at peak times, for example by developing a more efficient public transport system or implementing a tariff for private vehicles entering the area during peak hours.

Urban Transportation

Urban transportation, as described by Hanson & Giuliano (2021), states that transportation in urban areas is part of a complex system that involves interactions between various elements, including road infrastructure, vehicles, government policies, and road user behavior. In this system, there are two main components that interact with each other: supply and demand. When demand (number of vehicles) exceeds supply (road capacity), congestion occurs (Moyano et al., 2021).

This systems approach considers traffic as an entity that is inseparable from other factors, such as economic activity, goods distribution and land use patterns. In commercial areas such as Jl. Karanggetas, traffic congestion occurs due to an imbalance between increased economic activity and the limited capacity of road infrastructure. Therefore, effective traffic management needs to involve various parties and consider the entire existing transportation system, including urban spatial planning, mass transportation management, and policies to facilitate the distribution of goods (Rahman & Halder, 2023).

Application of Urban Transportation System Theory: On Jl. Karanggetas, this theory leads to the application of more holistic policies, such as traffic zoning, road division for private vehicles, public transport, and goods vehicles, and improvement of the quality of public transport infrastructure.

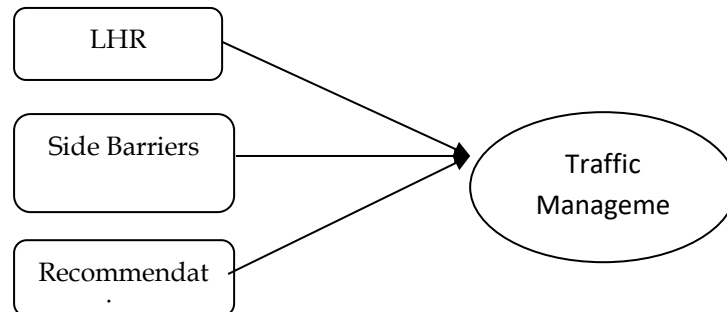


Figure 1. Framework of Thought

METHODOLOGY

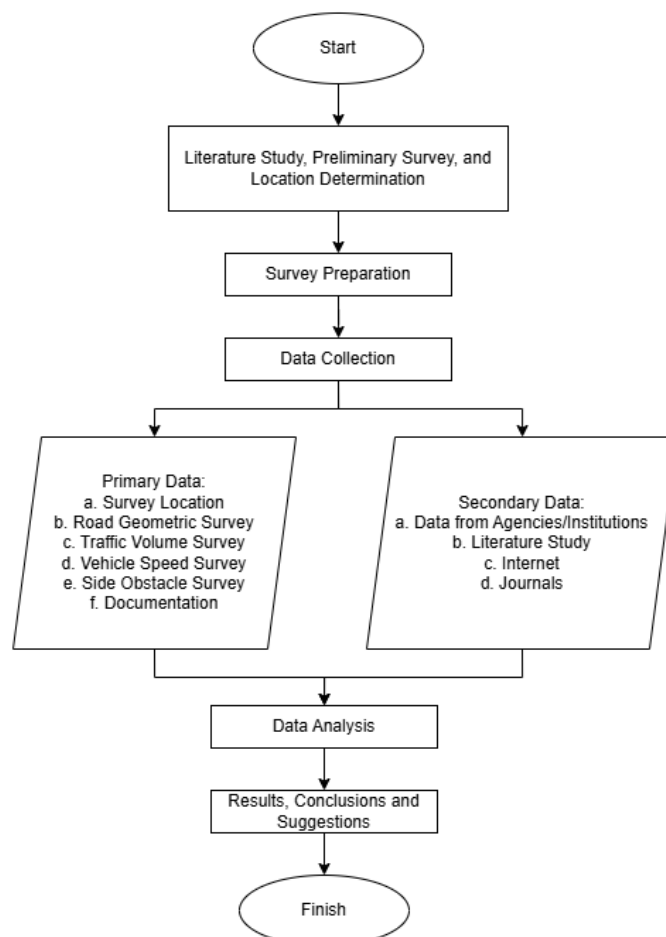


Figure 2. Research Flowchart

This research adopts a mixed-methods approach that combines quantitative and qualitative methods. The research location was Karanggetas Street,

Pekalangan Urban Village, Pekalipan Sub-district, Cirebon City, West Java Province. Quantitative data was obtained from secondary data such as 2024 Average Daily Traffic (LHR), average vehicle speed, and road geometric data. Primary data was collected through field measurements and distributing questionnaires to 30 respondents who are road users in the area. The correlation test was used to analyze the relationship between variables of road users' perception of congestion. The results show that most of the correlations between variables are weak or insignificant. For example, there is a low positive correlation (0.233) between compliance with traffic rules and frequency of congestion, and a moderate negative correlation (-0.314) between frequency of congestion and impact on productivity. One variable, "Traffic Rules Not Enforced Causes Congestion", did not produce a valid correlation due to incomplete or non-standardized data (NaN value), so it was excluded from further analysis.

RESEARCH RESULTS

To analyze overall road performance, road geometrics need to be evaluated using PKJI 2023 standards, then combined with Level of Service (LOS) to identify traffic flow conditions, along with side obstacle analysis based on the results of the questionnaire distribution.

Road Geometrics

Road geometric data obtained after taking measurements at the location under study using a meter and Georeferencing on Google Earth the results can be seen in the picture below.

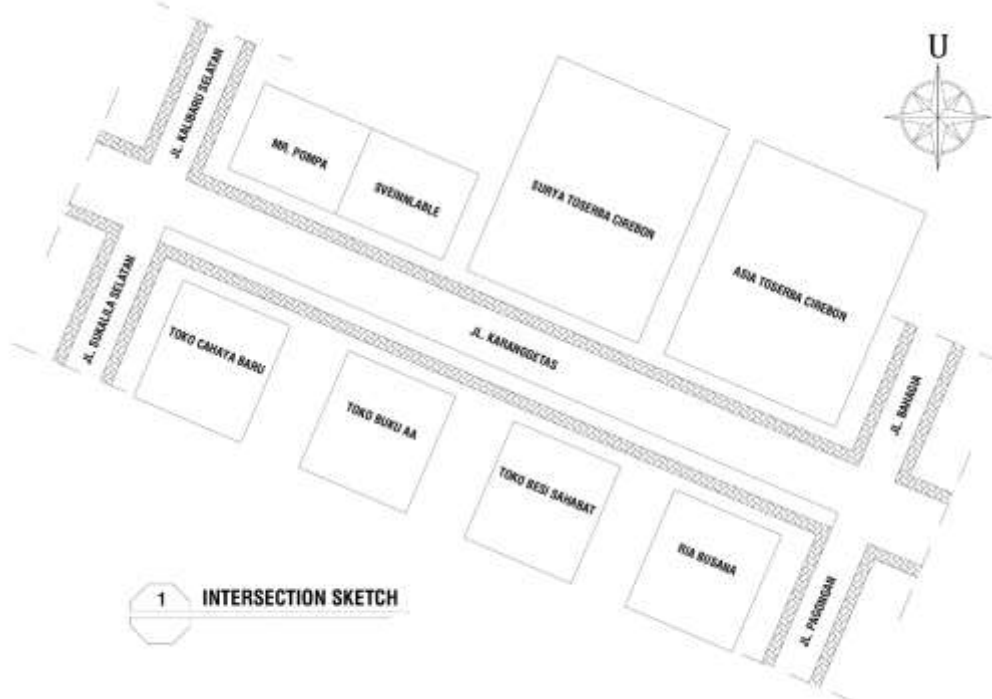


Figure 3. Road Geometrics

Table 1. Design Criteria

| Existing Condition | | Road Section |
|--------------------|-------|--------------|
| Slope | | 2% |
| Road Width | | 11 m |
| Road Shoulder | | 0,5 m |
| On Street Parking | | 3,5 m |
| Sidewalks | Width | 2,5 m |
| | High | 0,3 m |

Capacity

$$C = C_0 \times FC_{LJ} \times FC_{PA} \times FC_{HS} \times FC_{UK}$$

$$C = 2800 \times 1.34 \times 1 \times 0.95 \times 0.90 = 3207.96$$

Degree of Saturation

$$DJ = \frac{q}{c}$$

$$DJ = \frac{1517,45}{3207,96}$$

$$DJ = 0,47$$

Table 2. Loss of Service of Karanggetas Road

| Time | Saturation Degree | LOS |
|---------------|-------------------|-----|
| 06.00 - 07.00 | 0.24 | B |
| 07.00 - 08.00 | 0.29 | B |
| 08.00 - 09.00 | 0.30 | B |
| 09.00 - 10.00 | 0.43 | B |
| 10.00 - 11.00 | 0.37 | B |
| 11.00 - 12.00 | 0.40 | B |
| 12.00 - 13.00 | 0.46 | C |
| 13.00 - 14.00 | 0.50 | C |
| 14.00 - 15.00 | 0.42 | B |
| 15.00 - 16.00 | 0.37 | B |
| 16.00 - 17.00 | 0.35 | B |
| 17.00 - 18.00 | 0.31 | B |

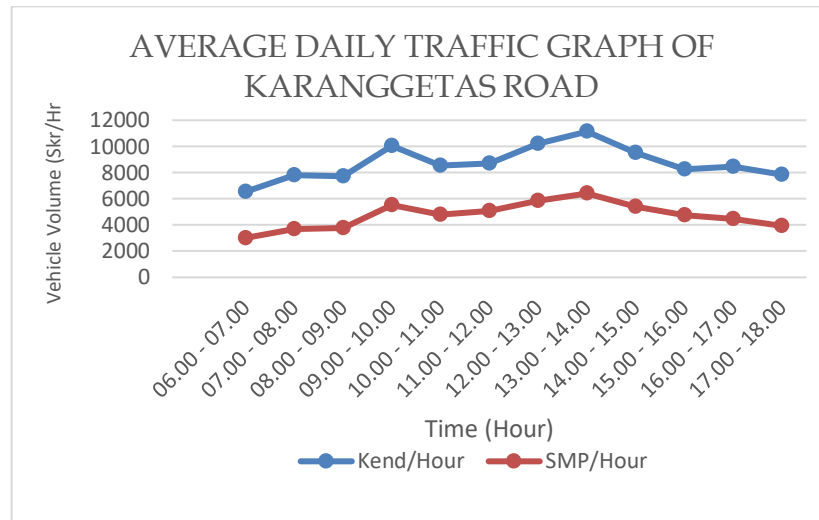


Figure 4. Average Daily Traffic on Karanggetas Street

The results of the analysis show that the LoS (*Level of Service*) level on Jl. Karanggetas is B and C, with values between 0.24 and 0.50. This indicates that the traffic flow is almost unstable, where the vehicle speed starts to be disturbed and decreases due to insufficient road capacity.

Side Barriers

Table 3. Side Barriers of Jl.Karanggetas

| Time | Total Frequency Side Barriers | Classification Side Barriers |
|---------------|-------------------------------|------------------------------|
| 06.00 - 07.00 | 115.25 | Low |
| 07.00 - 08.00 | 199.5 | Medium |
| 08.00 - 09.00 | 248.9 | Medium |
| 09.00 - 10.00 | 270.8 | High |
| 10.00 - 11.00 | 295.25 | High |
| 11.00 - 12.00 | 364.65 | Very High |
| 12.00 - 13.00 | 505.7 | Very High |
| 13.00 - 14.00 | 510.35 | Very High |
| 14.00 - 15.00 | 345.35 | High |
| 15.00 - 16.00 | 250.4 | High |
| 16.00 - 17.00 | 190.25 | Low |
| 17.00 - 18.00 | 101.15 | Low |

After the calculation, the classification of side obstacles at peak traffic hours on Jalan Karanggetas at 11:00-14:00 (KHS = Very High) was obtained.

Results of Questionnaire Distribution

Table 4. Questionnaire Results

| Variables | Obey Traffic Rules | Frequent Congestion on Jl. Karanggetas | Time Stuck in Traffic | The Severity of Congestion | The Impact of Congestion on Productivity |
|--|---------------------------|---|------------------------------|-----------------------------------|---|
| Obey Traffic Rules | 1.000 | 0.233 | -0.041 | 0.055 | -0.179 |
| Frequent Congestion on Jl. Karanggetas | 0.233 | 1.000 | -0.150 | -0.014 | -0.314 |
| Time Stuck in Traffic | -0.041 | -0.150 | 1.000 | -0.084 | -0.247 |
| The Severity of Congestion | 0.055 | -0.014 | -0.084 | 1.000 | 0.035 |
| The Impact of Congestion on Productivity | -0.179 | -0.314 | -0.247 | 0.035 | 1.000 |
| Unenforced Traffic Rules Cause Congestion | NaN | NaN | NaN | NaN | NaN |

Based on the correlation table analysis, the relationship between variables in this study shows a relatively low association. There is a weak positive correlation (0.23) between compliance with traffic rules and frequency of congestion on Jl. Karanggetas, indicating that road user compliance only slightly affects congestion, possibly due to external factors such as limited road capacity. In contrast, the frequency of congestion has a negative relationship (-0.31) with the impact on productivity, meaning that the more often one is stuck in traffic, the greater the perceived decrease in productivity. This finding suggests that technical solutions, such as improving road geometrics or adding lanes, are more important than simply socializing traffic rules.

Handling Recommendation

As a follow-up to the research findings, the Cirebon City Government and the Transportation Agency are advised to implement several strategic steps. Parking management and special zones need to be done by establishing official parking areas and implementing no-parking zones during peak hours, complete with strict sanctions. In addition, the timing of loading and unloading of goods should be enforced by prohibiting logistics activities during peak hours and providing special zones that do not interfere with traffic flow. In addition, the application of technology such as CCTV and traffic sensors at vulnerable points will help monitor violations in real-time. Furthermore, temporary traffic

engineering with special lanes for logistics vehicles should also be considered. Lastly, increased public education and participation through regular socialization and communication forums between the government, businesses, and local communities is essential to devise solutions together. These measures are expected to reduce congestion and improve traffic efficiency in the area.

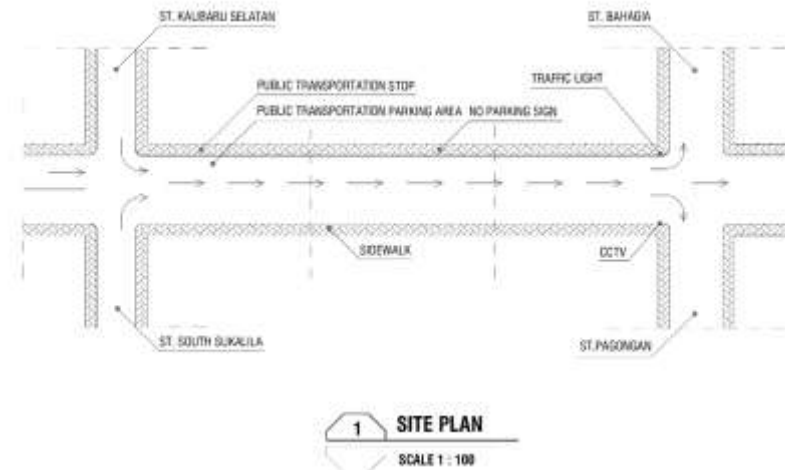


Figure 4. Site Plan of Congestion Management Recommendations

DISCUSSION

Based on the results of the traffic analysis on Jl. Karanggetas, peak congestion occurs at 11:00-14:00 with the classification of side obstacles in the "very high" category. The level of service (LoS) at that time is in the B and C categories, indicating that traffic flow is starting to be disrupted and less stable due to insufficient road capacity. This finding is in line with Hanson & Giuliano's (2021) urban transportation system theory, which states that the imbalance between demand and supply of road capacity is the main cause of congestion in urban areas.

The correlation test results show weak relationships between road user perception variables, including between traffic compliance and frequency of congestion ($r = 0.233$) and a moderate negative relationship between frequency of congestion and reduced productivity ($r = -0.314$). This suggests that technical solutions are more influential than educational efforts alone, as confirmed by Litman (2022) and Purwanto et al. (2023). Traffic management recommendations such as the structuring of parking zones, logistics timing, and the construction of angkot shelters are all the more relevant because they directly address the problems observed on the ground. Dedicated angkot stops, for example, are important to prevent the practice of loading and unloading passengers at random points, which has been one of the main causes of congestion.

A local needs-based approach and the integration of monitoring technology (e.g. CCTV and traffic monitoring applications), as recommended in the Artificial Intelligence-Based Real-Time Traffic Management study (2023), is considered effective in strengthening traffic management strategies in mid-level commercial areas such as Jl. Karanggetas.

CONCLUSIONS AND RECOMMENDATIONS

Congestion in the commercial area of Jl. Karanggetas, Cirebon City, occurs due to a combination of limited road capacity and road user behavior. Problems such as illegal parking, loading and unloading activities during peak hours, as well as lack of supervision and supporting infrastructure such as official parking zones, cause disrupted and unstable traffic flow. The analysis also shows that the correlation between road users' perception of traffic compliance and congestion is relatively weak, signaling the need for solutions that are more technical and structural than merely educational. Strategic recommendations from this study include the elimination of on-street parking, repositioning parking zones, limiting the time of logistics activities, implementing monitoring technology (CCTV and application-based traffic information systems), and building angkot stops at strategic points. These stops are expected to reduce the practice of raising or lowering passengers carelessly, which often causes traffic obstacles. This approach is contextual, and responsive to the actual needs of the area. The phased implementation of this solution can also serve as a model for handling congestion in similar commercial areas in other developing cities.

ADVANCED RESEARCH

Traffic management in commercial areas is increasingly important in the face of congestion due to population growth and technological advances. The surge in population in urban areas leads to an increase in vehicle volume, which has a negative impact on mobility, economic activity, and environmental quality. To address these issues, the application of advanced technologies such as real-time traffic information systems, navigation applications, and big data analysis can provide up-to-date information and help plan more effective transportation policies. Adaptive policies, such as regulating heavy vehicle operating hours and developing efficient public transportation, are also needed to reduce traffic congestion. With the right integration of technology and policy, traffic management can be more responsive to the dynamics of population growth, creating a more comfortable and productive environment.

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