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Policy Analysis Of Closing Level Crossing On The Citayam Road

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Abstrak

The level crossing at Citayam Station is located on the Bogor electric train (KRL) line which is strategically located, where around the area there are markets and housing that are currently developing. The high activity in the level crossing area has had an impact on increasing mobilization and economic activities of the surrounding community. Several other supporting mobilizations aside from electric trains (KRL) there are modes of transportation such as public transportation/microbuses, online motorcycle taxis, and base motorcycle taxis. Apart from that, there are street vendors who spread along the road around Citayam Station and pedestrians passing by who want to go to locations around the station. It is this large number of community activities that makes the conditions around the crossing area on the same level as Citayam Station crowded and traffic jams often occur, thus affecting the level of road service. Therefore, a government policy is needed to handle level crossings to eliminate congestion. One of the policies that can be taken by the Government is closing level crossings or building underpasses. By carrying out a road inventory, namely by knowing the geometric conditions of the road and the condition of land use around the road section, the capacity of the road can be calculated. The indicators seen are road width, median width, side obstacle conditions, road shoulder width and road type. In addition to calculating road capacity, it is necessary to process data related to road volume and degree of saturation. So that we get a correlation between these three things and the congestion that occurs. By using multiple linear regression analysis techniques, it can be seen the correlation between the correlation of road capacity, road volume, and degree of saturation (variable x) with congestion that occurs (variable y). So that decisions can be taken regarding government policies to deal with the problem of level crossings.

Keywords: Road Capacity, Road Volume, Degree of Saturation, Congestion

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PENDAHULUAN

The Citayam Station level crossing is a cross-section of the Bogor electric train (KRL) line which is strategically located, where around the area there are markets and housing that are currently developing. The high activity in the level crossing area has had an impact on increasing mobilization and economic activities of the surrounding community. Several other supporting mobilizations aside from electric trains (KRL) there are modes of transportation such as public transportation/microbuses, online motorcycle taxis, and base motorcycle taxis. Apart from that, there are street vendors who spread along the road around Citayam Station and pedestrians passing by who want to go to locations around the station. It is this large number of community activities that makes the conditions around the crossing area on the same level as Citayam Station crowded and traffic jams often occur, thus affecting the level of road ser

1. Condition of Road Infrastructure Around the Crossing Area of the Citayam Highway

Road inventory is used to determine the geometric condition of the road and land use conditions around the roads. The indicators seen are road width, median width, side obstacle conditions, road shoulder width and road type. From the results of the survey that has been carried out, the inventory of roads and intersections around the study area and the calculation of their capacity can be seen below:

a. Road Capacity

Road capacity is the ability of a road section to accommodate the ideal traffic flow or volume in a certain time unit, expressed in terms of the number of vehicles that pass through a certain road section in one hour (veh/hour), or by considering the various types of vehicles that pass through a road in units of time. Passenger car as a vehicle unit in capacity calculations, capacity uses passenger car units per hour or (pcu)/hour.

Road Name	Total Capacity (C)
Jl. Raya Citayam (Segmen 1)	1897
Jl. Raya Citayam (Segmen 2)	1897
Jl. Utan Jaya	1372
Jl. Ken Arok	1221
Jl. Pabuaran (segmen 1)	1897
Jl. Pabuaran (segmen 2)	1897
Jl. Pemuda Kampung Pulo	1372
Jl. Mushola Al Barokah	1221
Jl. Camat Kanang	1221

Source: Analysis results, 30 Mei 2022

Table 1 Analysis of Road Capacity

b. Traffict Volumes

Traffic volume is the number of vehicles that pass a certain cross section on a certain road segment in a certain time unit

Road Name	

	Traffict Volumes (Q)
Jl. Raya Citayam (Segmen 1)	1333
Jl. Raya Citayam (Segmen 2)	2151
Jl. Utan Jaya	1333
Jl. Ken Arok	806
Jl. Pabuaran (segmen 1)	1893
Jl. Pabuaran (segmen 2)	1821
Jl. Pemuda Kampung Pulo	835
Jl. Mushola Al Barokah	701
Jl. Camat Kanang	717

Source: Analysis results, 30 Mei 2022

Table 2 Analysis of Traffict Volumes

c. Degree of Saturation
The degree of saturation is the ratio of traffic flow (pcu/hour) to capacity (pcu/hour) and is used as a key factor in assessing and determining the level of performance of a road segment.

Road Name	Degree of Saturation
Jl. Raya Citayam (Segmen 1)	0,70
Jl. Raya Citayam (Segmen 2)	1,13
Jl. Utan Jaya	0,97
Jl. Ken Arok	0,66
Jl. Pabuaran (segmen 1)	1,00
Jl. Pabuaran (segmen 2)	0,96
Jl. Pemuda Kampung Pulo	0,61

Jl. Mushola Al Barokah	0,57
Jl. Camat Kanang	0,59

Source: Analysis results, 30 Mei 2022

Table 3 Analysis of Degree of Saturation

METODOLOGI

The framework of thought according to Sapto Haryoko is a study that will examine two or more variables. Thus, the framework contains a list of variables that are topics or certain elements related to research and writing activities. These variables are recorded, then compared, and explained in writing. This research will identify Road Traffic Performance, Road Capacity, Degree of Saturation and Queue Length (congestion). Where the dependent variable is congestion (queue length), and the independent variable is road capacity, road volume and degree of saturation. From the capacity of the existing road and seeing the conditions in the field, the performance of road traffic at the level crossing at Citayam shows long queues (congestion). This is very disturbing to road users. So it is necessary to handle the level crossing so that the existing congestion can be eliminated. In this study the authors conducted an analysis based on the 2014 Indonesian Highway Capacity Guidelines (PKJI) and conducted an analysis of previous studies.

HASIL DAN PEMBAHASAN

1. Road Performance Analysis
   Based on the results of the analysis, it was found that road performance for Jalan Raya Citayam (segment 2) has the highest road volume compared to the volume of other affected roads, namely 2151 pcu per hour, that is, within one hour, vehicles passing through the road are as many as 2151 cars. passenger (smp). In addition, it can be seen that the degree of saturation of the road is also the highest compared to other affected roads, namely 1.13, it can be explained that the ratio between road volume and road capacity is 1.13. And it can be seen from the data that the length of the queue that occurs on that road is 95 meters during rush hour and the crossing gate is closed

Road Name	**Total Capacity (C)**	**Traffict Volumes (Q)**	**Degree of Saturation**
Jl. Raya Citayam (Segmen 1)	1897	1333	0,70
Jl. Raya Citayam (Segmen 2)	1897	2151	1,13
Jl. Utan Jaya	1372	1333	0,97
Jl. Ken Arok	1221	806	0,66

Jl. Pabuaran (segmen 1)	1897	1893	1,00
Jl. Pabuaran (segmen 2)	1897	1821	0,96
Jl. Pemuda Kampung Pulo	1372	835	0,61
Jl. Mushola Al Barokah	1221	701	0,57
Jl. Camat Kanang	1221	717	0,59

Source: Survey Results (2022)

Tabel 4 Analysis of 1. Road Performance

2. The Influence of Road Performance on Congestion That Occurs at Level Crossings on Jalan Raya Citayam
   To find out whether road performance has an effect on congestion, it can be done by testing, namely hypothesis testing. Hypothesis testing in this study examines the relationship between congestion (queue length) and road capacity, road volume and degree of saturation, carried out using the Multiple Linear Regression method with the help of the Microsoft Excel application. Researchers use this method because it involves 3 independent variables and 1 dependent variable. For this reason, the following steps are carried out to test the hypothesis:

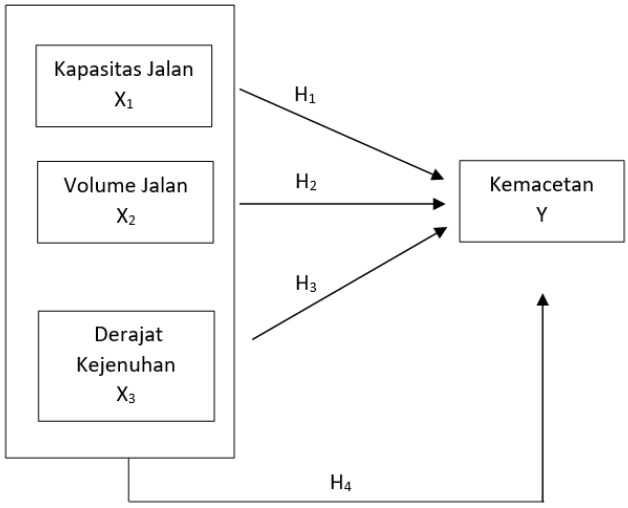

Figure IV.25 Research paradigm

So that is obtained:

H1 = variable road capacity affects congestion;

H2 = variable degree of saturation effect on congestion;

H3 = queue length variables affect congestion;

H4 = Variable road capacity, degree of saturation, queue length affect congestion.

From the calculation, it is found that the correlation value between road capacity, road volume, degree of saturation and queue length (congestion) is 0.95. So it can be concluded that the correlation between the independent variable and the dependent variable is very strong, both partially and simultaneously.

From the calculation, it is found that the correlation value between road capacity, road volume, degree of saturation and queue length (congestion) is 0.95. So it can be concluded that the correlation between the independent variable and the dependent variable is very strong, both partially and simultaneously.

The coefficient of determination is 0.8607 or 86.07%, it can be explained that the increase and decrease in queue length (congestion) is caused by road capacity, road volume and degree of saturation of 86.07%, while the remaining 13.93% is influenced by other factors .

From the ANOVA table with a significance value of < alpha = 0.05, it can be concluded that there is a significant influence between the variables of road capacity, road volume, and degree of saturation with queue length (congestion). Because the significance value is F (0.044) < alpha (0.05).

The regression equation is obtained from the coefficients table, namely:

Y = 43.3134 – 0.0083 X1+ 0.0814 X2 - 94.7308 X3

Based on the equation above, it can be explained that if X1, X2, and X3 are zero then Y = 43.3134, namely the length of the queue that occurs is 43.3134 meters long. And if X1 is 1 then Y = 43.3134 – 0.0083, that is, the queue length is 43.3134 meters minus 0.0083 meters to 43.3051 meters. If X1 and X2 are 1 then Y = 43.3134 – 0.0083 + 0.0814, that is, the queue length is 43.3134 meters - 0.0083 meters + 0.0814 meters becomes 43.3865 meters. And if X1, X2 and X3 are 1, then Y = 43.3134 – 0.0083 + 0.0814 - 94.7308, namely the length of the queue that occurs is 43.3134 meters – 0.0083 meters + 0.0814 meters - 94 .7308 meters to -51.3443 meters or no queue at all.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,9555
R Square	0,9129
Adjusted R Square	0,8607
Standard Error	9,6273
Observations	9,0000

KATEGORI KORELASI	
0,00 - 0,199	Sangat Rendah
0,20-0,399	Rendah
0,40-0,599	Sedang
0,60-0,799	Kuat
0,80-1,00	Sangat Kuat

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3,0000	4858,7977	1619,5992	17,4743	0,0044
Residual	5,0000	463,4245	92,6849		
Total	8,0000	5322,2222			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	43,3134	87,5544	0,4947	0,6418	-181,7524	268,3792	-181,7524	268,3792
Kapasitas Jalan	-0,0083	0,0571	-0,1459	0,8897	-0,1550	0,1384	-0,1550	0,1384
Volume Lalu Lintas	0,0814	0,0709	1,1476	0,3030	-0,1009	0,2637	-0,1009	0,2637
Derajat Kejenuhan	-94,7308	116,6625	-0,8120	0,4537	-394,6214	205,1597	-394,6214	205,1597

3. Management of level crossings with the construction of underpass

In handling the problem of congestion at level crossings on Jalan Raya Citayam there are several alternatives that can be done (the author has mentioned this in the previous chapter). For the case that this research is currently conducting, the most suitable is the decision making of transportation policy by the Government using the road performance improvement method (road capacity).

Increasing road capacity can be done by widening roads, reducing side barriers, constructing underpasses, and constructing flyovers.

Widening the road is not possible for this case, because the right and left sides of the road are currently very crowded shops. So that if land acquisition is carried out it will require a very large cost. In addition, level crossings still exist, so there are still frequent closures of level crossings.

It is also impossible to reduce the side friction on Jalan Raya Citayam because near a level crossing on Jalan Raya Citayam there is a Citayam Station. Where Citayam Station is a very congested transportation node, because Citayam Station is a confluence of KRL trips between the Nambo - Jakarta route and the Bogor - Jakarta route, besides that, looking at Citayam Station passenger data an average of 11,460 passengers per day (source PT. Kereta Commuter Indonesia). These two things have caused many conventional motorcycle taxis, online motorcycle taxis and public transportation to stop around the station.

Meanwhile, the construction of a fly over cannot be carried out because the road conditions are uphill right at level crossings, so that it will require a high fly over and form a road with a large slope.

The most appropriate step to take is the construction of an underpass, because of the road conditions which are uphill right at the level crossing of Jalan Raya Citayam, so that the underpass can be built under the level crossing. And apart from that, the construction of the underpass does not need land acquisition.

And to prove that the construction of level crossings on Jalan Raya Citayam can improve road performance, it can be done from the following calculations:

Nama Jalan	Tipe Lajur jalan	Lebar Jalan (M)	Lebar / Lajur	Faktor Koreksi					Kapasitas Total (C)
				Co	FCw	FCcs	FCsp	FCsf	
Jl. Raya Citayam (Segmen 2)	2/2 UD	7	3,5	2900	1	1,03	1	0,89	2658

From the table above it can be seen that the capacity of the road with the construction of the underpass was 2658 pcu, while the capacity of the road before the construction of the underpass can be seen in table VI.2 which is 1897 pcu. With the known road capacity, the degree of saturation with a fixed road volume can be calculated as follows:

Jalan Raya Citayam (segmen 2)	Kapasitas Total (C)	Volume Jalan (Q)	Derajat Kejenuhan
Tanpa pembangunan underpass	1897	2151	1,13
Dengan pembangunan underpass	2658	2151	0,80

Based on the calculation above, it can be seen that the degree of saturation decreases so that by looking at Table II.1 Standard Road Service Level, the service level for Jalan Raya Citayam (segment 2) with the construction of the underpass will increase to the level of road service category C, namely stable flow, limited speed (traffic flow is still good and stable with acceptable slowdown).

DICCUSION

Based on the data obtained from the analysis, it can be seen that the capacity of Jalan Raya Citayam (segment 2) is 1897 pcu per hour, that is, the volume of vehicles that can pass Jalan Raya Citayam (segment 2) within one hour is 1897 units of passenger cars (pcu). And Jalan Raya Citayam (segment 2) has the highest road traffic volume compared to the traffic volume of other affected roads, namely 2151 pcu per hour, that is, within one hour, the number of vehicles passing through the road is 2151 units of passenger cars (pcu). In addition, it can be seen that the degree of saturation of the road is also the highest compared to other affected roads, namely 1.13, it can be explained that the ratio between road volume and road capacity is 1.13. And it can be seen from the data that the length of the queue that occurs on that road is 95 meters during rush hour and the crossing gate is closed. The average free-flow speed on the Citayam Highway (segment 2) is 18.3 km/hour and 17.9 km/hour, based on the road service level table it can be concluded that the road service level is category F as evidenced by the degree of saturation of 1.13. By looking at the results of multiple linear regression it is found that the road capacity variable, road volume variable and queue length variable greatly affect the level of congestion (queue length). And the regression equation is Y = 43.3134 – 0.0083 X1+ 0.0814 X2 - 94.7308 X3. Based on the equation above, it can be explained that if X1, X2, and X3 are zero then Y = 43.3134, namely the length of the queue that occurs is 43.3134 meters long. And if X1 is 1 then Y = 43.3134 – 0.0083, that is, the queue length is 43.3134 meters minus 0.0083 meters to 43.3051 meters. If X1 and X2 are 1 then Y = 43.3134 – 0.0083 + 0.0814, that is, the queue length is 43.3134 meters - 0.0083 meters + 0.0814 meters becomes 43.3865 meters. And if X1, X2 and X3 are 1, then Y = 43.3134 – 0.0083 + 0.0814 - 94.7308, namely the length of the queue that occurs is 43.3134 meters – 0.0083 meters + 0.0814 meters - 94 .7308 meters to -51.3443 meters or no queue at all. So that from all the analyzes that have been carried out above, it can be concluded that the current condition

of the performance of Jalan Raya Citayam (segment 2) is no longer able to serve the needs of the surrounding community for transportation, because the traffic volume compared to road capacity is already more than number 1. This is because by the existence of a level crossing between the road and the railroad track on that road. Therefore it is necessary to have a regional government policy to close existing level crossings. With the policy of closing level crossings, to be able to serve the needs of the community in transportation, a scenario of increasing road capacity, namely the construction of an underpass, can be carried out. This policy needs to be implemented to eliminate the current bottleneck. The underpass construction was chosen by researchers because of the alternatives to increase the capacity of existing roads (road widening, reducing side barriers, construction of fly overs, and construction of underpasses) that are most suitable for the conditions of the surrounding area and road conditions at the level crossing of Jalan Raya Citayam is the underpass. That is, without land acquisition and road structures that go uphill at that level crossing. Based on the data obtained from the analysis, it can be seen that the capacity of Jalan Raya Citayam (segment 2) is 1897 pcu per hour, that is, the volume of vehicles that can pass Jalan Raya Citayam (segment 2) within one hour is 1897 units of passenger cars (pcu). And Jalan Raya Citayam (segment 2) has the highest road traffic volume compared to the traffic volume of other affected roads, namely 2151 pcu per hour, that is, within one hour, the number of vehicles passing through the road is 2151 units of passenger cars (pcu). In addition, it can be seen that the degree of saturation of the road is also the highest compared to other affected roads, namely 1.13, it can be explained that the ratio between road volume and road capacity is 1.13. And it can be seen from the data that the length of the queue that occurs on that road is 95 meters during rush hour and the crossing gate is closed. The average free-flow speed on Raya Citayam road (segment 2) is 18.3 km/hour and 17.9 km/hour, based on the road service level table it can be concluded that the road service level is category F as evidenced by the degree of saturation of 1.13. By looking at the results of multiple linear regression it is found that the road capacity variable, road volume variable and queue length variable greatly affect the level of congestion (queue length). And the regression equation is Y = 43.3134 – 0.0083 X1+ 0.0814 X2 - 94.7308 X3. Based on the equation above, it can be explained that if X1, X2, and X3 are zero then Y = 43.3134, namely the length of the queue that occurs is 43.3134 meters long. And if X1 is 1 then Y = 43.3134 – 0.0083, that is, the queue length is 43.3134 meters minus 0.0083 meters to 43.3051 meters. If X1 and X2 are 1 then Y = 43.3134 – 0.0083 + 0.0814, that is, the queue length is 43.3134 meters - 0.0083 meters + 0.0814 meters becomes 43.3865 meters. And if X1, X2 and X3 are 1, then Y = 43.3134 – 0.0083 + 0.0814 - 94.7308, namely the length of the queue that occurs is 43.3134 meters – 0.0083 meters + 0.0814 meters - 94 .7308 meters to -51.3443 meters or no queue at all. So that from all the analyzes that have been carried out above, it can be concluded that the current condition of the performance of Jalan Raya Citayam (segment 2) is no longer able to serve the needs of the surrounding community for transportation, because

the traffic volume compared to road capacity is already more than number 1. This is because by the existence of a level crossing between the road and the railroad track on that road. Therefore it is necessary to have a regional government policy to close existing level crossings. With the policy of closing level crossings, to be able to serve the needs of the community in transportation, a scenario of increasing road capacity, namely the construction of an underpass, can be carried out. This policy needs to be implemented to eliminate the current bottleneck. The underpass construction was chosen by researchers because of the alternatives to increase the capacity of existing roads (road widening, reducing side barriers, construction of fly overs, and construction of underpasses) that best suit the conditions of the surrounding area and road conditions at the level crossing of Jalan Raya Citayam is the underpass. That is, without land acquisition and road structures that go uphill at that level crossing.

SIMPULAN

This research was conducted to determine the relationship between the level crossing closure policy and the performance of existing roads. And based on the results of the analysis it can be concluded the following thing:

1.Based on the results of the analysis, it was found that the condition of the road infrastructure at the level crossing of Jalan Raya Citayam (segment 2) has a road capacity of 1897 pcu per hour, i.e. the volume of vehicles that can pass Jalan Raya Citayam (segment 2) in one hour is 1897 units passenger car (smp).

2.Based on the results of the analysis, it was found that the road performance for Jalan Raya Citayam (segment 2) has the highest road volume compared to the volume of other affected roads, namely 2151 pcu per hour, that is, within one hour, the number of vehicles that pass through the road is 2151 passenger car unit (smp). In addition, it can be seen that the degree of saturation of the road is also the highest compared to other affected roads, namely 1.13, it can be explained that the ratio between road volume and road capacity is 1.13. As well as it can be seen from the data that the length of the queue that occurs on that road is 95 meters during rush hour and the crossing gate is closed;

3.Based on the results of the analysis using multiple linear regression statistical tests, it was found that road capacity variables, road volume variables and degree of saturation variables greatly affect the level of congestion (queue length). And the regression equation is Y = 43.3134 – 0.0083 X1+ 0.0814 X2 - 94.7308 X3. Based on the equation above, it can be explained that if X1, X2, and X3 are zero then Y = 43.3134, namely the length of the queue that occurs is 43.3134 meters long. And if X1 is 1 then Y = 43.3134 – 0.0083, that is, the queue length is 43.3134 meters minus 0.0083 meters to 43.3051 meters. If X1 and X2 are 1 then Y = 43.3134 – 0.0083 + 0.0814, that is, the queue length is 43.3134 meters - 0.0083 meters + 0.0814 meters becomes 43.3865 meters. And if X1, X2 and X3 are 1, then Y = 43.3134 – 0.0083 + 0.0814 - 94.7308, namely the length of the queue that occurs is 43.3134 meters – 0.0083 meters + 0.0814 meters - 94 .7308 meters to -51.3443 meters or no queue at all.

4.Based on the calculations that have been carried out, the handling of the level crossing of Jalan Raya Citayam has resulted in increased road performance. Namely an increase in road capacity from 1897 junior high school to 2658 junior high school. With the increase in road capacity, the degree of saturation also decreased, from 1.13

to 0.80. So that the level of road service increases from category F to category C, namely stable traffic, limited speed (traffic flow is still good and stable with acceptable slowdowns).

Referensi :

_____ . (2009), Undang-undang No. 22 Tahun 2009 Tentang Lalu Lintas dan Angkutan Jalan. Jakarta.

_____. (2017). Undang-undang Nomor 23 Tentang Perkeretaapian. Jakarta

_____. (2011) Peraturan Pemerintah (PP) Nomor 32 Tahun 2011 Tentang Manajemen Rekayasa, Analisa Dampak, serta Manajemen Kebutuhan Lalu lintas.

_____. (2015) Peraturan Menteri (PM) Nomor 75 Tahun 2015 Tentang Penyelenggaraan Analisis Dampak Lalu lintas.

_____. (2015) Peraturan Menteri (PM) Nomor 96 Tahun 2015 Tentang Pedoman Pelaksanaan Kegiatan Manajemen Lalu Lintas.

_____. (2014). Peraturan Menteri Perhubungan Nomor 13 Tentang Rambu Lalu Lintas.

_____. (2014). Peraturan Menteri Perhubungan Nomor 49 Tentang Pemberi Isyarat Lalu lintas.

Hydén, C. (1987). *The Development of A Method For Traffic Safety Evaluation: The Swedish Traffic Conflicts Technique.* Swedia: Lund University.

Stover dan Koepke. (1998). *Transportation and Development.* New Jersey: Prentice Hal.

Warpani, S. (1993), *Rekayasa Lalu Lintas*. Jakarta: Barata Karya Aksara.

Abbas, Salim. 2000. *Manajemen Transportasi*. Cetakan Pertama. Edisi Kedua. Jakarta: Ghalia Indonesia

Djoko Setijowarno, R. B. Frazila, 2001, *Pengantar Sistem Transportasi*, Semarang: Universitas Katolik Soegijapranata

Miro, F. 2005. *Perencanaan Transportasi untuk Mahasiswa, Perencana, dan Praktisi*. Jakarta: Erlangga.

Nasution, Arman Hakim. 2008. *Perencanaan dan Pengendalian Produksi*. Yogyakarta: Graha Ilmu

Ofyar, Tamin Z. (2008). *Perencanaan, pemodelan, dan rekayasa transportasi: Teori contoh soal, dan aplikasi*. Bandung: ITB

Kementrian Pekerjaan Umum. (2012). *Panduan Teknis 1 Rekayasa Keselamatan Jalan*. Jakarta: Kementrian Pekerjaan Umum.

Khisty.C.J, Kent L.B. (2005). *Dasar-dasar Rekayasa Transportasi Jilid 1*.Jakarta: Erlangga

Black, Jhon. (1993). *Traffic ImpactAssesment*. Jakarta: Erlangga

Lawalata, G.M. (2010). *Studi Konflik lalu Lintas (Studi Kasus Satu Simpang 3 Di Kota Bandung) (Traffic Conflict Study As Evaluation Tools Of Traffic Management:Case Study At One T-Intersection in Bandung)*. Bandung. Pusat Litbang Jalan dan Jembatan.

Muis,Z.A dan Agung, M. Perbandingan Kinerja Simpang Berdasarkan program Kaji dan Sidra (Stufi Kasus : Simpang Setia Budi – DR.Mansyur dan DR.Mansyur – Jamin Ginting). Medan. Universitas Sumatera Utara.

Prima Juanita Romadhona, Shafira Artistika. (2020). Pengaruh Penutupan Perlintasan Sebidang Kereta Api Di Jalan H.O.S. Cokroaminoto, Yogyakarta. Jurnal Rekayasa Sipil (Jrs-Unand). 16 (2) 119-131

https://www.peta-kota.blogspot.c