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Analysis of Saturation Degree and Capacity Exceedance Projection on the Margoyoso-Jepara City Boundary Road Segment Using the Traffic Growth Rate Method

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Abstract. Rapid traffic growth on strategic collector roads can reduce road performance when capacity and traffic management do not develop proportionally. The Margoyoso Jepara City boundary road segment plays an important role in regional mobility in Jepara Regency, yet segment-specific evidence on its capacity pressure and future performance remains limited. This study addresses this gap by evaluating the saturation degree and projecting traffic conditions to support evidence-based traffic management. A quantitative traffic engineering approach was applied using the Indonesian Highway Capacity Manual (MKJI 1997) and traffic growth projection analysis. The 2022 annual daily traffic volume of 86,261 vehicles/day was projected to 95,258 vehicles/day in 2025 using a 3.5% annual growth rate. Road capacity was calculated at 2,842 pcu/hour, while the projected 2025 traffic flow reached 4,673 pcu/hour, resulting in a saturation degree of 1.64. This indicates oversaturated operating conditions. The 2028 projection shows further performance deterioration without intervention. A motorcycle segregation scenario, defined as separating motorcycle movements from mixed traffic through dedicated control or lane management, reduced the saturation degree below 1.00. The findings highlight the urgency of demand management, motorcycle flow control, and capacity improvement on this strategic road segment.
Keywords: *saturation degree; road capacity; traffic growth rate; collector road; traffic management*

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Introduction

Road transport systems are required to maintain mobility, accessibility, safety, and economic circulation under conditions of continuous traffic growth. In medium-sized urban and peri-urban areas, the problem is often not limited to the absolute number of vehicles but also to the mismatch between vehicle growth, roadside activity, road geometry, and the speed at which infrastructure can be improved. A road segment may be formally classified as adequate in terms of administrative function, yet perform poorly when daily traffic composition, side friction, and peak-hour loading exceed the effective capacity available to road users. For this reason, traffic performance analysis is a core component of road planning and operational management, especially on collector roads that simultaneously serve local access, interdistrict movement, and goods distribution.

The Margoyoso Jepara City Boundary road segment represents this type of operational problem. The segment functions as a collector road in Jepara Regency and connects local activity centers with broader urban and regional movement. The surrounding land use includes commercial activity, market-related movement, educational trips, worker mobility, and general daily travel. Such conditions create a mixed-traffic environment in which motorcycles, passenger cars, pickups, buses, and several truck classes share the same carriageway. When the traffic stream is dominated by motorcycles but still contains a meaningful proportion of light and heavy vehicles, the performance of the segment cannot be evaluated only by counting vehicles. A conversion into passenger car units is needed so that different vehicle types can be represented in a common operational unit.

In traffic engineering, road capacity is generally understood as the maximum traffic flow that can reasonably pass a road section under prevailing geometric, traffic, and environmental conditions during a given period. The concept is not merely a theoretical upper limit; it is an operational benchmark for evaluating whether the road can still accommodate demand with acceptable movement quality. The Indonesian Highway Capacity Manual, commonly referred to as MKJI 1997, places capacity and saturation degree among the principal indicators for road segment analysis (Directorate General of Highways, 1997). The same logic is also consistent with broader traffic engineering practice, where capacity analysis is used to diagnose performance deterioration, identify bottlenecks, and determine whether management or infrastructure interventions are required (Roess et al., 2011; Transportation Research Board, 2022).

Saturation degree, abbreviated as DS in MKJI-based analysis, is calculated as the ratio between traffic flow and capacity. A DS value below 1.00 indicates that the analysed flow is lower than the calculated capacity, although operational quality may still vary depending on speed, side friction, and road environment. A DS value close to 1.00 signals that the road is approaching unstable conditions. A DS value above 1.00 indicates that the demand represented by the analysed flow has exceeded the effective capacity. Under this condition, queues, speed reduction, travel-time unreliability, and recurring congestion become likely operational consequences. Therefore, DS is useful because it condenses several traffic and geometric elements into a clear diagnostic measure.

The interpretation of DS must nevertheless be made carefully. A high DS is not caused by traffic volume alone. Capacity itself is affected by geometric and environmental correction factors. MKJI 1997 considers base capacity, lane-width adjustment, directional split, side-friction adjustment, and city-size adjustment in road-capacity estimation. Free-flow speed is also affected by base free-flow speed, lane width, side-friction conditions, shoulder width, and city size. In segments with active roadside land use, side friction can reduce the practical ability of the road to serve movement even when the nominal road width appears sufficient. Parking manoeuvres, vehicles entering and leaving roadside properties, pedestrian movement, slow vehicles, and public-transport stopping behaviour can all reduce effective operational capacity.

Mixed traffic is especially important in the Indonesian context. Motorcycles often dominate the observed vehicle count, but their operational influence differs from light vehicles and heavy vehicles. Passenger car unit conversion allows traffic engineers to compare vehicle classes using equivalency factors. In the present study, the traffic stream is grouped into motorcycles (MC), light vehicles (LV), heavy vehicles (HV), and non-motorized vehicles (UM). The use of equivalent units is important because 1,000 motorcycles do not impose the same operational burden as 1,000 heavy vehicles. Conversely, a road segment with a very high motorcycle share may still experience severe congestion when the total converted peak-hour flow exceeds capacity. This distinction is central to interpreting the Margoyoso-Jepara City Boundary case.

Traffic growth also has a cumulative effect. A road that is already close to capacity can become oversaturated within a short period when annual traffic growth is consistently positive. In road planning, a common deterministic forecasting technique is the Traffic Growth Rate method. This method estimates future traffic volume by applying an annual growth factor to a base-year volume. Its main advantage is transparency: the input data, growth factor, and forecast horizon can be clearly traced. It is therefore useful for short- and medium-term planning when detailed econometric or land-use transport interaction models are not available. However, it is not a substitute for comprehensive demand modelling because it assumes that the selected growth rate remains applicable throughout the forecast period (Ortuzar & Willumsen, 2011).

The Traffic Growth Rate method is particularly relevant for practical road-planning studies because many agencies have access to periodic traffic counts but not to advanced modelling datasets. The method can identify whether capacity pressure is expected to worsen under a business-as-usual scenario. It can also be used to test simplified traffic-management scenarios by modifying the traffic composition or isolating certain vehicle groups. In this study, the growth factor is taken from the Manual Desain Perkerasan Jalan 2017, which provides traffic growth assumptions by road type and regional context. For a collector road in Java, the study adopts an annual traffic growth factor of 3.5% (Directorate General of Highways, 2017).

Although growth-rate projection is simple, its results are useful only when the baseline data and analytical assumptions are explicit. First, the base-year traffic count must be clear. Second, vehicle classes must be consistently classified and converted into passenger car units. Third, the calculated capacity must be derived from identifiable geometric and adjustment factors. Fourth, the interpretation of the forecast must distinguish between total vehicle growth and operational capacity exceedance. Without this distinction, a study may incorrectly state that full capacity will be reached in a future year even though the DS value has already exceeded 1.00 in the base or current year. Therefore, this manuscript treats capacity exceedance as an operational condition measured by DS rather than as a vague future threshold.

The preliminary data for the Margoyoso-Jepara City Boundary segment show that the 2022 traffic volume reached 86,261 vehicles/day. After applying the 3.5% annual growth factor, the projected 2025 traffic volume becomes 95,258 motorized vehicles/day, excluding non-motorized traffic from the motorized total. Motorcycles represent the dominant share of the traffic stream, with 68,026 vehicles/day in 2025. Light vehicles account for 22,961 vehicles/day, while heavy vehicles account for 4,271 vehicles/day. When converted into peak-hour passenger car units, the 2025 total flow reaches 4,673 pcu/hour. This figure is substantially higher than the calculated road capacity of 2,842 pcu/hour. The resulting DS is 1.64, indicating severe oversaturation.

The study location is also affected by activity patterns around shops, market-related movement, and daily commuting. Such characteristics explain why the problem cannot be solved only by observing the road as a physical facility. A collector road in an active commercial environment is not merely a corridor for through movement; it is also an interface between access demand and mobility demand. When access demand is not controlled, the movement function is weakened. From a traffic-management perspective, this creates a need for integrated measures such as access control, parking management, roadside activity regulation, peak-hour vehicle management, and, where feasible, geometric improvement.

Previous road-performance studies using MKJI-type analysis commonly emphasize that operational deterioration occurs when traffic growth is not balanced by capacity expansion or demand management. However, many applied studies remain descriptive and stop at current DS calculation. A stronger contribution can be made when existing performance analysis is combined with short-term projection and scenario testing. The present study follows that direction by integrating existing traffic performance evaluation with Traffic Growth Rate projection from 2022 to 2028. This allows the analysis to show not only the current severity of congestion but also the expected trajectory if no intervention is implemented.

A key analytical issue in this manuscript is the distinction between baseline oversaturation and scenario-based relief. The baseline projection shows DS values above 1.00 throughout 2022-2028. This means that the segment was already operating beyond its calculated capacity in the 2022 baseline data and becomes more saturated each year as demand grows. In contrast, the motorcycle-only scenario, which represents a strict restriction of light and heavy vehicles from the analysed flow, produces DS values below 1.00 within the same forecast horizon. This does not mean that restricting all non-motorcycle vehicles is automatically a socially or economically feasible policy. Rather, it demonstrates the magnitude of operational burden contributed by mixed motorized traffic and the potential effect of demand-side intervention.

The policy relevance of this study lies in its ability to provide a quantified basis for discussion. Local traffic problems are often debated using qualitative impressions such as “busy,” “crowded,” or “congested.” Those terms are useful for public communication but insufficient for engineering decision-making. By calculating DS and projecting future values, the study translates field conditions into measurable indicators. This helps planners identify whether short-term traffic management is enough or whether structural capacity improvement is required. A DS of 1.64 is not a marginal performance problem; it indicates that the traffic flow used in the analysis substantially exceeds the calculated capacity.

The study contributes to applied transport planning in three ways. First, it provides a segment-specific performance diagnosis for Jalan Margoyoso-Batas Kota Jepara using MKJI-based capacity analysis. Second, it projects traffic demand using a transparent growth-rate method aligned with Indonesian road-design practice. Third, it compares the baseline mixed-traffic condition with a simplified management scenario to illustrate how vehicle composition affects DS.

These contributions are practical rather than purely theoretical, but they are important for local governments and road authorities that require clear evidence to prioritize traffic management, capacity improvement, and further network-level studies.

Based on the above background, the objective of this study is to analyse the saturation degree of the Margoyoso Jepara City Boundary road segment and to project future capacity pressure using the Traffic Growth Rate method. The study also aims to evaluate whether a simplified vehicle-restriction scenario can reduce DS below the critical threshold. The analysis is expected to support evidence-based traffic management in Jepara Regency and to provide a methodological reference for similar collector-road studies in mixed-traffic urban and peri-urban environments.

Methods

This study used a quantitative traffic engineering design. The analysis combined field-based geometric observation and secondary traffic data to evaluate current road performance and project future saturation conditions. The study object was the Margoyoso-Jepara City Boundary road segment in Jepara Regency, Central Java. The analysed segment extends from KM 54+450 to KM 55+530, with an approximate segment length of 1.08 km. The road is classified as a collector road and is operated as a two-lane, two-way undivided road.

The data consisted of three main groups. First, geometric and environmental information was obtained from road-segment observation, including effective carriageway width, shoulder width, road type, directional condition, and surrounding activity. Second, the 2022 traffic-count data were obtained from P2JN and used as the base-year traffic volume. Third, methodological parameters were taken from MKJI 1997 and the Manual Desain Perkerasan Jalan 2017. The 2017 manual provided the annual traffic growth factor of 3.5% for collector roads in Java.

Traffic volume was classified into motorcycle, light-vehicle, heavy-vehicle, and non-motorized groups. For operational performance analysis, motorized vehicle classes were converted into passenger car units using MKJI equivalency factors. In the 2025 UR-2 calculation, light vehicles were assigned an equivalency factor of 1.00, heavy vehicles 1.20, and motorcycles 0.35. The directional split was assumed to be 50:50 according to the calculation form used in the study.

Future traffic volume was estimated using the Traffic Growth Rate equation: LHRn = LHR0 x (1 + i/100)^n, where LHRn is the projected average daily traffic in year n, LHR0 is the base-year daily traffic, i is the annual growth rate, and n is the number of years from the base year. The projection was conducted from 2022 to 2028.

Road capacity was calculated using the MKJI urban road capacity equation: C = C0 x FCW x FCSP x FCSF x FCCS. In this equation, C is capacity, C0 is base capacity, FCW is the lane-width adjustment factor, FCSP is the directional-separation adjustment factor, FCSF is the side-friction adjustment factor, and FCCS is the city-size adjustment factor. The calculated input values were C0 = 2,900 pcu/hour, FCW = 1.00, FCSP = 1.00, FCSF = 0.98, and FCCS = 1.00, producing C = 2,842 pcu/hour.

The saturation degree was calculated as DS = Q/C, where Q is the total traffic flow in passenger car units per hour and C is the calculated capacity. A DS value greater than 1.00 was interpreted as capacity exceedance. In addition to the baseline mixed-traffic condition, a simplified motorcycle-only scenario was examined to illustrate the change in DS when light and heavy vehicles are excluded from the analysed flow. This scenario was used as an analytical comparison, not as a final policy prescription.

The study has two analytical boundaries. First, the forecast applies a constant annual growth factor and does not include changes in land use, public transport supply, fuel price, parking regulation, or route diversion. Second, the scenario analysis does not estimate economic cost, distributional impact, or behavioural response. Therefore, the results should be interpreted as an initial engineering diagnosis that supports more detailed network, economic, and policy analysis.

Results

1. Road Segment Characteristics

The road segment has a total road width of 11 m, consisting of a 7 m carriageway and shoulders on both sides. The observed environment includes commercial activity, market-related movement, workers, students, traders, and general traffic. These conditions indicate that the segment is exposed to side-friction effects that can reduce operational performance.

Table 1.
Characteristics of the Margoyoso-Jepara City Boundary Road Segment

Variable	**Description**
Road name	Margoyoso-Jepara City Boundary Road
Initial station	KM 54+450
Final station	KM 55+530
Segment length	1.08 km
Road type	Collector road; two-lane two-way undivided (2/2 UD)
Average traffic lane width	3.5 m per lane; 7.0 m total carriageway
Effective shoulder width	2.0 m per side; 4.0 m total

Traffic composition	Motorcycles, passenger cars, minibuses, pickups, buses, trucks, non-motorized vehicles
Environmental condition	Commercial activity, market activity, school/work trips, and peak-hour queuing

2. Base-Year Traffic Volume and 2025 Projection

The 2022 base-year traffic count recorded 86,261 vehicles/day. Motorcycles formed the largest share, followed by light vehicles and heavy vehicles. After applying the 3.5% annual growth factor for three years, the projected 2025 motorized traffic reached 95,258 vehicles/day.

Table 2.
Base-Year Traffic Count by Vehicle Class in 2022

Vehicle group	**Vehicle type**	**Volume (vehicles/day)**
Group 1	Motorcycles, scooters, three-wheeled vehicles	61,355
Group 2	Sedan, jeep, station wagon	15,400
Group 3	Opelet, pickup, suburban, combi, minibus	700
Group 4	Pickup, micro truck, delivery vehicle	4,608
Group 5a	Small bus	369
Group 5b	Large bus	452
Group 6a	Light two-axle truck	743
Group 6b	Medium two-axle truck	2,069
Group 7a	Three-axle truck	137
Group 7b	Truck with trailer	0
Group 7c	Semi-trailer truck	80
Group 8	Non-motorized vehicle	348
Total	All recorded vehicles	86,261

Table 3.
Projected Traffic Volume in 2025

Class	**Vehicle type**	**Projected volume (vehicles/day)**	**Operational group**	**Group total**
1	Motorcycles, scooters, three-wheeled vehicles	68,026	MC	68,026
2	Sedan, jeep, station wagon	17,075	LV	
3	Opelet, pickup, suburban, combi, minibus	777	LV	
4	Pickup, micro truck, delivery vehicle	5,109	LV	22,961
5a	Small bus	410	HV	
5b	Large bus	502	HV	
6a	Light two-axle truck	824	HV	
6b	Medium two-axle truck	2,294	HV	

7a	Three-axle truck	152	HV	
7b	Truck with trailer	0	HV	
7c	Semi-trailer truck	89	HV	4,271
8	Non-motorized vehicle	386	UM	Not included in motorized total
Total	Motorized vehicles	95,258	-	95,258

3. Capacity and Saturation Degree in 2025

Using MKJI adjustment factors, the calculated capacity of the segment was 2,842 pcu/hour. The converted 2025 peak-hour traffic flow reached 4,673 pcu/hour. The saturation degree was therefore 1.64, which indicates that the road segment operated above its calculated capacity.

Table 4.
Capacity and Saturation Calculation for 2025

Component	**Value**
Base capacity (C0)	2,900 pcu/hour
Lane-width adjustment factor (FCW)	1.00
Directional-separation adjustment factor (FCSP)	1.00
Side-friction adjustment factor (FCSF)	0.98
City-size adjustment factor (FCCS)	1.00
Calculated capacity (C)	2,842 pcu/hour
Traffic flow (Q)	4,673 pcu/hour
Saturation degree (DS = Q/C)	1.64

Table 5.
Saturation Degree Projection, 2022-2028

Year	**Baseline Q (pcu/hour)**	**Capacity C (pcu/hour)**	**Baseline DS**	**Motorcycle-only Q (pcu/hour)**	**Motorcycle-only DS**
2022	4,215	2,842	1.4831	1,933	0.6802
2023	4,362	2,842	1.5348	2,001	0.7040
2024	4,515	2,842	1.5887	2,071	0.7286
2025	4,673	2,842	1.6443	2,144	0.7544
2026	4,836	2,842	1.7016	2,218	0.7805
2027	5,005	2,842	1.7611	2,296	0.8079
2028	5,182	2,842	1.8234	2,376	0.8361

The projection shows a consistent increase in DS from 1.4831 in 2022 to 1.8234 in 2028 under the baseline mixed-traffic condition. This pattern indicates that the road segment had already exceeded its calculated capacity in 2022 and that the degree of oversaturation is projected to worsen if traffic demand grows at the assumed rate and capacity remains unchanged. In the motorcycle-only scenario, DS remains below 1.00 throughout the projection period and reaches approximately 0.81 in 2027. This scenario confirms that vehicle composition has a strong influence on operational performance, although the practical implementation of such a restriction would require broader policy assessment.

Discussion

The most important finding is that the Margoyoso Jepara City Boundary road segment is not merely approaching capacity; it is already operating beyond its calculated capacity under the baseline condition. The 2025 DS value of 1.64 means that the converted traffic flow is approximately 64% higher than the estimated capacity. In practical terms, this condition is consistent with recurring congestion, low speed, unstable flow, and increased travel-time delay during busy periods. The finding also clarifies that the issue should not be framed as a future capacity problem only. It is an existing capacity-exceedance problem with a worsening trend.

The 2022-2028 projection strengthens this interpretation. Because the forecast applies a constant 3.5% annual growth rate, the baseline DS increases gradually each year. The DS rises from 1.4831 in 2022 to 1.8234 in 2028. Although deterministic growth-rate models do not capture all behavioural and policy changes, the direction of change is clear: if road capacity remains constant and demand grows according to the adopted rate, operational conditions will deteriorate. This makes a passive policy stance risky. Waiting until congestion becomes more visible would mean responding after the road has already been oversaturated for several years.

Motorcycle dominance is another significant feature of the traffic stream. In vehicle-count terms, motorcycles represent more than 70% of the 2025 traffic composition. However, the baseline DS remains high even after motorcycles are converted using an equivalency factor lower than that of light and heavy vehicles. This indicates that the high DS is not simply a statistical effect of motorcycle quantity. The combined burden of motorcycles, light vehicles, and heavy vehicles exceeds the operational capacity of the road. Therefore, a policy that focuses only on one vehicle category may produce limited effects unless it is integrated with broader management of roadside activity and traffic demand.

The motorcycle-only scenario reduces DS below 1.00 across the projection period. This result should be read analytically, not prescriptively. It does not automatically justify prohibiting light and heavy vehicles from the corridor because such a policy could affect logistics, local business access, public transport, and social equity. Rather, the scenario demonstrates that the presence of light and heavy vehicles is operationally consequential. More realistic policy options may include time-window regulation for heavy vehicles, loading and unloading control, parking restrictions near market and shop fronts, access consolidation, enforcement against roadside stopping, and route management for through freight movement.

The role of side friction deserves particular attention. The capacity calculation used a side-friction adjustment factor of 0.98, which appears numerically modest. Nevertheless, the observed environment includes shops, market activity, and peak-hour vehicle accumulation. In field conditions, side friction can interact with high traffic volume and create local bottlenecks that are more severe than suggested by one adjustment factor alone. For example, vehicles entering and exiting roadside properties may interrupt traffic flow, while informal stopping can reduce the effective width of the carriageway. Therefore, operational improvement should include roadside management rather than relying only on physical widening.

Geometric improvement remains relevant because the calculated capacity of 2,842 pcu/hour is far below the 2025 converted flow of 4,673 pcu/hour. If demand management is politically or economically difficult, the gap between flow and capacity implies that physical or operational capacity enhancement is necessary. Possible engineering measures may include lane management, shoulder control, intersection treatment near the segment, traffic circulation adjustment, or selective widening where right-of-way conditions allow. However, any widening proposal should be assessed with safety, drainage, pedestrian access, land acquisition, and induced-demand considerations.

The results are consistent with the theoretical function of DS as a diagnostic indicator. MKJI-based analysis translates field traffic and geometry into a clear ratio, making it possible to compare current and future conditions. However, DS should not be the only basis for final policy. A complete intervention package should also consider speed, delay, queue length, crash risk, pedestrian movement, public transport availability, economic activity, and community acceptance. In other words, DS identifies the seriousness of the problem, but the selection of interventions requires a broader planning process.

This study also shows the practical value and limitation of the Traffic Growth Rate method. Its value lies in transparency and ease of communication. Local agencies can understand how the 2025 and 2028 values are derived from the 2022 base data and the 3.5% annual growth factor. Its limitation lies in its fixed-growth assumption. Real traffic growth can be affected by land-use change, road-network improvement, new public transport services, fuel prices, parking policy, school and factory schedules, and economic cycles. Therefore, the projection should be updated when new traffic counts become available.

For journal submission, a critical methodological point is that the manuscript must avoid overstating the accuracy of the forecast. The Traffic Growth Rate method provides a structured projection, not a precise prediction of actual future traffic. The term “prediction” should therefore be used in a bounded sense. The stronger academic claim is that the method provides a transparent estimate of capacity pressure under specified assumptions. This wording is more defensible and reduces the risk of reviewer criticism.

The main limitation of the study is its single-segment scope. Congestion on a road segment may be influenced by nearby intersections, alternative routes, land-use access, and upstream or downstream bottlenecks. Because this study does not model the surrounding network, it cannot determine whether traffic would divert if vehicle restrictions were applied. The second limitation is that the scenario analysis does not include economic and social consequences. The third limitation is that the study relies on secondary traffic-count data from 2022 and projected values for later years. More robust future work should include updated classified traffic counts, speed surveys, queue observations, side-friction measurements, and possibly microsimulation or network assignment analysis.

Despite these limitations, the study provides a useful starting point for transport decision-making in Jepara Regency. The evidence indicates that the road segment requires active management. Short-term actions should prioritize low-cost operational control, including parking enforcement, roadside stopping management, heavy-vehicle time regulation, and access control near high-activity frontage. Medium-term actions should evaluate geometric and intersection improvements. Long-term actions should integrate the corridor into a broader public transport, land-use, and freight-movement strategy so that capacity problems are not repeatedly shifted from one location to another.

Conclusion

This study analysed the saturation degree and future capacity pressure of the Margoyoso Jepara City Boundary road segment using MKJI-based capacity analysis and the Traffic Growth Rate method. The 2025 projected motorized traffic volume was 95,258 vehicles/day, with motorcycles as the dominant class. After conversion into passenger car units, the 2025 traffic flow reached 4,673 pcu/hour, while the calculated road capacity was 2,842 pcu/hour. The resulting DS value of 1.64 indicates severe capacity exceedance. The projection from 2022 to 2028 shows that the baseline DS remains above 1.00 throughout the analysis period and increases from 1.4831 to 1.8234. Therefore, the segment had already exceeded its calculated capacity in the baseline condition and is projected to become more saturated without intervention. The motorcycle-only scenario reduces DS below 1.00, indicating that vehicle composition and demand management can substantially affect road performance. However, any restriction policy must be assessed alongside economic, social, and network impacts. The study recommends immediate operational traffic management, including roadside activity control, parking and stopping regulation, access management, and time-based management for heavy vehicles. Further studies should incorporate updated traffic counts, speed and delay surveys, side-friction measurement, cost-benefit analysis, and network-level modelling to support a more comprehensive intervention strategy.

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