Analysis of the Degree of Service at Gajayana Intersection of Malang City

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Abstract. The A good indicator of whether or not an intersection is appropriate is whether or not it allows vehicles to pass each other on the road. If the degree of service is C or D, or E or F, it indicates that the intersection has to be fixed, just as the Gajayana intersection has achieved a C grade, which suggests that changes need to be sought to increase the level of service. By manipulating the length of time that the green light is on, the purpose of this study is to enhance the level of service that is provided at Simpang Gajayana. through the utilization of the Indonesian Road Capacity Manual (MKJI). In accordance with the progression of steps involved in recording traffic via the Time Slice approach, the data was then tallied. The following step is to carry out the computations and then interpret the results. According to the findings of the investigation, the Degree of Service for the South and East Arms was determined to be an A, however it was determined to be a B for the West Arm.

Keywords: Analysis, Degree of Service, Intersection.

1 Introduction

1.1 Background

The occurrence of traffic congestion at junctions is the source of the problem with traffic all over the world. In addition, the degree of service that is typically provided at the intersection is lower than a C. According to the findings of a number of international researchers (Ezat Estabraq Nashat (2008), Abojaradeh M., Msallam M., and Jrew B. (2014), Kumar S. V. and Ranjitha J. (2013), and Kumar N. and Nagakumar M.S. (2014)), the degree of service at the intersection under review was lower than C, which indicates that it was extremely crowded.

In the meantime, traffic is backed up in various Indonesian cities, including Malang City. This is also the case in Malang City. According to findings from studies conducted by Djakfar Ludfi and Wicaksono A. (2015), Hinggiranja N. U. M. (2019), Suhudi and Tenabolo Alfian (2017), and Supiyono (2016), which came to the conclusion that the level of service on Jalan Sunan Kalijogo Dinoyo is, respectively, good, satisfactory, and poor, respectively; F. According to the findings of Supiyono (2016), the degree of service at the Sabilillah intersection, the Ciliwung intersection, the Sa

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rangan (Luwe) intersection, and the Brigjend Slamet Riyadi (PLN) intersection is F, Sarangan (Luwe) intersection, Brigjend Slamet Riyadi (PLN) intersection is F.

1.2 Initial Exploration and Research

The occurrence of traffic congestion at junctions is the source of the problem with traffic all over the world. In addition, the degree of service provided at intersections is generally lower than a C. According to the findings presented by a number of researchers from different parts of the world, in particular Ezat Estabraq Nashat (2008), who found that out of ten junctions analyzed in the city of Baghdad, Iraq, five of those crossroads had a service level of D, four of those intersections had a service level of E, and two of those intersections had a service level of F, The researchers Abojaradeh Mohammad, Msallam Majid, and Jrew Basim (2014) came to the conclusion that the degree of saturation at five different crossings in Amman City, Jordan, was all F., The name Kumar. Based on their research from three crossroads in Bangalore City, India, Sunil V. and Ranjitha J. (2013) came to the conclusion that two of the intersections of service degrees are F, while the other intersection of service degrees is E and the third intersection of service degrees is E and F. According to the findings of Kumar Naveen and Nagakumar M.S. (2014), the degree of service at the intersection under consideration was lower than a C, which indicates that it was crowded.

This is also the case in Indonesia, according to research conducted by Apriliyanto Rangga and Sudibyo Tri (2018), who came to the conclusion that the level of service on the route connecting Sangan and Depok is an F. Ismawanda Zajuli Agvio (2018) came to the conclusion that the arm capacity of the Legundi 4 intersection is only 1,900.95 pcu/hour, but the existing flow reaches 4,732.5 pcu/hour. This contradicts the findings of Intari Dwi Esti, Kuncoro Hendrian Budi Bagus, and Rahmayanti Rahayu (2019), who found that the level of service at Simpang Tiga Jalan Raya Serang is F. The findings of Novalia Cindy, Sulistiyorini Rahayu, and Putra Sasana (2016) led them to the conclusion that the Simpang Jl. Imam Bonjol-Tamin Sisinga mangaraja has the letter F. The Pratama According to the findings of Muhammad Daryl Marta and Elkhasnet (2019), the level of saturation that can be found at the intersection of Jalan A.H. Nasution and Jalan Cikadut in Bandung City is 0.983.

During this time, Isya at. all (2020) conducted the Service Level research with Vissim 10.00-02 (Vis-sim) Software. The results showed a delay (D) of 25.32 seconds, a queue length (Q) of 101.12 meters, and a level of service (LOS) of E. In addition, it offers recommendations concerning the execution of additional study utilizing Vissim Software for Level of Service analysis.

The following factors ultimately led to the decision to carry out this research:

1. In order to implement some of the suggestions made by Isya at. All (2020),
2. As a follow-up to the partnership between the Malang State Polytechnic and the Malang City Transportation Service, which was outlined in the Malang City SPK dated January 17, 2022 (attached).

3. To continue working together with the Malang City Government and the Malang State Polytechnic, as outlined in the Malang City SPK dated May 23rd, 2022. (see attachment).

To lend support to the Research Map Towards Food Security being developed by the Integrated Applied Technology Research Center at Malang State Polytechnic.

2 Method

2.1 Road Level of Service

The level of road service is the road's ability to carry out its functions. The calculation of the level of road service can be calculated using the Level of Service (LOS) calculation. LOS is a form of qualitative measurement that describes the traffic operating conditions on a road section. In other words, road service levels are a measure that states the quality of service provided by a road under certain conditions. There are two definitions of the level of service of a road section, namely (Tamin, 2000: 46):

1. The level of service depends on the flow (Flow Dependent). This is related to the speed of road operations/facilities, which depends on the ratio of flow to capacity.

Therefore, the level of service on a road depends on traffic flow.

Table 1. Road Classification According to Road Service Level

No	Level of Service	V/C	Classification
1	A	< 0,60	With Low volume and high-speed free flow, the driver can choose the desired speed.
2	B	0,60 < V/C < 0,70	The steady flow of speed is slightly limited by traffic, but the driver still has freedom in choosing his speed.
3	C	0,70 < V/C < 0,80	Stable flow, controlled traffic speed.
4	D	0,80 < V/C < 0,90	The current is unstable, the speed is low.
5	E	0,90 < V/C < 1,00	Unstable flow, low and variable speed, volume approaching capacity.
6	F	> 1,00	Blocked flow, low speed, volume above capacity, traffic jams often occur for long periods of time so that speed can drop to zero.

2. The level of service depends on the facility (Facility Dependent).

The level of road service is assessed from the results of calculations/comparison of traffic volume with road capacity (V/C). Road classification based on road service

level is indicated at 6 intervals. These levels are denoted A, B, C, D, E and F, where the best level of road service is denoted by A and successively the lowest quality is up to F.

2.2 Research Flow

The first stage of research began with identifying problems at the Gajayana intersection. The second stage is recording traffic at Simpang Gajayana. The third stage carried out a traffic census at the intersection, Simpang Gajayana. The fourth stage is to tabulate traffic data and look for the Degree of Service at Gajayana Interchange.

The research stages include several stages, as in **fig. 1** below:

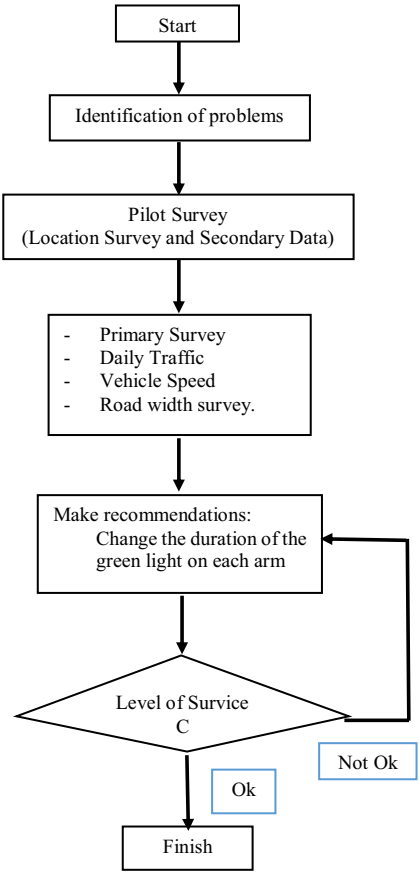

Fig. 1. Research Flow

Figure 1 is the research stages, which include problem identification, secondary survey, primary survey of Average Daily Traffic, arranging the green light and finding the best Degree of Service.

2.3. Research sites

This research was carried out at Simpang Gajayana Malang, as in fig 2. And fig 3. Fig 2 is a photo of the intersection and Fig 3 is the measurement of the width of the lanes of each arm at Simpang Gajayana Malang City.

Fig. 2. Traffic on Gajayana Intersection

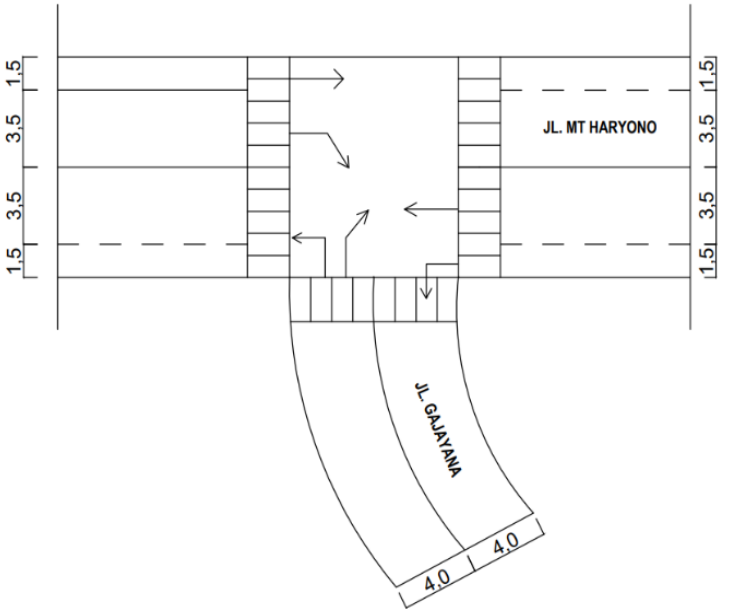

Fig. 3. Gajayana Intersection

3 Result

3.1. Traffic Flow

From research at the Gajayana intersection, the results obtained are as shown in Table 1, Table 2, and Table 3 below:

Table 2. Number of Vehicles per direction per arm

Arm	fase no.	Approach	vehicle turn			self direction	opposite direction	efektif (m)
			P_{LTOR}	P_{LT}	P_{RT}	Q_{RT}	Q_{RTO}	W_e
S	3	O	0,60432		0,396	270	457	8
E	2	O	0,310					10
W	1	P			0,418	457	270	10
W	1	P			0,418			10

From Table 1 it can be seen that the factor for vehicles turning left directly on the south arm is 0.604, the largest right turn factor on the west arm is 0.418.

Table 3. Factors affecting capacity

Ap-proach	Mark base	Saturated current smp/hour green						Dise value adjust
		Adjustment factors						
		All types of approaches				adjust		
	pcu/ hour green	City Size	Side Friction	slope	Park	Right Turn	Left Turn	pcu / hour green
	S o	F_{CS}	F_{SF}	F_G	F_P	F_{RT}	F_{LT}	S
S	4800	0,89	0,93	1,0	1,00	1,10	1,10	4830
E	6000	0,89	0,93	1,0	1,00	0,00	1,05	5240
W	7750	0,89	0,93	1,0	1,00	1,11	0,00	7149
W	7750	0,89	0,93	1,0	1,00	1,11	0,00	7149

From Table 2 it is known that the influencing factors are basic capacity, city size, side obstacles, slope, parking, left turning factor, and right turning factor. And the largest capacity in the West arm is 7149.

Table 4. The number of degrees of service per arm

Ap-proach	Current then cross	Ratio current FR	Rasio fase PR =	Green Time det	Capacity pcu / hour	Degre of Saturity
	smp / jam		FR_{CRIT}		S x g/c	
	Q	Q/S	IFR	g	C	Q/C
S	415	0,0859	0,2668	20	1192,71	0,35
E	690	0,1316	0,4088	30	1940,63	0,36
W	312	0,0436	0,1355	8	706,045	0,44
W	435	0,0608	0,1888	8	706,045	0,62

From table 3 it can be seen that the degree of service for the southern arm is 0.35, the eastern arm is 0.36, the western arm is 0.62.

4 Conclusion.

From the analysis it is known that the best solution is to set the green light on. And the resulting Degree of Service is 0.51, entering class A. The signal is operated in 4 phases, from the South arm to the East arm and then to the West arm. The West Arm has 2 phases (To turn right towards South and to go straight towards East.

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