

The impact of Covid-19 on areas prone to traffic accidents in Depok City (Margonda Raya Road Case Study)

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Abstract

Traffic accidents and congestion is one of the main problems in Depok city. Jalan Margonda Raya is one of the streets in Depok city. Jalan Margonda Raya is one of the roads in Depok city with quite high traffic activity. To prove this, research is done by analyzing the area of accident prone and road performance with the aim of analyzing the areas prone to traffic accident and know the performance of mesh and how to correct alternative solution to overcome it. The method used in this research to analyse areas prone to accident is to use the AEK (equivalent number of accident) approach, and to know the area of traffic accident (black spot) with the method BKA (upper control limit), while to know the performance of the segment using Manual Road capacity 1997. Based on the results of analysis concluded that Jalan Margonda Raya, belongs to the category of road prone traffic accidents, because it has a value of AEK greater or greater than the value of BKA and UCL. Road with the highest AEK value is Jalan Margonda Raya with a value of AEK 40 where the value of BKA is only 24.250 and UCL value of 35.949. On the road, there have been 4 accidents with the total death toll of 1 person, 3 people with severe injuries, a light injury of 5 people, and a material loss of 5.3 million Rupiah. The most common type of accident is the front-back sprinck of 45.45% of the total number of accidents. The most common time for accident at Jalan Margonda Raya Depok is at night at 18.00 WIB – 06.00 WIB with a percentage of 63.63% from the total accident. As for the level of service on Jalan Margonda Raya Sunday Direction Jakarta-Depok is B, this is due to the degree of saturation (V/C ratio) of 0.530, while the direction of Depok-Jakarta is B, this is because the degree of saturation (V/C ratio) of 0.540 and for the day, Monday 15 May 2020 direction Jakarta-Depok is B, this is because the degree of saturation (V/C ratio) of 0.669 while the direction of Depok-Jakarta is B, this is because the degree of saturation (V/C 0.608 From the analysis obtained some alternative solution that is to install and repaint road markers and Zebra Cross, repaint on sidewalks or kerb, and do periodic supervision work, check periodically on street lighting lamps.

Keywords

Area Prone To Accident, Degree Of Saturation, Number Equivalent Accidents, Service Level, Traffic Accident.

1. Introduction

1.1. Background

Transportation is a very important part of human life, especially transportation by motor vehicle, both for the needs of human movement and freight transport. In the transportation of safety is serious and must be taken into account by the service users. According to the law No. 14 years 1992 about traffic and road transport, transportation aims to realize traffic and road transport safely, securely, quickly, smoothly, orderly and orderly, comfortable and efficient, able to integrate other modes of transportation, reaching all corners of the mainland, to support equitable, growth and stability as a driver, Mobilizer and support national development at an affordable cost by the purchasing power of the public. This makes the safety aspect should be a major concern. At the end of the year 2019 a virus appeared first in the wild animal market in Wuhan City, the Chinese virus is called Corona Virus or COVID-19. The spread of viruses that have not been found by the antiarism is now uncontrollable. Already 200 more countries in the world reported a case of exposure to Corona virus. In Indonesia, this case was first found in two people in Depok, West Java in early March. Data until July 14, 2020 the number of citizens expressed positively affected corona virus reached 78,572 people with 3,710 of whom died and 37,636 people were declared cured (Source: Task Force acceleration Handling Covid-19 <https://covid19.go.id/>). Corona-transmitted Virus through mucus (droplet) a positive human COVID-19 that jumps to the negative human COVID-19. The slime is splashed when the human positive COVID-19 sneezes. coughing, or speaking and then exposed to other negative people, in the middle of March, the Government appealed to all the people to indirectly contact to reduce the spread figures of this COVID-19 Virus. Along with

increasingly gencar-gencarnya the government's efforts in tackling the spread of the COVID-19 Virus, one of them performs PSBB (large scale social restriction). On Jalan Margonda Raya which is the main access link Depok City with the capital of DKI Jakarta, based on a report issued by the National Police of the Republic of Indonesia region of Metro Jaya Resort Depok City There is a total accident throughout the year 2020 amounted to 11 incidents with a loss of Rp. 11,350, 000. Based on the matter outlined above, the study aims to determine the number of traffic accidents with the method of the AEK (equivalent of accident number) approach, and to know the area prone traffic accident (black Spot) with method BKA (upper control limit) then in the effort to reduce the accident on Jalan Margonda Raya then done research with the title impact Covid-19 on the vulnerable area traffic accident in Depok City (case studies Margonda Raya).

1.2. Library Overview

1.2.1 Identification of areas prone to accidents

Areas prone to accidents are an area or location where high accident figures with repeated accidents in a space and a relatively equal time span caused by a certain cause (Pd T-09-2004-B).

One method for identifying accident-prone locations, namely the accident equivalent number (AEK) method. AEK calculation is bound by the level of accident fatality and the number of accident events. The AEK is calculated by summing the accident event at each kilometer of the road, then multiplied by the weight of the value according to the fatality level due to the accident. From this weighted you will get a list of new accident rankings.

This method is determined by the formula:

$$AEK = 12MD + 3LB + 3LR + 1K$$

Where:

MD = Deceased

LB = Heavy Injuries

LR = Light Cuts

K = Accident with Material Loss

The value of accidents occurring on road segments taking into consideration the level of fatality of victims:

Fatality rate	Weights
Deceased (MD)	12
heavy injuries (LB)	3
Light Cuts (LR)	3
accident with material loss (K)	1

Source: Location Handling prone traffic accidents (Pd T-09-2004-B) Department of Settlements and regional infrastructure

The determination of accident-prone locations is based on the number of each kilometer of road that has a value of AEK exceeds certain limits. This limit value is calculated by using the upper control boundary (BKA) method (Margareth Evelyn Bolla et al., 2013) Upper control limit Value formula:

$$BKA = C + 3\sqrt{C}$$

Where :

C = Average of AEK accidents

1.2.2. Road Performance

Road performance is the ability for road segments to serve the needs of traffic flows according to their functions that can be measured and compared with the level of road service standards. The road service level value is used as a road performance parameter (Ahmad Syukarman, Indra Syahrul Fuad, 2017) Road performance includes:

a. Road capacity

Capacity is defined as the maximum current through a the in the path that can be maintained per unit of hour under certain conditions (eg: geometric plans, environment, traffic composition and so on. Usually expressed in a kend/hour or Junior/h)(erwin kusunandar, 2009)

$$C = C_o \times FCW \times FCSP \times FCSF \times FCCS$$

Where:

C = Capacity (SMP/hr)

C_o = Basic Capacity (SMP/hr)

FC_w = Traffic path width adjustment factor

FC_{SP} = directional Separation adjustment factor

FC_{SF} = side barrier Adjustment factor

FCCS = City Size Adjustment factors

b. Free flow speed

This speed can be measured in different ways. In general, vehicle speed is measured using light vehicles (LV). In MKJI (1997) The speed of free flow of light vehicles (FV) is expressed with the following equation.

$$FV = (FVo + FVW) \times FFVSF \times FFVCS$$

Where:

FV = Light base free flow speed (km/h)

FVo = Light vehicle base free current speed (km/h)

FVW = wide adjustment of effective traffic path (km/h)

FFVSF = adjustment factor of side barrier condition

FFVCS = City Size adjustment factor

c. Degrees of saturation

The degree of saturation (DS) is defined as the ratio of road currents to capacity, which is used as a major factor in determining the level of junction performance and road segments.

$$DS = \frac{Q}{C}$$

Where:

DS = degree of saturation

Q = traffic flow (SMP/hr)

C = Capacity (SMP/hr)

d. Service level

The size of the effectiveness of the road service level or Level of Service (LOS) is differentiated into six classes, i.e. from A to the best level up to F level for the worst conditions.

Level Service	Characteristics of related operations
	1. Arus bebas 2. Kecepatan perjalanan rata-rata ≥ 80 km/jam V/C ratio $\leq 0,6$ Load factor pada simpang = 0
	1. Arus stabil 2. Kecepatan perjalanan rata-rata turun s/d ≥ 40 km/jam V/C ratio $\leq 0,7$ Load factor $\leq 0,1$
	1. Arus stabil 2. Kecepatan perjalanan rata-rata turun s/d ≥ 30 km/jam V/C ratio $\leq 0,8$ Load factor $\leq 0,3$
	1. Mendekati arus tidak stabil 2. Kecepatan perjalanan rata-rata turun s/d ≥ 25 km/jam V/C ratio $\leq 0,9$ Load factor $\leq 0,7$
	1. Arus tidak stabil, terhambat, dengan tundaan yang tidak dapat ditolerir 2. Kecepatan perjalanan rata-rata sekitar 25 km/jam Volume pada kapasitas Load factor pada simpang $\leq 1/$
	1. Arus tertahan, macet 2. Kecepatan perjalanan rata-rata < 15 km/jam V/C ratio permintaan melebihi 1 Simpang Jenuh

Figure 1. Service level

Sumber: Peraturan Menteri Perhubungan Nomor: KM 14 Tahun 2006 Tentang Manajemen Dan Rekayasa Lalu Lintas Di Jalan

2. Methodology

2.1. Final Task Research flowchart

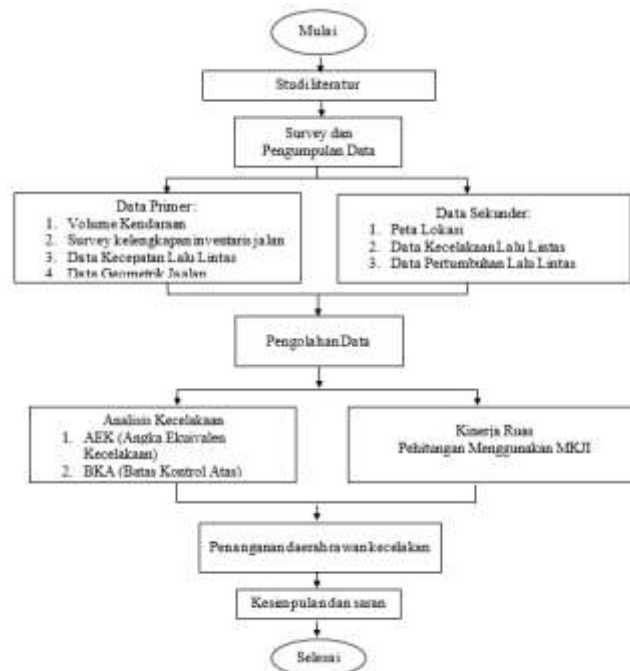


Figure 2. Final task Research Flow Diagram
Source: Personal Picture

2.2. Location and research time

Research analysis conducted in the Area of Margonda Raya Road, the time of research was conducted in May 2020-June 2020 using traffic accident data in the year 2020. Road performance surveys are conducted on Sundays and Mondays, 14-15 May 2020 at 06.30-17.30 WIB.

3. Result and Discussion

3.1. Overview

Research analysis is conducted on Jalan Margonda Raya, Depok City with a length of road 2 KM can be seen in Figure 4.1

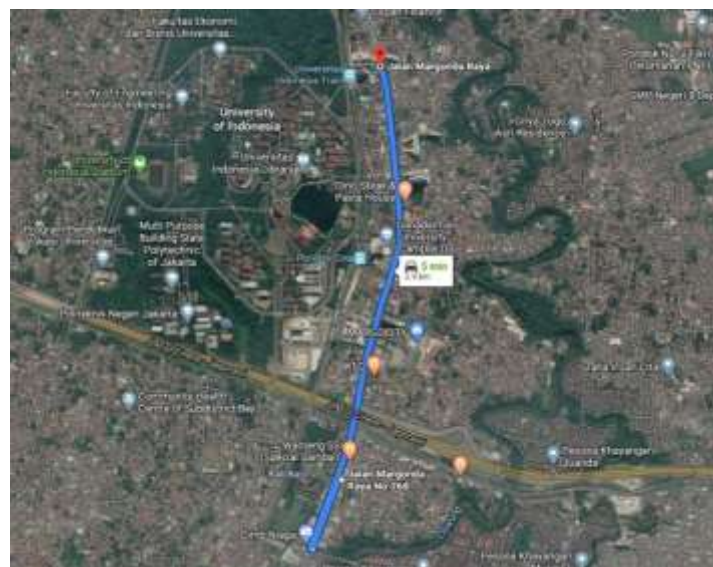


Figure 3. Research location
Sumber: www.google.co.id/maps

3.2. Primary Data

Primary data is data collected directly by the study through observations in the field or research site namely Jalan Margonda Raya. Primary Data The final project includes:

1. Vehicle Volume Data

Traffic vehicle surveys are conducted on holidays and weekdays in times of unoccupied hours and peak hours. Survey time selected based on preliminary survey, namely:

- a. Day : Sunday, 14 May 2020
Hours : 06.30 – 17.30 WIB
- b. Day : Monday, 15 May 2020
Hours : 06.30 – 17.30 WIB

2. Surveying completeness of road inventory

Data collection completeness of road inventory is done to see the completeness of supporting components such as road markers, traffic signs, etc.

3. Geometric Data Path

The collection of road geometric data is done by measuring the length of the examined road segments and then measuring the road width as well as the road shoulder width. In this data collection used meter as measuring aids.

3.3. Secondary Data

Secondary data is the data that researchers can do not go through direct observation on the field but by looking at other people's observations. This Data usually comes from research conducted by institutions or organizations such as the Department of Transportation and the Department of Population and Civil registry. Secondary Data used in this final project can be from the traffic Unit (satafterwards) of the city of Depok. It is necessary to support this research:

1. Accident data covering data about accident location;
2. Number of accidents, causes of accidents;
3. And the casualty of Margonda Raya Road in 2018 and 2020;
4. Population growth Data.
5. Traffic growth Data.

3.4. Regional analysis prone to accidents

Here is a table of traffic accident fatalities on the road of Margonda Raya City of Depok in the year 2020.

Table 2. Fatality of traffic accident in Depok city street Margonda Raya

No	Tanggal Kejadian	Tingkat Kecelakaan	MD	LB	LR	Jumlah Korban	Perkiraan Nilai Rugi Material
1	20/01/2020 16:00	Berat	1	1	2	4	Rp 2.000.000
2	20/02/2020 01:30	Ringan	0	0	1	1	Rp 250.000
3	14/03/2020 07:10	Ringan	0	0	1	1	Rp 1.000.000
4	14/03/2020 08:30	Berat	1	1	1	3	Rp 1.500.000
5	14/03/2020 23:30	Sedang	0	1	1	2	Rp 1.000.000
6	15/03/2020 20:00	Sedang	0	1	2	3	Rp 300.000
7	28/03/2020 02:00	Ringan	0	0	1	1	Rp 2.500.000
8	05/03/2020 21:15	Sedang	0	1	1	2	Rp 400.000
9	08/03/2020 04:30	Ringan	0	0	1	1	Rp 500.000
10	04/03/2020 08:30	Sedang	1	1	0	2	Rp 1.200.000
11	11/03/2020 23:30	Sedang	0	0	0	0	Rp 700.000

The result of identification of accident prone location with the AEK method can be seen in Table

Table 3 of Accident prone location identification calculation

Panjang (km)	AEK				Nilai					UCL
	12MD	3LB	3LR	1K	AEK	C	BKA	λ	Ψ	
0,5	12	6	9	3	30					34,501
0,5	12	9	15	4	40	24,250	39,023	24,250	2.576	35,949
0,5	0	3	3	1	7					31,106
0,5	12	3	3	2	20					32,892

Source: Calculation result

Example of identification calculation area prone road accident Margonda Raya Depo City:

$$AEK = 12MD + 3LB + 3LR + 1K$$

$$\begin{aligned} \text{Rata-rata AEK (C) atau } (\lambda) &= \frac{AEK}{\text{Jumlah Segmen Jalan}} \\ &= \frac{30+40+7+20}{4} \\ &= \frac{97}{4} \\ &= 24,250 \end{aligned}$$

$$\begin{aligned} \text{Batas Kontrol Atas (BKA)} &= C + 3\sqrt{C} \\ &= 24,250 + 3\sqrt{24,250} \\ &= 39,023 \end{aligned}$$

$$\begin{aligned} \text{Upper Control Limit (UCL)} &= \lambda + \Psi \times \sqrt{\left(\frac{\lambda}{m} + \frac{0,829}{m} + \left(\frac{1}{2}xm\right)\right)} \\ &= 24,250 + 2,576 \times \sqrt{\left(\frac{24,250}{30} + \frac{0,829}{30} + \left(\frac{1}{2} \times 30\right)\right)} \\ &= 34,501 \end{aligned}$$

Table 4. difference in AEK, BKA, and UCL values

No. Segmen	Nilai				
	AEK	BKA	UCL	Deviasi (BKA)	Deviasi (UCL)
1	30		34,501	9,023	4,501
2	40	39,023	35,949	-0,977	-4,051
3	7		31,106	32,023	24,106
4	20		32,892	19,023	12,892

Source: Calculation result

Based on table 4.3, it can be concluded that Jalan Margonda Raya is included in the road prone traffic accident, especially in segments 1 and 2 with the value of AEK greater than the value of BKA and UCL. The highest deviation value is in segment 2 with the coordinate point (L = -6.389022; B = 106.819795) up to (L = -6.3822578; B = 106.832605) So it needs to be given special handling to reduce the accident prone level on the road.

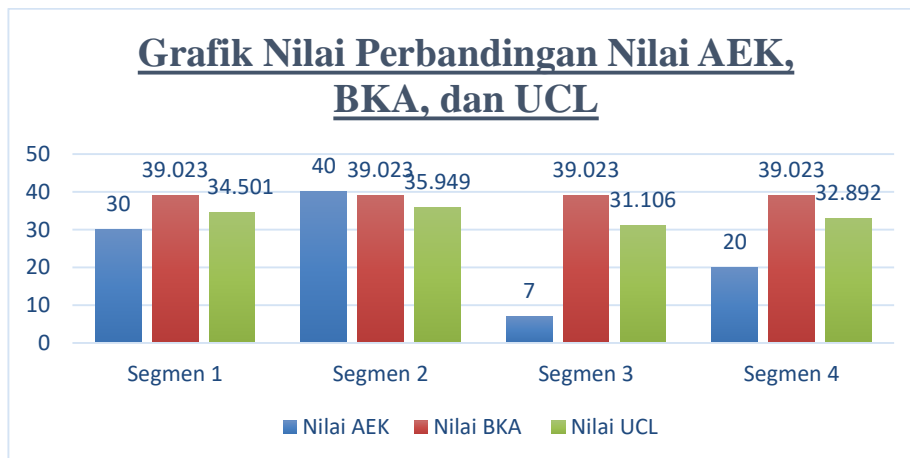


Figure 2. Here is a graph of the value comparison of the AEK, BKA, and UCL values can be seen in

Accident causing factors :

Faktor Pengemudi

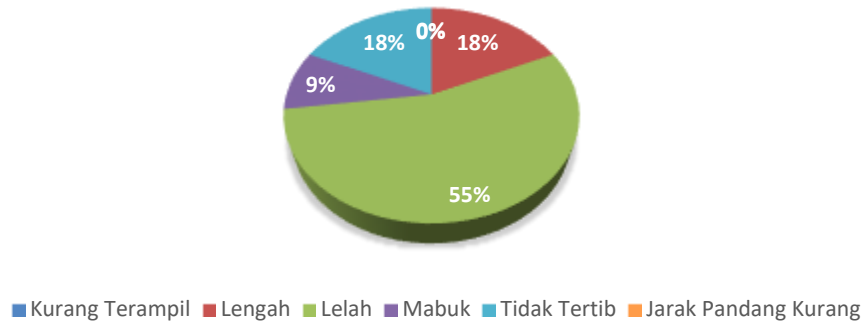


Figure 3. Accident causing factors

Faktor Pengemudi

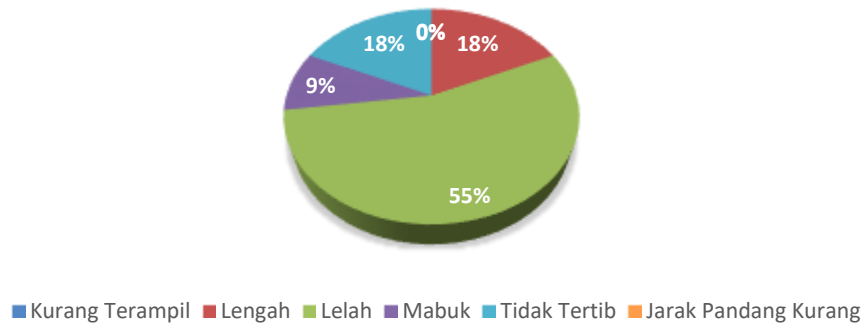


Figure 4. the driver's factor

Faktor Kendaraan

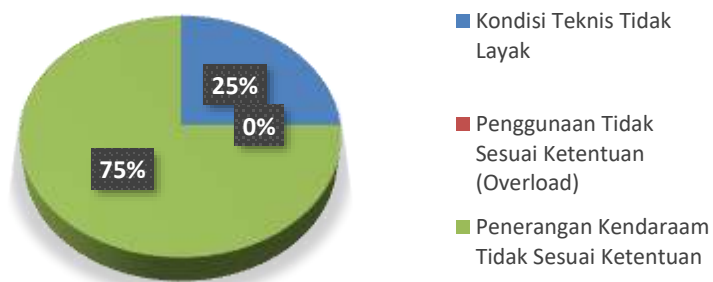


Figure 5. vehicle factor

Faktor Jalan/Lingkungan

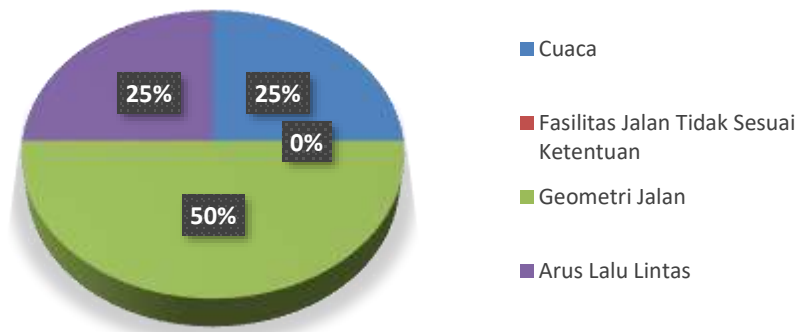


Figure 6. road / environmental factors

Tipe Kecelakaan

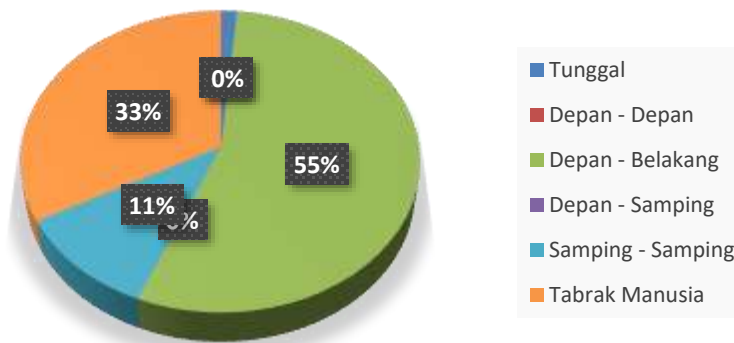


Figure 7. accident type

Waktu Kecelakaan

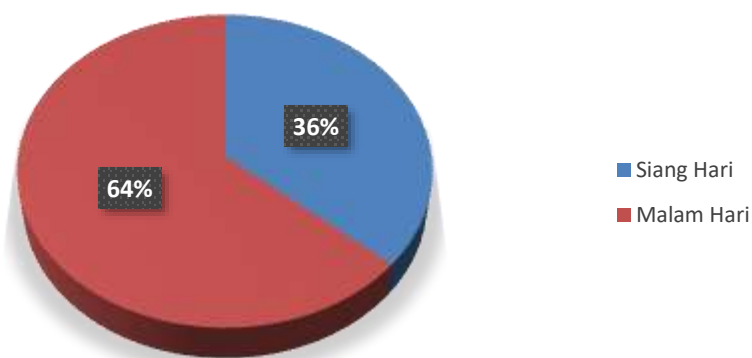


Figure 8. the time of the accident

Comparison of accidents at the time before the Covid-19 and when Covid-19 can be seen as follows:

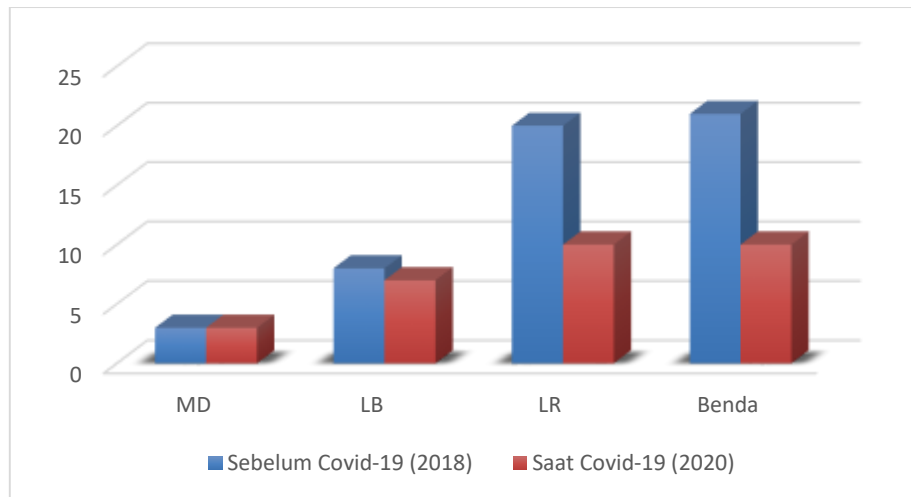


Figure 9. Comparison of accidents at the time before the Covid-19 and when Covid-19 can be seen as follows

Table 5. Comparison of accidents at the time before the Covid-19 and after the Covid-19

No. Segmen	Nilai					Saat Terjadi Wabah Covid-19 (2020)				
	AEK	BKA	UCL	Deviasi (BKA)	Deviasi (UCL)	AEK	BKA	UCL	Deviasi (BKA)	Deviasi (UCL)
1	48		48,066	5,062	0,065	30		34,501	9,023	4,501
2	54	53,062	48,800	-0,938	-5,200	40	24,250	35,949	-0,977	-4,051
3	8		42,765	45,062	34,764	7		31,106	32,023	24,106
4	31		45,766	22,062	14,765	20		32,892	19,023	12,892

3.5. Road performance analysis

Performance calculation on Jalan Margonda Raya includes calculation of traffic volume, capacity, speed of free flow, degree of saturation, travel time and analysis of service level based on road capacity Manual Indonesia (MKJI), geometric conditions Jalan Margonda Raya are as follows:

- Road type: Secondary artery
- Road type: 6/2D
- Length of road section: 2,135 m
- Road width: 12 m/Line
- Median width: 2 m
- Jalan Margonda Raya consists of 6 lanes and 2 lanes, with the width of each column is 4 m.
- Jalan Margonda Raya has no road shoulder, but has a sidewalk with a width of 2.2 m.
- Jalan Margonda Raya has a separator on the Jakarta-Depok line of Flyover Universitas Indonesia to the Simpang Jalan Juanda with a width of separator is 0.5 m.

Pictures of Margonda Raya Road can be seen in Figure 10.

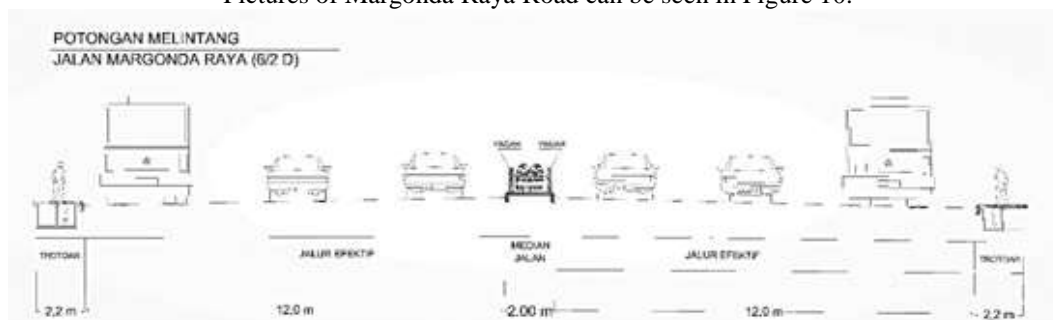


Figure 10. The Cross of Margonda Raya Road

The results of the performance analysis can be seen as follows:

Table 6. Recapitulation of analysis results

Arah	Volume Kendara an Lalu Lintas (Q) Smp/jam	Kapasit as Dasar Co	Kapasti as Aktual C	Kecepat an Arus Bebas FV	Derajat Kejenu han DS	Vlv Km/j am	LOS Q/C	Keccepat an Aktual Km/jam	LOS
Hari Minggu, 14 Mei 2020									
Jakart a- Depok	2726	4950	5146	59	0.530	49	A	59,06	B
Depok - Jakart a	2784	4950	5146	61	0.540	59	A	59,87	B
Hari Senin, 15 Mei 2020									
Jakart a- Depok	3445	4950	5146	59	0.669	49	B	59.03	B
Depok - Jakart a	3130	4950	5146	61	0.608	59	B	59.17	B

4. Conclusion

4.1. Conclusion

Based on the results of the research in the analysis, it can be concluded that:

- The factors causing the traffic accident in Depok Street of Margonda Raya in 2020 include:
 - The driver factor is the most dominant cause of the accident with a percentage of 83.75% with the majority of motorists who are not orderly traffic.
 - Lack of facilities for pedestrians such as Zebra cross to cross the road, road marking colors and sidewalks have faded, road surfaces there are many holes or puddles and the result of patchwork of holes arising, and there are some waypoints that are not exposed to lighting into additional factors that can cause accidents.
- Level of road service Margonda Raya on Sunday, May 14th 2020 Direction Jakarta-Depok is A, this is because the degree of saturation (V/C ratio) of 0.530, while the direction of Depok-Jakarta is A, this is due to the degree of saturation (V/C ratio) of 0.540 and for the day, Monday 15 May 2020 direction Jakarta-Depok is b, this is because the degree of saturation (V/C ratio) of 0.669 while the direction of Depok-Jakarta is B, this is because the degree of saturation (V/C) 0.608
- After the analysis using the method of accident equivalent number (AEK), upper control limit (BKA), and Upper Limit Control (UCL) concluded that the Jalan Margonda Raya Depok City is included in the category of roads prone to traffic accidents, because there are two road segments that have a value of AEK greater or greater than the value of BKA and UCL, the number of accidents on Jalan Margonda Raya Depok city decreased by 28.812% when reviewed from the value of BKA, in the year 2020 (when Covid-19) amounted 24.250% and in 2018 amounted to 53.062% (before Covid).
- Solution and handling of traffic accident on Jalan Margonda Raya city in the future, namely:
 - Perform installation and repainting of road markers and zebra cross according to the function and placement that suits the needs of the road Margonda Raya
 - Repaint on the sidewalk or kerb on the side of Jalan Margonda Raya according to the function.
 - Conduct periodic supervision work on Jalan Margonda Raya to prevent road damage that could result in traffic accidents.
 - Periodic check on street lighting to prevent lights from dying, and cuts against trees that cover street lighting

4.2. Advice

1. There is counseling about the importance of safe driving or safety riding for riders and conducting special operations from the police in the field of traffic to deal with traffic problems or things that can trigger traffic accidents.
2. There is improvement on the road Margonda Raya section including: To Repaint road markers, zebra cross and sidewalks and the addition of supporting signs.
3. Need to do additional analysis to complement secondary data such as number of vehicles involved, weather, gender and the age of the victim. And also can be used other methods in determining the prone point of accident in the Jalan Margonda Raya Depok City to get more accurate results.

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Biography / Biographies (Optional)

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