ISSN No:-2456-2165

Evaluation of Signalized Intersection at Sultan Adam Street in Banjarmasin City

Ginanjar Priadikusumah[1*], Muhammad Yasin[2]
[1] Lecturer, Civil Engineering Department, Faculty of Engineering and Planning, Nahdlatul Ulama Kalimantan Selatan University
[2] Colleger, Postgraduate Civil Engineering, Engineering Faculty, Lambung Mangkurat University
Banjarmasin, South Kalimantan, Indonesia

Abstract:- The design of traffic lights at an intersection is an alternative form of solution to the problems that occur on roads in urban areas. In particular, the intersection of Jalan Sultan Adam Banjarmasin is one of the intersections that uses alternative control of the problem. The dominant problem at this intersection is the large amount of traffic flow that occurs during peak hours. These problems cause opportunities for traffic accidents, both serious and minor accidents. To evaluate the traffic lights at this four-way intersection, data such as road geometric conditions and traffic flow volumes are required, which are the basic data supporting traffic evaluation. Data processing procedures include determining the phase of the intersection, the calculation of signal time, cycle time, road capacity, and degree of saturation. all of which are the core of this traffic light evaluation calculation, where the calculation for 1 cycle time that is feasible in MKJI is 130 seconds using the calculation of 4 (four) phases based on the Webster method, until the calculation of existing conditions on the Jalan SPBU C = 724. 50 pcu/hour and DS = 1.35 pcu/hour, Jalan Sungai Andai C = 207.66 pcu/hour and DS = 2.62 pcu/hour, Jalan Benua Anyar C = 341.95 pcu/hour and DS = 2.38 pcu/hour, Jalan Sultan Adam C = 256.05 pcu/hour and DS = 1.98 pcu/hour. Also obtained is the calculation of setting conditions on Jalan SPBU C = 1220.97 pcu/hour and DS = 0.80 pcu/hour, Jalan Sungai Andai C = 684.74 pcu/hour and DS = 0.80 pcu/hour, Jalan Benua Anyar C = 1018.58 pcu/hour and DS = 0.80 pcu/hour, Jalan Sultan Adam C = 632. 31 pcu/hour and DS = 0.80 pcu/hour.

Keywords:- *Signalized Intersection; Traffic Light; Road Capacity; Saturation Degree.*

I. INTRODUCTION

Banjarmasin City is one of the fastest-growing municipalities and has the potential to become a trade center. This certainly triggers an increase in traffic volume along with the increase in time and progress. Of course, many traders from outside the area come in and out of Banjarmasin City with various needs. Especially at the Sultan Adam intersection, intersection is a heavily populated area. In this area, there are gas stations that cause side obstacles, and due to the narrow road conditions, it often causes traffic jams. The absence of lane dividers also affects the course of traffic, because of the absence of these dividers many people take the next lane during the red light queue, because of this also the next lane becomes closed and causes delays to other incoming intersection lanes.

As a result of the congestion, there are many conflicts such as accidents, congestion, and long queues of vehicles. This certainly results in a high level of saturation for the road user. As one of the alternative ways to overcome congestion and saturation, there is a need for a traffic arrangement to overcome it.

Based on field observations, traffic conditions at the Sultan Adam intersection in Banjarmasin, South Kalimantan are quite congested. Especially at certain hours. For example, in the morning around 07.00 - 08.00 WITA, in the afternoon around 12.00 - 13.00 WITA, and in the afternoon around 16.00 - 17.00 WITA, because at these hours many people carry out activities from several directions of the intersection. This is the basis for evaluating the traffic lights at the Sultan Adam intersection in Banjarmasin City by emphasizing the calculation using four phases.

In the MDP 2017 guidelines [3] [4], the design of pavement thickness based on the ESA value of rank 4 should be used based on Pt T-01-2002-B guidelines [2]. In addition, if subsurface drainage cannot be provided in the MDP 2017 guidelines, the thickness of the aggregate foundation layer must be adjusted by using the drainage coefficient (m) value according to Pt T-01-2002-B. Then in a special case where there are many design variables and it is difficult to accommodate all of them using a design chart, the reconstruction design solution for heavy traffic must be determined using the mechanistic design procedure, namely the Pt T-01-2002-B method.

Based on the above, the old method can still be used to provide a comparison of design results. Therefore, this research will compare the design of flexible pavement thickness between the Pt T-01-2002-B method and the MDP 2017 method which aims to provide a comparison of design results and find out which method is considered more conservative in pavement design.

II. RESEARCH METHODS

The method used is the observation method, namely direct observation and recording in the field. This observation emphasizes more on direct field data collection, the data required is primary data. Primary data collection includes,

traffic volume data collection is carried out with a manual recording device (counterhand) by counting vehicles passing through the intersection from each approach.

The survey time was conducted for 2 days, Monday and Tuesday. The survey was carried out every one-hour period which was carried out for three hours, from 07.00 - 08.00 WITA for the first section, 12.00 - 13.00 WITA for the second section, and 16.00 - 17.00 WITA for the third section. From the survey results, the busiest day is the first day of Monday at 07:00 - 08:00 WITA.

The records for the types of vehicles passing through the intersection on each approach were categorized into four types of vehicles, namely:

- Light Vehicle (LV): four wheel motorized vehicles including passenger cars, minibusses, pick-ups, sedans, and jeeps.
- Heavy Vehicle (HV): Motorized vehicles with more than 4 four wheels including buses, two axis trucks, three axis trucks, or more.
- Motor Cycle (MC): All motorized vehicles with two wheels and three wheels including motorcycles, bajaj, and Tossa.
- Unmotorized (UM): Non-motorized vehicles including bicycles, tricycles, and carts.
  Secondary data collection, carried out directly in the field which includes lanes, lane widths, and intersection layouts.

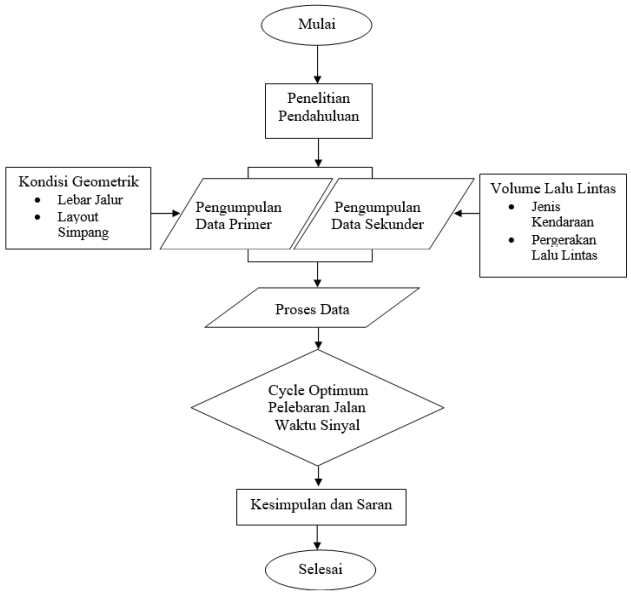

Fig. 1. Research Flow Chart

III. RESULTS AND DISCUSSION

A. *Field Data*

- **Geometric Condition**

The intersection of Sultan Adam Street in Banjarmasin City has four arms of intersection where there are no sidewalks and road medians.

- **Approach Code**

Arm A: Sultan Adam Street (gas station)
Arm B: Sungai Andai Street
Arm C: Benua Anyar Street (Bridge and Ufik Futsal)
Arm D: Sultan Adam Street (towards SMA 5 Banjarmasin)

- **Approach Width**

Arm A has a street width of 3.85 m
Arm B has a street width of 3.10 m
Arm C has a street width of 4.15 m
Arm D has a street width of 3.35 m

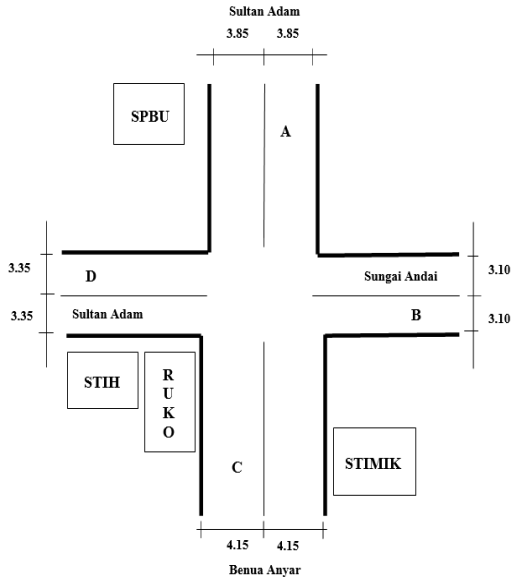

Fig. 2. Road geometric condition

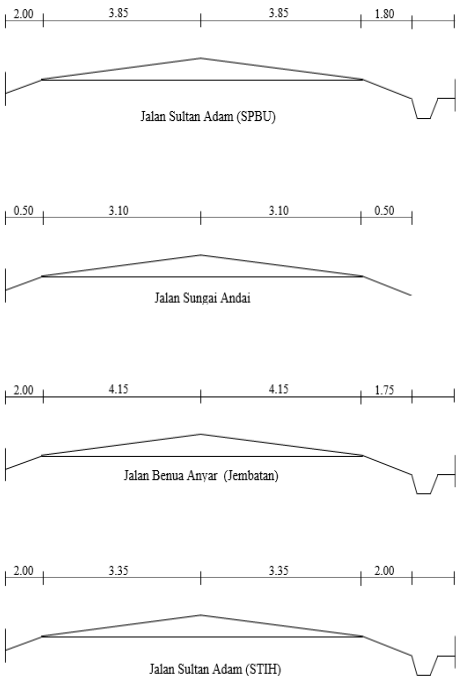

Fig. 3. Road geometric shape

ISSN No:-2456-2165

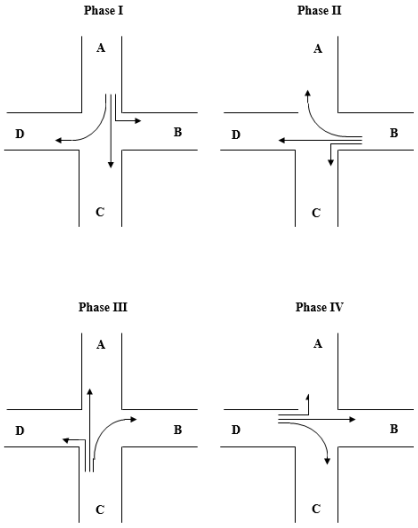

Fig. 4. Phase Form

For calculations at the intersection of Sultan Adam Banjarmasin, maximum traffic flow data was used. From the survey data for two days, the maximum flow was obtained during the observation period on Monday, at 07.00 - 08.00 WITA.

TABLE I. MAXIMUM TRAFFIC FLOW DATA USED FOR EVALUATION

Arm	Movement	Vehicle		
		LV	HV	MC
A	Straight	176	78	2004
	Right	69	5	695
	Left	3	2	383
B	Straight	26	2	1172
	Right	16	6	629
	Left	8	3	600
C	Straight	138	26	1920
	Right	7	2	343
	Left	41	6	663
D	Straight	6	1	444
	Right	63	14	739
	Left	59	4	588

B. Experiment Results

After several trials of signal timing and road widening. The road width that is suitable for the current traffic flow at the Fourth Intersection of Sultan Adam Banjarmasin, namely: Roads were widened to 3.5 meters each and used MKJI feasible cycles

- Intersection A (Sultan Adam Gas Station) = 3.85 meters + 3.5 meters = 7.35 meters
- Intersection B (Sungai Andai street) = 3.10 meters + 3.5 meters = 6.60 meters
- Intersection C (Benua Anyar street) = 4.15 meters + 3.5 meters = 7.65 meters
- Intersection D (Sultan Adam street) = 3.35 meters + 3.5 meters = 6.85 meters

For the calculation of green time settings with a four-phase cycle on the Sultan Adam Banjarmasin intersection based on traffic flow data obtained from the field, the following results are obtained:

TABLE II. GREEN TIME SETTING - FOUR PHASE CYCLE

Intersection	Red (sec)	Yellow (sec)	Green (sec)	(C) pcu/hour	(DS)
A	93	3	38	1220,97	0,80 < 0,85
B	107	3	24	684,74	0,80 < 0,85
C	99	3	32	1018,58	0,80 < 0,85
D	111	3	20	632,31	0,80 < 0,85

From the results of the calculation it can be seen that the green time for existing conditions is no longer effective, this can be seen from the magnitude of the degree of saturation per each intersection, which on average exceeds the ideal limit of <0.85. thus it is clear that at these intersections congestion has occurred, meaning that in each section of green time, the

ISSN No:-2456-2165

length of the queue is not entirely exhausted, there is still a queue left behind and must wait again until the next cycle.

The widening of the road in the setting conditions is indeed considered difficult to reach, because judging from the existing situation, especially at the Sultan Adam intersection, there is no more vacant land to widen the road. However, if the road widening can be fulfilled, there will certainly be no conflict at all. With a feasible cycle time according to MKJI (130 seconds) and the degree of saturation can also be said to meet the requirements, namely <0.85.

TABLE III. COMPARISON OF EXISTING CONDITIONS AND SETTING CONDITIONS

Intersection	Existing Condition			Setting Condition		
	Red	Yellow	Green	Red	Yellow	Green
A	105	5	50	93	3	38
B	133	5	18	107	3	24
C	124	5	23	99	3	32
D	134	5	20	111	3	20

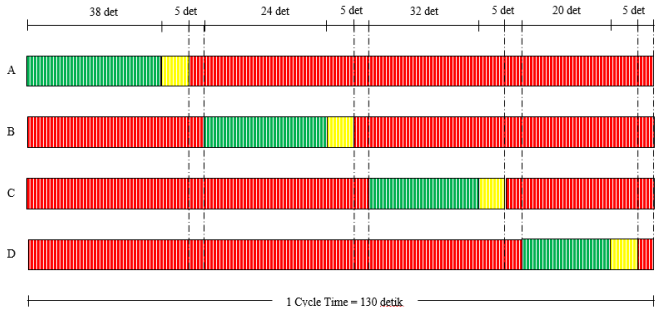

Fig. 5. Timing Diagram

IV. CONCLUSION

Based on the survey and research results, the following conclusions can be drawn:

1) The existing condition of the Signalized Intersection at the Sultan Adam Intersection in Banjarmasin City in 2019 is no longer effective. Can be seen from the degree of saturation:

- Intersection A: 1.35 > 0.85 (saturated)
- Intersection B: 2.62 > 0.85 (saturated)
- Intersection C: 2.38 > 0.85 (saturated)
- Intersection D: 1.98 > 0.85 (saturated)

2) Due to the narrow width of the road, the calculation in determining the signal time cannot be achieved (saturated). After widening the road by 3.5 meters each, the current traffic flow can be met. Can be seen from the degree of saturation:

- Intersection A: 0.80 < 0.85 (safe)
- Intersection B: 0.80 < 0.85 (safe)
- Intersection C: 0.80 < 0.85 (safe)
- Intersection D: 0.80 < 0.85 (safe)

REFERENCES

[1]. Hadihardaja, Joetata. (1997). Sistem Transportasi. Gunadarma. Jakarta.
[2]. Khisty, C. J., & Lall, B. K. (2003). Dasar-Dasar Rekayasa Transportasi Jilid 1 Edisi Ketiga. Erlangga. Jakarta.
[3]. Makridakis, S., Wheelwright, S. C., & McGee, V. E. (1999). Metode dan Aplikasi Peramalan Jilid 1 Edisi Revisi. Binarupa Aksara. Tangerang.
[4]. Makridakis, S., Wheelwright, S. C., & McGee, V. E. (1999). Metode dan Aplikasi Peramalan Jilid 2 Edisi Revisi. Binarupa Aksara. Tangerang.
[5]. Masyhuri & Zainuddin, M. (2008). Metodologi Penelitian, Pendekatan Praktis dan Aplikatif. Refika Aditama. Bandung.
[6]. Morlok, Edward K. (1988). Pengantar Teknik dan Perencanaan Transportasi. Erlangga. Jakarta.
[7]. Munawir, Ahmad. (2005). Dasar-Dasar Rekayasa Transportasi. Beta Offset. Yogyakarta.
[8]. Standart Nasional Indonesia. (1997). Manual Kapasitas Jalan Indonesia (MKJI). Direktorat Bina Marga. Jakarta.
[9]. Sweroad Associated with PT. Bina Karya. (1997). Manual Kapasitas Jalan Indonesia (MKJI). Direktoran Jendral Bina Marga. Jakarta.
[10]. Tamin, Ofyar Z. (2000). Perencanaan dan Pemodelan Transportasi. ITB. Bandung.
[11]. Warpani, Suwardjoko P. (2002). Pengelolaan Lalu Lintas dan Angkutan Jalan. ITB. Bandung.