

Analysis Of Accident Problems On The Yogya Road Segment Winosari, Gunungkidul Regency

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ABSTRACT

Gunungkidul is a district in the province of the Special Region of Yogyakarta, with an area of 1,485.36 km², almost half of the Yogyakarta area, which is 43.63%. One of the main roads in Gunungkidul Regency is the Jalan Yogya – Wonosari section which is a national road. Gunungkidul is also an area with many destinations tourism, it is also one of the factors causing traffic accidents that occur, negligence and the winding road conditions in Gunungkidul are also the causes accident. The purpose of this study was to analyze the characteristics of accidents, Analyze the factors that cause accidents. Analysis of This study uses the Accident Equivalent Rate (AEK) method with a total of the highest of 192 and also the Z-score with the highest number of 1.307402893. From the results of the analysis The main factor of the accident was human (28 single accidents). Type of vehicle that frequently involved are motorcycles (120 vehicles). The type of single accident accident becomes most accidents with (28 incidents). Accident-prone hours are at 06.00 – 12.00 (33 events). The location of the accident-prone area on the Yogyakarta Road Section Wonosari is at Km.30 – Km.36 (33 events). Accidents that occurred during 1 year (2020) on the Yogyakarta-Wonosari Road Section, Gunungkidul Regency is as many as 87 events. The total number of victims was 111 minor injuries and 6 died. From data and conditions at the site can be recommended that to reduce past accidents traffic, it is necessary to add lighting at the location, because the road conditions are dark and winding at night can reduce visibility and prone to accidents.

Keywords: Accident, Jogja-Wonosari, Prone Area

1. INTRODUCTION

Traffic accidents can occur due to the movement of transportation, it is necessary sustainability of several aspects that support transportation to run smoothly smoothly, so as not to cause traffic accidents, starting from the driver, vehicles, as well as adequate traffic infrastructure. Gunungkidul is located in the province of the Special Region of Yogyakarta, with an area of 1,485.36 km², almost half of the Yogyakarta area which is 43.63%. According to BPS the number Gunungkidul population is 747,161 people. As the population increases, Of course, transportation users are increasing, so the number of accidents is increasing increasing every year. One of the main roads in Gunungkidul Regency is the Jalan Yogya – Wonosari which is a national road. Gunungkidul is also an area that has many tourist destinations, it is also one of the contributing factors traffic accidents, negligence and poor road conditions in Gunungkidul winding is also a cause of accidents. From this, it is necessary to conduct research on accident-prone areas that useful in knowing where the location is prone to traffic accidents. And useful to formulate ways of handling and preventing traffic accidents on the road section Yogya – Wonosari, Gunungkidul Regency.

RESEARCH PURPOSES

To analyze the characteristics of accidents on the Jogja – Wonosari road section, Gunungkidul Regency, analyze what factors are the cause of the occurrence accident on Jalan Jogja – Wonosari, Gunungkidul Regency. For the last namely analyzing accident-prone areas on the Jogja – Wonosari road section, Kabupaten Gunungkidul.

LITERATURE REVIEW

Mulyono et al (2009) conducted a research on infrastructure safety audit road, to minimize the occurrence of accidents, prevention is carried out starting from road infrastructure to be improved, road geometry affecting visibility when driving, bends with a radius that must be adjusted to the regulations so that does not harm the rider, as well as many other aspects such as speed limits when turns, signs for sharp turns and also necessary street lights added.

Kurniawan [1]research was conducted to determine areas and hotspots accidents, as well as the factors that cause accidents using the Upper Control method Limits. This analysis was made using several methods based on the LQ of the intersection and road length, AR, BKA and UCL. Malang Village and Baluk Village on sta 11+020 – 18+020 become an area with an accident rate that exceeds BKA and UCL. From research results many factors that occur as a result of accidents, such as lack of concentration while driving, drunkenness, driving too close to other motorists, violating traffic and streak accident.

Untari (2019) conducted research using the Upper Control Limit (UCL) method to determine where the accident-prone areas are. From the research results Serang Km. Highway 23 – Km 35 becomes a prone area with accident characteristics occurring at 18.01 – 05.59 WIB with a percentage of 58%, the age range of 21-30 is dominated by men, not concentrating 26% and side crash accidents 20%. Losses that occurred reached Rp. 511,900,006.00.00.

Bolla et al (2013) conducted a study on areas prone to traffic accidents. Analysis using the EAN (Equivalent Accident Number) method was carried out with data that has been obtained, then the next method is BKA (Upper Control Limit) and UCL (Upper Control Limit). Control Limit) is carried out in order to obtain accident-prone areas. From research results It was found that the Jalan Timor Raya Km 02 - Km 11 Kupang section was included in the black category site, where at Km 07, BKA = 142, UCL = 141 and Km 08, BKA = 142, UCL 39. So BKA and UCL on these road sections exceed the control limit for the number of accidents.

Hairudin (2013) this research was conducted to determine the factors causing accidents, to determine DRK, multi-criteria analysis is used, from the results of the study it can be sorted that the Kayu Ara Village Road Km.91+500; km. 91+920 and Jalan Dusun Betung Pulau Village Tonang Km.109+231 Landak Regency is in the category of low DRK and moderate with weights (0-15) and (16-30). Some roads that enter in high DRK are: Jalan Seliung Km. 50+960 Pontianak Regency, Liansipi Village Road Km. 89+300, Hamlet Beres Street Tonang Village Km. 117+890 and Jalan Dusun Simpang Paser, Sidas Village km. 150+400 all three are included in the Landak Regency area.

Rifai and Sriyanto (2016) conducted research to minimize the occurrence of work accidents experienced by mechanics in automotive workshops, with the method Failure Mode and Effect Analysis (FMEA). In order to expedite the production process and also to find the cause of the frequent occurrence of accidents, the FMEA method was chosen. The result can be seen accidents such as hands hit by elbow ruler, head hit sponges, electrocuted hands and also welding exhaust gases that cause eye irritation accidents with the highest RPN rate of 25.

Wicaksono et al [2] conducted research on the Ungaran – Bawen Highway Section to find out the location and factors of the accident using a computer program SPSS, while the traffic control statistical technique was applied to determine the area accident prone. As a result, there are many factors that cause accidents.

the main factor that causes accidents is human (66.89%). Accident with the type of front collision being the most dominant accident (50.58%), vehicles who are often involved are motorcycles (53.78%). To reduce accidents, road conditions must be paid more attention because of the increased vehicle capacity This causes congestion on the road, so the potential for accidents will be greater.

Hidayati and Hendrati (2016) conducted research on junior high school students in the Wonokromo, the purpose of this study is to determine the relationship between accidents that occur in junior high school students in 2015. The two-stage cluster random sampling method was used in this study involving 100 respondents. driving knowledge, knowledge of using the correct lane and driving speed are important

analysis in this study. The result shows driving knowledge ($p=0.027$; $RR=1,966$), ($p=0,005$; $RR=1,894$) for knowledge of lane usage and speed driving ($p=0.017$; $RR=1.941$) from this conclusion, the accidents that occur are associated with motorcyclists, especially junior high school students.

Marsaid et al (2013) conducted a study on the incidence of accidents on cyclists motor, in this study many factors were analyzed ranging from human factors vehicles as well as the road factor itself, 263 respondents were involved in this study, design Cross Sectional and Logistic Regression data analysis were used to analyze the research this. The results of the study concluded that motorcyclists should be more orderly and obeying traffic signs because the human factor plays an important role in the occurrence of an accident.

Oktopianto et al [3] conducted an analysis of areas and hotspots accidents, to find out the accident-prone areas and points used the EAN, Z . Method score and to analyze accidents by knowing the frequency of accidents in the area the. From the results of the study, it was found that 1 road section, namely the Central Sumatra Cross Road entered

Zanuardi and Suprayitno (2018) conducted a study to analyze the characteristics of accidents, determine black spots and factors that trigger accidents. RapidMiner and SPSS used in research with the Knowledge Discovery in Databases method with data mining. In this study, the results obtained include: 85.9% multiple accidents, Monday become the biggest accident potential, precisely at 20.00-21.00; motorcycle dominate with a percentage (69.61%); the severity level is low (75.9%). During that period the total loss reached Rp. 10.78 Trillion.

Imtihan and Fahmi's (2020) research analyzes vulnerable areas and vulnerable points traffic accidents to reduce the number of accidents, geographic information system (GIS) will later become an information map generated by the blueprint from the analysis results accident-prone areas and areas. The Z-score method and also the cussum in the research that carried out in 2017 the Road Section in Kota Praya Quadrant A, namely Jalan Tuan H Guru Lopan is categorized as an accident-prone road with a standard deviation value of 80.97 and an average of the average accident value is 50.03. The cussum graph explains that the road is a accident-prone areas (blackspots) with a cussum value of 2.25 at Km 1- Km 2 at sta 2– sta 3.

Research by Thoib et al (2014) conducted analytical research in vulnerable areas accidents, surveys and literature review were conducted before collecting research data. The research is located on Jalan Siliwangi-Walisongo at KM SMG 7+200 – KM SMG 8+100. Analysis of vehicle-based accident rate kilometers, distance, and the relationship between variables used as a research method. The results in segment 6, segment 13 and 16 numbers accidents in the segment exceeds the specified limit, the biggest factor of accidents due to the driver's lack of anticipation, so the number of accidents that occur has relationship with the capacity of passing vehicles.

in the category (black site), while for Km 18-26 many factors such as the use of land, road geometry conditions and traffic signs that cause the area to enter in the category (black spot).

Manggala et al (2015) conducted a study on sharp turns to determine causes of frequent accidents and knowing the characteristics of accidents in Bend. The geometric condition of the bend is something that will be assessed from the research this. The results are R Square values of 0.859 and 0.91 being the value of the fatality level of the relationship radius and velocity relationship of this study. These factors are the main factors

the occurrence of accidents at sharp turns, making a rumble stripe when turning and setting a speed limit is an effort to reduce the occurrence of accidents.

Zahiya et al (2017) conducted a study to find out which vehicles frequently used involved in an accident and the geometric characteristics of roads in Surabaya, using the method Generalized Linear Model and frequency descriptive analysis. The results of the study show Motorcyclists aged 15-25 are more frequently involved in accidents. Volume vehicles: 1845.83 – 12594.03 smp/hour, with a speed of: 19.55 - 55.88 km/hour, wide and number of lanes: 7,4 -28.0; 2-6, for road shoulder width: 0-3 m.

2. METHODS

The material used in this research is secondary data. Where is the data secondary is a data report in a certain time along the way Yogya - Wonosari, Gunungkidul Regency. Consists of the time of the incident, the number of victims of the accident, the number of accident losses, and the type of vehicle involved in the accident.

Accident Prone Area

According to Bolla et al (1999) Traffic accident-prone areas can be defined if: an area has a high accident rate and exceeds the number of average accidents and occur repeatedly, in close time at the same place relatively the same. For the criteria for vulnerable areas in urban areas, the length of the segment is 100 meters - 300 meters, while 0.3 kilometers - 1 kilometer for roads outside the city.

An area can be called accident-prone if a segment has the following characteristics, following:

1. Over a period of time, the accident rate (per vehicle-kilometer) exceeds predetermined value.
2. In a certain period of time, the number of accidents (accidents/kilometers) exceeds predetermined value.
3. Values (1) and (2) exceed the predetermined limit.
4. The critical value of the accident rate exceeds the existing analysis data.

Factors Causing Accident

According to Austroads (2002) human factors, vehicles, and the road environment, become the cause of the accident and also the relationship of two or more of these factors.

1. Human factor

Humans are the most frequent factor or the main cause traffic accidents, whether driving or walking. Traffic violations are the initial cause of accidents. Driver and road users play an important role in the occurrence of these accidents, There are various causes, such as poor hearing, response when driving is lacking, as well as behavior violating traffic signs.

2. Vehicle Factor

Driving safety is a factor value that has been designed by the factory, by producing safe and comfortable motorized vehicles according to road conditions. The condition of the brakes, lights, oil and support halme when driving must always be considered when you want to drive. With attention things like the above, it can reduce the number of accidents, the number of victims and also reduce vehicle damage when driving.

3. Road Conditions and Natural Factors

The cause of the accident can be caused by the condition of the damaged road or not functioning of traffic signs, road markings, and traffic lights. Weather factor too be the cause of traffic accidents. In making the road, of course, pay attention and calculated both from the width of the road.

Accident Classification based on LLAJ Law No. 2 Year 2009 Article 299

The characteristics of traffic accidents can be classified into three groups: based on LLAJ Law number 22 of 2009 article 229, namely:

1. Minor Traffic Accident, if the accident results in a damage to vehicles or goods.
2. Moderate Traffic Accident, if the accident results in vehicle damage and minor injuries.
3. Heavy Traffic Accident, if the accident causes damage vehicle, the victim died and was also seriously injured.

Accident Rate

For the calculation of the number of accidents by ranking the quality control statistics, then the AEK (Accident Equivalent Rate) method is used. This method is used for analyze an area to find out where the highest accident point is. Body Research and Development Department of Kimpraswil (2004), made a formula for use determine the formula that can calculate the accident value, namely:

$$AEK = 12MD + 3 (LB+LR) + K(1).....(3.5)$$

Information:

MD = Died (soul)

LB = Serious injury

LR = Minor injury

K = Number of accidents and material losses

The next method to determine the prone area is the Z-score method. Z-score is the number Z or the standard number or the standard number. The number Z is obtained from the example which is size n. To find the Z-score value, the Z formula can be obtained with the formula as following:

$$Z_i = \frac{X_i - \bar{X}}{S} \dots \dots \dots (3.5)$$

Information:

Z_i = Accident Z-score score

X_i = number of accidents per segment

S = Standard deviation

= Average number of total accidents

Classification to determine the prone area is as follows:

Table 3.1 Classification of accident prone Areas

NO	Z-SCORE	CRITERIA
1	Positive Value (0.)	Accident Prone
2	Negative Value (-0.)	Not Accident Prone

Source: (Austroad, 1992)

If the value of the Z-score calculation results in a positive value, then it can be said the area has an accident rate below the average, while a negative value in Z-score calculation shows the results of the accident above the average. The road section that has calculation with a negative result, then the road segment is included in the area not accident prone, and vice versa.

3. RESULTS AND DISCUSSION

Traffic Accident Analysis 2020

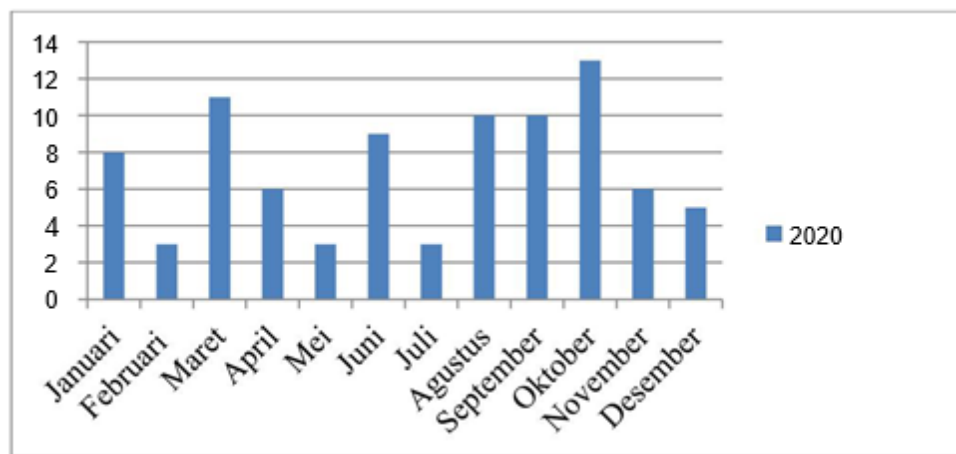
The number of traffic accidents on Jalan Yogya – Wonosari in 2020 can be seen from table 5.1

Table 5.1 Number of accidents on Jl.Yogya-Wonosari Regency Gunungkidul Year 2020

ACCIDENT PER MONTH	YEAR 2020	ACCIDENT PER MONTH	km. 18-24	km. 24-30	km. 30-36
January	8	January		4	4
February	3	February	1	1	1
March	11	March	4	3	4
April	6	April	1	3	2
May	3	May		1	2
June	9	June	4	3	2
July	3	July	1	1	1
August	10	August	2	1	7
September	10	September	5	2	3
October	13	October	6	1	6
November	6	November	2	2	2
December	5	December			2
AMOUNT	87	AMOUNT	2 28	1 23	36

Source: Gunungkidul Police

Graph 5.1 Graph of Accidents



From the table or graph above, it can be concluded that the number of incidents in 2020 as many as 87 accidents, October is the month with the most accidents namely 13 accidents. Km.30 to Km.36 is the most vulnerable segment with a total of 36 incident.

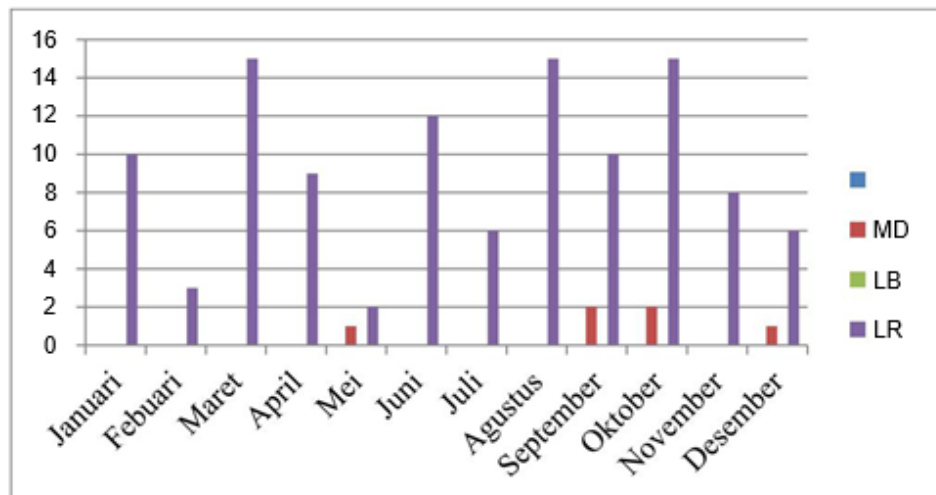
Accident Victim Class Analysis

Table 5.2 Data on the Number of Accident Victims

MONTH	VICTIM		
	MD LB		LR
January	0	0	10
February	0	0	3
March	0	0	15
April	0	0	9
May	1	0	2
June	0	0	12
July	0	0	6
August	0	0	15
September	2	0	10
October	2	0	15
November	0	0	8
December	1	0	6
AMOUNT	6	0	111

Source: [Gunungkidul Police](#)

Graph 5.2 Class of Accident Victims



Information :

MD : Died

LB : Seriously injured

LR : Minor Injury

The accident victims in the table and graph above can be seen that the victims Minor injuries became the victims with the highest number with 111 victims and victims 6 died, for March, August, and October are the months with a total of 15 incidents.

Vehicle Type Analysis

Table 5.3 Data on the Number of Accidents by Vehicle Type

Accident AN PER MONTH	AMOUNT Accident AN	SEPED A MOTO R	PIC K UP	BUS/MINIB US	TRUC K	STUDENTS N FEET
January	8	11	1	4	1	1
February	3	3		1		1
March	11	18				1
April	6	10				
May	3	14				1
June	9	12		3		1
July	3			1		
August	10	3		5		2
September	10	10 12	1			1
October	13	16		5 6		
November	6	5		4		
December	5	6		2		1
AMOUNT	87	120	2	31	1	9

Source: [Gunungkidul Police](#)

In the table above, it can be seen that motorcycles are the vehicles with the most accidents with a total of 120 vehicles, then buses/minibuses with a total of 31 vehicles.

Analysis of the Number of Accidents by Type of Accident

The types of accidents on the Yogya – Wonosari road section can be seen from the table below this:

Table 5.5 Data on the Number of Accidents by Type of Accident

Accident PER MONTH	AMOUNT KAAN	FRONT FRONT	FRONT REAR ANG	FRONT G	BERUN TUN	LACQUER A GGAL	PEDESTRIAN FOOI
January	8	3	2		1	1	1
February	3	1				1	1
March	11	3	1	3		3	1
April	6	1	2			3	
May	3	2				1	
June	9	1	3	1		4	
July	3	1				1	1
August	10			3	1	4	2
September	10	2	4		1	2	1
October	13	1	4	1	1	5	1
November	6	2	2			2	
December	5	2	1			1	1
AMOUNT	87	19	19	8	4	28	9

Source: Gunungkidul Police

From the table data above, it can be concluded that the most common types of accidents are: occurred was a single accident with a total of 28 incidents.

Accident Analysis With Occurrence Time

Table 5.5 Data on Number of Accidents with Time of Occurrence

ACCIDENT PER MONTH	AMOUNT ACCIDENT	00.00 up until 06.00	06.00 up to 12.00	12.00 up to 18.00	18.00 up to 24.00
January	8		4	3	1
February	3	1		1	1
March	11		7	1	3
April	6		3	2	1
May	3		1	1	1
June	9		3	5	1
July	3	1		1	1
August	10	2	4	3	1
September	10		2	4	4
October	13		5	6	2
November	6	1	1	2	2
December	5		3	1	1
AMOUNT	87	5	33	30	19

Source: Gunungkidul Police

Table 5.6 Accident Material Loss Data

ACCIDENT PER MONTH	MATERIAL LOSS
January	Rp 5,200,000.00
February	Rp. 1,300,000.00
March	Rp. 8,750,000.00
April	Rp. 1,100,000.00
May	Rp. 1,600,000.00
June	Rp. 1,400,000.00
July	Rp. 350,000.00
August	Rp. 3,400,000.00
September	Rp. 5,250,000 .00
October	Rp 15,600,000.00
November	Rp 3,300,000,00
December	Rp 1,600,000.00
AMOUNT	Rp 48,850,000,00

Source: Gunungkidul Police

From the table above, it can be concluded that the most vulnerable time of occurrence is at 06.00– 12.00, while for losses during accidents in 2020 it is Rp. 48,850.000,00.

Accident Equivalent Rate Analysis (AEK)

In determining accident-prone areas, the method used is Figure Accident Equivalent (AEK). Where to use the weighting ratio $(12MD+3(LB+LR)+K(1))$. With the following calculations:

KM.18 – KM.24

$$AEK = (12.2 + 3(0+35) + 28) = 157$$

KM.24 – KM.30

$$AEK = (12.2 + 3(0+30) + 23) = 137$$

KM.30 – KM.36

$$AEK = (12.1 + 3(0+48) + 36) = 192$$

The calculation results are obtained by knowing the number of victims who died (MD), minor injuries (LR), and serious injuries (LB) and also the amount of loss per accident. The calculation results from the AEK are then entered in the form of the table below.

Table 5.7 Ranking by AEK

NO	Roads Yoga – Wonosari	AEK value				Total AFK	Rank
		MD	LB	LR	K		
1	KM.18 – KM.24	24	0	105	28	157	2
2	KM.24 – KM.30	24	0	90	23	137	3
3	KM.30 – KM.36	12	0	144	36	192	1

From Table 5.7. resulting in the highest ranking obtained on the Yogya Road Section – Wonosari which is located at (KM.30 – KM.36) which is 192.

Z-score analysis

To identify accident-prone areas, the Z . analysis method is also used scores. This formula is used to determine the average growth of accidents and an accident-prone area on the Yogya – Wonosari Road Section, Gunungkidul Regency.

$$Z_i = \frac{X_i - \bar{X}}{S} \dots \dots \dots (5.3)$$

Z_i = Accident Z-score score

X_i = number of accidents per segment

S = Standard deviation

-average total accident rate

Table 5.8 Results of Z-score Analysis of accident prone areas

No.	Section Name	Year	Z-score	Criteria
		2020 events		
1	km.18 – Km.24	28	-0.186771842	Not Prone Accident
2	Km.24 – Km.30	23	-1.120631051	Not Prone Accident
3	Km.30 – Km.36	36	1.307402893	Accident Prone

Source: Analysis Results, 2020

From the table above, it can be concluded that the Yogya - Wonosari District Road Section Gunungkidul which starts from km.18 to km.36, which is categorized as a vulnerable area the accident occurred on the segment km.30 to km.36. Having the highest number of accidents is in table number 3, with a total of 36 occurrences, and the value of Z-score (1.307402893).

4. CONCLUSION

Based on the analysis that has been done, it can be concluded as follows:

- 1) In 2020 on the Yogyakarta-Wonosari Road, Gunungkidul Regency, Km.30 up to Km.36 to be the most accident-prone area, both for AEK analysis and Z-score with a value of 192 and 1.307402893.
- 2) Based on the results of data analysis, the most accident victims are victims of minor injuries with a total of 111 people, 6 people died. vulnerable hours accidents at 06.00 – 12.00, single accidents become types of accidents mostly dominated by motorcyclists. Total material loss in a year to reach Rp. 48,850.000,00.
- 3) The most dominant factor causing the accident that occurred was the negligence of the driver, it can be seen from the analysis that a single accident occurs at most with a total of 28 events. Another factor is the lack of availability supporting infrastructure on Jalan Yogya – Wonosari.

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