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# EVALUATION OF UNSIGNALIZED INTERSECTION PERFORMANCE USING THE PKJI METHOD (CASE STUDY OF JENDRAL AHMAD YANI STREET, ABU BAKAR LAMBOGO STREET AND BUKIT MADANI STREET, PAREPARE CITY)

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**ABSTRACT**
Traffic conditions at the intersections of Jalan Jenderal Ahmad Yani, Jalan Abu Bakar Lambogo, and Jalan Bukit Madani in Parepare City indicate congestion and potential conflicts between vehicles that can reduce the level of safety and smoothness of traffic. Evaluation of the performance of unsignalized intersections at these locations is necessary to provide optimal traffic services and minimize the risk of accidents. This study aims to analyze traffic flow performance and intersection service levels using the PKJI method, so that recommendations for road infrastructure improvements that support the efficiency and safety of road users in the area are obtained. This research is a quantitative study. The research location is Jalan Jenderal Ahmad Yani KM 2, Parepare City, South Sulawesi, and the implementation period is approximately two months. Data collection was carried out in two stages: secondary data and primary data. The data were then analyzed using the PKJI 2023 method to assess traffic flow volume, unsignalized intersection performance, saturation level, delays, and queueing opportunities, thus obtaining a comprehensive picture of the basic intersection capacity and level of traffic performance in the study area. Based on the analysis results, it shows that the performance is still good with a service level of category B, which means that the traffic flow is stable with minimal obstacles. The highest traffic volume was recorded on Tuesday at 4,691 vehicles/hour and on Saturday at 3,547 vehicles/hour, with an intersection capacity of around 3,180 smp/hour and a degree of saturation of 0.61 and 0.50, respectively, indicating that the intersection is still able to accommodate the existing vehicle flow. The low delay value and small queue opportunity indicate the operational efficiency of the intersection, but the potential for increased vehicle volume during peak hours in the future may reduce its performance, so adaptive traffic management is needed, such as adjusting the priority of the main flow or increasing the intersection capacity to maintain optimal performance.
**Keywords:** Traffic Flow, Jalan Jenderal Ahmad Yani, Intersection Performance, PKJI Method, Unsignalized Intersection

## INTRODUCTION

Transportation is one of the most important means for human life in supporting economic activities as well as for survival in an effort to fulfill daily needs (Yunus & Mirajhusnita, 2020). The rapid development of a city is in line with the growth of economy and population have a direct impact on increasing transportation movement. This causes an increase in vehicle volume who cross the roads, especially at intersections as points of conflict various directions of vehicle movement. Intersections are an important part of the road network system that requires special arrangements for optimize movement and minimize traffic conflicts.

Intersections as a form of transportation infrastructure are places a meeting point of several roads and functions as a place for vehicles change the direction of traffic flow. Types of intersections can vary from simple intersections consisting of the meeting two sections of road to a complex intersection consisting of several intersection of roads (Pignataro, 1973). Movement and activity at intersections and its surroundings make the intersection a crucial location on the road network. Due to the meeting of traffic flows from various directions. The main cause of the conflict is what happens at an intersection is the large number of straight and moving vehicles turn right which meets at the intersection. The more conflicts there are, the more This will reduce the

performance of the intersection and cause traffic problems.
in the form of traffic jams and accidents. To overcome the above problems, carried out by increasing the capacity of intersections, reducing conflicts and regulation of movement rights in the form of installing APILL (Herlina et al., 2023).
Intersections are the most important part of the road network system, which In general, the capacity of the intersection can be controlled in controlling traffic.
traffic volume in the network system. In principle, the intersection is the meeting point of two or more road networks (Haryati & Sugiarsyah, 2025). Intersections function as controllers and traffic volume regulators crossing in the road network system. Each intersection includes many continuous traffic movements and interconnected traffic movement intersecting one or more and also includes rotational movements, intersections. There are frequent conflicts between the direction of vehicles and the inhibition or reduction in speed at intersection performance, the occurrence of vehicle delays and queues. Unsignalized intersections are generally intended for low traffic volume areas. At this type of unsignalized intersection, the right-of-way. The main traffic light is set on vehicles that are already at the intersection of vehicles that will enter the intersection (Anggraini et al., 2022).
Based on observations made at the intersection of Jalan Jenderal Ahmad Yani, Abu Bakar Lambogo Street and Bukit Madani Street are frequent occurrences congestion caused by the high population of vehicles that do not balance with the availability of adequate road infrastructure. The demands for carrying out these activities are adjusted to the dynamics of life diverse society, this requires the fulfillment of transportation public transportation and city transportation along with adequate facilities and infrastructure. That's what which a benchmark is for the good or bad performance of an intersection, and causes problems in the form of delays or traffic jams. Reduction the effective width of the road section and the conflicts that occur at the intersections resulting in congestion on the intersection arms.
If this condition is not supported by increased facility performance transportation, it will cause traffic congestion problems. This occurs due to the increasing number of vehicles passing through the route every year. During peak hours (morning and afternoon) the traffic volume passing the intersection of Jalan Jendral Ahmad Yani, Jalan Abu Bakar Lambogo, and Bukit Madani road has experienced significant improvement so that causing a fairly high level of density. This is influenced by the area around the intersection is a strategic place for activities community. This problem affects the level of performance of the intersection. causing the intersection performance to be less than optimal.
In this situation, the intersection of Jalan Jenderal Ahmad Yani, Jalan Abu Bakar Lambogo and Jalan Bukit Madani needs to get sufficient attention by providing road infrastructure at the intersection so that it can serve the traffic flow well and avoid conflicts and minimize accidents in the area. The formulation of the problem in this study focuses on the analysis of traffic flow performance and its impact on the level of intersection service on Jalan Jenderal Ahmad Yani as a major road and Jalan Abu Bakar Lambogo and Jalan Bukit Madani as minor roads in Parepare City. In line with that, the purpose of this study is to determine how the performance of traffic flow on the three road sections and analyze the effect of traffic flow on the level of intersection service, so that it can provide an overview of the efficiency and quality of vehicle movement in the area. Based on the description of the problems above with what happened, it is necessary to conduct research in accordance with the conditions that occurred with the title "Evaluation of Unsignalized Intersection Performance Using the PKJI Method".

## LIBRARY REVIEW

An intersection is a node in a transportation network where two or more more road sections meet (Andika, 2022). According to the Ministry of Public Works (2023), an intersection is a meeting of two or more roads. more level road sections and are not regulated by APILL. Meanwhile, the intersection is the meeting of two or more road sections, which can be an intersection or a junction APILL or roundabout or non-level intersection. The more the number of the number of intersection arms in a road network, the greater the number the possibility of delays (Naomi et al., 2025).
Intersections are generally divided into two types: at-grade intersections and non-at-grade intersections. A grade intersection is the intersection of two or more roads with the same or one level different in function. At-grade intersections, they are further divided into two types based on the type of traffic control facility: signalized intersections and unsignalized intersections. At signalized intersections, traffic flow is regulated by signal lights to allow traffic to pass through the intersection in turn. At unsignalized intersections, traffic flow is not regulated by signal lights (Mbaling et al., 2024). Unsignalized intersections are generally used in urban residential areas and at intersections between local roads in rural and interior areas, or in environments with very low traffic flow (Desanta et al., 2024).
Intersection capacity is the flow of vehicles passing through an intersection according to controls, traffic conditions, and geometric features. Factors affecting intersection capacity and service levels include its physical and operational conditions, the traffic environment, and heavy vehicle traffic (Hasanuddin et al., 2021). Decreased intersection performance will result in losses for road users due to reduced speeds, increased delays, increased vehicle queues, and decreased environmental quality (Sahertian et al., 2022). Congestion at an intersection is caused by several factors, such as the absence of APILL (Automobile Traffic Management), on-road vehicle

parking, overtaking behavior of road users, high vehicle volumes, and lack of awareness of traffic regulations (Syaifullah et al., 2024).

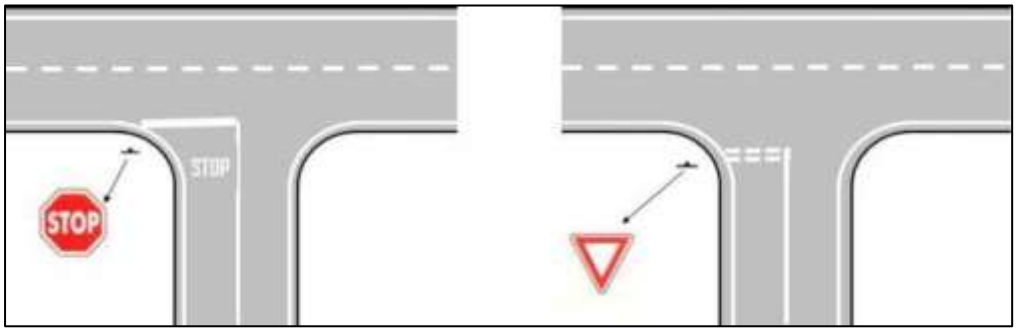


Figure 1. Priority intersections requiring stopping (left) and priority intersections requiring prioritization of vehicles from other directions (right)
Source: (PKJI 2023)

Intersections are considered perpendicular or near 90°, on a flat alignment, and with traffic flow at a DJ <0.85. Intersection types are Intersection-3 or Intersection-4, which are intersections between 2/2-TT, 4/2-T, or a combination of these types. Intersection criteria for determining basic capacity are intersections with curbs and sidewalks, located in urban areas, moderate side barriers, all turning movements are considered permitted, and priority arrangements, even if they exist, are not considered followed by all road users. The selection of intersection types for a region should be based on economic considerations, traffic safety considerations, and environmental considerations (Pamungkas et al., 2023). Road network performance must take into account delays due to intersections. The more intersections in a road network, the greater the delays that occur (Saputra & Sianipar et al., 2022).

## RESEARCH METHODS

The type of research used in this study is descriptive research quantitative which is a research method that requires a lot of use numbers, starting from data collection, interpretation of the data, as well as the appearance of the results is accompanied by images, tables, graphs, or displays this research was conducted on Jalan Jendral Ahmad Yani KM 2, Parepare City, South Sulawesi.

Figure 2. Research Location
*(Sumber: Goggle Maps)*

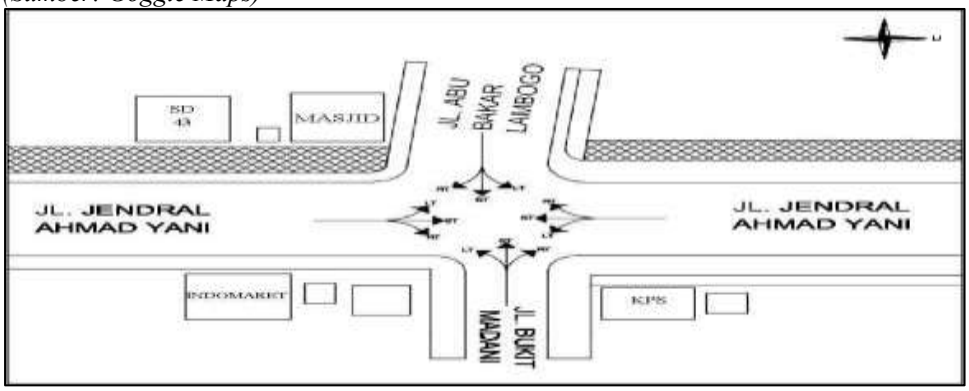


Figure 3. Sketch of the research location
*(Source: Personal Documentation)*

The research period was approximately 2 months. The tools used were survey forms, meters, stationery, and

mobile phones. The research procedures and plans were structured in an orderly and systematic manner. The stages to be carried out in this study were preparation, data collection, classification and recapitulation, data analysis, and conclusions and suggestions.

The data collection technique in this study was carried out in two stages, namely secondary data collection and primary data. Secondary data was obtained indirectly from various sources such as books, documents, and relevant literature to determine the next research steps. Meanwhile, primary data was collected directly from the field, including average daily traffic data (ADR), vehicle speed, pedestrian activity, on-road parking, traffic density levels, vehicle types, and surrounding environmental conditions. Data analysis was carried out using the 2023 PKJI method which is used to calculate and assess traffic flow volume, unsignalized intersection performance, saturation level, delays, and queue opportunities on Jalan Jenderal Ahmad Yani KM 2, Parepare City. Through this method, an overview of the basic capacity of the intersection and the overall level of traffic performance at the research location was obtained.

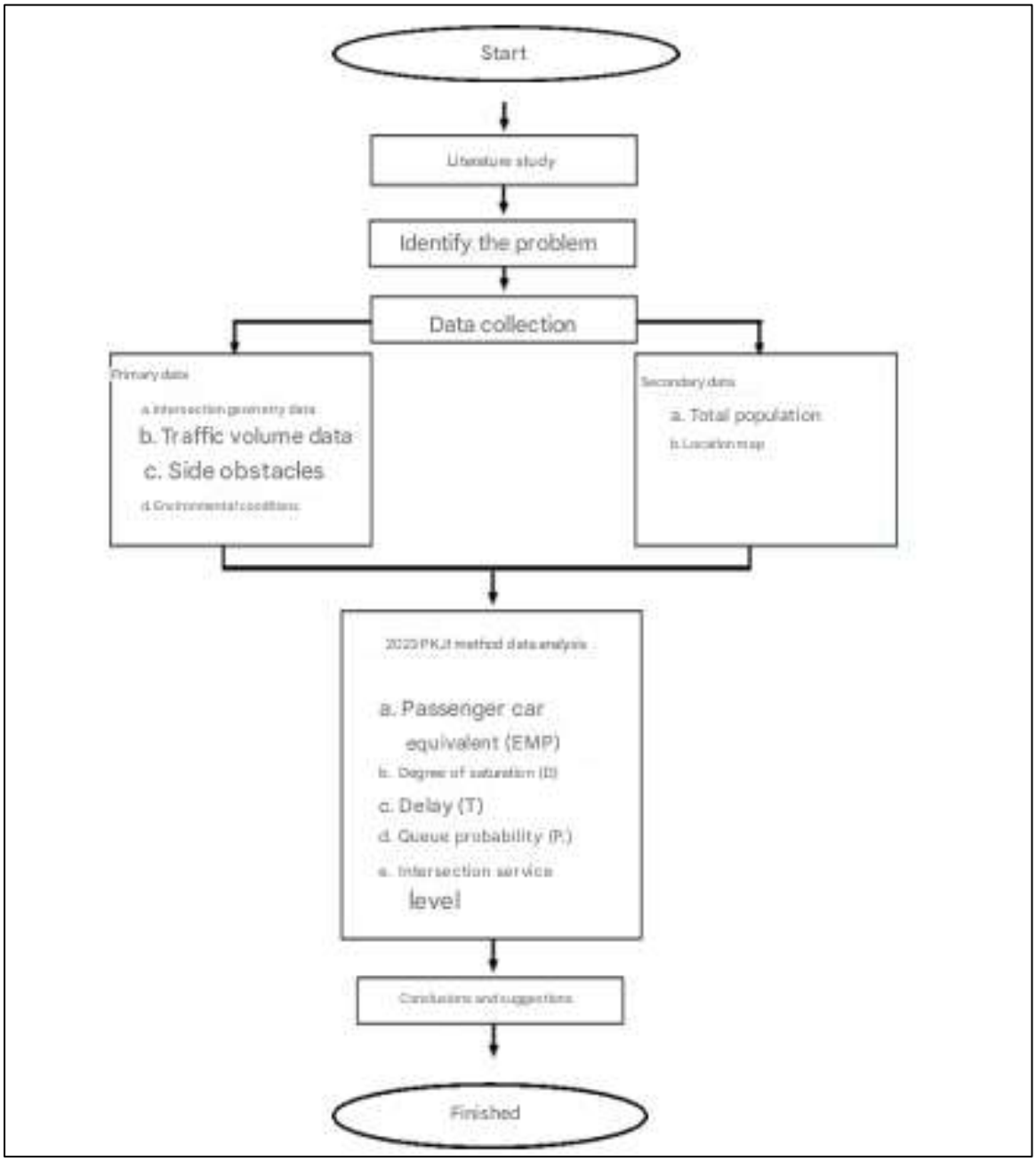


Figure 4. Research Flowchart

## RESULTS AND DISCUSSION

Peak-hour traffic volume data was collected from a one-week field survey. For calculation purposes, the data with the highest volume among the seven peak-hour periods was used. Therefore, after conducting the survey, the data selected to represent weekdays was Tuesday from 8:00 AM to 9:00 AM WITA (Central Indonesian Time), while the data selected to represent holidays was Saturday from 4:00 PM to 5:00 PM WITA (Central Indonesian Time).

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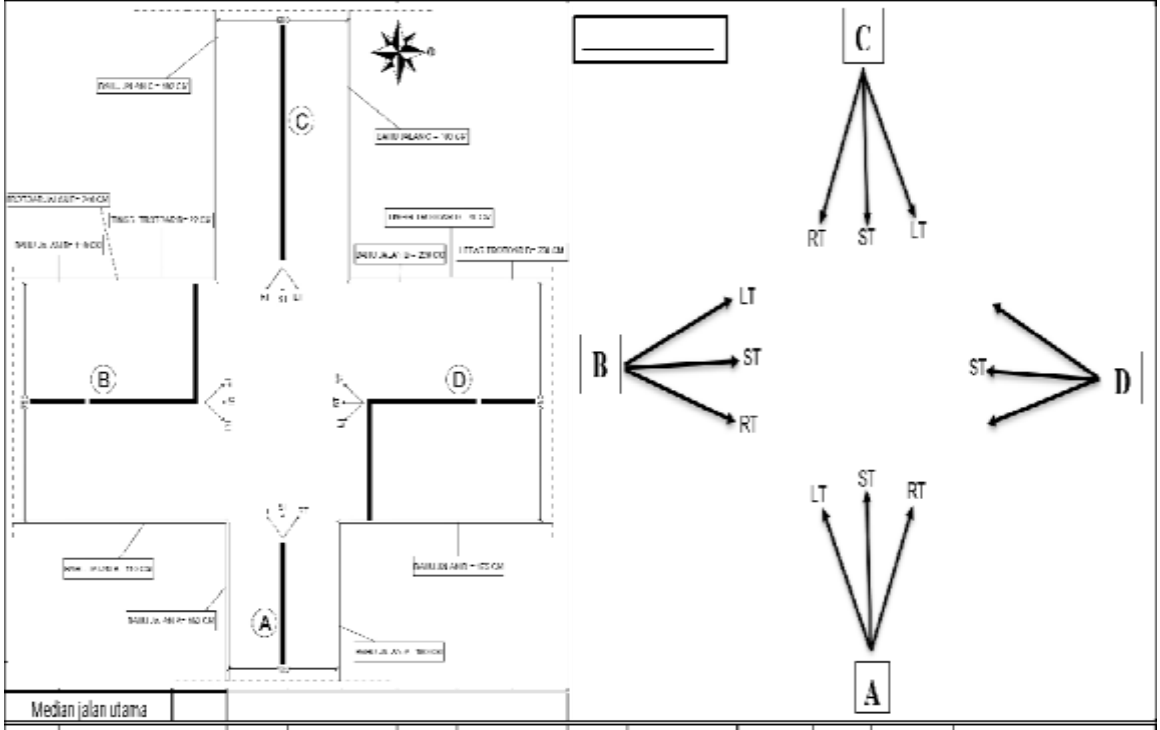
**Table 1.** Peak traffic volume data on weekdays, Tuesday, April 8, 2025 at 08:00-09:00

| | | | |
|---|---|---|---|
| SIMPANG TAK BERSINYAL | Hari/Tanggal | : Selasa/8-april-2025 | Propinsi : Sulawesi Selatan |
| FORMULIR USIG - I | Kota | : Parepare | |
| - GEOMETRI | Jalan Utama | : JL. Jend. Ahmad Yani | |
| - ARUS LALU LINTAS | Jalan Minor | : JL. Abu Bakar Lambogo - JL. Bukit Madani | |
| | Periode | : Puncak (08:00-09:00) | |




| 1 | KOMPOSISI LALU LINTAS | | LV % : | | HV % : | | MC % : | | Faktor smp : | | Faktor k : | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ARUS LALU LINTAS | | Kendaraan ringan LV | | Kendaraan berat HV | | Sepeda motor MC | | Kendaraan bermotor total MV | | | |
| | Pendekat | Arah | kend/jam | emp = 1,0 smp/jam | kend/jam | emp = 1,30 smp/jam | kend/jam | emp = 0,20 smp/jam | kend/jam | smp/jam | Rasio Belok | Kend. tak bermotor UM kend/jam |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| 2 | Jl. Minor A | LT | 14 | 14 | 0 | 0 | 178 | 35,6 | 192 | 49,6 | 0,359 | 1 |
| 3 | | ST | 28 | 28 | 0 | 0 | 211 | 42,2 | 239 | 70,2 | | 0 |
| 4 | | RT | 12 | 12 | 0 | 0 | 31 | 6,2 | 43 | 18,2 | 0,132 | 0 |
| 5 | | Total | 54 | 54 | 0 | 0 | 420 | 84 | 474 | 138 | | |
| 6 | Jl. Minor C | LT | 85 | 85 | 0 | 0 | 192 | 38,4 | 277 | 123,4 | 0,557 | 1 |
| 7 | | ST | 12 | 12 | 0 | 0 | 72 | 14,4 | 84 | 26,4 | | 0 |
| 8 | | RT | 34 | 34 | 0 | 0 | 188 | 37,6 | 222 | 71,6 | 0,323 | 4 |
| 9 | | Total | 131 | 131 | 0 | 0 | 452 | 90,4 | 583 | 221,4 | | |
| 10 | Jl. Minor Total A+C | | 185 | 185 | 0 | 0 | 872 | 174,4 | 1057 | 359,4 | | |
| 11 | Jl. Utama B | LT | 34 | 34 | 0 | 0 | 195 | 39 | 229 | 73 | 0,092 | 0 |
| 12 | | ST | 409 | 409 | 61 | 79,3 | 1075 | 215 | 1545 | 703,3 | | 0 |
| 13 | | RT | 9 | 9 | 0 | 0 | 32 | 6,4 | 41 | 15,4 | 0,019 | 0 |
| 14 | | Total | 452 | 452 | 61 | 79,3 | 1302 | 260,4 | 1815 | 791,7 | | |
| 15 | Jl. Utama D | LT | 15 | 15 | 0 | 0 | 39 | 7,8 | 54 | 22,8 | 0,028 | 0 |
| 16 | | ST | 407 | 407 | 70 | 91 | 1058 | 211,6 | 1535 | 709,6 | | 0 |
| 17 | | RT | 37 | 37 | 0 | 0 | 193 | 38,6 | 230 | 75,6 | 0,094 | 0 |
| 18 | | Total | 459 | 459 | 70 | 91 | 1290 | 258 | 1819 | 808 | | |
| 19 | Jl. Utama Total B+D | | 911 | 911 | 131 | 170,3 | 2592 | 518,4 | 3634 | 1599,7 | | |
| 20 | Utama+Minor | LT | 148 | 148 | 0 | 0 | 604 | 120,8 | 752 | 268,8 | 0,137 | |
| 21 | | ST | 856 | 856 | 131 | 170,3 | 2416 | 483,2 | 3403 | 1509,5 | | |
| 22 | | RT | 92 | 92 | 0 | 0 | 444 | 88,8 | 536 | 180,8 | 0,092 | |
| 23 | Utama+ Minor Total | | 1096 | 1096 | 131 | 170,3 | 3464 | 692,8 | 4691 | 1959,1 | 0,229 | |
| 24 | | | | | Rasio Jl. Minor / (Jl. Utama+Minor) total | | | | | 0,225 | UM/MV : | 0,001 |

Based on the results *survey* that has been done, the peak hour traffic volume at unsignalized intersections on Jalan Jendral Ahmad Yani, Jalan Abu Bakar Lambogo and Jalan Bukit Madani occurred on Tuesday at 08.00 – 09.00 with a total volume of 4,691 vehicles and after being converted to light vehicle equivalents it became 1,959.1 smp/hour.

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**Table2.** Peak traffic volume data on holiday, Saturday, April 12, 2025 at 16:00-17:00

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIMPANG TAK BERSINYAL | | | Hari/Tanggal | : Sabtu / 12-april-2025 | | Propinsi | : Sulawesi Selatan | | | | | | | | | | |
| FORMULIR USIG - I | | | Kota | : Pare Pare | | | | | | | | | | | | | |
| - GEOMETRI | | | Jalan Utama | : JL. Jend. Ahmad Yani | | | | | | | | | | | | | |
| - ARUS LALU LINTAS | | | Jalan Minor | : JL. Abu Bakar Lambogo - JL. Bukit Madani | | | | | | | | | | | | | |
| | | | Periode | : Puncak (16.00-17.00) | | | | | | | | | | | | | |
| 1 | KOMPOSISI LALU LINTAS | | LV % : | | | HV % : | | | MC % : | | | Faktor smp : | | | Faktor k : | | |
| | ARUS LALU LINTAS | | Kendaraan ringan LV | | | Kendaraan berat HV | | | Sepeda motor MC | | | Kendaraan bermotor total MV | | | | | |
| | Pendekat | Arah | kend/jam | emp = 1,0 | smp/jam | kend/jam | emp = 1,30 | smp/jam | kend/jam | emp = 0,20 | smp/jam | kend/jam | smp/jam | | Rasio Belok | Kend. tak bermotor UM kend/jam | |
| | (1) | (2) | (3) | (4) | | (5) | (6) | | (7) | (8) | | (9) | (10) | | (11) | (12) | |
| 2 | Jl. Minor A | LT | 15 | 15 | | 0 | 0 | | 69 | 13,8 | | 84 | 28,8 | | 0,250 | 0 | |
| 3 | | ST | 14 | 14 | | 0 | 0 | | 131 | 26,2 | | 145 | 40,2 | | | 0 | |
| 4 | | RT | 11 | 11 | | 0 | 0 | | 11 | 2,2 | | 22 | 13,2 | | 0,161 | 0 | |
| 5 | | Total | 40 | 40 | | 0 | 0 | | 211 | 42,2 | | 251 | 82,2 | | | | |
| 6 | Jl. Minor C | LT | 54 | 54 | | 0 | 0 | | 149 | 29,8 | | 203 | 83,8 | | 0,495 | 2 | |
| 7 | | ST | 7 | 7 | | 0 | 0 | | 87 | 17,4 | | 94 | 24,4 | | | 0 | |
| 8 | | RT | 35 | 35 | | 0 | 0 | | 131 | 26,2 | | 166 | 61,2 | | 0,361 | 0 | |
| 9 | | Total | 96 | 96 | | 0 | 0 | | 367 | 73,4 | | 463 | 169,4 | | | | |
| 10 | Jl. Minor Total A+C | | 136 | 136 | | 0 | 0 | | 578 | 115,6 | | 714 | 251,6 | | | | |
| 11 | Jl. Utama B | LT | 28 | 28 | | 8 | 0 | | 191 | 38,2 | | 219 | 66,2 | | 0,088 | 1 | |
| 12 | | ST | 438 | 438 | | 64 | 83,2 | | 710 | 142 | | 1212 | 663,2 | | | 0 | |
| 13 | | RT | 8 | 8 | | 8 | 0 | | 54 | 10,8 | | 62 | 18,8 | | 0,025 | 0 | |
| 14 | | Total | 474 | 474 | | 64 | 83,2 | | 955 | 191 | | 1493 | 748,2 | | | | |
| 15 | Jl. Utama D | LT | 19 | 19 | | 8 | 0 | | 37 | 7,4 | | 56 | 26,4 | | 0,043 | 0 | |
| 16 | | ST | 331 | 331 | | 45 | 58,5 | | 721 | 144,2 | | 1097 | 533,7 | | | 0 | |
| 17 | | RT | 28 | 28 | | 8 | 0 | | 159 | 31,8 | | 187 | 59,8 | | 0,090 | 0 | |
| 18 | | Total | 378 | 378 | | 45 | 58,5 | | 917 | 183,4 | | 1340 | 619,9 | | | | |
| 19 | Jl. Utama Total B+D | | 852 | 852 | | 109 | 141,7 | | 1872 | 374,4 | | 2833 | 1368,1 | | | | |
| 20 | Utama+Minor | LT | 116 | 116 | | 0 | 0 | | 446 | 89,2 | | 562 | 205,2 | | 0,127 | | |
| 21 | | ST | 790 | 790 | | 109 | 141,7 | | 1649 | 329,8 | | 2548 | 1261,5 | | | | |
| 22 | | RT | 82 | 82 | | 0 | 0 | | 355 | 71 | | 437 | 153 | | 0,094 | | |
| 23 | Utama+Minor Total | | 988 | 988 | | 109 | 141,7 | | 2450 | 490 | | 3547 | 1619,7 | | 0,221 | | |
| 24 | | | | | | | Rasio JL Minor / (JL Utama+Minor) total | | | | | | 0,201 | | UM/MV : | 0,001 | |

Based on the results of the survey that has been conducted, the peak hour traffic volume at unsignalized intersections on Jalan Jendral Ahmad Yani, Jalan Abu Bakar Lambogo and Jalan Bukit Madani, especially on holidays, which occurs on Saturdays at 16.00 – 17.00 with a total volume of 3,547 vehicles and after being converted to light vehicle equivalents, it becomes 1,619.7 smp/hour.

Next, intersection performance analysis is conducted by considering several important aspects that describe the level of efficiency and smoothness of traffic flow at an intersection. In this study, intersection performance assessment includes four main parameters: intersection capacity, saturation analysis, delay analysis, and queue probability analysis.

### 1. Intersection Capacity

The intersection capacity is calculated using the following equation:

**C = C0 x FLP x FM x FUK x FHS x FBKI x FOkay x FRmi (junior high school/hour)**

To obtain the intersection capacity value (C), it is first determined that basic capacity ($C_0$)and a some correction factor which reflects the real traffic conditions in the field. To find the value basic capacity ($C_0$), used as a reference from Table 1which contains the basic capacity value based on the intersection type. The intersection under review has type 422, so the C value$_0$profit type 422 intersection = 2900 smp/hour.

Next, it is average width of approach (LRP)This value is calculated by adding the widths of each approach lane divided by two, then dividing the result by the number of intersection arms. The formula used is:

$L_{RP}$ = ( a + b + c + d ) : 4

From the calculation results obtained:

$L_{RP} = (\frac{4}{2} + \frac{7,5}{2} + \frac{6,8}{2} + \frac{7,5}{2}) : 4 = 6,45$

L-value$_{RP}$is then used to determine the average approach width correction factor ($F_{LP}$)with the following formula:

$F_{LP}$ = 0,70 + ( 0,0866 x $L_{RP}$ )

$F_{LP}$ = 0,70 + (0,0866 x 6,45 ) = 1,259

So for the results$F_{LP}$namely 1,259

The next step is to determine the city size correction factor ($F_{UK}$). Based on data from the Central Statistics Agency (BPS, 2024), the population of Parepare City was recorded as 161,599 people. Based on the classification of city size, the F value is obtained as large as 0.88.
Then, a determination is made of the resistance correction factor ($F_{HS}$). Based on observations of conditions around the intersection, the environment around the intersection is a commercial environment type where the land around the intersection is needed for commercial purposes such as shops, restaurants, offices, and places of worship. The type of commercial area environment with side barriers of 0.95 is in the low category.
Next, it is determined turn current ratio correction factor**(**$F_{BKi}$**),** which is calculated using the following equation:
FBKi=0,84+1,61($R_{BKi}$)
R-value$_{BKi}$is the ratio of the flow of vehicles making left turns to the total traffic flow. Based on Table 1 and calculation results, for Tuesday, April 8, 2025, obtained $R_{BKi}$= 0.137, so:
$F_{BKI}$ = 0,84 + 1,61 ($R_{BKi}$)
$F_{BKI}$ = 0,84 + 1,61 (0,137)
$F_{BKI}$ = 1,061
Then the value is obtained$F_{BKi}$namely 1,061
Whereas for Saturday, April 12, 2025, in table 2 we get $R_{BKi}$=0.127, so:
$F_{BKi}$ = 0,84 + 1,61 ($R_{BKi}$)
$F_{BKi}$ = 0,84 + 1,61 (0,127)
$F_{BKi}$ = 1,044
Then the value is obtained$F_{BKi}$namely 1,044
Next, it is determined right turn current ratio correction factor (FBKa). The right turn flow ratio correction factor is obtained by using equation (8), for intersection 4 $F_{Okay}$ = 1,0
The next step is to calculate the minor road current ratio correction factor **(**$F_{me}$**)**This value is obtained from the ratio of minor road traffic flow ($q_{me}$) to total traffic flow ($q_{TO}$), which is called $R_{me}$. F Calculation $_{me}$ is done using the formula:
$F_{me}$=1,19 ×$R_{mi}$ $^2$ − 1,19×$R_{mi}$ +1,19
Based on the calculation results, the correction factor for the minor road flow ratio on Tuesday, April 8, 2025. Intersection type = 422
$F_{me}$ = 1,19 ×$R_{mi}$ $^2$ −1,19×$R_{mi}$ +1,19
$R_{me}$ = 0,225
$F_{me}$ =1,19 ×0,225 $^2$ −1,19×0,225 +1,19
= 0,982
Meanwhile, for the correction factor for the minor road flow ratio on Saturday, April 12, 2025. Intersection type = 422
$F_{me}$ = 1,19 ×$R_{mi}$ $^2$ −1,19×$R_{mi}$ +1,19
$R_{me}$ = 0,201
$F_{me}$ =1,19 ×0,201 $^2$ −1,19×0,201 +1,19 = 0,999
After all the correction factor values are obtained, the intersection capacity (C) on Jalan Jendral Ahmad Yani, Jalan Abu Bakar Lambogo and Jalan Bukit Madani can be calculated by substituting all values into the capacity equation, namely:
a) On Tuesday, April 8, 2025
C = $C_0$ x $F_{LP}$ x $F_M$ x $F_{UK}$ x $F_{HS}$ x $F_{BKi}$ x $F_{BK}$ x $F_{Rmi}$
C = 2900 x 1,259 x 1 x 0,88 x 0,95 x 1,061x 1 x 0,982
= 3180.435 smp/hour
b) On Saturday, April 12, 2025
C = $C_0$ x $F_{LP}$ x $F_M$ x $F_{UK}$ x $F_{HS}$ x $F_{BKi}$ x $F_{BK}$ x $F_{Rmi}$
C = 2900 x 1,259 x 1 x 0,88 x 0,95 x 1,044 x 1 x 0,999
= 3181.988 smp/hour

**2. Saturation Degree Analysis**
Degree of saturation ($D_J$) unsignalized intersections can be analyzed using equation (10) after obtaining the total traffic volume ($q_{TO}$) and capacity (C).
a) Saturation levels during peak weekday hours, Tuesday, April 8, 2025
$D_J$ = q/C
$D_J$ = 1959,1/3180
$D_J$ = 0,61
So the degree of saturation ($D_J$) on Tuesday was 0.61
b) Saturation level during peak holiday hours, Saturday, April 12, 2025
$D_J$ = q/C
$D_J$ = 1619,7/3181
$D_J$ = 0,50
So the degree of saturation ($D_J$) on Saturday at 0.50

**3. Delay Analysis**

a. Traffic delays

The delay is determined using equation (11), where the average traffic delay (T) must first be calculated.$_{LL}$) and the average geometric delay ($T_G$) before calculating the intersection delay.

1) Due to the value of $D_J > 0.60$ then the average traffic delay on Tuesday, April 8 2025 is analyzed using equation (13).

$T_{LL} = \frac{1,0504}{(0,2742-0,2042\ DJ)} - (1- D_J)^2$

$T_{LL} = \frac{1,0504}{(0,2742-0,2042\ x\ 0,61)} - (1- 0,61)^2$

$T_{LL}$ = 6.87 smp/hour

2) Due to the value of $D_J \leq 0.60$ then the average traffic delay on Saturday, April 12, 2025 is analyzed using equation (12).

$T_{LL} = 2 + 8,2078\ D_J - (1-D_J)^2$

$T_{LL} = 2 + 8,2078 \times 0,50 - (1-0,50)^2$

$T_{LL}$ = 5.85 smp/hour

b. Major road traffic delays

1) Due to the value of $D_J > 0.60$ then the major road traffic delays on Tuesday, April 8 2025 are analyzed using equation (15).

$T_{LLMa} = \frac{1,0503}{(0.3460-0.2460DJ)} - (1- D_J)^{1,8}$

$T_{LLMa} = \frac{1,503}{(0,3460-0,2460\ x\ 0,61)} - (1-0,61)^{1,8}$

$T_{LLMa}$ = 5.11 smp/hour

2) Due to the value of $D_J \leq 0.60$ then the major road traffic delays on Saturday, April 12, 2025 are analyzed using equation (14).

$T_{LLMa} = 1,8000 + 5,8234\ D_J - (1- D_J)^{1,8}$

$T_{LLMa} = 1,8000 + 5,8234 \times 0,50 - (1- 0,50)^{1,8}$

$T_{LLMa}$ = 4.42 smp/hour

c. Minor road traffic delays

Traffic delays on minor roads are calculated using equation (16)

$T_{LLM} = \frac{qKB\ X\ TLL - qma\ X\ TLLma}{who}$

1) Minor road traffic delays on Tuesday, April 8, 2025

$T_{LLM} = \frac{qKB\ X\ TLL - qma\ X\ TLLma}{who}$

$T_{LLM} = \frac{1959,1\ X\ 6,87 - 1599,7\ X\ 5,11}{359,4}$

$T_{LLM}$= 14,703 smp/hour

2) Minor road traffic delays on Saturday, April 12, 2025

$T_{LLM} = \frac{qKB\ X\ TLL - qma\ X\ TLLma}{who}$

$T_{LLM} = \frac{1619,7\ X\ 5,85 - 1368,1\ X\ 4,42}{251,6}$

$T_{LLM}$= 13,625 smp/hour

d. Geometric Delay

The average geometric delay of all intersections can be calculated using equation (17).

$D_J < 1 : T_G = (1- D_J) \times \{6\ R_B + 3(1 - R_B)\} + 4\ D_J$

1) Geometry postponement on Tuesday, April 8, 2025

$T_G = (1- D_J) \times \{6\ R_B + 3(1 - R_B)\} + 4\ D_J$

$T_G = (1- 0,61) \times \{6 \times 0,229 + 3(1 - 0,229)\} + 4 \times 0,61$

$T_G$= 3.88 smp/hour

2) Geometry postponement on Saturday, April 12, 2025

$T_G = (1- D_J) \times \{6\ R_B + 3(1 - R_B)\} + 4\ D_J$

$T_G = (1- 0,50) \times \{6 \times 0,221 + 3(1 - 0,221)\} + 4 \times 0,50$

$T_G$= 3.83 smp/hour

After analyzing traffic delays and geometric delays, the T value can be determined using equation (11).

$T = T_{LL} + T_G$

a) Intersection delays on Tuesday, April 8, 2025

$T = T_{LL} + T_G$

T = 6,87 + 3,88

T = 10.75 deg/mp

b) Intersection delays on Saturday, April 12, 2025

$T = T_{LL} + T_G$

T = 5,85 + 3,83

T = 9.68 deg/mp

**4. Queue Opportunity Analysis**

The queue probability is expressed as a percentage (%). The queue probability is determined by finding the upper limit of the probability and the lower limit of the probability using equation (18) for the upper limit and equation (19) for the lower limit.

a. Queue opportunities on Tuesday, April 8, 2025

Upper limit of $P_a$ $= 47{,}71\ D_J - 24{,}68\ D_J^2 + 56{,}47\ D_J^3$

$= 47{,}71(0{,}61) - 24{,}68(0{,}61^2) + 56{,}47(0{,}61^3)$

$= 33\ \%$

Lower Limit of $P_a = 9{,}02\ D_J - 20{,}66\ D_J^{\ 2} + 10{,}49\ D_J^3$

$= 9{,}02(0{,}61) - 20{,}66(0{,}61^2) + 10{,}49(0{,}61^3)$

$= 0{,}19\ \%$

b. Queue opportunities on Saturday, April 12, 2025

Upper limit of $P_a$ $= 47{,}71\ D_J - 24{,}68\ D_J^2 + 56{,}47\ D_J^3$

$= 47{,}71(0{,}50) - 24{,}68(0{,}50^2) + 56{,}47(0{,}50^3)$

$= 24\ \%$

Lower Limit of $P_a = 9{,}02\ D_J - 20{,}66\ D_J^{\ 2} + 10{,}49\ D_J^3$

$= 9{,}02(0{,}50) - 20{,}66(0{,}50^2) + 10{,}49(0{,}50^3)$

$= 0{,}65\ \%$

After analyzing the four main parameters, which include intersection capacity, degree of saturation, delays, and queue opportunities, the overall results of the analysis are presented briefly in the following table.

**Table 3.** Intersection performance analysis results

| Analysis | Peak Hour | |
|---|---|---|
| | Tuesday 08.00-09.00 | Saturday 4:00-5:00 PM |
| Traffic Volume | 4.691 kend/jam | 3.547 kend/jam |
| Capacity (C) | 3180.435 smp/hour | 3181,988 smp/hour |
| Degree of Saturation ( $D_J$) | 0,61 | 0,50 |
| Delay (T) | 10.75 det/smp | 9.68 det/smp |
| Queue Probability ($P_a$) | 0,19 – 33 % | 0,65 – 24 % |
| Intersection Service Level | B | B |

(Source: 2025 Calculation Results)

Based on Table 3, the results of the performance analysis of the unsignalized intersection at the intersection of Jalan Jendral Ahmad Yani, Jalan Abu Bakar Lambogo, and Jalan Bukit Madani show that on Tuesday at 08.00–09.00 the traffic volume reached 4,691 vehicles per hour, while on Saturday at 16.00–17.00 it was recorded at 3,547 vehicles per hour. The intersection capacity (C) values obtained at both times were relatively similar, namely 3,180.435 smp/hour for Tuesday and 3,181.988 smp/hour for Saturday. The calculation results show that the degree of saturation (DJ) was 0.61 and 0.50, respectively, which means that the traffic flow conditions at the intersection were still below the critical value (DJ < 0.75). Therefore, the intersection capacity was still adequate to accommodate the existing traffic volume. The average delay value (T) of 10.75 seconds/smp on Tuesday and 9.68 seconds/smp on Saturday, as well as the queue probability (Pa) between 19–33% and 24–65%, indicates that traffic conditions are still within the limits of good service. Based on these results, the level of service at the intersection is categorized as Level of Service (LOS) B, which indicates that traffic flow is running smoothly with relatively low delays.

These results indicate that the intersection's performance is still relatively good and is able to serve traffic volume efficiently. A saturation value below 0.75 indicates that the intersection's capacity has not been exceeded and vehicle flow can still flow stably. The low delay value also indicates that road users only experience minor obstacles due to vehicle interaction at the intersection (Cakici & Aksoy, 2024). This condition reflects that the geometric arrangement of the intersection and the surrounding environmental conditions, such as low side obstacles and adequate approach width, play an important role in maintaining smooth traffic flow.

Compared to previous research, intersection performance at the study site showed relatively better conditions. Based on research by Huliselan & Rusmin (2019), the unsignalized intersection on Jalan R.A. Kartini has a saturation level between 0.3 and 0.46, indicating that traffic conditions are still in the unsaturated category. Meanwhile, research conducted by Seran et al. (2020) at unsignalized intersections at Jalan Veteran, Jalan Belakang Taman Nostalgia, and Jalan Depan Hotel Naka showed the potential for traffic conflicts due to the high volume of vehicles heading to surrounding public activity centers, such as parks, schools, shopping centers, and markets. Meanwhile, research by Said & Syafei (2022) on Jalan Bau Massepe showed that the intersection's service level was in category C with a saturation level below 0.75, which is still considered good.

Based on the comparison results, it can be concluded that the intersection at the study site has its planned capacity and is being optimally utilized. This condition reflects the intersection's efficient performance, which is also supported by a relatively orderly surrounding environment that does not create significant side obstacles. Therefore, the studied intersection can be categorized as having stable performance and capable of serving vehicle flow well, both on weekdays and weekends.

Nevertheless, efforts to improve intersection performance are still necessary to anticipate future traffic volume growth. Some recommended steps include regular monitoring of traffic volume and vehicle movement patterns, particularly during peak hours, to identify potential increases in saturation levels.Gupta et al., 2023). In addition, parking arrangements and commercial activities around the intersection area need to be managed well so as not to cause side obstacles that can disrupt the flow of vehicles (Said & Syafey, 2021). The addition of traffic signs, clearer road markings, and improvements to the quality of road surfaces are also expected to increase the safety and efficiency of vehicle movement (Fiolić et al., 2023). If in the future there is a significant increase in traffic volume, then the implementation of a traffic light control system (traffic signal) can be an alternative to maintain an optimal level of intersection service.

## CONCLUSION

Based on the results of the analysis of the performance of unsignalized intersections at the intersection of Jalan Jendral Ahmad Yani, Jalan Abu Bakar Lambogo, and Jalan Bukit Madani, it can be concluded that traffic conditions at this location are still classified as good and can operate with a service level of category B, which indicates stable traffic flow with minimal obstructions. The highest traffic volume occurred on Tuesday, April 8, 2025, at 4,691 vehicles/hour at 08:00–09:00, while on Saturday the highest volume was 3,547 vehicles/hour at 16:00–17:00. The intersection capacity values on both days were relatively similar, at around 3,180 pcu/hour, with a saturation degree of 0.61 on Tuesday and 0.50 on Saturday, indicating that the intersection capacity was still able to accommodate the existing traffic volume. The relatively low traffic delays, at 10.75 sec/pcu on Tuesday and 9.68 sec/pcu on Saturday, and the relatively low probability of queues indicate that the intersection is still functioning efficiently without any indication of significant congestion. These results imply that although current traffic conditions are still good, increasing vehicle volumes during peak hours have the potential to reduce intersection performance in the future, so adaptive traffic management is recommended, such as prioritizing main traffic or increasing intersection capacity to maintain optimal service levels.

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