Analysis of Traffic Accidents Using the Accident Rate Method (Case Study: MT. Haryono Street – Gatot Subroto Street South Jakarta City)

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ABSTRACT

MT. Haryono - Gatot Subroto Street South Jakarta is one of the arterial roads in the Special Capital Region of Jakarta that connects three cities, South Jakarta City and East Jakarta City. Based on IRSMS (Integrated Road Safety Management System), data from the National Police showed increased traffic accident cases in MT. Haryono Gatot Subroto Street South Jakarta, where in 2019, there were 21 traffic accident cases. In 2020, there were 30 traffic accident cases, and in 2021, there were 38 traffic accident cases. This research method was descriptive, which describes current conditions using the Accident Rate method. This study aims to determine the level of traffic accidents on MT Haryono - Gatot Subroto Street, South Jakarta, to know the factors that cause accidents, and to find the black site area on MT. Haryono - Gatot Subroto Street South Jakarta, and to provide alternatives and solutions for prevention and management in reducing traffic accidents. This research shows that the black site area was on Gatot Subroto Street Segment 6, KM 5+500 – KM 6+500, with an accident rate of 6.33. The Blackspot identification was based on an accident rate of 0.27, and the black site identification was based on an accident rate of 0.27. The highest time of occurrence of traffic accidents was on Sunday at 03.00 – 04.00 WIB, so an actual speed survey was implemented at that time. The primary cause of traffic accidents based on POLRI IRSMS data was the human factor as drivers who are negligent and undisciplined in driving. An example of the causal factors found during the survey was drivers driving over the maximum speed limit—the alternatives and solutions for prevention and countermeasures in reducing traffic accidents on MT. Haryono-Gatot Subroto Street South Jakarta provides adequate lighting along the way and adds traffic signs before black site areas.

Keywords: Traffic Accidents; Blacksite; Accident Rate

Introduction

MT Haryono Street- Gatot Subroto Street is an arterial road with two lanes with six lanes, with a width of each lane ±7.5 meters separated by the inner city toll road. MT Haryono Street - Gatot Subroto Street is one of the busiest highways in DKI Jakarta; this road connects the city of East Jakarta, West Jakarta, and South Jakarta. But the road conditions on MT Haryono Street - Gatot Subroto Street does not support high traffic every day due to damaged and potholed roads, lack of lighting at night, and lack of traffic signs, so these conditions can increase the potential for traffic accidents[1].

Based on IRSMS (Integrated Road Safety Management System) data from the Indonesian National Police, there were 131 cases of traffic accidents along the MT. Haryono Street - Gatot Subroto Street is 9.85 km away. Over the last four years (2019 - 2022), there have been seven deaths. In 2019 there were 21 cases of traffic accidents. In 2020 there were 30 cases of traffic accidents. In 2021 there were 38 traffic accidents, and as of December 2022, there were 42 traffic accidents[2].

In 2020 there was a decrease in community activity due to the high number of Covid-19 cases in Jakarta. However, even though community activities were reduced, there were still traffic accidents, so traffic conditions on MT Haryono Street - Gatot Subroto Street could not be safe. Meanwhile, in 2021 there is an increase in traffic accident cases caused by the return to regular community activities considering the decrease in positive cases of covid-19, and the majority of people have received vaccines to booster vaccines [3].

Research Methods

This type of research was conducted using descriptive research. Descriptive research is a method aimed at describing existing phenomena which occur in the present or past moments. This research does not manipulate or change free variables but describes a condition as it is. Conditions can be depicted as individual or using numbers [4][5].

The research location this time is MT Haryono Street - Gatot Subroto Street, South Jakarta, DKI Jakarta Province. The section studied is 9.86 km long as the MT—Haryono Street - Gatot Subroto Street road sections towards the West [6]–[10].
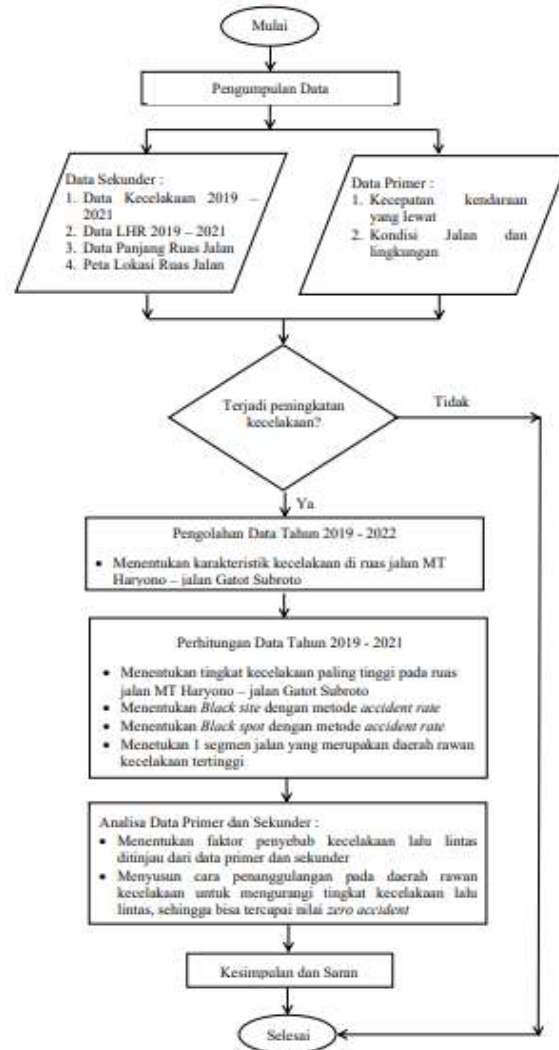
The research flow set in this study is as follows:

Figure 1 Research Flow

Results and Discussion

Traffic Accident Rate Analysis

1. Accident Rate Frequency

Figure 1 shows that the most severe accidents occurred in 2021, with as many as 38. This increase could occur due to increased community activities after the government relaxed the PPKM policy during the Covid-19 pandemic [11]–[15].
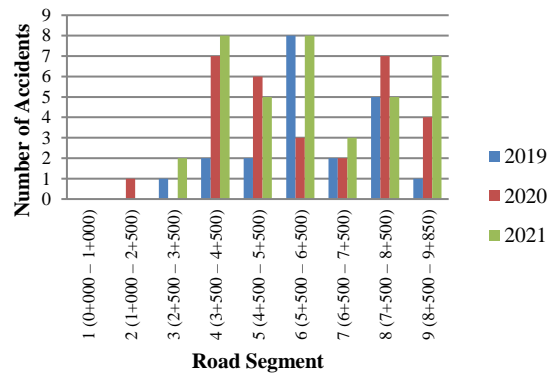
Figure 2 Accident Frequency Graph

The average number of accidents per year (JKL) on each road segment can be calculated with an example calculation for segment one.

From the calculation, it can be seen that the average accident/year for each road segment. For the average accident/year of the road segment on the MT Haryono - Gatot Subroto road, the highest is segment 6, with three years of 19 accidents and an average of 6.33 accidents per year [16]–[19].

2. Travel Rate

The calculation of the conversion value into passenger car units is as follows.

- The year 2019

Motorcycle	= 121,190 x 0.25	= 30,928 SMP/day
Car	= 39,650 x 1.0	= 39,650 SMP/day
Buses and trucks	= 5,466 x 1.2	= 6,559 SMP/day

The calculation of the conversion value into passenger car units each year can be seen in the table below.

Table 1 Recapitulation of LHR Calculations

Vehicle Type	Equivalent Number	LHR (junior high school/day)		
		2019	2020	2021
Motorbike	0,25	30.298	17.419	21.893
Cars	1,00	39.650	23.411	41.169
Buses and trucks	1,20	6.559	5.924	5.150
Total		76.507	46.754	68.212

So that the average LHR is obtained over three years, namely:

$$\text{Average LHR} = \frac{76.507 + 46.754 + 68.212}{3} = \frac{191.473}{3}$$
$$= 63.824,25 \text{ SMP/day}$$

In table 12 and figure 3, it can be seen that there was a decrease in community activity in 2020 caused by the reduced activity and mobility of the people of DKI Jakarta and its surroundings caused by the soaring Covid-19 cases and again increased in 2021 when the government relaxed the PPKM policy.

After getting the LHR value for three years, the number of trips per day on each existing road section can be calculated according to the length of the current road section with the average LHR amount obtained. The number of trips on each existing road section can be seen in Table 13 as follows [20]–[27].

Table 2 Recapitulation of Performance Calculations

Road Section Name	Road Section Length (km)	LHR (SMP/hr)	Performance (SMP.km/hr)
1 (0+000 – 1+000)	1,00	63.824,25	63.824,25
2 (1+000 – 2+500)	1,50	63.824,25	95.736,38
3 (2+500 – 3+500)	1,00	63.824,25	63.824,25
4 (3+500 – 4+500)	1,00	63.824,25	63.824,25
5 (4+500 – 5+500)	1,00	63.824,25	63.824,25
6 (5+500 – 6+500)	1,00	63.824,25	63.824,25
7 (6+500 – 7+500)	1,00	63.824,25	63.824,25
8 (7+500 – 8+500)	1,00	63.824,25	63.824,25
9 (8+500 – 9+850)	1,35	63.824,25	86.162,74

Accident Rate Analysis Based on Accident Rate Method

The accident rate on the MT Haryono – Gatot Subroto road section can be calculated using Equation 2.1 for each year. The accident rate for segment one can be calculated as follows.
Thus, the overall calculation for each segment can be seen in the following table

Table 3 Recapitulation of Performance Calculations

Road Section Name	Average Accident Rate (accident. km/year)
1 (0+000 – 1+000)	0,00
2 (1+000 – 2+500)	0,22
3 (2+500 – 3+500)	1,00
4 (3+500 – 4+500)	5,67
5 (4+500 – 5+500)	4,33
6 (5+500 – 6+500)	6,33
7 (6+500 – 7+500)	2,33
8 (7+500 – 8+500)	5,67
9 (8+500 – 9+850)	2,96

Based on the results of the calculations above, it was found that all road segments in this study were categorized into black spot areas because all road segments had an accident rate greater than 1.0 which indicates that the case rate of traffic accidents on the MT Haryono - Gatot Subroto road is relatively high and it can be known that segment 6 (5 + 500 - 6 + 500) has the highest accident rate value.

Blackspot Identification Based on Accident Rate

After getting the value from the accident rate calculation, the accident rate can be calculated according to Equation 2.2 by entering the average accident value per year and the average LHR value obtained to find the accident rate based on the blackspot in each segment as follows.
Segment 1 (0+000 – 1+000)

$$TKL = \frac{1.000.000 \times JKL}{365 \times V} = \frac{1.000.000 \times 0}{365 \times 63.824,25}$$
$$= 0 \text{ accidents/km.year}$$

Segment 2 (1+000 – 2+500)

$$TKL = \frac{1.000.000 \times JKL}{365 \times V} = \frac{1.000.000 \times 0,22}{365 \times 63.824,25}$$
$$= 0.01 \text{ accidents/km.year}$$

Thus, the overall calculation for each segment can be seen in the following table

Table 4 Recapitulation of Blackspot Calculations Based on Accident Rate

Road Section Name	JKL$_{track}$ (accident. km/year)	LHR (junior high school/day)	Accident Rate
1 (0+000 – 1+000)	0,00	63.824,25	0,00
2 (1+000 – 2+500)	0,22	63.824,25	0,01
3 (2+500 – 3+500)	1,00	63.824,25	0,04
4 (3+500 – 4+500)	5,67	63.824,25	0,24
5 (4+500 – 5+500)	4,33	63.824,25	0,19
6 (5+500 – 6+500)	6,33	63.824,25	0,27
7 (6+500 – 7+500)	2,33	63.824,25	0,10
8 (7+500 – 8+500)	5,67	63.824,25	0,24
9 (8+500 – 9+850)	2,96	63.824,25	0,17

Table 15 shows the accident rate based on blackspot, with the highest value in segment 6 (5+500 – 6+500) of 0.27. According to Abd's theory. As Hery Sartono (2018) quoted, the blackspot has an essential accident rate value criterion = 0.76 or more, so all segments on the MT Haryono - Gatot Subroto road are not classified as black spots.

Blacksite Identification Based on Accident Rate
In the black site calculation based on the accident rate, there is an additional parameter: the length of the road section (km) according to Equation 2.3. The analysis can be seen as follows.
Segment 1 (0+000 – 1+000)

$$\text{TKL} = \frac{1.000.000 \times JKL}{365 \times K*} = \frac{1.000.000 \times 0}{365 \times 63.824,25}$$
$$= 0 \text{ accidents/km.year}$$

Segment 2 (1+000 – 2+500)

$$\text{TKL} = \frac{1.000.000 \times JKL}{365 \times K*} = \frac{1.000.000 \times 0,22}{365 \times 95.736,38}$$
$$= 0.01 \text{ accidents/km.year}$$

Thus, the overall calculation for each segment can be seen in the following table

Table 5 Recapitulation of Blackspot Calculations Based on Accident Rate

Road Section Name	JKL$_{track}$ (accident. km/year)	LHR (junior high school/day)	Accident Rate
1 (0+000 – 1+000)	0,00	63.824,25	0,00
2 (1+000 – 2+500)	0,22	63.824,25	0,01
3 (2+500 – 3+500)	1,00	63.824,25	0,04
4 (3+500 – 4+500)	5,67	63.824,25	0,24
5 (4+500 – 5+500)	4,33	63.824,25	0,19
6 (5+500 – 6+500)	6,33	63.824,25	0,27
7 (6+500 – 7+500)	2,33	63.824,25	0,10
8 (7+500 – 8+500)	5,67	63.824,25	0,24
9 (8+500 – 9+850)	2,96	63.824,25	0,17

According to Abd's theory. As Henry Sartono (2018) quoted, a black site has a criterion for an accident rate value of less than one threshold. It can be said that the level of accident vulnerability is less at a point where the accident-prone area is found from the Accident Rate = 0.003. This shows that the road segment is a black site point where the numbers in the table above meet the standard statistical provisions of probability = 0.003 so that the road segment with the highest accident rate value was taken, namely in segment 6 (5 + 500 - 6 + 500) of 0.27.

Primary Data Analysis
1. Location and Time of Survey Implementation

Figure 3 Segment 6 Accident Site Map

The traffic accident location map above shows that accidents most often occur in front of the location of the Telkom Hub building, so the site for the primary data survey in segment six is carried out in front of The Telkom Hub building. To determine the time and day of conducting the study, it is taken from the secondary data with the highest values, which can be seen in the following tables.

Table 6 Accident Time on Segment 6

Time	Hit	Number of Accidents	Total Accident
Early Morning	00.00 – 01.00	1	9
	01.00 – 02.00	1	
	02.00 – 03.00	1	
	03.00 – 04.00	3	
	04.00 – 05.00	1	
	05.00 – 06.00	2	
Morning	06.00 – 07.00	1	7
	07.00 – 08.00	2	
	08.00 – 09.00	2	
	09.00 – 10.00	1	
	10.00 – 11.00	1	
	11.00 – 12.00	0	
Noon	12.00 – 13.00	1	4
	13.00 – 14.00	1	
	14.00 – 15.00	0	
	15.00 – 16.00	0	
	16.00 – 17.00	2	
	17.00 – 18.00	0	
Evening	18.00 – 19.00	0	3
	19.00 – 20.00	2	
	20.00 – 21.00	1	
	21.00 – 22.00	0	

22.00 – 23.00	0
23.00 – 24.00	0

Based on table 20 above, the highest speed on a motorcycle (MC) is 86.89 km / h at 03.30 - 03.45 WIB, and the lowest is 45.05 km / h at 07.30 - 07.45 WIB, then on light vehicles (LV), the top speed is 75.62 km / h at 03.30 - 03.45 WIB and the lowest is 39 km/hour at 08.45 - 09.00 WIB. While in heavy vehicles (HV), the top speed is 77.23 km / h at 03.45 - 04.00 WIB, and the lowest is 24.14 km/hour at 08.30 - 08.45 WIB.

Factor Analysis of Causes of Accidents

Based on the secondary data analysis and survey results on primary data, there are several causes of traffic accidents, as shown in the figure below.

Figure 4 Factors Causing Traffic Accidents

Collision Diagram

Figure 5 Collision Diagram

Analysis of Proposed Accident Prevention and Management

Prevention and countermeasures that can be taken to reduce accidents on the MT Haryono – Gatot Subroto road specifically based on the results of surveys in the field include:

1. Making road markings on road sections where there are no road markings.

Figure 6 Road markings creation

2. The lighting of lighting on the side of the road

Figure 7 Addition of lighting lamps

3. Pruning tree branches

Figure 8 Pruning tree branches

4. Installation of junction warning signs

Figure 9 Installation of warning signs

5. Installation of speed limit signs

Figure 10 Installation of speed signs

6. Pavement cleaning of parking vehicles

Figure 11 Pavement cleaning

Conclusion

The conclusions obtained from the results and analysis of the discussion in this study are:

1. The accident rate on the MT Haryono - Gatot Subroto Road section during 2019 - 2021, divided into nine segments, obtained the highest average annual traffic accident value in the segment 6 KM 5 + 500 - 6 + 500 with a value of 6.33 accidents/year. Thus, in analyzing accident rates based on blackspot and black site segments, 6 KM 5 + 500 – 6 + 500 still get the highest value of 0.27.
2. The causes of traffic accidents that continue to increase yearly are the main causal factors: the human factor at 78%, road, and environmental conditions at 28%, and vehicle factors at 1%.
3. Several methods can do alternative prevention and handling of traffic accidents in the future, one of which is to use parts of the road according to their designation, such as sidewalks used only for pedestrians, not for stopping or selling vehicles, improving facilities on the highway such as adding traffic signs that do not yet exist at the required points and providing socialization to motorists to comply traffic.

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