



Evaluation of the Performance of the Four-Way Intersection of Dr. M. Djamil General Hospital, Jalan Perintis Kemerdekaan, Padang City

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Abstract

The rapid growth of vehicles in Padang city causes congestion at crucial points, one of which is the RSUP Dr. M. Djamil Intersection. Despite having APILL infrastructure, this intersection operates as an unsignalized intersection because the traffic lights are not functioning. This study aims to evaluate the existing performance and provide alternative solutions based on the 2023 Indonesian Road Capacity Guidelines (PKJI). Primary data was obtained through a four-day field survey during the morning, afternoon, and evening peak times. The results of the analysis of existing conditions during the afternoon peak hour (Saturday, 5:00 PM - 6:00 PM WIB) showed a degree of saturation (DJ) value of 0.89 with an intersection delay of 15.34 sec/vehicle, which is included in the service level C (stable flow, moderate density). Three alternative solutions were studied: the addition of APILL (3 phases), widening of major roads with APILL, and widening of major roads without APILL. The comparison results show alternative solution 3 (widening the major road by 1 meter without APILL) as the most effective with a DJ value of 0.87, a delay of 14.84 sec/vehicle, and a service level of B.

Keywords: Intersection Performance, PKJI 2023, Degree of Saturation, Delay, Service Level

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1. Introduction

The rapid growth in the number of motorized vehicles in recent years has been a major cause of increasing traffic congestion in various cities in Indonesia, including Padang. As the capital of West Sumatra Province, Padang's residents rely heavily on various modes of transportation, from private vehicles to public transportation services. logistics, For support activity economy And daily they. However, The increase in the number of vehicles is not balanced with the development of the capacity of existing road infrastructure.

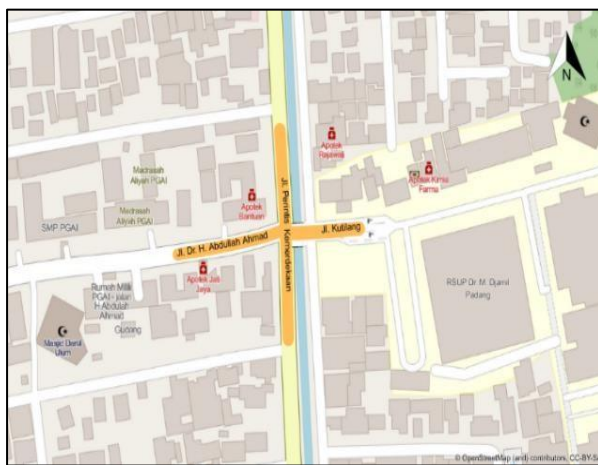
One crucial congestion point is the Dr. M. Djamil General Hospital Intersection, which provides vital access to healthcare, educational, and office facilities. Based on field surveys, this

intersection has a four-arm configuration connecting Jalan Perintis Kemerdekaan, Jalan Dr. H. Abdullah Ahmad, and Jalan Kutilang. Although technically equipped with Traffic Signal Devices (APILL), in reality, the traffic lights Then cross the No functioning, so that intersection operate without arrangement adequate signal.

The condition of APILL not being used causes traffic flow to depend solely on the initiative driver And ethics passed cross in look for gap For passing by. Matter This This can trigger conflicts between vehicles traveling from different directions, increase delays, and create uncertainty about traffic behavior, potentially leading to higher congestion. This irregularity significantly reduces intersection efficiency, especially during rush hour when traffic

volumes peak.

To accurately assess the intersection's ability to serve traffic flow, this study uses an unsignalized intersection analysis approach based on the 2023 Indonesian Road Capacity Guidelines (PKJI). This method was chosen based on the need for calculations that are in accordance with current traffic characteristics in Indonesia. This evaluation is expected to provide a comprehensive picture of the intersection's actual performance and become a reference for the study. runway technical in formulate recommendation repair for the sake



of smoothness Then crossing in the area.

Figure 1. Research Location

2. Research methodology

This research methodology begins with problem identification and data collection, which is divided into primary and secondary data. Primary data is obtained directly through observation. field in intersection Four General Hospital Dr. M. Djamil, City Padang, Which covering volume Then cross, condition geometric road, And condition environment around. Temporary That, secondary data in the form of information amount resident obtained from literature or agency related to support road capacity analysis.

Process collection data volume Then cross done with take notes amount vehicle that passes intersection on period time certain. Data This

Then classified based on the type of vehicle and converted into Passenger Car Units (PCU) using factor conversion Which has set in Guidelines Capacity Road Indonesia (PKJI) 2023. Data processing is carried out systematically using Microsoft Excel software to minimize calculation errors.

After data volume And geometric available, done calculation parameter performance intersections that include intersection capacity, degree of saturation, delays, and queuing opportunities. This analysis fully referring to on method PKJI 2023 For evaluate whether condition The current intersection is still able to serve traffic flow well. This evaluation serves as an important basis for determining the level of saturation that occurs at each intersection approach. In the final stage, an assessment of the *Level of Service* is carried out based on the degree of saturation and the resulting delays. From the results of this evaluation, researchers formulate conclusions regarding the current intersection performance and develop various alternative improvement solutions to increase traffic efficiency at that location. The flow of all stages of this research is systematically arranged in a research flowchart to ensure consistency of analysis.

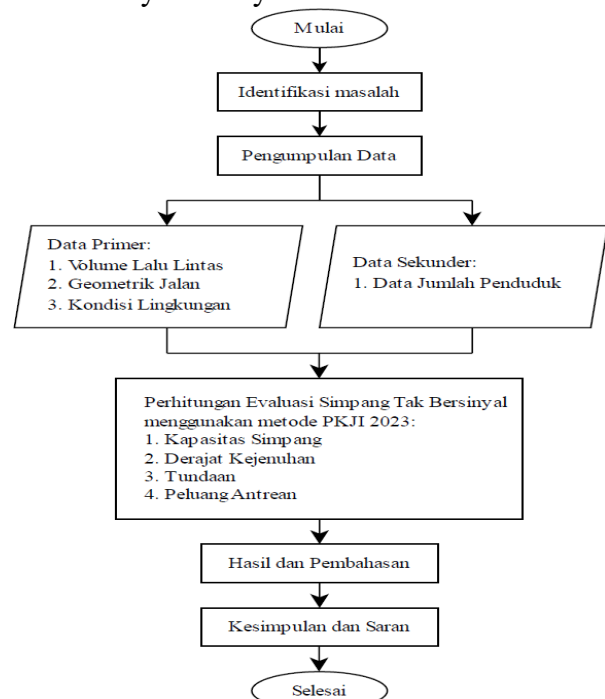


Figure 2. Diagram Flow Study

3. Results and Discussion

and vehicle number data.

3.1. Condition Existing intersection

Data Which used For analysis on study This that is data primary and data Secondary data in the research are: intersection geometric data, traffic volume data, side obstacle data

3.2. Condition Intersection Geometry

The RSUP Dr. M. Djamil Intersection is an unsignalized intersection consisting of four roads: the north and south are major roads, and the east and west are minor roads. The western minor road is a one-way street.

Table 3.1 . Data Geometry intersection

Street Name	Wide Approacher			
	Width (m)	Wide Lane (m)	Wide Median (m)	Wide Sidewalk (m)
Jl. Pioneer Independence (U)	10	5	-	1.7
Jl. Pioneer Independence (S)	10	5	-	1.7
Jl. finch (T)	11.5	5	1.5	1.5
Jl. Dr. H. Abdullah Ahmad (B)	7.5	3.75	-	1.25

3.3. Data Volume So Cross

The traffic volume survey was conducted for four days within a week, namely Monday, July 28, 2025, Wednesday July 30, 2025, Friday, August 1, 2025 and Saturday, August 2, 2025 August 2025 which was carried out on O'clock Busy Morning

O'clock 06.00-09.00, Afternoon O'clock 11.00-13.00 And afternoon O'clock 3:00 PM - 6:00 PM. Based on the survey results, the following is the calculation of traffic volume during peak hours (5:00 PM - 6:00 PM WIB) for Saturday, August 2, 2025.

Table 3.2 . Data Volume So Cross Day Saturday, 2 August 2025

Direction		Vehicle Type			Volume		Total	
		SM	MP	KS	Vehicle/Wat ch	Junior High School/Hou rs	Vehicle/Wat ch	Junior High School/Hou rs
East	q _{BKi}	163	79	3	245	165.9		
	q _{LRS}	0	0	0	0	0	380	187
	q _{BKa}	217	108	3	328	221.9		
West	q _{BKi}	60	25	5	90	64		
	q _{LRS}	83	31	4	118	79.7	200	86
	q _{BKa}	57	30	2	89	62.1		
North	q _{BKi}	230	68	9	307	199.2		
	q _{LRS}	1135	398	20	1553	1001.5	1365	466
	q _{BKa}	0	0	0	0	0		
South	q _{BKi}	0	0	0	0	0		
	q _{LRS}	1165	393	18	1576	1007.9	1257	460
	q _{BKa}	92	67	5	164	122		

Table 3.3. Recapitulation Data Volume So Cross Day Saturday, 2 August 2025

Period	Direction	Volume		Total	
		Vehicle/Watch	Junior High School/Hours	Vehicle/Watch	Junior High School/Hours
17.00-18.00	East	573	387.8	4470	2924.2
	West	297	205.8		
	North	1860	1200.7		
	South	1740	1129.9		

study uses traffic volume data at existing intersections. Intersection capacity analysis is based on the average width of the approach lane, the capacity of which is determined based on the highest traffic flow. Based on the data analysis, results are obtained for calculating the performance of unsignalized intersections for hours. peak Which there is on day Saturday 2 August 2025 period afternoon o'clock 17.00-18.00 WIB.

3.4.1 Capacity Intersection (C)

Based on PKJI (2023), mark Capacity intersection can counted use the following equation .

$$C = C_0 \times F_{LP} \times F_M \times F_{UK} \times F_{HS} \times F_{BK_i} \times F_{BK_a} \times F_{Rmi}$$

Information:

C_0 = basic capacity intersection (junior high school/hour) = 2900 (Type Intersection 422)

F_{LP} = factor correct average width of approach = $0.70 + (0.0866 \times 5.625) = 1,187$

F_M = correction factor type median = 1.00 (None) median on major roads

F_{UK} = factor correct size city = 0.94 (Size City Currently)

F_{HS} = factor correct side barriers = 0.94 (Commercial, Medium)

F_{BK_i} = correction factor left turn flow ratio = $0.84 + (1.61 \times 0.15) = 1,082$

F_{BK_a} = factor ratio correction current turn right = 1.0 (Intersection 4)

F_{Rmi} = factor minor road correction = 0.997.

So we can obtain the intersection capacity value for peak hours on Saturday afternoons from 17.00-18.00 WIB as follows:

$$C = 2900 \times 1,187 \times 1.00 \times 0.94 \times 0.94 \times 1,082 \times 1.00 \times 0.997 = 3281.16 \text{ smp/hour}$$

Based on the calculations above, the intersection capacity calculation summary results are obtained. The intersection capacity calculation summary results can be seen in the following table.

Table 3.4. Calculation Performance intersection Based on PKJI 2023

Choice	Basic capacity C_0	Past performance cross							Capacity C
		Average approach width flat	Major road median	City size	Side barriers	Turn left	Turn right	Minor/Total ratio	
	Junior high school/hour	F_{LP}	F_M	F_{UK}	F_{HS}	F_{BK_i}	F_{BK_a}	F_{Rmi}	Junior high school/hour
Existing	2900	1,187	1.00	0.94	0.94	1,082	1.00	0.997	3281.16

3.4.2 Degree Saturation (D_J)

Based on PKJI (2023), mark Degrees Saturation intersection can counted using the following equation.

$$D_J = q / C$$

D_J = Degrees saturation

C = Capacity segment road (junior high school/hour)

q = Traffic volume (SMP/hour)

So, Calculation of the degree of saturation for peak hours on Saturday afternoon period at 17.00-18.00 WIB as follows:

$$D_J = 2924.2 / 3281.16$$

$$= 0.89$$

3.4.3 Delay (T)

Based on PKJI (2023), mark Delay intersection for O'clock peak on day Saturday afternoon period 17.00-18.00 WIB as follows:

$$T_{LL} = 1.0504 / (0.2742 - 0.2042 \times D_J) - (1 - D_J)^2$$

$$= 1.0504 / (0.2742 - 0.2042 \times 0.89) - (1 - 0.89)^2$$

$$= 11.35 \text{ seconds/vehicle.}$$

$$T_{LLma} = 1.0504 / (0.346 - 0.246 \times D_J) - (1 - D_J)^{1.8}$$

$$= 1.0504 / (0.346 - 0.246 \times 0.89) - (1 - 0.89)^{1.8}$$

$$= 8.07 \text{ seconds/vehicle}$$

$$T_{LLmi} = (q_{KB} \times T_{LL} - q_{ma} \times T_{LLma}) / q_{mi}$$

$$= (2926.7 \times 11.35 - 2330.6 \times 8.07) /$$

$$593.6$$

$$= 24.23 \text{ seconds/vehicle.}$$

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

$$= (1 - 0.91) \times (6 \times 0.29 + 3 (1 - 0.29)) + 4 \times 0.89$$

$$= 3.99 \text{ seconds/vehicle.}$$

$$T = T_{LL} + T_G$$

$$= 11.35 + 3.99$$

$$= 15.34 \text{ seconds/vehicle}$$

3.4.4. Opportunities Queue (P_a)

Based on PKJI (2023), Degrees Saturation intersection For O'clock peak on day Saturday afternoon period 17.00-18.00 WIB as follows

$$P_a \text{ Upper Limit} = 47.71 \times D_J - 24.68 \times D_J^2 + 56.47 \times D_J^3$$

$$= 47.71 \times 0.89 - 24.68 \times 0.89^2 + 56.47 \times 0.89^3$$

$$= 62.72 \%$$

$$P_a \text{ Lower Limit} = 9.02 \times D_J - 20.66 \times D_J^2 + 10.49 \times D_J^3$$

$$= 9.02 \times 0.89 - 20.66 \times 0.89^2 + 10.49 \times 0.89^3$$

$$= 31.79 \%$$

Based on calculation on obtained recapitulation calculation degrees saturation. A summary of the intersection performance calculation results can be seen in the following table.

Table 3.5 . Calculation Performance intersection Based on PKJI 2023

Choice	Total traffic flow q_{TOT}	Past performance cross							Service Level
		Degree of saturation	Intersection traffic delays	Major road traffic delays	Minor road traffic delays	Intersection geometry delay	Intersection delay	Queue opportunities %	
	Junior high school/hour	D_J	T_{LL}	T_{LLma}	T_{LLmi}	T_G	$T = T_{LL} + T_G$	P_a	
Existing	2924.2	0.89	11.35	8.25	23.52	3.99	15.34	31.79 - 62.72	C

From results analysis on intersection based on PKJI 2023 obtained size wide approach average (L_{RP}) on road minor namely 6.25 meters And on road major namely 5 meters, The capacity (C) of the intersection is 3281.16 smp/hour, the degree of saturation (D_J) is 0.89, and the intersection delay (T) is 15.34 seconds/vehicle, so the level of service at the intersection is at point C.

3.5 Solution Alternative Improvement

Performance intersection

Based on the results of the performance analysis of unsignalized intersections with existing conditions, the level of service at the intersection has been obtained. Next,

calculations are carried out based on Guidelines Capacity Road Indonesia 2023 For increase performance from the intersection .

Solution Alternative 1 Addition APILL On intersection

On solution alternative 1 This done with addition APILL on intersection with cycle time 80 second And 3 phase. Analysis on solution alternative 1 This use data geometry and traffic volume data at the intersection under existing conditions. The results of the calculation of the analysis of alternative solution 1 at the intersection can be seen as follows.

Table 3.6 . Recap Calculation Capacity intersection APILL Solution Alternative 1

Parameter	Unit	Approacher			
		U	S	T	B
Current So Cross (q)	Junior high school/hour	878	993	145	125
Current Fed up Basic (J_0)	Junior high school/hour	3000	3000	3000	4500
Wide Effective Approacher (L_E)	Meter	5.00	5.00	5.00	7.50
Obstacle Side (F_{HS})	-	1.00	1.00	1.00	0.94
Size City (F_{UK})	-	0.94	0.94	0.94	0.94
Slope (F_G)	-	1.00	1.00	1.00	1.00
Parking (F_P)	-	1.00	1.00	1.00	1.00
Current So Cross Turn Left (F_{BK_i})	-	1.00	1.00	0.93	1.15
Current So Cross Right (F_{BK_a})	-	1.00	1.00	1.15	1.00

Current Fed up (J)	Junior high school/hour	2820	2820	3016	3976
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Table 3.7 . Recap Time Cycle Solution Alternative 1

Parameter	Unit	Approacher			
		U	S	T	B
Time Yellow (W_K)	second	2	2	2	2
Time Red All (W_{MS})	second	2	2	2	2
Time Is lost Green (W_{HH})	second	12	12	12	12
Time Cycle (s)	second	80			
Time Green (W_{Hi})	second	28	30	10	10

Table 3.8 . Recapitulation Results Solution Alternative 1

Parameter	Unit	Approacher			
		U	S	T	B
Degrees Saturation (D_J)	-	0.89	0.94	0.38	0.25
Capacity (C)	Junior high school/hour	987.0	1057.5	377.0	497.0
Long Queue (P_a)	m	90.44	102.28	11.84	6.69
Delay So Cross (T_{LL})	junior high school	39.83	38.67	32.15	31.61
Delay Geometry (T_G)	junior high school	4.12	4.14	4.34	3.93
Delay (T_i)	junior high school	43.95	42.81	36.49	35.54
Delay intersection Average	junior high school	42.43			
Level Service	-	E			

Based on the calculation results of alternative solution 1 above, after analysis using the 2023 PKJI reference, the D_J value for the North arm was 0.89, for the South arm it was 0.94, for the East arm it was 0.38 and for the West arm it was 0.25, with an average delay at the intersection (T) of 42.43 sec/smp. The results of the analysis of alternative solution 1 can be concluded that the saturation degree and delay values have increased. Therefore, the level of service at the intersection is at point E.

Solution Alternative 2, Widening Road Major as big as 1 meters And Addition APILL At the intersection

On solution alternative 2 this is done with widening Mayor Street as big as 1 meters, and then the intersection that has been widened given additional APILL at the intersection with a cycle time of 70 seconds with 3 phases.

Work This done with do subtraction wide sidewalk existing on second side of the main road to increase space for vehicles. The sidewalk, which was previously 1.7 meters wide, meters will reduced as big as 0.5 meters Good on side left and side right road. Thus, the effective width of the sidewalk after adjustment will be 1.2 meters, while the total space of 1 meter from the reduction will be fully allocated. For widen lane vehicle use minimize obstacle Then cross.

The results of the calculation of the analysis of alternative solution 2 at the intersection can be seen as follows.

Table 3.9 . Recap Calculation Capacity intersection APILL Solution Alternative 2

Parameter	Unit	Approacher			
		U	S	T	B
Current So Cross (q)	Junior high school/hour	878	993	145	125
Current Fed up Basic (J_0)	Junior high school/hour	3300	3300	3000	4500
Wide Effective Approacher (LE)	Meter	5.50	5.50	5.00	7.50
Obstacle Side (F_{HS})	-	1.00	1.00	1.00	0.94
Size City (F_{UK})	-	0.94	0.94	0.94	0.94
Slope (F_G)	-	1.00	1.00	1.00	1.00
Parking (FP)	-	1.00	1.00	1.00	1.00
Current So Cross Turn Left (F_{BK_i})	-	1.00	1.00	0.93	1.15
Current So Cross Right (F_{BK_a})	-	1.00	1.00	1.15	1.00
Current Fed up (J)	Junior high school/hour	3102	3102	3016	3976

Table 3.10 . Recap Time Cycle APILL Solution Alternative 2

Parameter	Unit	Approacher			
		U	S	T	B
Time Yellow (W_K)	second	2	2	2	2
Time Red All (W_{MS})	second	2	2	2	2
Time Is lost Green (W_{HH})	second	12	12	12	12
Time Cycle (s)	second	70			
Time Green (W_{Hi})	second	22	26	10	10

Table 3.11 . Recapitulation Results Solution Alternative 2

Parameter	Unit	Approacher			
		U	S	T	B
Degrees Saturation (D_J)	-	0.90	0.86	0.34	0.22
Capacity (C)	Junior high school/hour	974.9	1152.2	430.9	568.0
Long Queue (P_a)	m	73.60	79.02	10.16	5.73
Delay So Cross (T_{LL})	junior high school	37.43	32.49	27.02	26.54
Delay Geometry (T_G)	junior high school	4.21	4.03	4.38	3.92
Delay (T_i)	junior high school	41.64	36.52	31.40	30.46
Delay intersection Average	junior high school	37.92			
Level Service	-	D			

Based on the calculation results of alternative solution 2 above, after analysis using the 2023 PKJI reference, the DJ value for the North arm was 0.90, for the South arm it was 0.86, for the East arm it was 0.34 and for the West arm it was 0.22, with an average delay at the intersection (T) of 37.92 sec/smp. The results of the analysis of alternative solutions solution 2 can concluded that mark degrees saturation And mark delay No much reduced from solution alternative 1. So obtained For level service on intersection located at point D.

Alternative Solution 3: Widening the Major Road by 1 meter without Adding APILL at the Intersection

Alternative solution 3 involves widening the main road by 1 meter, without adding an APILL at this intersection. This work involves reducing the width of the existing

sidewalks on both sides of the main road to increase vehicle space. The main road, which was previously 10 meters wide, will be widened to 11 meters, by widening each lane by 0.5 meters, from 5 meters to 5.5 meters. The sidewalk, which was previously 1.7 meters wide, will be reduced to 1.1 meters. as big as 0.5 meters Good on side left and side right road. With thus, The effective width of the sidewalk after adjustment will be 1.2 meters, while the total space of 1 meter from the reduction will be allocated entirely to widening the vehicle lane to minimize traffic congestion. The results of the calculation of alternative solution 3 analysis at the intersection can be seen as follows.

Table 3.12 . Calculation Capacity intersection Solution Alternative 3

Choice	Basic capacity C_0	Performance Then cross							Capacity C
		Approach width flat- flat	Road media n major	City size	Side barriers	Turn left	Turn right	Minor ratio/ Total	
	Junior high school/hour	F_{LP}	F_M	F_{UK}	F_{HS}	F_{BK_i}	F_{BK_a}	F_{Rmi}	Junior high school/hour
3	2900	1,209	1.00	0.94	0.94	1,082	1.00	0.997	3341.97

Table 3.13 . Calculation Performance intersection Solution Alternative 3

Choice	Total traffic flow q_{TOT}	Past performance cross							Service Level
		Degree of saturation	Intersection traffic delays	Major road traffic delays	Minor road traffic delays	Intersection geometry delay	Intersection delay	Queue opportunities %	
	Junior high school/hour	DJ	T_{LL}	T_{LLma}	T_{LLmi}	T_G	$T = T_{LL} + T_G$	P_a	
3	2924.2	0.87	10.86	7.93	22.36	3.98	14.84	30.39 - 60.01	B

Based on the results of the calculations for alternative solution 2 above, after carrying out analysis using reference PKJI 2023 with size wide approach average (LRP) on road minor road is 6.25 meters and on major roads is 5.5 meters, the intersection capacity value (C) is 3341.97 smp/hour, the degree of

saturation (DJ) is 0.87, and the intersection delay (T) is 14.84 seconds/vehicle. So the level of service at the intersection is at point

On solution alternative 4 This done addition

APILL on intersection with 60 second cycle time with three phases and opening or adding incoming flow on the westbound intersection arm and widening the major road by 1 meter

The analysis of alternative solution 4 uses geometric data and traffic volume data at the intersection. Four General Hospital Dr. M. Djamil on condition existing. Data Which used is the result of a survey on Saturday, August 2, 2025 in the afternoon period at 17.00–18.00 WIB which is O'clock peak Then cross. However, on approach direction west done assumptions against incoming vehicle flow.

The assumed traffic flow values are determined based on the proportion of vehicle movements on other approaches. For vehicle movements from the north to the west (BKa), it is assumed to be 20% of the total volume of vehicles moving straight south. Furthermore, for vehicle movements from the south to the west (BK_i), it is assumed to be 20% of the total volume of vehicles moving straight north. Meanwhile, for vehicle movements from the east to the west (Straight) assumed as addition from 50% volume vehicle Which turn going to North direction (BK_i) and 50% of the volume of vehicles turning towards the South (BKa).

The assumption of additional inflow on the Westward approach causes changes in wide effective approach the. Wide effective Which previously as big as 7.5 meters transformed into 3.75 meters. Matter This due to wide 7.5 meters the shared become two track, which on condition previously only consists of from One track. After existence addition current enter, approach direction West assumed own two track movement so that wide effective each lane becomes 3.75 meters.

Based on results calculation solution alternative 4 with use reference PKJI 2023, for volume Then cross on O'clock peak day Saturday o'clock 17.00–18.00 WIB, obtained mark degree of saturation (DJ) on arm North as big as 0.85, on arm South as big as 0.88, on East Arm as big as 0.41, and on the West arm it is 0.38. Meanwhile, the average delay value of the intersection (T) obtained was 35.03 seconds per smp.

Solution analysis results alternative 4 shows that The degree of saturation and delay values obtained did not experience a significant decrease when compared with alternative solutions. 1 And solution alternative 2. Based on mark delay average intersection Which obtained, then the level of intersection service is in category D.

4. Conclusion

Based on results analysis calculation use parameter PKJI 2023, can it is concluded that performance intersection not signal on intersection Four General Hospital Dr. M. Djamil, Road Pioneers of Independence, City Padang, moment This is at on condition currently. Matter This shown by degree of saturation (DJ) value on existing conditions of 0.89 with delay value (T) reached 15.34 det/kend. Besides That, mark opportunity queue (Pa) is at on range limit on 62.72% and a lower limit of 31.79%. Based on these delay values, the intersection's current service level is at level C, indicating the need for optimization efforts to improve traffic flow efficiency. As a step for improvement, the results of the analysis of the three alternative solutions show that the solution Alternative 3 is choice Which most effective For increase performance intersection. This solution includes widening the main road by 1 meter, where the North and South lanes that were originally measuring 10 meters widened to 11 meters. The technical implementation is carried out by reducing the width of the existing sidewalk on both

sides of the road by 0.5 meters, so that dimensions sidewalk Which back to the beginning 1.7 meters become 1.2 meters. With increase The lane width was reduced from 5 meters to 5.5 meters, reducing the degree of saturation to 0.87, with a delay of 14.84 seconds per vehicle. This change significantly improved the intersection's service level to level B, with good condition.

5. List References

- Adha, SA (2023). *Journal of Traffic Performance Evaluation at Unsignalized Intersections on Pulo Wonokromo Road City Surabaya Use Method Capacity Guidelines Road Indonesia 2023*. Surabaya State University.
- Body Center Statistics (BPS). (2025). Amount Resident City Padang Year 2025. Padang: Padang City Statistics Office.
- Desanta, D. F. F., Sholichin, I., & Estikhamah, F. (2024). *Journal Analysis performance intersection unsignalized Menganti Road – Sepat Road – Wisma Lidah Kulon Road, Surabaya City using the 2023 PKJI method* . Veteran National Development University.
- Directorate General of Highways. (2023). *Indonesian Road Capacity Guidelines (PKJI 2023)* . Jakarta: Directorate General Build Clan, Ministry Work General And Public Housing .
- Ministry Transportation Republic Indonesia. (2015). *Regulation Minister Transportation No. 96 Years 2015 about Guidelines Determination Level Service Road* . Jakarta: Ministry of Transportation.
- Khisty, CJ, & Lall, BK (2005). *Fundamentals of Transportation Engineering*. Jakarta: Erlangga. 3(1), 274–278.
- Najla, SH (2024). *Journal of Traffic Performance Analysis at the Pisang By Pass Intersection Using the PKJI 2023 Method* . Bung Hatta University.
- Prananda, M. H. (2023). *Journal Analysis performance intersection signal And No signal Cebongan Intersection based on MKJI 1997 and PKJI 2023* (Thesis, Islamic University of Indonesia). Islamic University of Indonesia.
- Putri, O., Murniati, & Robby. (2025). *Journal of Analysis of the Performance of Unsignalized Intersections on Temanggung Road Kanyapi – Road Carrot – Road Seth Adji City Palangka Raya* . University of Palangka Raya.
- Riski, S., Isya, M., & Fisaini, J. (2024). *Journal of Analysis of Unsignalized Intersection Performance Using method PKJI 2023 (Studies case: Road WR Supreme Man – Road Cut Mutia – Teungku Dianjung Street)* . Syiah Kuala University.
- Sagraha, & Puspito, IH (2025). *Journal of Signalized Intersection Performance Analysis Using the 2023 PKJI Method (Case Study: Puntodewo Intersection, Malang)*. Artesian Journal of Civil Engineering.
- Syafri, W. (2021). *Journal of Road Section Performance Analysis (Case Study: Siteba Highway, Padang City)* . Padang Institute of Technology and Ministry of Public Works and Public Housing, Directorate General of Highways.
- Tamin, OZ (2008). *Transportation Planning, Modeling, and Engineering Book* . Bandung: ITB.
- Law of the Republic of Indonesia No. 38 of 2004 and Government Regulation of the Republic of Indonesia No. 34 of 2006 concerning Roads. Jakarta: State Secretariat of the Republic of Indonesia.