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EVALUATION OF TRAFFIC ENGINEERING ON DEWI SARTIKA ROAD AT THE CILILITAN INTERSECTION CAWANG INTERSECTION SEGMENT

By
Jujuk Kusumawati[1], Djoko Subagijo[2], Udien Yulianto[3], Yudi Setiawan[4]
[1,2,3,4] Program Studi Teknik Sipil, Institut Teknologi Budi Utomo, Indonesia
Email: jujuk@itbu.ac.id[1], djokos@itbu.ac.id[2], udien@itbu.ac.id[3], yudisetia@itbu.ac.id[4]

ABSTRACT

The problem at each intersection is the capacity of the road and intersection, due to the increasing volume of vehicles, other road users such as pedestrians, bicycles, vehicle parking and public buildings, the intersection requires regulation to avoid and minimize conflicts or problems that may arise in the intersection area. Cililitan Intersection and Cawang Intersection are one of the centers of activity in East Jakarta which are located in Kramat Jati sub-district. Both intersections are currently congested due to the presence of a shopping center, namely the Cililitan Wholesale Center (PGC). This study aims to evaluate the performance of the intersection using the PKJI 2023 standard. Based on the results of the performance analysis at the Cililitan and Cawang intersections, it was obtained that the addition of the green light cycle time had a positive impact on the Cililitan intersection, the addition of the green light cycle time made the vehicles on the northern approach unravel. From the results of the analysis of the two alternatives, namely alternative 1 and alternative 2, the most likely alternative to be used is alternative 1 because in alternative 2 the closure of the intersection can cause drivers to look for alternative routes which cause congestion at other intersections.

Keywords: Traffic Engineering, Intersection Branch, Cililitan Intersection, Evaluation

EVALUASI TEKNIK LALU LINTAS JALAN DEWI SARTIKA DI PERTIGAN JALAN CILILITAN PERTIGAN JALAN CAWANG

ABSTRAK

Masalah yang ada di setiap persimpangan adalah kapasitas jalan dan persimpangan, akibat meningkatnya volume kendaraan, pengguna jalan lain seperti pejalan kaki, sepeda, parkir kendaraan, dan bangunan yang umum, sehingga persimpangan perlu diatur untuk menghindari dan meminimalkan konflik atau masalah yang mungkin timbul di area persimpangan. Persimpangan Cililitan dan Persimpangan Cawang merupakan salah satu pusat keramaian di Jakarta Timur yang terletak di Kecamatan Kramat Jati. Kedua persimpangan saat ini mengalami kemacetan akibat adanya pusat perbelanjaan, yaitu Pusat Grosir Cililitan (PGC). Studi ini bertujuan untuk mengevaluasi kinerja persimpangan menggunakan standar PKJI 2023. Berdasarkan hasil analisis kinerja di persimpangan Cililitan dan Cawang, diperoleh bahwa penambahan waktu siklus lampu hijau memiliki dampak positif pada persimpangan Cililitan, penambahan waktu siklus lampu hijau membuat kendaraan tersebar di pendekatan utara. Dari hasil analisis dua alternatif, yaitu alternatif 1 dan alternatif 2, alternatif 1 merupakan alternatif yang paling mungkin digunakan karena dalam alternatif 2 penutupan persimpangan dapat menyebabkan pengendara mencari jalan alternatif yang menyebabkan kemacetan di persimpangan lain.

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Kata kunci: Teknik Lalu Lintas, Persimpangan Cawang, Persimpangan Cililitan, Evaluasi

INTRODUCTION

Traffic engineering is a regulation that is enforced in order to prevent congestion on the highway. The problem that exists at each intersection is the capacity of roads and intersections, due to the increasing volume of vehicles, other road users such as pedestrians, bicycles, vehicle parking and buildings that are general, so intersections need to be regulated to avoid and minimize conflicts or problems that may arise in the intersection area. Simpang Cililitan and Simpang Cawang are one of the crowded centers in East Jakarta located in Kramat Jati District. Both intersections are currently congested due to the existence of a shopping center, namely the Cililitan Wholesale Center (PGC). In addition, there are many business centers such as factories, malls, SMEs, markets, street vendors and schools that operate which cause a buildup of vehicles at both intersections. Long queues, delays and prone to conflicts. As a result of long queues and delays as well as poor interchange performance, one of them is economic losses which, according to the Jabodetabek Transportation Management Agency (BPTJ) for the Greater Jakarta area, losses caused by Rp.71.4 trillion per year, one of the contributors of which is the Cawang intersection and the Cililitan intersection. This is caused by the waste of fuel oil (BBM) and decreased productivity due to the time wasted by people being stuck in traffic. Therefore, it is necessary to optimize intersections so as to reduce delays and traffic queues at intersections.

The congestion conditions that occur at the two intersections will increase the cost of transportation for road users which in the end will reduce the economic competitiveness of the region. This shows that the road infrastructure is not able to compensate for the load of vehicles. Therefore, it is necessary to find a suitable solution so that the congestion can be handled properly and be able to provide benefits to the community. This study aims to evaluate the performance of signaled intersections on the Dewi Sartika road section at the intersection of Cililitan road and Cawang road intersections using the Indonesian road capacity guideline method (PKJI), as well as provide alternative intersection repair to improve the intersection services in the future.

Simpang Cawang and Simpang Cililitan located in Cililitan Kramat Jati are one of 67 locations prone to traffic jams according to data.jakarta.go. These two intersections are signaled intersections that have a dense traffic volume because this intersection is one of the access to and across Jakarta. This causes problems that occur at intersections, including long queues, delays and prone to conflicts. As a result of long queues and delays as well as poor interchange performance, one of them is economic losses which, according to the Jabodetabek Transportation Management Agency (BPTJ) for the Greater Jakarta area, losses caused by Rp.71.4 trillion per year, one of the contributors of which is the Cawang intersection and the Cililitan intersection. This is caused by the waste of fuel oil (BBM) and decreased productivity due to the time wasted by people being stuck in traffic. Therefore, it is necessary to optimize intersections so as to reduce delays and traffic queues at intersections.

RESEARCH METHODS

1) Data Collection Methods

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In this study, primary data and secondary data are needed. Primary data includes vehicle flow data, intersection geometric data, and intersection inventory data. Meanwhile, secondary data includes data from the Jakarta Central Statistics Agency, data from the East Jakarta city transportation office.

2) Data Analysis Methods

a. Method of Intersection Performance Evaluation Analysis

1) Traffic Flow
To find out the volume of traffic at the intersection, a survey will be carried out to calculate the volume of vehicles/classified turning movement counting (CTMC) at each leg of the intersection in units of vehicles per hour

2) Capacity
The junction capacity is calculated for the total incoming current from the entire junction arm, which is the multiplication of the base capacity (C0) and the correction factors that take into account the difference in environmental conditions to the ideal conditions

3) Degree of Saturation
The traffic flow data and road capacity obtained are then processed to find the degree of intersection saturation

4) Junction Delay
Intersection delays occur due to 2 (two) things, namely traffic delays (TLL) and geometric delays (TG). Junction delay is used to determine the level of service

5) Queue Opportunities
Intersection Service Level
Determination of the level of interchange service based on interchange delay

b. Alternative Problem Solving Evaluation Analysis Methods
There are 2 alternatives to solve the problem of congestion at the intersection of Cililitan road – Cawang road intersection, which are as follows:

1) Alternative 1
In alternative 1, namely by ressetting the Traffic Signaling Device (APILL) without changing the geometry of the intersection

2) Alternative 2
Alternative 2 is the closure of the Cililitan intersection to unravel the congestion on the Dewi Sartika road section which has an impact on the Cawang intersection

3) Method of Discussion of Analysis Results

a. Method of Discussion of Simpang Performance Analysis Results

b.

Table 1 Intersection Performance Analysis Table

No	Indikator	Nilai	Satuan
1	Arus Lalu Lintas (Q)		
2	Kapasitas (C)		
3	Derajat Kejenuhan (D_J)		
4	Tundaan (T)		
5	Tingkat Pelayanan Simpang (LoS)		

Source : Processed Research

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c. Best Alternative Analysis Results Discussion Method
After getting the results of the three problem-solving alternatives, the next step is to choose the best alternative. The following is a comparison table of the existing conditions with the administration of the three alternatives.

Table 2 Intersection Performance Analysis Table

No	Indikator	Kondisi				
		Eksisting	Alternatif 1	Alternatif 2	Satuan	Ket
1	Arus Lalu Lintas (Q)					
2	Kapasitas (C)					
3	Derajat Kejenuhan (D_J)					
4	Tundaan (T)					
5	Tingkat Pelayanan Simpang (LoS)					

Source : Processed Research

RESULTS AND DISCUSSION

1. Data Analysis
   a. Existing Traffic Engineering Analysis
      1) Volume/Capacity
      The analysis was obtained as follows: Light vehicles with an emp value of 1. Heavy vehicles with an emp value of 1.2. Motorcycles with an emp value of 0.25. And unmotorized vehicles are not considered part of the traffic flow

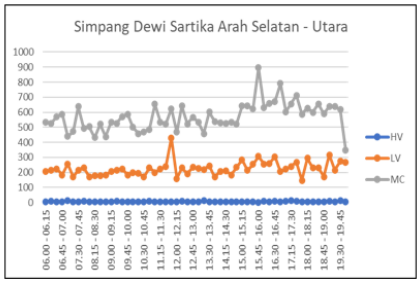

Figure 1 Vehicle Fluctuations at Simpang Cililitan
Source : Processed Independent Research

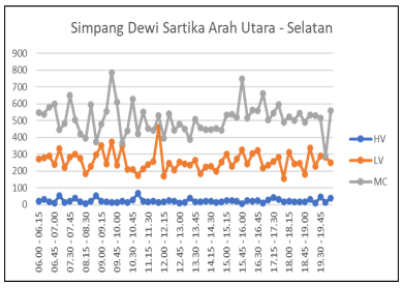

Figure 2 Fluctuations of Cililitan Junction Vehicles
Source : Processed Independent Research

2) Capacity

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It consists of several factors, namely the type of intersection (Jalan Dewi Sartika intersection is included in junction 422), Basic Capacity (2900 SMP/Hour), Average approach width adjustment factor, Main/major road median adjustment factor is 1.00, city size correction factor is 1, obstacle correction factor is 0.94, left turn current ratio correction factor is 1.111, right turn current ratio adjustment factor is 1.0, The adjustment factor of the minor road flow ratio is 0.94, and the capacity is 2801 SMP/Hour.

3) Traffic Behavior

The saturation factor was at 0.89 more than 0.6. Traffic delays with the formula TLL = (1.0504 /0.2042-20.2742DJ) - (1 − DJ). Main road traffic delay with formula (1.0503/0.3460−0.2460 DJ) – (1-89)1.8. Minor road traffic delays qKB x TLL−qMa x TLLMa/ qMi. Geometric Delay with the formula TG = (1 – DJ) x (6 x RB + 3(1-RB)) + 4 DJ. Junction delay T = TLL + TG. Upper limit queue odds with formula Pa = 47.71 DJ – 24.68 DJ2 + 56.47 Dj3. Lower limit with formula Pa = 9.02 DJ + 20.66 DJ2 + 10.49 Dj3

4) Traffic Behavior Assessment

a) Cililitan Junction

Calculation of the approach of the junction of the branch of the dewi sartika road in the direction of kp. Malay is 2455/3279 = 0.75 smp/hour.

b) Junction Cawang

for the approach of the junction of the Cawang section of the road section of Major General Sutoyo is 3243/2544 = 1.27 smp/hour. So the degree of saturation (DS) is 1.27.

The calculation of the service level at the 2 intersections is as follows: 1) the Cililitan intersection is 0.75 smp/hour, and 2) the intersection of the Majen Sutoyo road section is 1.27 smp/hour.

b. Alternative Analysis of Problem Solving

1) Alternative 1

namely by adjusting the phase and time of the traffic cycle, namely by extending the green light cycle at intersections with a high number of queues, then calculations and traffic behavior are carried out as follows: 1) Preparation of Geometry Data, Traffic and Environmental Regulation, 2) Preparation of traffic flow data, with the northern approach as follows: Rbki = 0.18 and Rbka = 0.20, The Southern Approach Rbki = 0.20 and Rbka = 0.19. Western approach with Rbki = 0.23 and Rbka = 0.21. 3) Calculate Wms and Whh (North-South and west Wms 2 seconds each), Total yellow time = 3+3+3 = 12 seconds/phase, green lost time = 15 seconds/phase. 4) Calculate the signal time with the Basic Saturated Current (J0) North = 10680 smp/h, South 9120 smp/h, West = 8400smp/h. City size adjustment factor = 1, Side obstacle adjustment factor = 0.94, Slope adjustment factor = 1, Parking adjustment factor = 1, North turn adjustment factor = 1.05, South 1.04, West 1.05, North left turn adjustment factor 0.96, South = 0.96 and west 0.96. North Saturated Current 10199 smp/hour, South 8641 smp/hour,

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West 7959 smp/hour. Traffic Flow north 2930, South 3665 and west 4930. The ratio of the North Current is 0.28, South 0.42 and the West is 0.61. Intersection Current Ratio is 0.55, North Phase Ratio = 0.50, South 0.76, West = 1.1. Pre-Adjustment Cycle Time = 74 seconds North Green Time 28 seconds, South 42 seconds, West 61 seconds. Adjusted Cycle Time is 146 seconds, North C Capacity 1901 cm/h, South C 2435 cm/h, West C 3258 cm/h. Degree of Saturation C North = 1.54 , C South 1.50 and C West = 1.50

In the calculation above that the addition of the green light cycle time results in a cycle of 74 seconds, a green time shorter than 30 seconds should be avoided. On the northern approach, at least 5 seconds of additional green light cycle time can be added because it can cause excessive red light violations.

2) Alternative 2

Alternative 2 is the closure of the Cililitan intersection to reduce congestion on the Dewi Sartika road section which has an impact on the branch intersection.
Technical data on the Dewi Sartika road section can be seen in the table below:

Table 3 Existing Data on the Simpang Dewi Sartika Road

Data Geometrik Jalan	
1. Tipe Jalan	4/2 D
2. Lebar lajur lalu lintas	15 meter
3. Lebar bahu efektif pada kedua sisi	-
4. Jenis Perkerasan	Aspal
5. Status Jalan	Jalan Provinsi
6. Kelas Jalan	I
Data Lalu Lintas	
1. Distribusi arah	100%
Data Ukuran Kota	
1. Jumlah Penduduk	3,25 juta penduduk
Data Hambatan Samping (Sedang)	
1. Banyak angkutan kota berhenti	Tinggi
2. Banyak pejalan kaki	Tinggi
3. Banyak akses kendaraan dari sisi jalan	Tinggi
4. Banyak kendaraan parkir/terhenti	Tinggi
5. Kondisi lingkungan sekitar	Campuran

Source : PKJI

Based on surveys in the field, it was found that the existing geometric conditions of the highway section are basically a 4/2 D type road section which means that the road section has 4 2-way lanes which also shows the many directions of movement of motor vehicles on the road section. Based on the analysis above, the capacity for Jalan Dewi Sartika is 3734 smp/hour or if calculated for each level of 1866.75 smp/hour per lane.

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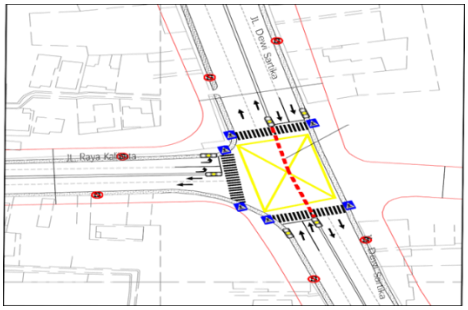

Figure 3 Map of the Path of the Goddess Sartika
Source : Detailed Spatial Plan of DKI Jakarta

Calculation of Free Flow Speed with the width of the road to 15 meters. From these values, the value of the free flow speed of Jalan Dewi Sartika can be obtained: FV = (44 + 7)x0.99x0.95 = 47.965 Km/Hour. The calculation of the capacity of Dewi Sartika road with a width of 15 meters can be found using the formula: From these values, the capacity value of Jalan Dewi Sartika can be obtained as: C = 2900 x 1.34 x 1.00 x 0.98 x 0.94 = 3579.783 Junior High School/hour

2. Discussion of Analysis Results
   a. Discussion of the Results of Intersection Traffic Engineering Analysis
      1) Discussion of the Results of the Traffic Engineering Analysis of Simpang Cililitan
      2)

Table 4 Results of Intersection Performance Calculation

Simpang	Arah	Kode Pendekat	Antrian	Number of Stop	Tundaan (detik)	LOS
Simpang Kalibata	U	Jl. Dewi Sartika	129,5	0,62	45,95	D
	S	Jl. Dewi Sartika	67,25	0,45	33,2	C
	B	Jl. Kalibata	80,31	0,58	43,27	C

Source : Processed Researcher Data

With the Number of Stop at 0.62 and the delay that occurred was 45.95 seconds, and the service level (LOS) was (D) From the South (S) queue that occurred along 67.25 m. With the Number of Stop 0.45 and the delay that occurred was 33.2 seconds, and the level of the flight (LOS) was (C). And in the West direction (B) the queue that occurs is 80.31 m. With a Number of Stop of 0.58 and the delay that occurs is 43.27 seconds, and the service level (LOS) is (C).

      3) Discussion of the Results of the Traffic Engineering Analysis of Simpang Cawang
      4)

Table 5 Results of Intersection Performance Calculation

Simpang	Arah	Kode Pendekat	Antrian	Number of Stop	Tundaan (detik)	LOS
Cawang	U	Jl. Dewi Sartika	135,56	0,65	55,24	D
	S	Jl. Cipinang Besar	106,44	0,71	49,65	D
	T	Jl. Meyjen Sutoyo	94,77	0,69	48,9	D
	B	Jl. Raya Bogor	126,8	0,88	58,49	E

Source : Processed Researcher Data

The result was obtained from the North (U) antirian along 135.56 m. With the Number of Stop at 0.65 and the delay that occurred was 55.24 seconds, and the

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service level (LOS) was (D). From the South (S) the queue that occurs is 106.44 m. With a Number of Stop of 0.71 and the delay that occurs is 49.65 seconds, and the level of the flight (LOS) is (D). And in the East (T) the queue that occurs is 94.77 m. With a Number of Stop of 0.69 and the delay that occurs is 48.9 seconds, and the service level (LOS) is (D). And in the West direction (B) the queue that occurs is 126.8 m. With a Number of Stop of 0.88 and the delay that occurs is 58.49 seconds, and the service level (LOS) is (E).

5) Discussion of the Results of Intersection Traffic Engineering Analysis
6)

Table 6 Results of the Calculation of Each Alternative

NO	Indikator	Eksistin g	Alternat if 1	Alternatif 2	Satuan	Keterangan
1	Arus Lalu Lintas	9130	9130	8950	smp/jam	Alternatif 1 lebih baik
2	Kapasitas Simpang	9831	9936	9933	smp/jam	Alternatif 1 lebih baik
3	Derajat Kejenuhan	0,62	0,6	0,58	-	Alternatif 2 lebih baik
4	Tundaan	45,95	39.98	43,56	detik	Alternatif 1 lebih baik
5	Tingkat Pelayanan	D	C	C	detik/kendaraan	Alternatif 1 lebih baik

Source : Processed Researcher Data

The following is a presentation in the form of a graph of the comparison of existing conditions with the provision of alternatives 1 and 2.

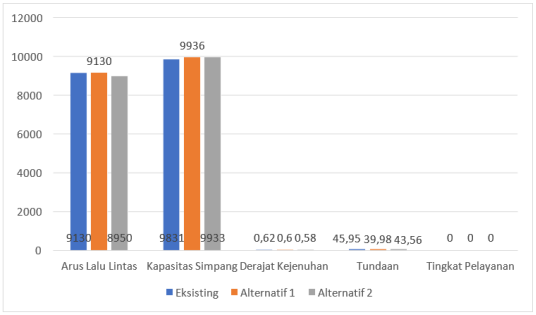

Figure 4 Comparison Chart of Existing Conditions
Source : Processed Researcher Data

Based on the comparison of the two alternative solutions offered, the alternative solution chosen at the intersection of Dewi Sartika road was found to be the most effective, namely alternative 2, because it has a smaller degree of saturation compared to the alternative.

CONCLUSION

Based on the results of the performance analysis at the intersection of Cililitan and Cawang, the following conclusions were obtained:

1. The addition of the green light cycle time has a positive impact on the Cililitan intersection, the addition of the green light cycle time makes the vehicle decompose on the northern approach. The evaluation of the performance of the intersection on the existing condition of the intersection along with road equipment facilities at the intersection of Jalan Dewi Sartika – Jalan Raya Kalibata, namely signs, markings,

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sidewalks and drainage is still inadequate. After analyzing the data in accordance with the provisions contained in PKJI 20234, it can be said that the intersection of Jalan Dewi Sartika – Jalan Raya Kalibata has a saturation degree of 0.62, which is higher than the saturation point of 0.58 with a delay of 43.27 seconds/vehicle per vehicle so that it is included in category C of the intersection service level. This shows that the intersection has shown performance that needs to consider increasing its capacity.

2. The closure of the intersection of Jalan Dewi Sartika – Jalan Kalibata can reduce congestion on the Dewi Sartika road section which has an impact on the intersection of branches. The best alternative to solving the problem is Alternative 2, namely by closing the intersection of Jalan Dewi Sartika – Jalan Raya Kalibata so that the level of service (Level of Service) becomes C.

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