Performance Analysis of Signalized Intersection Jl. Haji Bau-Jl. Penghibur-Jl. Rajawaliin Makassar

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Abstract: ***The imbalance between the growths of the number of vehicles with road capacities makes this condition create traffic especially at the junction area to become the traffic crosses into the peak hour. This study was conducted on the unsignalized intersection Jalan Haji Bau-JalanPenghibur-JalanRajawali and this work focused on forming simulation model parameters, intersection performance characteristics, and optimizing intersections. This research was conducted at the intersection of Jalan Haji Bau-JalanPenghibur-JalanRajawali during working time which started at 06.00-18.00 Wita. This study requires data of vehicle characteristics and road geometric. Survey method used for volume measurement and for speed measurement using speed gun. The analytical method used to calculate the traffic performance of the intersection in this study is the approach of the Vissim-based traffic micro-simulation model to calculate the intersection performance by calibration using GEH Test on vehicle volume parameters and then validating the length of the vehicle queue using Chi-Square test. Based on the simulation result that the calibration parameter of each time period is the same and different like the vehicle safe distance parameter, the queue length and delay value at Jalan Haji Bau, Jalan, Penghibur, and JalanRajawali are 138.78 m and 40 sec; 19.46m and 19 sec; 53.52 m and 18.95 sec. Furthermore, traffic engineering efforts conducted with 2 types of alternative changes to a signal intersection where in this study the first alternative condition is considered to produce better intersection performance than the existing conditions and the second alternative.***

Keywords: ***Chi-Square test, GEH, Signalized intersection, Simulation, Traffic.***

I. INTRODUCTION

The imbalance between the growth in the number of vehicles and the increase in road capacity that is affected by road conditions will cause transportation problems, namely congestion which will have an impact on increasing costs, travel time and pollution [1].

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The intersection is the meeting point of the flow of vehicles from several different road segments, the intersection serves as a place for the vehicle to change the direction of traffic movement [2]. The level of movement that varies from various types of vehicles will result in a queue that is large enough so that travel time and costs will be higher [3]. Intersections can vary from simple intersections consisting of meetings of two roads to a complex intersection consisting of meetings of several roads [4]. With the meeting of the various currents of these vehicles, of course there will be a variety of vehicle traffic conflicts and will increase the risk of congestion [5].

Congestion is a negative impact that is most felt by road users, and besides that it can also trigger other problems. These problems include increased vehicle operating costs, increased air pollution due to smoke from motorized vehicles, increased noise pollution, health problems caused by motorized vehicle pollution, to stress and decreased productivity in activities [6].

Congestion often occurs in segments and intersections. The performance of an intersection is the main factor in determining the most appropriate treatment to optimize the intersection function. Unlike the signified intersection, the driver at unmarked intersections in taking action lacking positive guidance, the driver aggressively decides to finish the maneuver needed when entering the intersection [7]. Traffic conditions are characterized by high density especially at intersections, in other words the existing intersection capacity is not proportional to the volume of the vehicle, resulting in congestion on the main road sections [8].

Vehicle growth rate in 2015 for two wheels in Makassar City is 6.29%, passenger cars 10.20%, buses 0.74% and trucks 7.55% [9]. Annual road growth is only 1-2% per year, road length according to road conditions in Makassar City 1989.02 km or 66.80% good, 400.77 km or 13.46% moderate, 442.81 km or 14.87% mildly damaged and 144.90 km or 4.87% severely damaged [9,10].

Unsignalized intersection Jalan Haji Bau-Jalan Metro Tanjung-JalanRajawali-JalanPenghibur is one of the busy intersections in the Makassar area where the area around the intersection is a commercial area because it is located in the coastal area. Around the intersection there are also many shops, culinary places and tourist attractions.

So that it is visually on ush hour and on weekends have a heavy traffic flow that causes vehicle queues and travel delays. Based on this fact, a comprehensive performance analysis is needed at the unsignalized intersection of Jalan Haji Bau - Jalan Metro Tanjung-JalanRajawali - JalanPenghibur to improve services at Jalan Haji Bau-Jalan Metro Tanjung-JalanRajawali-JalanPenghibur.

The performance of the unsignaled intersection of Jalan Haji Bau-Metro Tanjung-JalanRajawali-JalanPenghibur Road will be analyzed using Vissim software based on a micro-simulation model, so the calculation of intersection performance no longer uses the Indonesia Road Capacity Manual 1997 model (MKJI 1997), this is because the 1997 MKJI model was very long and there was no renewal so MKJI 1997 was no longer able to define the current intersection conditions. In this study, a problem analysis is done by using simulation software in order to produce a valid analysis and in accordance with the conditions in the field.

This study was conducted on the unsignalized intersection Jalan Haji Bau-JalanPenghibur-JalanRajawali and this research focused on forming simulation modelparameters, intersection performance characteristics, and optimizing intersections.This research was conducted at the intersection of Jalan Haji Bau-JalanPenghibur-JalanRajawali.

II. METHODOLOGY

Research Location and Time

The study was located in one of the intersections in the city of Makassar, the intersection of Jalan Haji Bau-JalanPenghibur-JalanRajawali-Jalan Metro TanjungBunga.

Survey Methods

For this work, three types of survey method were used which are inventory survey, vehicle flow survey and vehicle speed survey. Surveying equipment used for this work is roll meter, laptop, speed gun and survey form

Data Collection

Primary data retrieval is done using direct survey method at the research location. The placement of the equipment during the survey is important. Therefore it is necessary to pay close attention to the position of the equipment when making observations either through recording or measurement directly at the survey location. The data taken for this study is data on vehicle traffic volume. The data can be obtained through direct surveys at the research location for 12 hours with a total of 11 surveyors at 8 (three) points. The survey position is shown in Figure 1. Data compilation is data from later survey forms recap and tabulated using excel software in the form of data such as inventory data, vehicle volume data, and speed data. This research method uses micro software - PTV Vissim 9 simulation which functions to simulate the junction model.

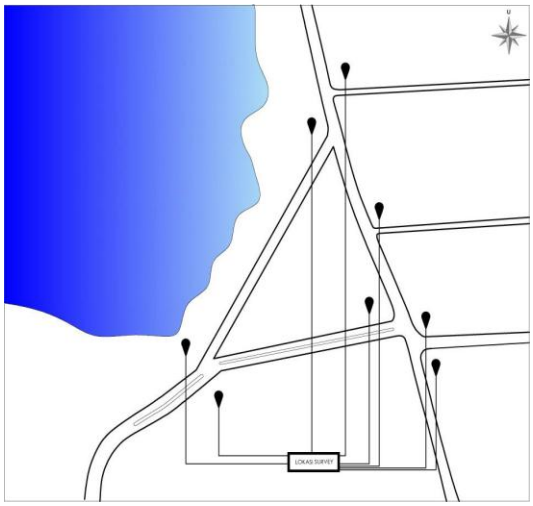

Fig. 1 Survey Location Position

III. RESULT AND DISCUSSION

Traffic performance based on the simulation results shown in Figure 2 and Figure 3 shows that queue phenomena and vehicle delays at each intersection are far different, especially queue length, seen queue length at the approaching Jalan Haji Bau is too large compared to the other leg with a maximum value of 138.78 m occurring in the period At 5:00 p.m. to 6:00 p.m., the difference is quite far from the approach of JalanYosepLatumahina around 6.1 m, JalanRajawali around 19.46 m and Jalan Metro TanjungBunga around 46.87 m. Whereas for vehicle delay shows the same thing where the delay on Jalan Haji Bau is higher than the other approach of about 40 seconds compared to the approach of JalanRajawali and Metro Tanjung only about 9-20 seconds due to the point of conflict / meeting which causes during simulation all vehicles move out of the intersection causing higher vehicle delays compared to other approaches.

Based on micro performance analysis - traffic simulation at Jalan Haji Bau-JalanPenghibur-JalanRajawali-Jalan Metro TanjungBunga using Vissim software obtained output of queue length and vehicle delay is quite large, so it is necessary to make an effort to engineer traffic at the intersection this, especially at the intersection of Jalan Haji Bau-JalanPenghibur-JalanRajawali-Jalan Metro Tanjung Bunga. There are two alternative traffic junction movements that are done by addition of Traffic Gainer (APILL) at the intersection.There are two alternative intersections that are carried out by adding the Traffic Signal Giving Tool (APILL) at the intersection. Changing the unsignalized intersection of Jalan Haji Bau-JalanPenghibur-JalanRajawali-Jalan Metro TanjungBunga became a signalized intersection. The green, red, yellow cycle times for each alternative are different and are divided into 2 phases and 3 phases, which are divided into 2 phases: phase 1 Jalan Haji Bau and Jalan Metro TanjungBunga, and phase 2 JalanRajawali.

For the division into 3 phases, namely phase 1 Jalan Haji Bau, phase 2 JalanRajawali, and phase 3 Jalan Metro TanjungBunga. Referring to the simulation results based on Figure 4 shows that to form the optimum performance of the junction is by adding Traffic Gainer to the approach. The results of addition of APILL For phase 1 and 2 respectively, at Jalan Haji Bau road approximation 55.99 m; 100.4 m, JalanRajawali is 30.95 m; 41.4 m, and the nearest Metro MetroTanjungBunga 40.52 m; 50.56 m. At the approach of Jalan Haji Bau the queue length is shorter, but there are also approaches that are longer in line than existing conditions. So in the case of the intersection of Jalan Haji Bau-JalanPenghibur-JalanRajawali-JalanMetroTanjungBunga, to produce a sufficiently optimum intersection performance that is by using the phase of plan 1 move because it can produce traffic performance that is better than the phase of the existing movement and plan 2.

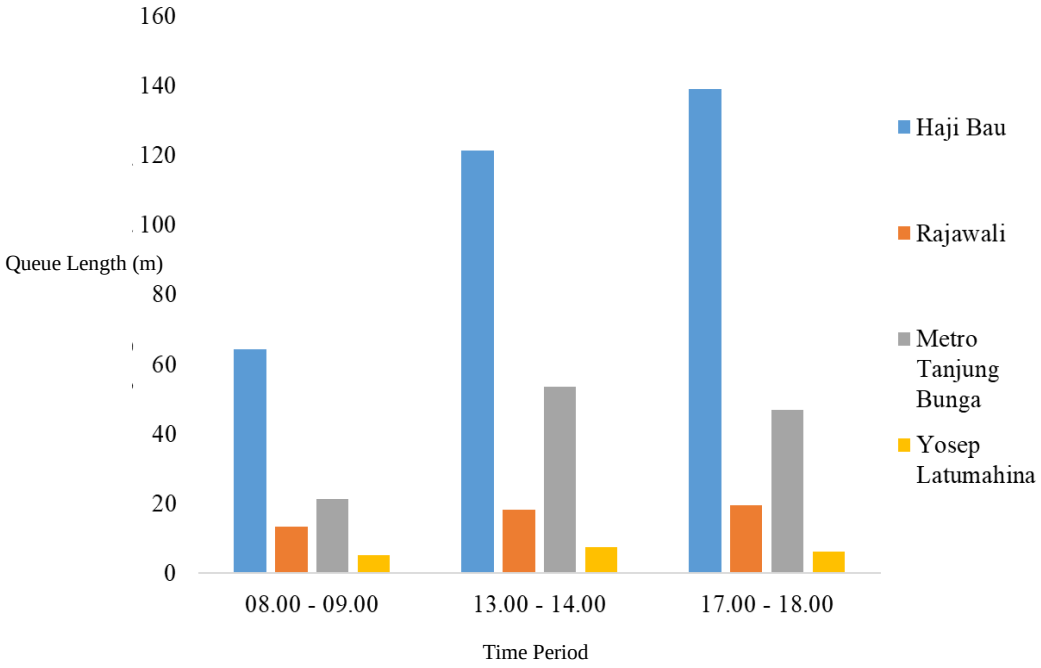

Fig. 2 Vehicle Queue Length

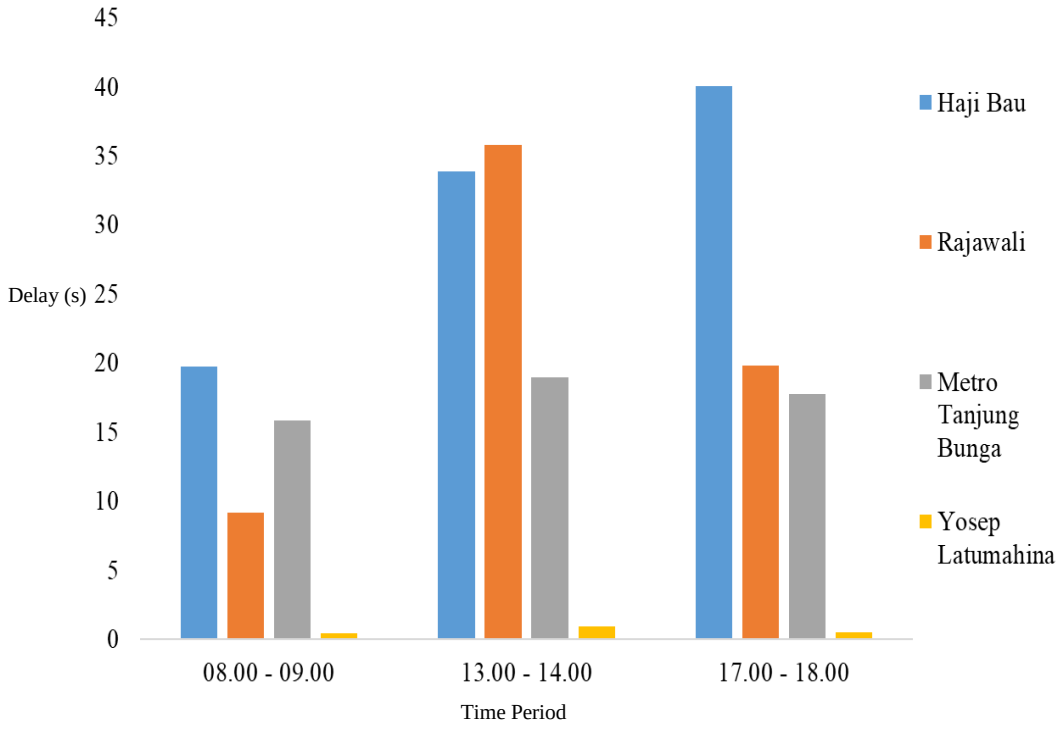

Fig. 3 Vehicle Delay

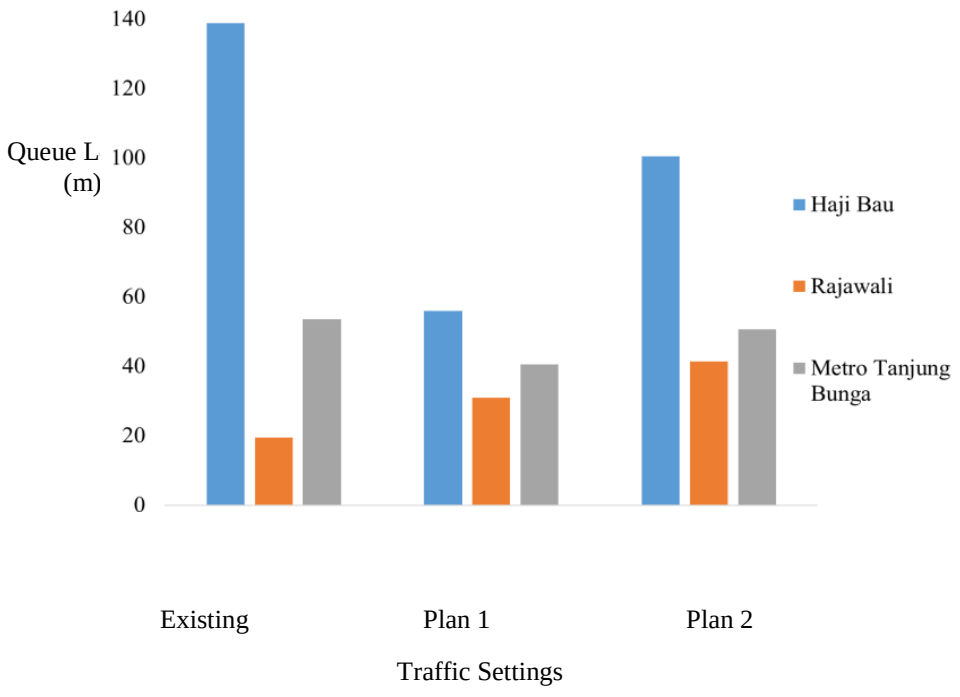

Fig. 4 Optimization simulation results

IV. CONCLUSION

Traffic performance of existing conditions at Jalan Haji Bau - JalanPenghibur - JalanRajawali - Jalan Metro TanjungBunga based on simulation results on Jalan Haji Bau has queue length and delay in peak hours with values of 138.78 m and 40 sec, JalanRajawali with a value of 19.46 m and 10.4 sec, Jalan Metro TanjungBunga with a value of 53.52 m and 18.95 sec and JalanYosepLatumahina with a value of 7.4 m and 0.96 sec. The performance of intersections for traffic engineering efforts is intersection signaled, done with 2 alternative plans. Value of vehicle queue length at approaching Jalan Haji Bau 55.99 m; 100.4 m, approaching JalanRajawali 30.95 m; 41.4 m, and approaching Jalan Metro TanjungBunga 40.52 m; 50.56 m. So in this case using the alternative conditions of the first plan because it produces traffic performance that is better than the phase of the existing movement and plan 2. With the first plan cycle time is 50 seconds where on Jalan Haji Bau and Metro TanjungBunga time is 25 seconds, red is 22 seconds and yellow 3 seconds, on JalanRajawali green time 16 seconds, red 31 seconds, and yellow 3 seconds.

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