

Analysis of Accident Characteristics and Accident-Prone Areas in Sleman Regency, Yogyakarta (Case Study: Kaliurang Road Section Km 3.5 – Km 10)

Maria Lovernia Hay, J. Dwijoko Anusanto

Department of Civil Engineering, Faculty of Engineering, Atma Jaya University Yogyakarta,
INDONESIA

E-mail: 205103235@students.uajy.ac.id, dwijoko.anusanto@uajy.ac.id

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ABSTRACT

This study aims to identify accident-prone locations on the Kaliurang road km 3.5 – km 10 Sleman Regency, D.I. Yogyakarta Province to find steps to reduce accidents in these accident-prone areas. The initial data is traffic accident data for 2020 – March 2022 which is then analyzed to determine the characteristics of traffic accidents on the Kaliurang km 3.5 – km 10 road segment classified by type of collision, type of vehicle, and material loss. Determination of the location of accident-prone areas based on ranking using the Equivalent Accident Number (EAN). A total material loss of Rp. 86,300,000.00 for the last two years and three months. The location of the accident-prone area is the Kaliurang kilometer 8 road with an EAN value of 203. The results of the analysis are interpreted that the better the handling related to complementary buildings and road facilities, the more likely it is to reduce the number of accidents in the accident-prone area.

Keywords: accident; safety; traffic; accident characteristics; accident-prone areas.

INTRODUCTION

Kaliurang km 3.5 – km 10 is located in Sleman regency, Yogyakarta. This area is one of the busy points of transportation due to the fairly dense number of vehicle users, some of the causes that affect it include this section of the road being an access that connects Sleman regency and Yogyakarta city. High vehicle activity is certainly related to traffic order, advice and road infrastructure, and even accident rates. Therefore, it is the reason why the author as background for this research was carried out on the Kaliurang road section km 3.5 - km 10

Some other causes that cause an increase in traffic on this section of the road are the presence of shops along the roadway and also the vehicle activities of students, students, and work people. During peak vehicle hours, the vehicle volume increases.

The increased volume of vehicles, of course, results in traffic disorganization, congestion, and even traffic accidents. As calculated by Sleman police data, from 2020 to March 2022, the surge in accidents on the road section recorded 145 cases with various characteristics. Therefore, transportation support infrastructure plays an important role in helping to reduce accidents in accident-prone areas.

RESEARCH METHODS

Research methodology is a scientific way used to obtain data in a certain way. In this case, data is needed in the form of primary data, namely data obtained by making observations, while secondary data is in the form of data obtained from related agencies. The method used in this study is quantitative, namely by analyzing accident data from the police, in this case traffic accident data from the Sleman Regency police in 2020 – March 2022. The data analyzed will group accident characteristics and determine accident-prone areas on the Kaliurang Km 3.5 – Km 10 road section.

In addition to using quantitative methods, the author also uses literature study methods to help authors as references in the research conducted.

RESULTS AND DISCUSSION

Total population

The total population of Sleman Regency based on data from the Central Statistics Agency of Sleman

Regency in 2018 was 1,206,714 people, in 2019, the number of people was 1,219,640. In 2020, the total number of inhabitants was 1,125,804. In 2021 the total population was 1,136,474 with an area of 57,482 ha or 574.82 km².

Table 1. Total Population of Sleman Regency, 2018 – 2021

| No | Year | Male | Female | Total |
|----|------|---------|---------|-----------|
| 1 | 2018 | 608.968 | 597.746 | 1.206.714 |
| 2 | 2019 | 615.505 | 604.135 | 1.219.640 |
| 3 | 2020 | 559.385 | 566.419 | 1.125.804 |
| 4 | 2021 | 564.378 | 572.096 | 1.136.474 |

(Source: BPS, Sleman Regency, 2022)

Accident Data Analysis

The number of traffic accidents in Sleman Regency, especially on the Kaliurang road section km 3.5 – km 10. Based on accident data from the Sleman Police Satlantas, there were 145 incidents recorded in a period of two years and three months, between 2020-2022 which have claimed 193 lives, consisting of 191 minor injuries, 1 serious injury, and 1 death.

The following is a table of the number of incidents and the number of victims of traffic accidents in Jalan Kaliurang.

Table 2. The number of incidents and the number of accident victims on the Kaliurang road section km 3.5 – km 10

| Year | Number of Events | Types of Victims | | | Number of Victims | Accident Rates |
|-------|------------------|------------------|----|-----|-------------------|----------------|
| | | MD | LB | LR | | |
| 2020 | 44 | 0 | 0 | 54 | 54 | 6.29 |
| 2021 | 79 | 1 | 1 | 109 | 109 | 11.29 |
| 2022 | 22 | 0 | 0 | 28 | 29 | 3.14 |
| Total | 145 | 1 | 1 | 191 | 193 | |

(Source: Analysis)

From the existing data, some data are lacking or empty due to delays in reporting and negligence of officers in filling out accident books.

Mortality Rate by Population

Traffic hazards for people's lives are expressed as the number of traffic deaths per 100,000 population. This figure illustrates the number of accidents for all regions. The calculation of mortality by population in 2020, and 2021 can be seen in the following table:

Table 3. Mortality rate by population

| Year | Death (B) | Population (P) | Mortality $R_{ap} = (B \times 100,000) / P$ |
|------|-----------|----------------|---|
| 2020 | 0 | 1.125.804 | 0 |
| 2021 | 1 | 1.136.474 | 0,0879 |

(Source: Analysis)

Accident Review By Collision Type

Table 4. Traffic accidents by collision type

| Year | Collision Type |
|------|----------------|
|------|----------------|

| | Number of Events | Front | Front-Side | Front-Rear | Side-By-Side | Single | Streak | Unidentified |
|-------|-------------------------|--------------|-------------------|-------------------|---------------------|---------------|---------------|---------------------|
| 2020 | 44 | 3 | 18 | 4 | 3 | 10 | 0 | 6 |
| 2021 | 79 | 4 | 26 | 7 | 3 | 27 | 0 | 12 |
| 2022 | 22 | 1 | 12 | 1 | 0 | 4 | 0 | 4 |
| Total | 145 | 8 | 56 | 12 | 6 | 41 | 0 | 22 |

Accident review based on the type of collision on the Kaliurang road section km 3.5 - km 10 is carried out with collision type parameters, namely: front collision, front-side collision, front-rear collision, single collision, and continuous collision (mass).

Accident Analysis by Vehicle Type.

Judging from the type of vehicle involved in a traffic accident, it is recorded that the vehicles most involved in traffic accidents are 2-wheeled vehicles (Motorcycles), namely 210 units of motorcycles recorded.

Table 5. Traffic Accidents By Vehicle Type

| Year | Types of Motor Vehicles involved | | | | Non-motorized Vehicles | Pedestrian |
|-------------|---|-------------------|-----------------------|-----------------------|-------------------------------|-------------------|
| | Number of Events | Motor-bike | Light Vehicles | Heavy Vehicles | | |
| 2020 | 44 | 65 | 11 | 1 | 0 | 2 |
| 2021 | 79 | 109 | 20 | 3 | 5 | 1 |
| 2022 | 22 | 36 | 3 | 0 | 0 | 1 |
| Total | 145 | 210 | 34 | 4 | 5 | 4 |

(Source: Satlantans Polres Sleman, 2022)

Material Losses

Table 6 Material losses due to traffic accidents

| Year | Result | | | Material Losses |
|-------------|---------------|-----------|-----------|------------------------|
| | MD | LB | LR | |
| 2020 | 0 | 0 | 54 | IDR 26,100,000 |
| 2021 | 1 | 1 | 109 | IDR 51,300,000 |
| 2022 | 0 | 0 | 28 | IDR 8,900,000 |
| Total | 1 | 1 | 191 | IDR 86,300,000 |

(Source: Satlantas Polres Sleman, 2022)

Material losses due to accidents include victim maintenance costs, property loss costs, traffic handling fees, traffic accident handling fees, and loss costs for victims.

Accident Prone Areas

Based on accident data from the Sleman Police Satlantas in 2020 - 2022, there are several locations where traffic accidents occur on the Kaliurang Km 3.5 - Km 10 road. To find out accident-prone areas, a ranking is carried out based on the level of the number of events as a determinant of an accident-prone area on the road section. The following is Table 7 which shows the location of traffic incidents/accidents on the Kaliurang Km 3.5 – Km 10 road section.

Table 7. Location of a traffic accident on Kaliurang Road section km 3.5 – km 10.

| No | Location of the Incident | Number of Events | Percentage of Occurrence |
|-----------|---------------------------------|-------------------------|---------------------------------|
| 1 | Jl. Kaliurang Km 3.5 | 5 | 3.45% |
| 2 | Jl. Kaliurang Km 4 | 8 | 5.52% |

| | | | |
|-------|---------------------|-----|---------|
| 3 | Jl. Kaliurang Km 5 | 18 | 12.41% |
| 4 | Jl. Kaliurang Km 6 | 17 | 11.72% |
| 5 | Jl. Kaliurang Km 7 | 24 | 16.55% |
| 6 | Jl. Kaliurang Km 8 | 38 | 26.21% |
| 7 | Jl. Kaliurang Km 9 | 15 | 10.34% |
| 8 | Jl. Kaliurang Km 10 | 20 | 13.79% |
| Total | | 145 | 100.00% |

(Source: Analysis)

The determination of accident-prone areas is analyzed based on the accident rate. Accident data is analyzed with the Accident Equivalent Number (EAN) approach with a weighting system and then ranked to find out which location has the highest accident rate according to the severity. From the results of the analysis carried out, the location of the accident-prone area on the Kaliurang kilometer 8 road section with the highest EAN value of 203 was obtained. The results of the analysis of accident rates in 2020 - 2022 with an accident rate equivalent approach (EAN) can be seen in Table 8 below.

Table 8. Accident Rate for 2020 – 2021 based on EAN value

| No | Location of the Incident (Jl. Kaliurang) | Total Laka | Severity | | | | | EAN | | | Rank |
|-------|--|------------|----------|----|-----|-----|------|-----------|-------|-------|------|
| | | | MD | LB | LR | K | 12xM | 3 x (B+R) | 1 x K | Total | |
| 1 | Km 3.5 | 5 | 0 | 0 | 3 | 4 | 0 | 9 | 4 | 13 | 8 |
| 2 | Km 4 | 8 | 0 | 0 | 12 | 8 | 0 | 36 | 8 | 44 | 7 |
| 3 | Km 5 | 18 | 0 | 0 | 27 | 19 | 0 | 81 | 19 | 100 | 4 |
| 4 | Km 6 | 17 | 1 | 0 | 20 | 16 | 12 | 60 | 16 | 88 | 5 |
| 5 | Km 7 | 24 | 0 | 0 | 29 | 24 | 0 | 87 | 24 | 111 | 2 |
| 6 | Km 8 | 38 | 0 | 1 | 54 | 38 | 0 | 165 | 38 | 203 | 1 |
| 7 | Km 9 | 15 | 0 | 0 | 17 | 15 | 0 | 51 | 15 | 66 | 6 |
| 8 | Km 10 | 20 | 0 | 0 | 29 | 20 | 0 | 87 | 20 | 107 | 3 |
| Total | | 145 | 1 | 1 | 191 | 144 | 12 | 573 | 144 | 729 | |

(Source: Analysis)

Ranking of Accident-Prone Areas by Segment.**Table 9.** Analysis of Accident-Prone Areas by Segment

| No. | Segment | Year | | | Total |
|-------|----------------------------------|------|------|------|-------|
| | | 2020 | 2021 | 2022 | |
| 1 | Segment 1 (Sta. 8+000 - 8+100) | 1 | 0 | 0 | 1 |
| 2 | Segment 2 (Sta. 8+100 - 8+200) | 1 | 2 | 1 | 4 |
| 3 | Segment 3 (Sta. 8+200 - 8+300) | 1 | 3 | 1 | 5 |
| 4 | Segment 4 (Sta. 8+300 - 8+400) | 3 | 1 | 1 | 5 |
| 5 | Segment 5 (Sta. 8+400 - 8+500) | 3 | 2 | 3 | 8 |
| 6 | Segment 6 (Sta. 8+500 - 8+600) | 1 | 2 | 2 | 5 |
| 7 | Segment 7 (Sta. 8+600 - 8+700) | 2 | 0 | 0 | 2 |
| 8 | Segment 8 (Sta. 8+700 - 8+800) | 1 | 2 | 0 | 3 |
| 9 | Segment 9 (Sta. 8+800 - 8+900) | 1 | 1 | 0 | 2 |
| 10 | Segment 10 (Sta. 8+900 - 8+1000) | 0 | 2 | 1 | 3 |
| Total | | 14 | 15 | 9 | 38 |

(Source: Analysis)

Based on the results of road inspections that have been carried out in accident-prone locations with a length of 1 kilometer, several main problems are quite significant

The number of traffic accidents on the Kaliurang km 8 road section has been grouped into each segment as shown in table 10 above.

Kaliurang Road traffic volume Km 3.5 – Km 10

Traffic volume data is based on survey results for 30 hours in 2 directions, both north to south and from south to north on the Kaliurang road section.

$$Q_{\text{smp}} = (43.883 \times 0,40) + (24.408 \times 1,0) + (1.349 \times 1,3) = 43.714,9 \text{ smp/day}$$

Table 10. Traffic Volume on Kaliurang Road Km 3.5 – Km 10

| b | Front of Apotik Kentungan | Front of Pos Lantas Bulak Sumur | Total |
|----|---------------------------|---------------------------------|---------------|
| | (vehicle/day) | (vehicle/day) | (vehicle/day) |
| MC | 26.206 | 17.677 | 43.883 |
| LV | 13.321 | 11.087 | 24.408 |
| HV | 641 | 708 | 1.349 |

(Source: Dinas Perhubungan DIY, 2022.)

Analysis of Accident Rate in Accident-Prone Areas

Table 11. Accident Rate in Accident-Prone Areas by Segment

| No | Segment | Total Accidents | Kindergarten (100JPKP) |
|----|----------------------------------|-----------------|------------------------|
| 1 | Segment 1 (Sta. 8+000 – 8+100) | 1 | 3,13 |
| 2 | Segment 2 (Sta. 8+100 – 8+200) | 4 | 12,53 |
| 3 | Segment 3 (Sta. 8+200 – 8+300) | 5 | 15,67 |
| 4 | Segment 4 (Sta. 8+300 – 8+400) | 5 | 15,67 |
| 5 | Segment 5 (Sta. 8+400 – 8+500) | 8 | 25,07 |
| 6 | Segment 6 (Sta. 8+500 – 8+600) | 5 | 15,67 |
| 7 | Segment 7 (Sta. 8+600 – 8+700) | 2 | 6,27 |
| 8 | Segment 8 (Sta. 8+700 – 8+800) | 3 | 9,40 |
| 9 | Segment 9 (Sta. 8+800 – 8+900) | 2 | 6,27 |
| 10 | Segment 10 (Sta. 8+900 – 8+1000) | 3 | 9,40 |

(Source: Analysis)

An example of calculating the number of accidents on segment 8 (Sta. 8 + 700 – 8 + 800) as follows:

Accident Frequency (Fk) = 3

Traffic Volume Accident (LHRT)

$$= 43,714.9 \text{ smp/day}$$

Road section length (L) = 1 km

Number of Data Years = 2 Years

Then, by using the formula

$$T_k = \frac{F_k \times 100^B}{LHR_T \times n \times L \times 365} \text{ dalam satuan JPKP}$$

So that

$$T_k = \frac{100.000.000 \times 3}{365 \times 2 \times 43.714,9 \times 1}$$

$$T_k = 9.40 \text{ (100JKP)}$$

CONCLUSION

The following are the conclusions of the results of the research on the characteristics of accidents and road safety inspections on the Kaliurang km 3.5 – km 10 road section: Accident Prone Areas

Based on the results of the analysis, the accident-prone area is on the Kaliurang Km 8 road with an equivalent number / EAN of 203. Meanwhile, based on segments per segment of accident-prone areas on the Kaliurang Km 8 road, the segments that are the point of accident-prone areas are in segment 5 (Sta. 8 + 400 - 8 + 500) with a total of 8 accidents and an accident rate of 25.07 in 100 100 Million Vehicle Trips Per kilometers.

The results of the analysis of the characteristics of the accident are as follows:

- The number of accidents was 145 cases with 191 minor injuries, 1 serious injury and 1 fatality.
- The dominant type of vehicle for traffic accidents is motorcycles with a total of 210 vehicles.
- The most type of accident is front-side collisions.
- Material losses due to traffic accidents in the last 2 years and 3 months reached Rp 86,300,000.00

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