CERUCUK
Volume 10 No. 1 2026 (36-45)

PERFORMANCE ANALYSIS OF INTERSECTION AND NOISE LEVEL AT IR. PH. MOCH. NOOR GURU DANAU INTERSECTION, TANJUNG DISTRICT, TABALONG REGENCY

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ABSTRAK

One of the intersections where traffic jams often occur in Tabalong Regency is three-way intersection Ir. Ph. Moch. Noor as known as "guru lake", this intersection is in a high commercial area where there are shops and religious activities every Tuesday so there are often traffic jams, especially during peak hours in the afternoon.

From the research the peak traffic volume occurred between 17.10 – 18.00 WITA. The existing conditions yielded the following results: a Degree of Saturation (Dj) = 1.70 The suboptimal performance of the intersection, an alternative solution involving the implementation of a signalized intersection (TRAFFIC LIGHT) was involving widening of the intersection approach. This alternative produced the following results: Dj = 0.75, with to a LOS grade of B. Additionally, noise levels were recorded at 100.4 dB with correlation 0,571 on the intersection and 96.2 dB with correlation 0,53 in the surrounding area.

Keywords: Indonesian Road Capacity Guidelines (PKJI 2023), Simpang Traffic Light, Service Level Index, Capacity, Degree of Saturation, Delay Time, Chance of Queue, Noise Level, and Correlation

1. INTRODUCTION

According to Law No. 14 of 2006, the primary goal of traffic management and engineering is to make roads safer, more organized, and smoother. All types of roads, from national roads to village roads, must be managed comprehensively with a priority on main roads.

According to the Indonesian Highway Capacity Manual (PKJI, 2023), analyzing the capacity of an intersection requires considering actual traffic conditions, the physical form of the intersection, and its surrounding environment. The analysis results must be based on accurate data and not rely solely on general rules.

The study focuses on the Ir. Ph. Moch Noor intersection, a three-legged (T-junction) intersection with peak congestion occurring on Tuesday evenings. This

congestion is caused by weekly religious gatherings held in the area, which create traffic disruptions at the intersection.

2. THEORETICAL FRAMEWORK

Passenger Car Unit

According to PKJI (2023), Passenger Car Units (PCU) are used to measure traffic flow by converting various types of vehicles into passenger car flow using Passenger Car Equivalents (PCE). PCE is a conversion factor that accounts for differences in vehicle characteristics, such as speed, dimensions, acceleration, and maneuverability, to ensure the comfort and safety of road users.

Capacity

Capacity analysis is conducted for two purposes: planning and operational analysis. Capacity is calculated based on the total traffic flow from all intersection approaches by multiplying the basic capacity (C0) with correction factors that adjust for environmental conditions relative to ideal conditions.

$C = C0 \times F_{LP} \times F_{M} \times F_{UK} \times F_{HS} \times F_{BKi} \times F_{BKa} \times F_{Rmi}$

Degree of saturation

The degree of saturation is a key factor in assessing road traffic performance, visually indicating potential capacity issues.

Delay

Delay (T) occurs due to factors in traffic and the geometry of an intersection.

The queue probability

The queue probability is expressed as a percentage (%) and is used to assess the traffic performance of an intersection based on Dj.

Correlation

This study uses independent and dependent variables. The independent variable is vehicle volume, while the dependent variable is the noise level, which is influenced by vehicle volume.

2. 1 Table of Correlation

Correlation	Information
R = 0	There is no correlation between the two variables
0 ≤ R ≤ 0,25	Too weak
0,25 ≤ R ≤ 0,5	Strong enough
0,5 ≤ R ≤ 0,75	Strong
0,75 ≤ R ≤ 0,99	Very Strong
R = 1	Perfect

(Sumber: Arlan, M. 2021)

3. METHOD

Research Location

The intersection studied is the Ir. Ph. Moch. Noor Guru Danau intersection, located in Tanjung District, Tabalong Regency, Kalimantan Sekatan, with a population of 263,220 people in 2023, according to the Central Statistics Agency (BPS)

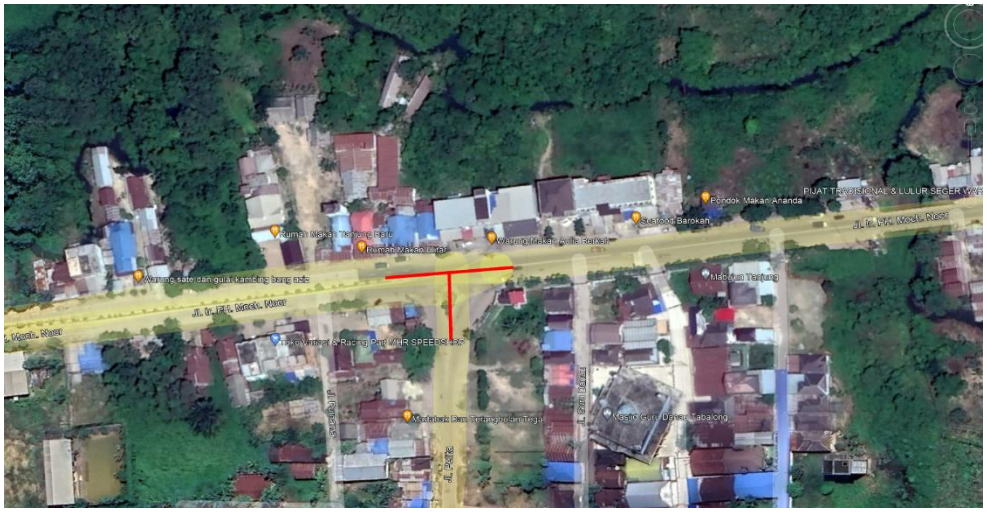

Image 3. 1 Ir. Ph. Moch Noor Guru Danau intersections

Method

This study uses the PKJI (2023) method by collecting field data such as traffic volume, intersection geometry, and noise, and then calculating the capacity and performance of the intersection using Microsoft Excel.

4. RESULTS AND DISCUSSION

Stages of Intersection Performance Research

The geometric shape of the Ir Ph Moch Noor Guru Danau intersection, Tabalong Regency can be seen in the following image. Which shows a picture of the road situation that has an intersection with three arms, two minor lanes, and 4 major lanes, which are then based on PKJI (2023), given the intersection type code 324.

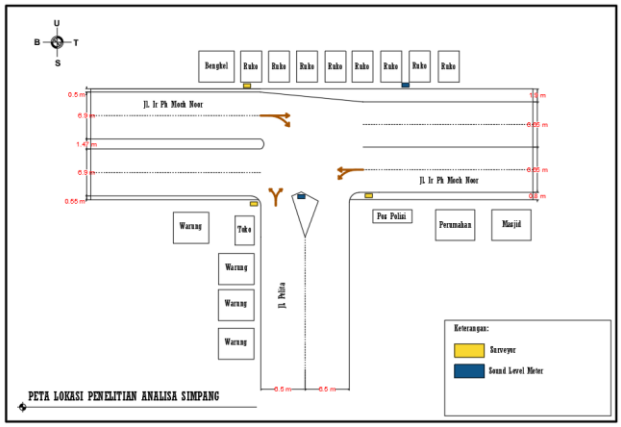

Image 4. 1 Intersection geometric

Table 4. 1 Geometric Data of Intersections, Environmental Types, and Side Obstacle Classes

Approach Code	Intersection Leg		
	Jl. Ir Ph Moch Noor (East)	Jl. Ir Ph Moch Noor (West)	Jl. Pelita (South)
Lane Width	13.3	13.8	13.0
Shoulder Width	3.6	2.2	-
Median Width	-	1.47	-
Sidewalk Width	2.7	1.1	-
Environmental type	Commercial	Commercial	Commercial
Side Friction Class	High	High	High

Traffic Flow Volume

Traffic volume data obtained in the field is converted using an equivalence factor to obtain results in passenger car units (PCU).

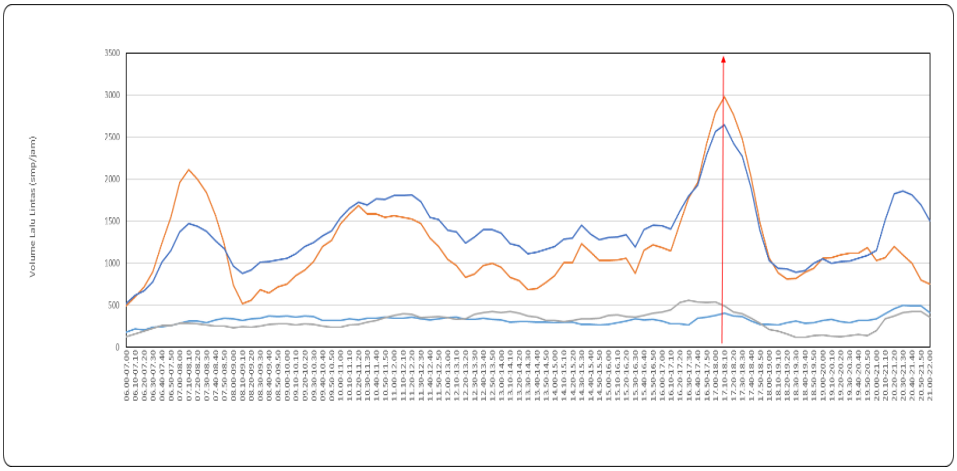

Image 4. 2 Traffic Volume

1. The East Approach has a traffic volume of 561 PCU/hour during the time period from 20.30 to 21.30 WITA.
2. The West Approach has a traffic volume of 1,754 PCU/hour during the time period from 17.10 to 18.10 WITA.
3. The South Approach has a traffic volume of 616 PCU/hour during the time period from 16.10 to 17.10 WITA.

Passenger car unit calculation

Traffic data on Tuesday at 17.10 – 18.10 WITA. In the calculation of PCU/hour with the equivalent of passenger car units.

Table 4. 2 Passenger car unit

Peak Time			SM	MP	KS	Total
17.10–18.10 WITA						
EAST	LT	Jalan Ir Ph Moch Noor (East)	32	56	25	113
	ST		48	110	130	288
WEST	RT	Jalan Ir Ph Moch Noor (West)	230	672	16	918
	ST		124	296	416	836
SOUTH	LT	Jalan Pelita (South)	94	143	58	295
	RT		85	112	0	197

From the data, the traffic variable calculation was obtained to determine the performance of the intersection at the Ir. Ph. Moch Noor Guru Danau intersection.

Table 4. 3 traffic variables

Traffic variables	
Q MI (S)	492 PCU/hour
Q MA (E and W)	2156 PCU/hour
Q TOT (Q MI + Q MA)	2648 PCU/hour
Q LT (Q_{LT} minor + Q_{LT} mayor)	408 PCU/hour
Q_{st} (Q_{ST} mayor)	1124 PCU/hour
Q RT (Q_{RT} minor + Q_{RT} mayor)	1116 PCU/hour
R_{LT} (Q_{LT} / Q_{tot})	0,15
R_{ST} (Q_{ST} / Q_{tot})	0.42
R_{RT} (Q_{RT} / Q_{tot})	0.42
R_{MI} (Q_{mi} / Q_{tot})	0,18
R_{MA} (Q_{ma} / Q_{tot})	0,81

After knowing the traffic variable values, intersection performance calculations are carried out to determine the performance results.

Table 4. 4 intersection performance

Traffic performance	Calculation results	
Capacity	1555	
Degree of Saturation	1.70	
Intersection Traffic Delay	-14.76	
Major Road Traffic Delay	-14.88	
Minor Road Traffic Delay	-13.85	
Geometric Delay	4	
Intersection Delay	-10.76	
Queue Probability Limit	Lower Limit	Higher Limit
Queue Probability	127.15%	288.73%
Average Queue Probability	207,94%	

Based on the research results without traffic signals (Traffic Light), The performance of the intersection is as follows:

1. The degree of saturation (Dj) of the intersection is 1.70, indicating that the intersection's performance is not optimal since Dj 1.70 ≥ 0.85.
2. The average traffic delay should not exceed 10 seconds/PCU. The calculated average traffic delay is -14.76 seconds/PCU, which is -14.76 < 10 seconds/PCU.

3. The intersection delay (T) is -10.76 seconds/PCU, which is not within the service level.
4. The queue probability (Pa) should be < 35%. The calculated value of Pa is 207.94%, which is 207.94% > 35%.

Based on the indicators from the current intersection analysis, it shows that the three-legged Guru Danau intersection is in poor condition or performance due to traffic flow exceeding the intersection's capacity. Therefore, the researcher conducted an alternative traffic management calculation by converting the intersection into an Traffic Light intersection.

In the Traffic Light calculation, passenger car units are used for protected and opposing approaches during peak hours, along with the widening of the intersection geometry on the approaches to ensure optimal performance of the Traffic Light intersection. The conclusion is as follows:

Table 4. 5 Intersection Performance

No.	Intersection Managemen	DJ	TLL	T	Pa	ITP
1	Existing	1,70	-14,76	-10,76	207,94	
2	Traffic Light Intersection (Existing)	0,82	32,4	20,11		C
3	Geometric Widening of Traffic Light Intersection	0,75	20,9	14,95		B

Correlation Data and Noise Level

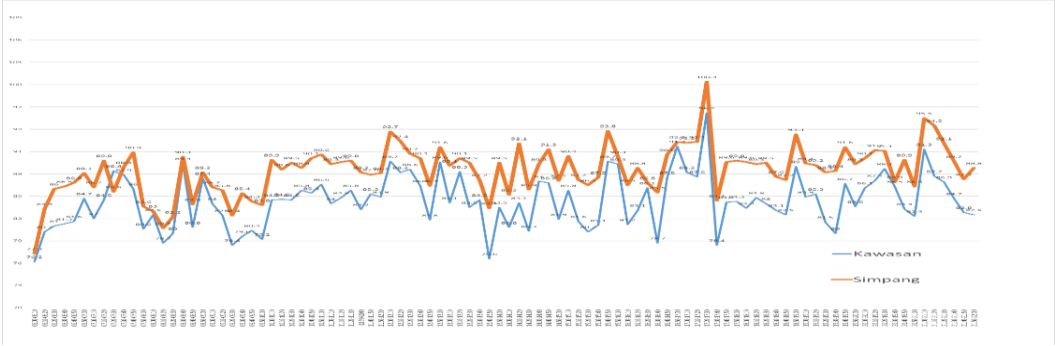

Image 4. 3 Intersection and Area Noise Graph

From the comparison of intersection noise data with area noise, it is known that the peak noise hour is at 17.20 – 17.30 with the highest noise level at the intersection being 100.4 dB and at the area noise being 96.2 dB. This does not meet the noise quality standard for religious activities, which is 55 dB. Meanwhile, the correlation value at the intersection is classified as strong based on the value of PCU/hour with the noise level, which is r = 0.571 and the correlation value for the area is also classified as strong with a value of r = 0.53.

5. CONCLUSION

The conclusion obtained in this final assignment by examining the performance of an intersection at the Ir. Ph. Moch Noor Guru Danau intersection is that the performance of the intersection in existing conditions has a high capacity value so that the degree of saturation value is 1.70 and it can be said that the intersection is classified as saturated so that alternative handling is needed by creating an Traffic Light intersection that makes the performance of the existing intersection optimal with a service level of B.

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