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# Analysis of Operational Efficiency at Unsignalized Intersections in Pontianak City

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***Abstract**. Congestion in Pontianak City significantly impacts traffic flow, affecting both efficiency and comfort of road transit. The city's unsignalized intersections, crucial for managing vehicle flow from multiple directions, are under scrutiny for their performance. A study using the Indonesian Road Capacity Guidelines (IRCG) has assessed intersections, that the degree of saturation often exceeds acceptable limits, leading to congestion and increased delays. The research highlights that the current capacity of these intersections is insufficient to handle the growing traffic demand. For instance, under maximum traffic flow conditions, one intersection recorded a total traffic flow of 2,978.20 pcu/hour against a capacity of 2,716.40 pcu/hour, resulting in a degree of saturation of 1.096. This indicates a need for interventions like installing traffic signals or modifying road geometry to enhance flow efficiency. Despite these findings, the analysis of existing conditions specific unsignalized intersections showed a level of service value of E and F, suggesting that these intersections currently require immediate improvements. However, to further improve intersection performance, recommendations include reducing side obstacles, enhancing road geometry, and installing two-phase traffic signals, which offer the highest capacity with minimal delay. These measures aim to ensure that Pontianak City's transportation infrastructure can effectively.*

***Keywords** Critical Points, Congestion, Traffic Flow, Unsignalized Intersection's Performance, The Indonesian Road Capacity Guidelines*

## 1. INTRODUCTION

The performance of unsignalized intersections in Pontianak City is a critical issue that reflects the growing challenges of urban traffic management. As the city experiences rapid population growth and increasing vehicle ownership, the existing roads infrastructure faces significant pressure, particularly at intersections that lack traffic signals (Wen, 2019). The guidelines provide essential metrics for evaluating traffic flow, capacity, and service levels at intersections, which are crucial for identifying congestion points and potential improvements. In Pontianak, unsignalized intersections often lead to delays and increased accident risks due to the absence of structured traffic control. The analysis will focus on various parameters such as traffic volume, degree of saturation, and average delay times to assess the current operational efficiency of these intersections. For instance, data collection will involve manual traffic counts during peak hours to determine the Level of Service (LOS) and identify critical gaps in vehicle flow. Intersections become critical points of the traffic system where vehicles from different directions meet, merge, intersect, and cross (Eom, 2020). The accident rate at unsignalized intersections is estimated at 0.60 accidents per million vehicles due to the lack of driver attention to yield signs and stop signs (Ertuğay, 2019). The density level of the intersection has a high traffic flow, especially during peak

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hours when the vehicles that pass through are so dense that they often cause congestion (Irwandi, 2023) and heavy traffic movements at an intersection can cause congestion and have a high potential for accidents (Sugiarto, 2022). Obstacles and traffic jams that occur at the intersection will affect the capacity of the roads concerned, so the level of service at the intersection will decrease, including a decrease in speed, safety, and comfort for roads users (Widodo, 2022).

Intersection performance is a key factor in determining the most appropriate process for optimizing intersection operations, and the parameters used to evaluate the performance of unsignalized intersections include capacity, degree of saturation, delay, and queuing opportunities (Mandasari, 2019). Unsignalized crossings may lead to complex and disorderly traffic conditions, resulting in decreased safety risks for both vehicles and pedestrians. The Vissim program is a microscopic multi-modal traffic flow simulation software that can be used to analyze traffic flow movements with problems such as lane configuration, vehicle composition, traffic signals and others (Sejati, 2024). The use of the Vissim program application is often used to analyze alternative handling of traffic flow problems both on roadss and intersections (PTV Vision, 2015). Vissim is a microsimulation-based software developed to analyze the characteristics of urban traffic, pedestrian, and transit systems. More specifically, vissim can be used to analyze traffic flow, such as lane configuration, traffic composition, public transport operations. Traffic simulation models have become an important and popular tool in transportation system modeling due to their fast processing using computers (Aghabayk, 2013).

The purpose of this study is to identify the performance of unsignalized intersections based on the Indonesian Roads Capacity Guidelines and provide recommendations for handling unsignalized intersections to facilitate traffic flow movements as well as intersection performance and roads user comfort. In recent years, the increasing vehicle volume in urban areas has led to significant traffic congestion, particularly at unsignalized intersections (Olayode, 2020). This phenomenon is notably evident in Pontianak City, where the performance of these intersections has become a pressing concern. Conducting research on the performance of unsignalized intersections in accordance with the Indonesian Roads Capacity Guidelines (IRCG) is essential for several reasons. By analyzing key performance indicators such as degree of saturation, delay times, and queue lengths, researchers can identify critical issues affecting traffic efficiency and safety.

Moreover, unsignalized intersections often lack clear traffic control measures, leading to unpredictable driver behavior and increased risk of accidents. This study aims to assess the current state of these intersections in Pontianak by collecting data during peak hours, allowing for a comprehensive analysis of traffic patterns and behaviors. The findings will not only inform local authorities about necessary improvements but also contribute to the development of effective traffic management strategies that enhance roads safety and optimize intersection performance. Ultimately, this research serves as a vital step towards creating a more efficient transportation network that meets the needs of a growing urban population while adhering to established Indonesian standards for roads capacity and safety.

In recent years, the performance of unsignalized intersections in Pontianak City has garnered significant attention due to increasing traffic volumes and congestion issues. A comprehensive study conducted on various intersections, including those at Putri Dara Nante Roads, Putri Dara Hitam Roads and Alianyang Roads, utilized the Indonesian Roads Capacity Guidelines (IRCG) to assess the degree of saturation and overall traffic flow efficiency. The research revealed that existing conditions at these intersections often lead to suboptimal service levels, with some intersections rated as level A, B and C, indicating a need for improved traffic management strategies (Yang, 2021). The analysis employed both manual calculations based on IRCG and advanced simulation techniques using the Vissim software, which provided insights into traffic behavior and potential bottlenecks. Findings suggested that while some intersections currently operate without significant delays, others may benefit from the installation of traffic signals or other control measures to enhance safety and efficiency. This study underscores the critical role of thorough traffic analysis in urban planning and infrastructure development, aiming to optimize mobility and reduce congestion in Pontianak City.

## 2. LITERATURE REVIEW

The study of operational efficiency at unsignalized intersections, particularly in urban areas like Pontianak City, is crucial for addressing traffic congestion and improving road safety. This literature review synthesizes findings from various studies and methodologies to support the analysis of unsignalized intersections' performance. Unsignalized intersections are critical nodes in urban traffic networks where vehicles from multiple directions meet without the guidance of traffic signals (Wang, 2024). These intersections often suffer from congestion due to high traffic volumes, side obstacles, and unstructured driver behavior (Yue, 2021). Key performance indicators include traffic volume, Degree of Saturation (DS), delay, queue length, and Level of Service (LOS). Studies reveal that the absence of structured control measures at these intersections leads to unpredictable driver behavior, increased delays, and higher accident risks (Ahmed, 2022). For example, the intersection capacity often fails to accommodate peak-hour traffic demand, resulting in LOS values as low as F, indicating severe congestion. The Indonesian Road Capacity Guidelines provide a standardized approach for evaluating intersection performance. This methodology assesses parameters such as capacity, DS, delay, and queuing probability.

Microsimulation tools like PTV VISSIM complement these guidelines by offering detailed analyses of traffic flow under various scenarios (Ullah, 2021). VISSIM is particularly effective in simulating alternative solutions such as geometric modifications or signal installations (Mitkas, 2020). Expanding road widths and optimizing lane configurations can significantly improve intersection capacity (Yao, 2021). Studies suggest that increasing lane widths by 0.5 meters on all approaches can enhance traffic flow and reduce delays (Wang, 2013). Installing two-phase or three-phase traffic signals is a proven strategy for managing congestion at unsignalized intersections (Luo,2024). Reducing side obstacles such as parked vehicles and street vendors is essential for improving traffic flow (Biswas, 2017). VISSIM software provides detailed insights into traffic dynamics by simulating various scenarios (Vrbanić, 2021).

## 3. METHODS

The study methodology encompassed the gathering of both primary and secondary data. The primary data consisted of surveys that collected information on traffic volume, intersection geometry, vehicle speed, and driver behavior. Site maps and historical traffic data were used to collect secondary data (De la Cruz-Nicolás, 2023). The investigation of intersection performance was carried out by estimating the degree of saturation, traffic delay, and geometric delay (Almutairi, 2024). The degree of saturation is determined by dividing the traffic volume by the intersection capacity.

The calculation of traffic delay is determined by the level of saturation, whereas geometric delay is determined by the proportions of stationary cars and turning vehicles. The volume of peak hour traffic is crucial in evaluating capacity and other parameters as it is the most critical time period. The survey was conducted for one day during morning peak hours 06.00–08.00, off peak hours 11.00–13.00, and afternoon peak hours 16.00–18.00

(Sutandi, 2005). The research analysis used the Indonesian Roads Capacity Guidelines. The data analyzed are traffic flow (q), capacity, degree of saturation, delay, queuing opportunities, and Level of Service (LOS). Using the Vissim software traffic microscopic simulation model program, traffic evaluation at intersections without traffic lights is simulated.

The survey was conducted to obtain data on the geometrics, roadsside land use, and infrastructure availability of the intersection by taking measurements (Mehdian, 2022). The unsigned intersection Roads. Alianyang-Roads. Putri Dara Nante-Roads. Putri Dara Hitam is an unsigned intersection with an undivided two-lane, two-way roads type (2/2 UD) for each leg of the intersection. There are many activities at this intersection, such as trading activities on the intersection arms and the entry and exit of vehicles parked on the side of the roads due to the many shops on the intersection arms, which cause congestion in the morning and afternoon without exception at night. Based on the results of the geometric measurements of the roads section in Table 1.

**Table 1.** Geometric Data of Unsignalized Intersections

| Arm intersection | Average Pavement Width (m) | Lanes Approach | Width Winlet (m) | Width Wexit (m) | Shoulder Width (m) | | Pavement Width (m) |
|---|---|---|---|---|---|---|---|
| | | | | | left | right | |
| Putri Dara Hitam Road | 6.00 | 2 | 3.0 | 3.0 | 1.0 | 1.0 | 1.0 |
| Putri Dara Nante Road | 6.30 | 2 | 3.15 | 3.15 | 1.0 | 1.0 | 1.0 |
| Alianyang Road | 10.0 | 2 | 5.0 | 5.0 | 1.0 | 1.0 | 1.0 |
| Alianyang Road | 10.0 | 2 | 5.0 | 5.0 | 1.0 | 1.0 | 1.0 |

Based on Table 1 explained the intersection comprises four distinct arms with varying geometric characteristics. Roads. Putri Dara Hitam features a 6.0-meter pavement width with symmetrical inlet and outlet widths of 3.0 meters. Roads. Putri Dara Nante exhibits slightly different dimensions with a 6.30-meter pavement width and asymmetrical inlet and outlet configurations of 5.15 and 3.15 meters respectively. Both segments of Roads. Alianyang maintain identical dimensions with 10.0-meter pavement widths and consistent 5.0-meter inlet and outlet measurements. The analysis of unsignalized intersections in Pontianak City reveals systematic geometric patterns across four major intersection arms. The average pavement width across all intersections is 6.075 meters, demonstrating consistency in roads design standards. This study examines the geometric features according to Indonesian Roads Capacity Guidelines. This geometric configuration reflects a standardized approach to urban intersection design in Indonesian cities. The consistency in shoulder widths and lane numbers demonstrates compliance with national infrastructure planning guidelines, while variations in inlet and outlet widths accommodate different traffic volumes and turning requirements at each intersection arm (Okonkwo, 2016).

Based on the results of the traffic volume survey obtained in 15-minute intervals, the data with 15-minute intervals was recapitulated to determine the highest traffic volume (Oktobrianto, 2022). The recapitulation results determine the traffic volume by the number of vehicles per hour at SM, KS, MP, and KTB. This calculation is carried out on all types of vehicles to get the highest number on each arm volume of the unsignalized intersection Roads. Alianyang, Roads. Putri Dara Nante, and Roads. Putri Dara Hitam, and analysis is carried out to obtain the peak hour time SMP per hour, which is then multiplied by the equivalent value of the vehicle in Table 2.

**Table 2.** Unsignalized Intersection Peak Hour Traffic Flow Data

| Hour | Arm intersection | Directional movement | Peak Hour Flow (pcu/h) | | | | $q_{KB}$ |
|---|---|---|---|---|---|---|---|
| | | | SM, EMP=0.5 | MP EMP=1.0 | KS EMP=1.3 | KTB | |
| 12.00-13.00 | Alianyang | $q_{BKi}$ | 40.5 | 25 | 0 | 0 | 950.8 |
| | | $q_{LRS}$ | 358.5 | 279 | 11.7 | 2 | |
| | Approach B | $q_{BKa}$ | 165.5 | 68 | 2.6 | 0 | |
| | | Jumlah | 564.5 | 372 | 14.3 | 2 | |
| 12.00-13.00 | Putri Dara Nante | $q_{BKi}$ | 220.5 | 59 | 0 | 0 | 554.4 |
| | | $q_{LRS}$ | 176.5 | 39 | 0 | 1 | |
| | Approach C | $q_{BKa}$ | 35.5 | 20 | 3.9 | 0 | |
| | | Jumlah | 432.5 | 118 | 3.9 | 1 | |
| 11.00-12.00 | Putri Dara Hitam | $q_{BKi}$ | 79.5 | 22 | 0 | 0 | 422.1 |
| | | $q_{LRS}$ | 180.5 | 52 | 1.3 | 0 | |
| | Approach A | $q_{BKa}$ | 69.5 | 16 | 1.3 | 0 | |
| | | Jumlah | 329.5 | 90 | 2 | 0 | |
| 07.00-08.00 | Alianyang | $q_{BKi}$ | 32 | 3 | 0 | 1 | 1,050.9 |
| | | $q_{LRS}$ | 273.5 | 110 | 10.4 | 0 | |
| | Approach D | $q_{BKa}$ | 497 | 125 | 0 | 2 | |
| | | Jumlah | 1.605 | 238 | 10.4 | 3 | |

Based on Table 2 explained the peak hour traffic flow data shows varying volumes across the three intersections. Ali Anyang Roads demonstrates the highest traffic flow with 950.8 pcu/hour, followed by Putri Dara Nante Roads with 554.4 pcu/hour, and Putri Dara Hitam Roads with 422.1 pcu/hour. These measurements indicate significant differences in intersection utilization and potential areas of traffic concentration. The unsignalized intersection analysis in Pontianak City demonstrates varying levels of performance across the studied locations. The findings suggest that traffic management strategies should focus particularly on Ali Anyang Roads due to its higher flow rates, while maintaining monitoring of the other intersections to ensure optimal traffic distribution and flow (Mehdian, 2022).

## 4. RESULT

The number of lanes based on the average approach width of minor and major roads as required is 2 lanes of minor roads and 2 lanes of major roads, with an intersection type of 422 which means it has 4 arms, 2 lanes of minor roads, and 2 lanes of major roads.

**Table 3.** Approach Width and Unsignalized Intersection Type

| Options | Arm Intersection | Approach Width, m | | | | | | | | | Type of Intersection |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Minor Road | | | Major Road | | | $L_{RP}$ | Lanes | | |
| | | $L_A$ | $L_C$ | $L_{AC}$ | $L_B$ | $L_D$ | $L_{BD}$ | | Minor Road | Major Road | |
| 1 | 4 | 3 | 3.15 | 3.08 | 5 | 5 | 5 | 4,04 | 2 | 2 | 422 |

Based on Table 3 explained the intersection is classified under type 422, which indicates a specific standardized configuration according to Indonesian road design guidelines. This classification takes into account the number of approaches, lane configuration, and geometric characteristics that influence the intersection's operational capacity and safety parameters. The geometric characteristics and lane configurations observed at this unsignalized intersection have significant implications for its operational performance (Kabir, 2021). The wider approach width on the major road facilitates higher traffic volumes, while the balanced lane distribution supports efficient traffic flow management. These design elements align with Indonesian road capacity standards and contribute to the intersection's functionality within Pontianak's urban. The basic capacity value is determined based on Te type of intersection, which is 422, and then the basic capacity value is 2,900 Pcu/h.

**Table 4.** Capacity of Unsignalized Intersection

| Options | Base capacity $C_0$ | Traffic Performance | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Average approach width | Major road median | City size | Side obstacle | Left turn ratio | Right turn ratio | Minor ratio | Capacity C |
| | pcu/h | $F_{LP}$ | $F_M$ | $F_{UK}$ | $F_{HS}$ | $F_{BKi}$ | $F_{BKa}$ | $F_{Rmi}$ | pcu/h |
| 1 | 2,900 | 1.049 | 1 | 0.94 | 0.93 | 1.103 | 1 | 0.927 | 2,716.40 |

Based on Table 4 explained the analysis of unsignalized intersection performance in Pontianak City follows the Indonesian Road Capacity Guidelines (IRCG), which provides a systematic approach to evaluate traffic flow efficiency. The base capacity of the unsignalized intersection is established at 2,900 passenger car units per hour, serving as the fundamental reference point for capacity calculations. The analysis reveals that the intersection's performance is influenced by multiple variables, with turning movements having a particularly significant impact on overall capacity (Dos' Santos, 2022). This comprehensive analysis provides valuable insights for traffic management and future infrastructure planning in Pontianak City, enabling authorities to make informed decisions regarding potential improvements or modifications to the intersection design.

**Table 5.** Traffic Performance of Unsignalized Intersections

| Options | Traffic Flows, qKB | Traffic Performance | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Degree of saturation | Traffic delay at intersection | Major road traffic delays | Minor road traffic delays | Delay of intersection geometry | Intersection delay | Queuing probability |
| | pcu/h | $D_s$ | $T_{LL}$ | $T_{LLma}$ | $T_{LLmi}$ | $T_G$ | $T=T_{LL}+T_G$ | $P_a$ |
| | (21) | (22) | (23) | (24) | (25) | (26) | (27) | (28) |
| 1 | 2,978.20 | 1.096 | 20.865 | 13.757 | 35.419 | 4 | 24.865 | 48-97% |

Based on Table 5 explained the analysis of unsignalized intersections in Pontianak City reveals significant variations in traffic performance metrics based on the Indonesian Road Capacity Guidelines. The study examined two distinct operational scenarios, providing comprehensive insights into intersection efficiency and congestion levels. The degree of saturation presents a critical concern, particularly in Option 1, where the value reached 1.096, exceeding the theoretical capacity threshold of 1.0. This oversaturation suggests potential congestion issues during peak periods (Doll, 2024).

## 5. DISCUSSION

After conducting an analysis at the unsignalized intersection located at Roads. Alinyang - Roads. Putri Dara Nante - Roads. Putri Darah Hitam, numerous significant concerns that impact traffic performance were identified Pavements and roads shoulders are being utilized as parking areas and spaces for street vendors, so impeding pedestrian rights and augmenting obstructions along the sides. The intersection performance evaluation, according to the Indonesian Roads Capacity Guidelines 2023, is based on the Degree of Saturation (DS) value under conditions ≥ 0.85. The evaluation resulted in a DS value of 1.096, which equates to a Level of Service (LOS) classified as F. This level of service is defined as traffic flows that exceed the capacity of the network, leading to slow speeds, volumes, and congestion. This level of service is defined as traffic flows that exceed the capacity of the network, leading to slow speeds, volumes that exceed capacity, and substantial delays (congestion). These results indicate that the system cannot effectively support vehicular traffic operations due to possible problems such as congestion and accidents. To restore a reasonable level of service at the unsignalized intersections of Alinyang Roads, Putri Dara Nante Roads, and Putri Darah Hitam Roads, it is imperative to resolve the traffic problems. Based on the analysis utilizing the Indonesian Roads Capacity Guideline, it has been ascertained that the unsignalized intersection at Alinyang Roads, Putri Dara Nante, Putri Darah Hitam Roads encounters. Problems with traffic congestion and even incidents of accidents. The reason for this is the present circumstances at the intersection, which have been evaluated with a Level of Service (LOS) rating of F. The following are the findings of the simulation results for various geometric widenings of each arm in Figure 1.

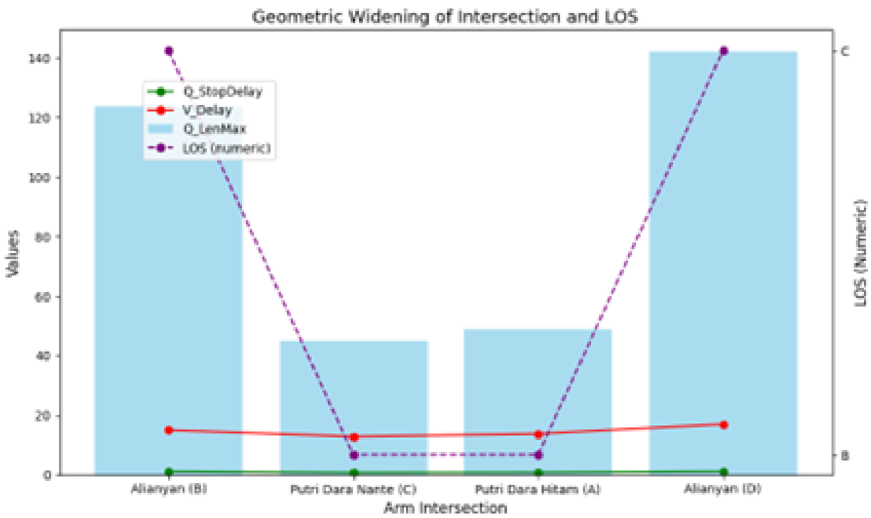


**Figure 1.** Results of Geometric Widening of Intersection

Based on Fig 1 explained the alternative plan for geometric widening resulted in a decrease in the level of service analysis from the previous Loss of Service F. Upon expanding the geometric roads, the intersection's level of service deteriorated to Loss of Service (LOS) B, while maintaining constant flow characteristics. However, the speed and motion of vehicles were controlled. According to Kuncoro, 2019 one way to enhance the performance of unsignalized intersections is by installing traffic signal devices. This helps optimize traffic flow, enhance safety, and facilitate the movement of vehicles and pedestrians. According to the Indonesian roads capacity standards, using a two-phase traffic signal device configuration is recommended as it offers the most capacity with the least delay compared to alternative phase layouts. The Vissim program utilizes a traffic simulation to provide an output that represents the performance or operation of an intersection. Install no-parking signs along the roadsside to mitigate the presence of obstructions resulting from unauthorized parking and street sellers. Enhance traffic management by implementing two-phase traffic lights to optimize the flow of vehicles and pedestrians, hence enhancing safety and efficiency. The following are the findings of the simulation of possible two-phase traffic signaling device settings in Figure 2.

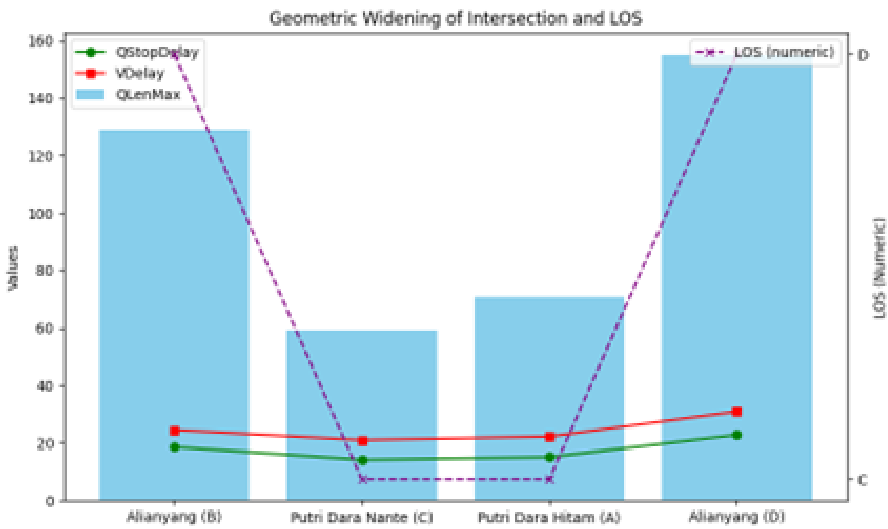


**Figure 2.** Result Two-phase setting of Intersection

Based on Fig 2 explained the alternative arrangement of two-phase traffic signal devices resulted in a decrease in the level of service analysis from the previous Loss of Service F to Loss of Service (LOS) D at the unsignalized intersection. This new arrangement allows for near-stable flow and the ability to control speed (Venkatachari, 2011). These conditions are marked by traffic flow that exceeds the capacity of the network, leading to slow speeds, volumes that transcend the capacity, and substantial waits (traffic congestion). The VISSIM software is a tool for microscopic traffic simulation that can be utilized to examine traffic conditions at unsignalized intersections. This program produces an analysis of the performance of intersections. Improvements to the intersection are required to optimize the movement of vehicles, better the overall performance of the intersection, and minimize the negative effects on road users' comfort and smoothness by minimizing congestion at the intersection. Here are multiple alternatives for resolving traffic congestion problems at the uncontrolled intersection of Jl. Alinyang, Jl. Putri Dara Nante, and Jl. Putri Darah Hitam. Minimizing barriers on all sides of the unsignalized intersection to a minimal amount of hindrance. This is done because side barriers are widespread in the existing geometric conditions on all approaches. In order to address the obstacles on the side, it is advisable to install signs that prohibit parking alongside the road. Instead of focusing on enhancing the efficiency of intersections, the approach is to broaden the parameters for road design. Unsignalized intersections represent critical points in urban road networks where traffic conflicts frequently occur due to the absence of traffic light control systems. In Pontianak City, these intersections pose significant challenges to traffic flow and road safety, necessitating comprehensive performance analysis using standardized methods. Performance analysis reveals that unsignalized intersections in Pontianak experience significant challenges during peak hours. The degree of saturation often exceeds optimal levels, particularly during morning and evening rush hours. To improve intersection performance, several interventions are suggested. Geometric modifications to expand intersection capacity, implementation of turning restrictions during peak hours, installation of traffic management systems, regular monitoring and evaluation of traffic patterns.


**Figure 3.** Road Direction at Intersection

Based on Figure 3 explained reducing obstacles on all sides of the unsignalized intersection to a low level of obstruction. This is done because side barriers are widespread in the existing geometric conditions on all approaches. In order to address the obstacles on the side, it is advisable to install signs that prohibit parking alongside the road. Expanding the criteria for road design instead of improving the effectiveness of intersections. Considering the current state of the road shoulder, it is feasible to increase the width of each geometric lane on both the major and minor road approaches by 0.5 meters, so maximizing the overall width of the road. The VISSIM software employs traffic simulations to generate output in the form of a performance or operational intersection. Figure 1 displays the simulation results for various geometric widenings of each arm. Unsignalized intersections represent critical points in urban road networks where traffic conflicts frequently occur due to the absence of traffic light control systems. In Pontianak City, these intersections pose significant challenges to traffic flow and road safety, necessitating comprehensive performance analysis using standardized methods. The analysis demonstrates that unsignalized intersections in Pontianak require significant attention to optimize their performance. The implementation of IRCG provides a structured approach to evaluate and enhance intersection capacity, ultimately contributing to better traffic flow and reduced congestion

## 6. CONCLUSION

The unmarked intersection of Jl. Alinyang-Jl. Putri Dara Nante-Jl. Putri Darah Hitam has been transformed into parking areas and street vendor spaces, violating pedestrian rights and creating obstacles. The highest traffic volume is observed on Jalan Alianyang approach B during the afternoon peak hour, with 1,514 vehicles/hour. Jalan Alianyang approach D experiences the highest traffic volume during the morning peak hour, with 1,854 vehicles/hour. Jalan Putri Dara Hitam approach A records the highest traffic volume during the afternoon peak hour, with 751 vehicles/hour. Jalan Putri Dara Nante approach C experiences the highest traffic volume during the afternoon peak hour. The capacity performance of the unsignalized intersection at Jl. Alinyang-Jl. Putri Dara Nante-Jl. Putri Darah Hitam is analyzed, showing a traffic flow of 2,978.20 pcu/h, a capacity of 2,716.40 pcu/h, a degree of saturation of 1.096, intersection traffic delay of 20.865 s/pcu, geometric delay of 24.865 s/pcu, and queuing opportunities ranging from 48%-97%. The service level is categorized as F, denoting traffic flow that beyond the typical capacity of the network, resulting in reduced speed, volume exceeding capacity, and extended lineups (traffic jams). The intersection that consists of the roads Jl. Alinyang, Jl. Putri Dara Nante, and Jl. Putri Darah Hitam fails to comply with the Ds ≥ 0.85 criteria. VISSIM software has been utilized to provide recommendations for enhancing performance through microscopic traffic simulation. In order to improve efficiency and reduce traffic congestion, several steps can be adopted. These include the installation of signs that prohibit parking on the roadside, enlarging the geometric road by 0.5 meters on each lane of every approach road, and installing a two-phase traffic signaling system. These modifications will lead to a consistent and controlled flow of traffic, ensuring controlled speed and vehicle movement.

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