Available online at JDR Website: http://journal.unublitar.ac.id/jdr

Journal Of Development Research, 7 (1), May 2023, Pages 1-4

DOI: https://doi.org/10.28926/jdr.v7i1.260

Performance Analysis of Signalized Intersections (Case Study: Jalan Kragan – Jalan Veteran Gresik)

Kholidia Ayunaning[(1)], Ridho Maulana Hakim[(2)]

Universitas Muhammadiyah Gresik, Indonesia

E-mail: : [(1)]kholidia.ayu@umg.ac.id, [(2)]ridhomh848@gmail.com

Received: 21 November 2022; Revised: 23 May 2023; Accepted: 26 May 2023

Abstract

The signalized intersection of Jalan Kragan-Jalan Veteran Gresik is the gateway to and from Gresik Regency and Surabaya City, so there are often traffic jams or delays at this signalized intersection and accidents. The evaluation of the performance of the signalized intersection of Jalan Kragan-Jalan Veteran Gresik shows that the signalized intersection Jalan Kragan-Jalan Veteran is experiencing saturation obtained from the 1994 MKJI signalized intersection performance analysis method. According to the Ministry of Transportation regulation No. 96 of 2015, the signalized intersection of Kragan Street – Veteran Street is included in the category D level in signaled crossing services.

Keywords: delay, intersection performance, signalized intersection

Introduction

Problems in the transportation sector are caused by the growth of transportation facilities which is much faster than the growth of transportation infrastructure, causing traffic congestion (Febri Suryaningsih & Kurniati, 2020). Significant disruption to traffic flow due to practical arrangements such as traffic lights or signs is not available, resulting in congestion due to irregular traffic, especially at intersections. Intersections are nodes in the road network where road segments meet and vehicle tracks intersect, which causes high traffic volume (Listiana & Sudibyo, 2019). Intersections also have a critical position in managing traffic flow. Not optimal and practically the performance of the intersection will cause problems. Gresik Regency, one of the largest industrial areas in East Java Province, is prone to traffic jams because class II and above vehicles pass it. If this condition is not supported by improved road infrastructure performance, it will cause severe traffic density problems. Due to the increasing number of motorized vehicles and the growing mobility of class II vehicles, queues and traffic jams often occur at crossroads in Gresik Regency, disrupting residents' activities.

Kragan Road Junction - Jalan Veterans is one example. The intersection is one of the gates for traffic flow to and from Gresik Regency and Surabaya City. Increased congestion on Jalan Kragan caused by increased mobility of class II vehicles and above, lack of cycle time at signalized intersections, presence of crossings, U-turns before signalized intersections, and entry and exit of vehicles at the Nippon paint factory on Kragan roads, which can disrupt residents' activities. The congestion usually occurs during peak hours in the morning and evening. So that Gresik Regency has traffic problems that arise due to the rapid growth of industrial areas in Gresik Regency, resulting in a rapid increase in traffic and can cause vehicle conflicts that pass through the intersection of Jalan Kragan - Jalan Veteran where the road is a 4/2D road. Therefore, this research was conducted to take remedial steps to increase the capacity and level of road service (LoS).

Materials and Method

The initial stage of this research was to collect secondary data from related agencies in the form of data on vehicle growth, city population, and land use. Field observations were carried out in the primary data collection. Field observations

were intended to obtain actual survey data according to what was seen at the location. The survey, so there are no errors in the evaluation (Pratama & Isradi, 2020). Field observations to obtain data on side barriers, road geometry, signal times, and daily traffic volume with the classification of types of light vehicles (LV), heavy vehicles (HV), and motorcycles (MC) (Barhmaiah et al., 2020). After the secondary and primary data are obtained, data processing is carried out.

Data processing here is to process raw data from field observations to become valid data in the research process (Widyawan & Rukman, 2019). Then perform a performance analysis calculation of signalized intersections using these data. The stages carried out in this study can be seen in the following flowchart show in Figure 1.

Results and Discussion

Calculation of Survey Data

1. Field observation results shows on Table 1.

Field data on traffic flow was obtained from field surveys on Mondays, Fridays, Saturdays, and Sundays, with the peak hours for the intersection of Jalan Kragan - Jalan Veteran at 08.00-10.00 WIB, with data on traffic flow during peak hours in each approach as follows Table 2.

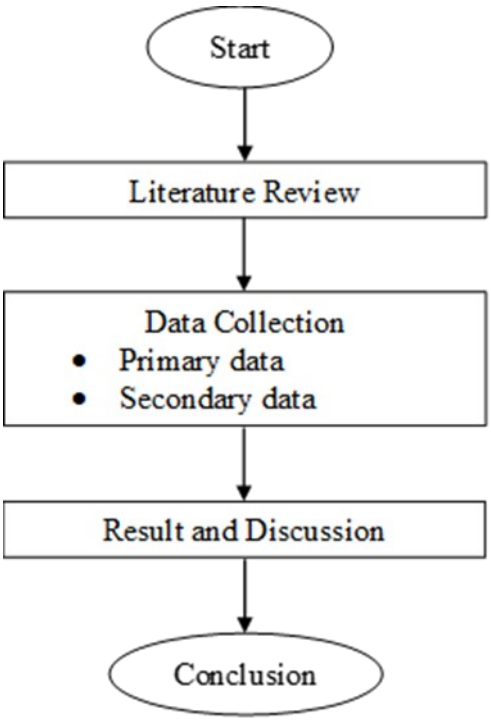

Figure 1. Laying chicken business experience

Table 3 shows field data regarding the signal time was obtained from a field survey at the intersection of Jalan Kragan-Jalan Veteran, with the following signal time data for each approach.

Saturated Current

The saturation current is calculated after knowing the primary saturation current, which determines the correction factor to obtain the saturation current value. Determination of the correction factor itself is as follows (Directorate General Bina Marga, 1997):

a. City size correction factor
   The correction factor for city size is determined based on the number of residents in the city. In Gresik Regency, based on data from the Central Bureau of Statistics for Gresik Regency, 1311215 people were found. In MKJI 1997, the population was in the 1.0-3.0 million category with a correction factor 1.00.
b. Side drag correction factor
   The area around the intersection consists of commercial, residential, and restricted regions. At the junction of Jalan Kragan-Jalan Veteran itself is a commercial area marked by stalls around the area. With side barriers in the form of vehicles parked on the Side of the road, public transport that picks up and drops off passengers, and pedestrians crossing the street. However, the side friction at the Kragan-Veteran Road intersection is still low, with a correction factor value of 0.95.
c. Gradient correction factor
   Several approaches have different slopes at the intersection of Jalan Kragan and Jalan Veteran. On the western system, the rudder is 2.5, with a correction factor of 0.975.
d. Parking correction factor
   Parker's correction factor for each approach, according to MKJI 1997, is 1.00.
e. Right turn correction factor
   The correct turn correction factor for each approach is 1.09 for the east path, 1.05 for the west approach, 1.02 for the north approach, and 1.04 for the south approach.

Degree of Saturation

The calculation of the degree of saturation of each approach at the intersection of Jalan Kragan-Jalan Veteran is as follows.

Table 1. Geometric data

Approach Code	Approach width (m)	Inlet width (m)	Direct left turn (m)	Exit width (m)
North	5.5	3	2.5	6
West	9	6	3	9.5
South	5.5	3	2.5	6
East	8	5.5	-	9

Table 2. Traffic flow during rush hour

Approach	Code	Time (08.00-10.00)		
		LT	ST	RT
North A phase	LC	65	74	78
	HV	17	36	26
	MC	137	116	129
West B Phase	LC	138	177	119
	HV	62	66	68
	MC	422	245	120
Southern C phase	LC	25	20	26
	HV	13	12	16
	MC	46	151	99
Eastern D Phase	LC	143	186	125
	HV	61	61	62
	MC	428	252	139

Table 3. Signal times

Approach Code	Time is on				Cycle Time (seconds)
	Green	Yellow	Red	Allred	
North	65	3	205	2	275
West	112	3	129	2	246
South	75	3	170	2	250
East	125	3	128	2	258

Table 4. Saturated Current

Approach Code	Adjustment factor						S
	So	F_{CS}	F_{SF}	F_G	F_P	F_{RT}	
U	3300	1	0.95	1	1	1.02	3197.7
B	5400	1	0.95	1	1	1.05	5386.5
S	3300	1	0.95	1	1	1.04	3260.4
T	4800	1	0.95	0.975	1	1.09	4846.14

Table 5. Derajat Kejenuhan

Approach Code	Traffic Flow (Q)	Capacity (C)	Degree of Saturation (DS)	Explanation
U	407.3	530	0.77	fed up
B	865.95	934	0.93	fed up
S	194.2	530	0.37	unsaturated
T	879.55	1007	0.9	fed up

Table 6. Queue Length

Approach Code	Number of queued vehicles				QL
	NQ_1	NQ_2	NQ	NQ_{max}	
			NQ_1 NQ_2		
U	0.000	3.491	3.491	6.8	21.54
B	0.814	5.542	6.356	10	34.78
S	0.000	3.514	3.514	7	22.57
T	0.954	6.245	7.199	11.7	40.70

Table 7. Stopped Vehicles

Approach Code	NS (stop/smp)	NSV (smp/jam)
U	0.69	140.55
B	0.70	203.43
S	0.65	139.77
T	0.74	288
Total		771.75
		0.6

Table 8. Delays

Approach Code	Delays			
	DT	DG	D	DxQ
U	29.5	3.7	33.2	13522.7
B	33.5	3.34	36.84	37901.6
S	27	3.2	30.2	5864.84
T	39.5	3.9	43.4	38172.5
Total				95461.64

Table 5 show based on the calculation results above, it is found that the North, West, and East approaches are saturated because DS > 0.75, while the South approach is unsaturated with a DS value of 0.37.

Performance Level

The calculation of the performance level at the Kragan-Veteran Street signalized intersection is as follows:

a. Queue Length

In calculating the queue length, it consists of NQ1 and NQ2 to get the value of NQmax to continue calculating QL. The results for calculating the queue length can be seen in the following table 6:

b. Vehicle Stopped

The calculation of stopped vehicles consists of the total stopping value for all intersections and the number of controlled vehicles (Arsyad & Septiana, 2021). The results of the analysis of stopped vehicles can be seen in the following table 7:

c. Delay

The delay calculation consists of average traffic delay, average geometric delay, average intersection delay, and total delay (Bangkit Prakoso et al., 2019). The results of the analysis of stopped vehicles can be seen in the following table 8:

Conclusion

Based on calculations using MKJI 1994, it is known that signaled intersections experience saturation, and based on the 2015 Minister of Transportation Regulation No. 96. It is included in the level D category of signaled intersection services with an average delay of an average of 35.91 sec/smp.

References

Arsyad, M., & Septiana, D. (2021). ANALISIS KINERJA SIMPANG BERSINYAL JALAN A. YANI-JALAN BACO KABUPATEN TABALONG. *Jurnal Teknologi Berkelanjutan (Sustainable Technology Journal*, *10*(2), 82. http://jtb.ulm.ac.id/index.php/JTB

Bangkit Prakoso, D., Sutoyo, & Sudibyo, T. (2019). *Performance Evaluation of Signaled Intersection of Pahlawan Street and Raden Saleh Sarif Bustaman Street in Bogor West Java)* (Vol. 04, Issue 02).

Barhmaiah, B., Singh, S., & Santhakumar, S. M. (2020). *Performance Analysis of Signalized Intersections on Arterial Roads under Mixed Traffic Conditions*. https://www.researchgate.net/publication/348002616

Directorate General Bina Marga. (1997). *HIGHWAY CAPACITY MANUAL PROJECT (HCM)*.

Febri Suryaningsih, O., & Kurniati, E. (2020). Analisis Kinerja Simpang… (Oyi/hal. 74-84). In *74 INERSIA* (Vol. 1).

Listiana, N., & Sudibyo, D. T. (2019). *Analsis Kinerja Simpang Tak Bersinyal Jalan Raya Dramaga-Bubulak Bogor, Jawa Barat (Performance Analysis of Non-Signal Intersection of Dramaga-Bubulak Street in Bogor, West Java)* (Vol. 04, Issue 01).

Menteri Perhubungan Republik Indonesia. (2015). PEDOMAN PELAKSANAAN KEGIATAN MANAJEMEN DAN REKAYASA LALU LINTAS. *Peraturan Menteri Perhubungan Republik Indonesia*.

Pratama, E. A., & Isradi, M. (2020). *Performance analysis of Unsigned Intersection and Road section with MKJI Method 1997 (Case Study of Intersection Telkom Jatiasih, Highway Wibawa Mukti II-Road Benda Jatiwarna-Jatiasih)*. https://doi.org/https://doi.org/10.29138/ijti.v4i1.1160

Widyawan, S., & Rukman. (2019). Analysis of Simular Simple Performance to Improve Safety on Intersection Depok Kota Depok. In *Jurnal Teknik dan Keselamatan Transportasi* (Vol. 2).

