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# Traffic Impact Assessment of the Balla Bontomarannu Residential Development in Gowa Regency

Nursafanah Dzakiyah Almakassari[1]*, Israil[2], Indah Nur Afiah[3]
[1]Universitas Muhammadiyah Parepare
[2]Universitas Muhammadiyah Makassar
[3]Universitas Negeri Makassar
**Corresponding Author:** Nursafanah Dzakiyah Almakassari;
nursafanahdzakiyah@gmail.com

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A B S T R A C T

The development of the Balla Bontomarannu Residential Development in Gowa Regency has the potential to affect traffic conditions in the surrounding area. This study analyzes the traffic impacts generated by the development using a quantitative approach based on field survey data. Traffic volume, free-flow speed, and road capacity were analyzed using data collected during weekdays and weekends. The Level of Service (LOS) analysis in the Indonesian Highway Capacity Manual (MKJI 1997) uses the volume-to-capacity ratio (Q/C) and degree of saturation (DS) as the main parameters. The results indicate that although traffic volume increases during peak hours, the Q/C ratio remains within Level of Service A under various scenarios, including existing conditions, construction stages, and the 2026 operational condition. This finding indicates that road capacity remains adequate to accommodate the additional traffic demand generated by the development. Mitigation measures such as traffic management and road widening are recommended to minimize potential impacts. This study is expected to serve as a reference for traffic-impact planning and mitigation, ensuring that future development does not adversely affect transportation performance in the surrounding area

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## INTRODUCTION

Urban areas serve as centers of economic and social activity, leading to increased transportation demand (Tamin, 2000). The high cost of land in city centers has encouraged residential development in suburban areas, leading to increased daily commuting. However, the rapid growth of suburban settlements is often not matched by adequate transportation infrastructure, leading to traffic congestion at several points along the road network, particularly during morning and evening peak hours.

Traffic congestion generates various negative impacts on urban communities, including travel time delays, increased fuel consumption, and social and psychological effects (Yulianyahya & Kasikoen, 2024). In the long term, congestion may also reduce urban environmental quality and transportation performance.

Sokkolia Village, located in Bontomarannu District, Gowa Regency, has experienced rapid development in recent years. Residential activities along Jalan Poros Borong Kaluku have contributed to population growth and increased mobility in the surrounding area. Consequently, the demand for transportation infrastructure and supporting public facilities has also increased. To accommodate the increasing housing demand, the Balla Bontomarannu Residential Development was established to provide clean and safe residential facilities for the community of Gowa Regency and the surrounding areas. In addition to creating employment opportunities and supporting regional economic growth, the development may also generate traffic impacts if not properly managed.

Traffic flow disturbances generally occur due to an imbalance between transportation demand and road network capacity (Directorate General of Highways, 1997). Therefore, transportation systems should be managed to ensure safe, smooth, and efficient traffic movement while maintaining environmental sustainability. Since the Balla Bontomarannu Residential Development is located on Jalan Poros Borong Kaluku, Sokkolia Village, Bontomarannu District, Gowa Regency, South Sulawesi, the development is expected to directly and indirectly affect traffic conditions, road performance, and road users in the surrounding area.

Accordingly, this study aims to analyze the traffic impacts of the Balla Bontomarannu Residential Development and identify appropriate mitigation measures to minimize potential negative impacts on the surrounding road network.

## LITERATURE REVIEW

This study focuses on traffic impact analysis associated with residential area development (Directorate General of Land Transportation, 2005) and road performance evaluation based on the Indonesian Highway Capacity Manual (MKJI). Traffic impact refers to changes in traffic flow resulting from trip generation and trip attraction caused by land-use development activities.

Based on MKJI, road performance can be evaluated using several main parameters, including traffic volume, road capacity, degree of saturation (DS), and level of service (LOS) (Mintorogo et al., 2026). Traffic volume represents the

number of vehicles passing through a road segment within a certain period, while road capacity indicates the maximum traffic flow that can be accommodated under prevailing road and traffic conditions. The degree of saturation is defined as the ratio of traffic volume to road capacity, where higher DS values indicate lower road performance and reduced service quality.

Residential developments generally increase traffic movement within the surrounding road network due to additional trip generation from residents and supporting activities (Tamin, 2000). This condition may result in increased traffic volume, reduced vehicle speed, congestion, and traffic conflicts, particularly at access points to and from the development area. Therefore, traffic impact analysis is required to evaluate existing and future traffic conditions and to determine appropriate traffic management and engineering measures to minimize potential negative impacts on the surrounding road network.

## METHODOLOGY

This study analyzes the traffic impacts generated by the Balla Bontomarannu Residential Development using the guidelines of the Indonesian Highway Capacity Manual (MKJI). The research was conducted through field surveys, traffic performance analysis, and the formulation of traffic management recommendations.

### *Data Collection*

This study utilized both primary and secondary data. Primary data were collected through traffic volume surveys, road geometric and side friction observations, and field documentation in the study area. Secondary data included land use plans, road network data, and residential development information obtained from relevant agencies and supporting literature.

### *Data Analysis*

Traffic performance analysis was conducted in accordance with MKJI procedures, including analyses of traffic volume, road capacity, degree of saturation (DS), and level of service (LOS). Traffic volume was converted into passenger car units (PCU/hour).

The degree of saturation was calculated using the following equation:

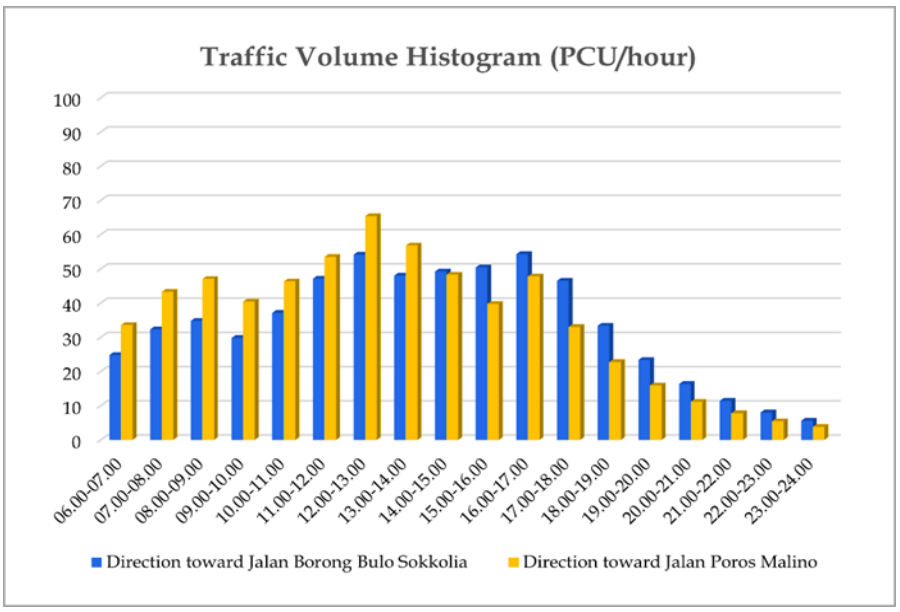
$$DS = Q/C \quad \ldots\ldots\ldots\ldots (1)$$

where DS represents the degree of saturation, Q represents traffic volume, and C represents road capacity.

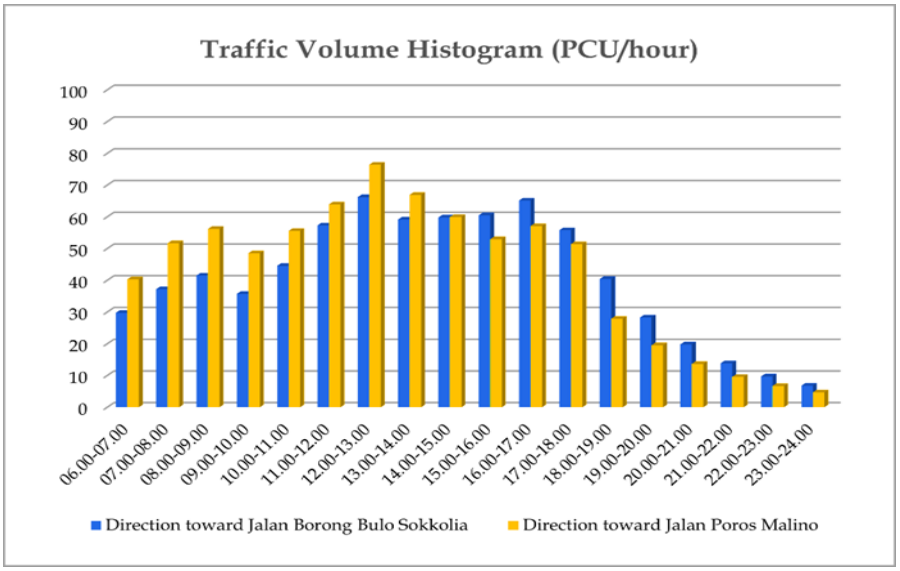
This analysis was used to identify the impacts of the residential development on the performance of surrounding road segments and to formulate appropriate traffic management and traffic engineering measures to minimize negative impacts and optimize traffic conditions.

## RESULT

### *Existing Traffic Conditions*




Picture 1. Existing Traffic Volume Variation on Saturday




Picture 2. Existing Traffic Volume Variation on Tuesday

The existing traffic conditions on Jalan Poros Borong Kaluku were analyzed based on traffic surveys conducted on Saturday and Tuesday. The traffic variation histograms indicate that on Saturdays, during the morning and midday peak hours, the highest traffic flow was directed toward Jalan Poros Malino, while during the evening peak hour, the highest traffic flow was directed toward Jalan Borong Bulo Sokkolia. The traffic variation pattern observed on Tuesday generally showed characteristics similar to those of the Saturday pattern.

***Traffic Volume (PCU/hour)***

Table 1. Traffic Volume on Jalan Poros Borong Kaluku on Saturday

| Road Segment | Peak Hour Period | LV (PCU/hour) | HV (PCU/hour) | MC (PCU/hour) | Total (PCU/hour) |
|---|---|---|---|---|---|
| Jalan Poros Borong Kaluku | 07.00–08.00 | 29 | 3 | 45 | 76 |
| | 08.00–09.00 | 32 | 3 | 48 | 82 |
| Jalan Poros Borong Kaluku | 11.00–12.00 | 34 | 4 | 63 | 101 |
| | 12.00–13.00 | 47 | 7 | 67 | 120 |
| Jalan Poros Borong Kaluku | 16.00–17.00 | 30 | 1 | 71 | 102 |
| | 17.00–18.00 | 24 | 0 | 56 | 80 |

Table 2. Traffic Volume on Jalan Poros Borong Kaluku on Tuesday

| Road Segment | Peak Hour Period | LV (PCU/hour) | HV (PCU/hour) | MC (PCU/hour) | Total (PCU/hour) |
|---|---|---|---|---|---|
| Jalan Poros Borong Kaluku | 07.00–08.00 | 34 | 1 | 53 | 89 |
| | 08.00–09.00 | 38 | 3 | 57 | 98 |
| Jalan Poros Borong Kaluku | 11.00–12.00 | 41 | 5 | 75 | 121 |
| | 12.00–13.00 | 53 | 7 | 83 | 143 |
| Jalan Poros Borong Kaluku | 16.00–17.00 | 36 | 1 | 85 | 122 |
| | 17.00–18.00 | 29 | 1 | 77 | 107 |

Traffic volume data on Jalan Poros Borong Kaluku were analyzed in passenger car units per hour (PCU/hour). Based on the survey results, the highest traffic volume on Saturday occurred during the midday peak hour, reaching 120 PCU/hour. Meanwhile, the highest traffic volume on Tuesday also occurred during the midday peak hour, at 143 PCU/hour.

***Road Segment Performance***

Table 3. Existing Performance of Jalan Poros Borong Kaluku on Saturday

| Road Segment | Peak Hour Period | Traffic Volume, Q | Capacity, C | Q/C Ratio | Level of Service |
|---|---|---|---|---|---|
| Jalan Poros Borong Kaluku | 07.00–08.00 | 76 | 1769.38 | 0.04 | A |
| | 08.00–09.00 | 82 | 1769.38 | 0.05 | A |
| Jalan Poros Borong Kaluku | 11.00–12.00 | 101 | 1769.38 | 0.06 | A |
| | 12.00–13.00 | 120 | 1769.38 | 0.07 | A |

| | | | | | |
|---|---|---|---|---|---|
| Jalan Poros Borong Kaluku | 16.00–17.00 | 102 | 1769.38 | 0.06 | A |
| | 17.00–18.00 | 80 | 1769.38 | 0.04 | A |

Table 4. Existing Performance of Jalan Poros Borong Kaluku on Tuesday

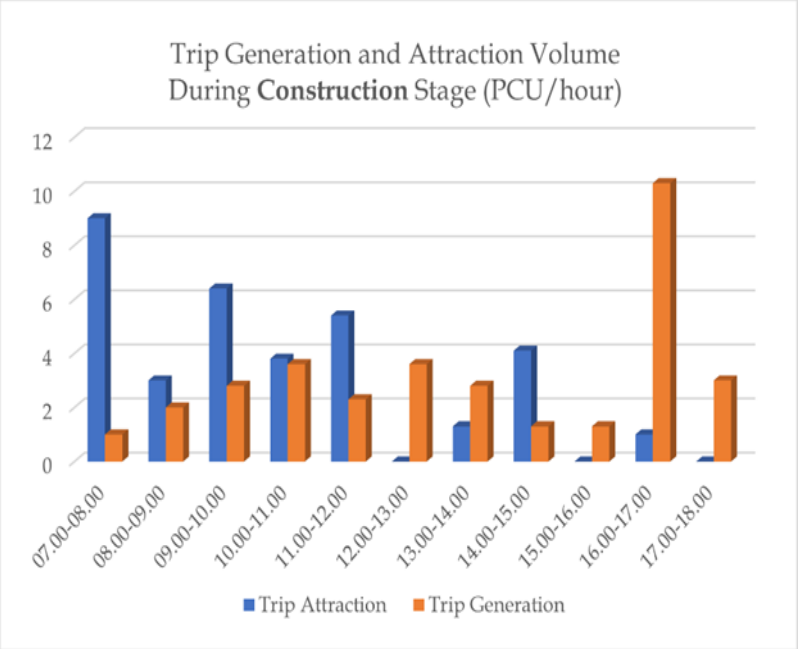
| Road Segment | Peak Hour Period | Traffic Volume, Q | Capacity, C | Q/C Ratio | Level of Service |
|---|---|---|---|---|---|
| Jalan Poros Borong Kaluku | 07.00–08.00 | 89 | 1769.38 | 0.05 | A |
| | 08.00–09.00 | 98 | 1769.38 | 0.06 | A |
| Jalan Poros Borong Kaluku | 11.00–12.00 | 121 | 1769.38 | 0.07 | A |
| | 12.00–13.00 | 143 | 1769.38 | 0.08 | A |
| Jalan Poros Borong Kaluku | 16.00–17.00 | 122 | 1769.38 | 0.07 | A |
| | 17.00–18.00 | 107 | 1769.38 | 0.06 | A |

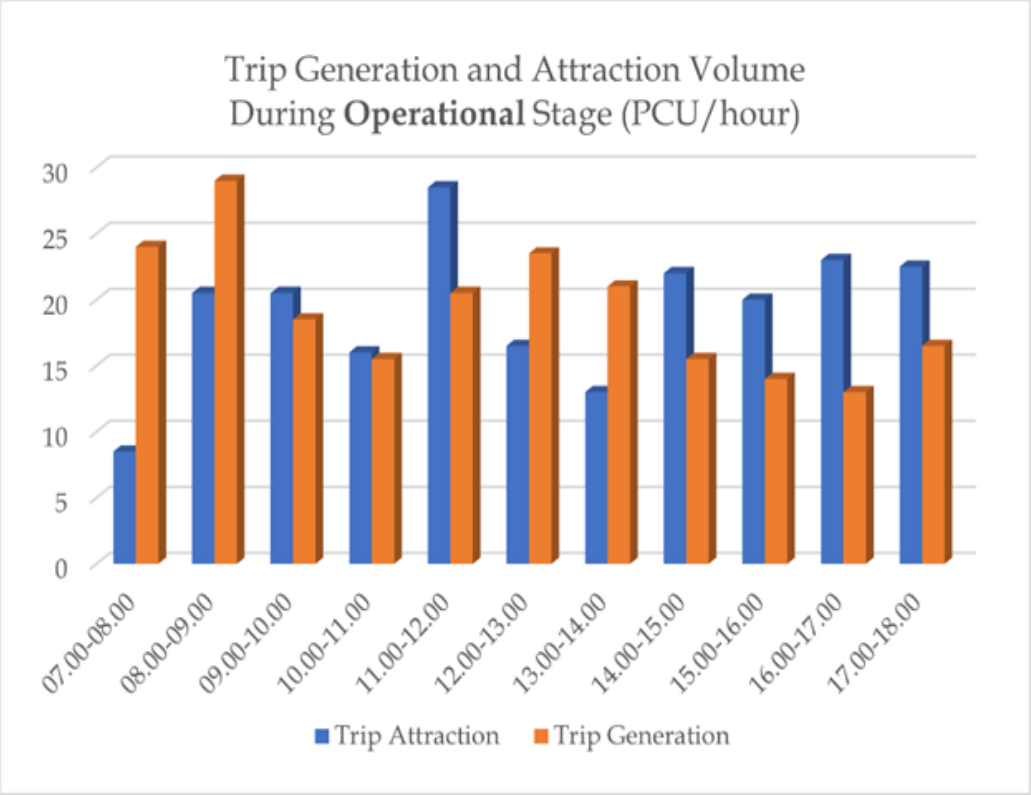
Road occupancy was evaluated using the volume-to-capacity ratio (Q/C ratio) on Jalan Poros Borong Kaluku. The analysis results show that the highest Q/C ratio on Saturday was 0.07, while on Tuesday it reached 0.08. The analyzed road segment, consisting of a two-lane undivided two-way road, has a capacity of 1,769.38 PCU/hour. Based on the MKJI criteria, the level of service (LOS) remains at Level A, indicating stable traffic flow conditions with low traffic volume and high travel speed.

***Trip Generation and Attraction Analysis***

Traffic generation depends on the characteristics and intensity of land-use activities. To estimate the traffic impacts generated by the residential development, trip attraction and trip generation during both construction and operational stages were analyzed. The trip generation data were derived using an analog approach based on the Borong Rappo Indah Residential Development, which was assumed to have characteristics similar to those of the Balla Bontomarannu Residential Development. The trip generation and attraction data were analyzed based on direct field survey results conducted at the Borong Rappo Indah Residential Development.

Picture 3. Vehicle Trip Generation and Attraction During the Construction Stage




Picture 4. Vehicle Trip Generation and Attraction During the Operational Stage

***Traffic Performance Simulation***
***Construction Stage***

Table 5. Road Performance of Jalan Poros Borong Kaluku During Construction Stage in 2026

| Road Segment | Peak Hour Period | Traffic Volume, Q | Capacity, C | Q/C Ratio | Level of Service |
|---|---|---|---|---|---|
| Jalan Poros Borong Kaluku | 07.00–08.00 | 99 | 1769.38 | 0.06 | A |
| | 08.00–09.00 | 103 | 1769.38 | 0.06 | A |
| Jalan Poros Borong Kaluku | 11.00–12.00 | 129 | 1769.38 | 0.07 | A |
| | 12.00–13.00 | 146 | 1769.38 | 0.08 | A |
| Jalan Poros Borong Kaluku | 16.00–17.00 | 134 | 1769.38 | 0.08 | A |
| | 17.00–18.00 | 110 | 1769.38 | 0.06 | A |

The projected performance of Jalan Poros Borong Kaluku during the construction stage of the Balla Bontomarannu Residential Development in 2026 indicates a maximum Q/C ratio of 0.08. Without mitigation measures, the road segment remains at Level of Service A, indicating free-flow traffic with low traffic volume and high operating speeds, where drivers can still select their desired speed.

***Operational Stage***

The projected road performance during the operational stage of the Balla Bontomarannu Residential Development in 2026 was analyzed under a do-nothing scenario. The analysis results indicate that Jalan Poros Borong Kaluku remains in free-flow traffic conditions, with low traffic volume and high operating speeds. Therefore, the existing road network is still capable of accommodating the additional traffic generated by the residential development.

Table 6. Performance of Jalan Poros Borong Kaluku During the Operational Stage on Saturday (Do-Nothing Scenario) in 2026

| Road Segment | Peak Hour Period | Traffic Volume, Q | Capacity, C | Q/C Ratio | Level of Service |
|---|---|---|---|---|---|
| Jalan Poros Borong Kaluku | 07.00–08.00 | 108 | 1769.38 | 0.06 | A |
| | 08.00–09.00 | 131 | 1769.38 | 0.07 | A |
| Jalan Poros Borong Kaluku | 11.00–12.00 | 150 | 1769.38 | 0.08 | A |

| | | | | | |
|---|---|---|---|---|---|
| | 12.00–13.00 | 160 | 1769.38 | 0.09 | A |
| Jalan Poros Borong Kaluku | 16.00–17.00 | 138 | 1769.38 | 0.08 | A |
| | 17.00–18.00 | 119 | 1769.38 | 0.07 | A |

Table 7. Performance of Jalan Poros Borong Kaluku During the Operational Stage on Tuesday (Do-Nothing Scenario) in 2026

| Road Segment | Peak Hour Period | Traffic Volume, Q | Capacity, C | Q/C Ratio | Level of Service |
|---|---|---|---|---|---|
| Jalan Poros Borong Kaluku | 07.00–08.00 | 121 | 1769.38 | 0.07 | A |
| | 08.00–09.00 | 147 | 1769.38 | 0.08 | A |
| Jalan Poros Borong Kaluku | 11.00–12.00 | 170 | 1769.38 | 0.10 | A |
| | 12.00–13.00 | 183 | 1769.38 | 0.10 | A |
| Jalan Poros Borong Kaluku | 16.00–17.00 | 158 | 1769.38 | 0.09 | A |
| | 17.00–18.00 | 146 | 1769.38 | 0.08 | A |

***Parking Analysis***

***Parking Facilities***

The parking facilities provided for residents and visitors of the Balla Bontomarannu Residential Development consist of parking spaces for passenger cars and motorcycles through the provision of private carports.

***Parking Impact Analysis***

The residential development applies an off-street parking system to avoid disrupting the performance of Jalan Poros Borong Kaluku. On-street parking activities could interfere with traffic flow due to vehicle maneuvering as vehicles enter and exit parking spaces along the roadway. Such conditions may increase traffic density and reduce road performance compared to conditions without roadside parking maneuvers.

***Parking Demand Analysis***

The parking demand for the Balla Bontomarannu Residential Development refers to the parking standards issued by the Directorate General of Land Transportation (Ditjen Hubdat) from the Ministry of Transportation of the Republic of Indonesia (Directorate General of Land Transportation, 1996). According to the regulation, residential developments require two parking spaces per housing unit. The parking space unit (PSU) dimensions consist of 1 PSU for a car measuring 2.5 × 5.0 m and 1 PSU for a motorcycle measuring 0.75 × 2.0 m.

## DISCUSSION

The development of urban and residential areas in suburban regions, including Sokkolia Village, has increased mobility and transportation demand within the surrounding area. This condition is reflected in the growth of residential activities along Jalan Poros Borong Kaluku, which functions as one of the main access corridors connecting residential areas with activity centers in Gowa Regency. The analysis indicates that the Balla Bontomarannu Residential Development has the potential to increase trip generation and attraction during both construction and operational stages. The additional traffic generated by the development contributes to increased volume on Jalan Poros Borong Kaluku, particularly during peak hours. Nevertheless, the traffic performance analysis shows that the highest Q/C ratio remains relatively low, ranging from 0.07 under existing conditions to 0.08 during construction and operational scenarios. These values indicate that the road segment still operates below its maximum capacity (Mintorogo et al., 2016).

With a road capacity of 1,769.38 PCU/hour, Jalan Poros Borong Kaluku continues to operate at Level of Service A under all analyzed scenarios, including the do-nothing condition in 2026. This finding indicates that the existing road network can still accommodate the additional traffic generated by the residential development while maintaining stable traffic flow, low traffic density, and relatively high operating speeds. Although the current traffic conditions remain stable, uncontrolled residential growth may potentially reduce road service quality in the future. Increased traffic movement may contribute to traffic flow disturbances, reduced travel speed, and congestion, particularly at access points and during peak hours. Therefore, implementing traffic management and traffic engineering measures remains necessary to maintain road performance and minimize potential negative impacts on the surrounding road network. The provision of off-street parking facilities through private carports also contributes positively to maintaining traffic performance on Jalan Poros Borong Kaluku. This parking system reduces the potential disruption caused by on-street parking maneuvers, which could interfere with traffic flow and increase roadside friction. Overall, the Balla Bontomarannu Residential Development should continue to be integrated with transportation planning and traffic management strategies to support the vision of Gowa Regency in developing a safe, orderly, and efficient transportation system while promoting sustainable and environmentally oriented regional development.

## CONCLUSIONS AND RECOMMENDATIONS

1. The Balla Bontomarannu Residential Development has the potential to increase traffic generation and attraction on Jalan Poros Borong Kaluku, particularly during peak traffic periods.
2. Based on the traffic performance analysis using the Indonesian Highway Capacity Manual (MKJI), the highest Q/C ratio ranges from 0.07 under existing conditions to 0.08 during construction and operational stages.
3. The analyzed road segment, with a capacity of 1,769.38 PCU/hour, consistently operates at Level of Service (LOS) A under existing, construction, and operational scenarios.

4. The analysis indicates that the existing road network can still accommodate the additional traffic generated by the residential development while maintaining stable traffic flow, low traffic density, and relatively high operating speeds.
5. The implementation of off-street parking facilities contributes positively to maintaining traffic performance by minimizing roadside parking disturbances and traffic conflicts along Jalan Poros Borong Kaluku. Overall, the results demonstrate that the development is well-supported by the existing road infrastructure and traffic management measures.

***Recommendations***

***Construction Stage***

1. Install temporary traffic signs and road equipment in accordance with applicable transportation regulations.
2. Regulate construction vehicle movements and avoid material transportation activities during peak traffic hours.
3. Provide traffic control personnel to manage construction vehicle access and maintain traffic safety around the project area.
4. Prohibit the roadside parking of construction vehicles and materials along Jalan Poros Borong Kaluku.
5. Conduct immediate road maintenance and repair any damage caused by construction vehicle operations.

***Operational Stage***

1. Implement off-street parking facilities and maintain adequate parking capacity within the residential area.
2. Apply one-way circulation systems at vehicle entry and exit points to improve traffic flow efficiency (Ministry of Transportation of the Republic of Indonesia, 2015).
3. Provide pedestrian facilities and appropriate traffic signs to improve traffic safety and accessibility (Ministry of Transportation of the Republic of Indonesia, 2015).
4. Arrange internal traffic circulation and monitor vehicle movements during peak activity periods to prevent congestion at access points (Ministry of Transportation of the Republic of Indonesia, 2015).
5. Coordinate with relevant government agencies regarding traffic monitoring, road maintenance, and future transportation management.

***Long-Term Recommendation***

1. Periodically evaluate traffic conditions and road performance to anticipate and address future traffic demand increases.
2. Integrate residential development planning with sustainable transportation management strategies to ensure safe, orderly, and efficient traffic conditions in Gowa Regency.

## FUTURE STUDY

This study is limited by the scope of traffic data and the relatively short observation period used in the analysis. Future studies are recommended to utilize longer-term traffic data and more comprehensive traffic surveys to obtain

more accurate traffic performance projections. Further research may also consider additional factors such as regional growth, land use changes, travel behavior, and future transportation demand. In addition, the application of traffic simulation models and alternative development scenarios is recommended to provide a more comprehensive evaluation of the impacts of residential development on the surrounding road network and transportation system.

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