

TRAFFIC ACCIDENT POINT ANALYSIS, ON PRIMARY ARTERIAL ROAD- SUKABUMI DISTRICT

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ABSTRACT

The increasing number of residents every year causes the need for transportation to also increase, this also occurs on the Sukabumi-Bogor Primary Arterial Road which is a road with a fairly high volume of traffic flow, in addition because the industrial center and tourism sector are located right on the national road, Insufficient geometric roads caused by the increasing number of vehicles is also a factor that affects the high number of traffic accidents along the Cibadak – Bogor Road. The purpose of this study was to analyze the characteristics of the accident-prone areas (blackspots) on the Jl. Surya Kencana, Pamuruyan Village, Cibadak District - Jl. Raya Ciutara, Pondok Kaso Landeuh Village, Parungkuda District. The method used in this study is the EAN (Equivalent Accident Number) method and the Cussum (Cumulative Summery) method. From the results of the weighting using the EAN method, it was identified that STA 1, STA 4, STA 5, and STA 6 were blackspots. Meanwhile, the Cussum method identified STA 1, STA 4, STA 5, STA 6, and STA 9 as blackspots. The right type of handling for accident-prone locations from the observations, among others, is making a thunder strip facility close to the zebra cross area to reduce vehicle speed and installing a safety fence on the shoulder of the road so as to minimize road crossings that directly cross the road without using zebra cross facilities.

Kata Kunci: traffic; accident, blackspot; EAN Method (Equivalent Accident Number).

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INTRODUCTION

Safety, security, comfort and efficiency of a road section are things that must be owned in geometric road planning (Elly, 2006). Specifications such as road alignment planning, road bodies consisting of road shoulders and traffic lanes, bends, road slopes, as well as improvements and embankments need handling to improve road performance (Paikun, Reffy W Andriani SP, et al. 2021). Good road performance can be an influence on road conditions and can run in traffic. And vice versa if the performance is especially close to boring congestion or traffic jams on the road at peak traffic times (Paikun, Suminar, et al. 2021).

Transportation needs that increase along with the increase in population will indirectly trigger traffic problems (Amiruddin, 2019). Aspects such as road geometry, people, and vehicles are the main factors in traffic problems. Currently, the handling of traffic accident-prone locations, including the definition, and priority of modifications has attracted attention and is used as an approach to improve the level of traffic safety on roads (Aghajani et al., 2017).

Population growth causes the volume of traffic on a road to increase. The traffic volume that is not in accordance with the geometric capacity of the road causes the road to accommodate more than the road performance capacity, it has an impact on the decline in road service performance, resulting in various activities being disrupted. This indirectly raises the risk of traffic accidents. The accident itself consists of 4 types, namely Fatal Injury Accidents or Death, Serious Injury Accidents, and Minor Injury Accidents.

Accident cases are difficult to minimize and increase as the length of the road increases and the number of vehicle movements increases. The increase in the number of transportation caused by a busy population with the growth of problems in the field of traffic on the Cibadak - Bogor National

Road section. Traffic problems usually grow faster than attempts to solve transportation problems, resulting in time getting worse as time goes on.

Cibadak National Road - Bogor is a road that connects Sukabumi Regency and Bogor Regency. This makes the road segment has a heavy traffic volume, with various activity centers such as offices, development centers, industrial and tourism sectors that cause various kinds of traffic problems. This condition of course causes traffic to become congested and this can lead to various traffic problems such as frequent traffic jams and accidents on the Cibadak - Bogor National Road section.

Traffic accidents are caused by many factors. The condition of the road surface is uneven, bumpy and many holes in each lane. The holes on the road surface are sometimes not visible to the vehicle driver, the consequences are very fatal. It is necessary to improve the road surface so that it can be passed safely and comfortably. Motorized driving requires comfort and safety so that drivers can arrive at their destination on time (Syaiful.S, Lasmana.L, 2020; Syaiful.S, Akbardin.J, 2020).

Research purposes

1. To identify the location of the blackspot traffic accident-prone points on the Jl. Surya Kencana, Des.Pamuruyan, Kec. Cibadak – Jl. Raya Ciutara, Dec. Pondok Kaso Landeuh, District Parung Kuda.
2. To obtain alternative handling at the location of traffic accident-prone points (blackspot) to reduce the accident rate on Jl. Surya Kencana, Des.Pamuruyan, Kec. Cibadak – Jl. Raya Ciutara, Dec. Pondok Kaso Landeuh, District Parung Kuda.

Basic Theory

Ranking With EAN (Equivalent Accident Number) Calculation. The weighting of human victims uses the EAN method (Pignataro, 1973), which is the weighting of the accident equivalent number referring to the cost of traffic accidents. EAN is calculated by adding up the incidence of accidents for each kilometer of road length and then multiplied by the weight value according to the severity level.

One method to calculate the number of accidents is to use the EAN (Equivalent Accident Number) method, which is a weighting of the equivalent number of accidents based on the cost of traffic accidents. The weight value adjusted for severity multiplied by the number of accidents on each road STA is a way of using EAN (Pignataro, 1973).

EAN is calculated by adding up the incidence of accidents for each kilometer of road length and then multiplied by the weight value according to the severity level. The standard weight values used are Death (MD) = 12, Serious injury (LB) = 6, Minor injury (LR) = 3, Damage to vehicle (K) = 1 (Soemitro, 2005).

EAN formula:

$$EAN = 12 MD + 6 LB + 3 LR + 1 K \quad (1)$$

It can be declared as an accident-prone area if the EAN value obtained exceeds the stipulation limit. The Upper Control Limit (BKA) and Upper Control Limit (UCL) in the EAN method are used in determining the boundaries of disaster-prone areas.

1) Upper Control Limit Method (BKA)

The upper control limit method is a method for identifying limits on the level of accidents with the average value of all accidents that occur, with the following equation (Bolla, 2013):

$$BKA = C + 3 \sqrt{C} \quad (2)$$

Where:

C = Average accident rate (EAN)

2) Metode Upper Control Limit (UCL)

The upper control limit method is a method for determining the accident-prone area with the highest accident-prone level, so that the accident point is obtained. With the equation below:

$$UCL = \lambda + \Psi \times \sqrt{([\lambda/m) + (0,829)/m + (1/2 \times m)]}$$
 (3)

Where:

λ = Average accident EAN

Ψ = Probability factor 2.576

m = Unit of Exposure, in kilometers

It can be seen in Table 1. The probability factor value (Ψ), which is often used is 2,576 with a probability of 0.005 and 1.645 with a probability of 0.05.

Table.1 Probability Factor Value (Gito and Ari 2017)

Probability	Ψ
0,005	2,576
0,0075	1,96
0,05	1,64
0,075	1,44
0,10	1,282

Segments above the road with accident rates that are within the control limits of the above road sections are accident-prone areas (Department of Settlement and Regional Infrastructure, 2004).

Cumulative Summer (Cussum)

Cussum is a method of determining blackspots by looking at the cusum graph which is a meetoddee in determining quality in detecting the mean value (Austroad, 1992. Cusum values can be searched with the following equation:

1. Finding the Mean Value (W)

Calculations to find the mean value of secondary data can be seen in the equation below:

$$W = \frac{\sum xi}{L \times T}$$
 (4)

Where:

W = Mean Value

$\sum i$ = Number of Accidents

L = Number of Stations

T = Time / period

$$S1 = Xi - W$$
 (5)

Where :

S1 = First year cussum

Xi = Number of accidents per segment in the first year

$$S2 = (S1 + (X2 - W))$$
 (6)

Where:

S1 = First year Cussum

S2 = Second year Cussum

X2 = Number of accidents per segment in the second year

$$S3 = (S2 + (X3-W))$$
 (7)

Where :

S2 = Second year Cussum

S3 = third year Cussum

X2 = Number of accidents in the third year

The classification in determining accident-prone points (black spots) in Table 2 is as follows:

Table.2 Classification of Accident-Prone Point Determination (Austroad, 1992)

No.	Cussum Score (S ₁)	Criteria
1.	Positif value (0,)	Accident-prone
2.	Negatif value (-0,)	Not prone to accidents

RESEARCH METHODS

Research Location

This research is located on the Primary Arterial Road, Sukabumi Regency, while the traffic accident-prone areas are analyzed along ± 10 km, starting from JL. Surya Kencana (Pamuruyan Cibadak Bridge) – Jl Raya Ciutara, Parungkuda.

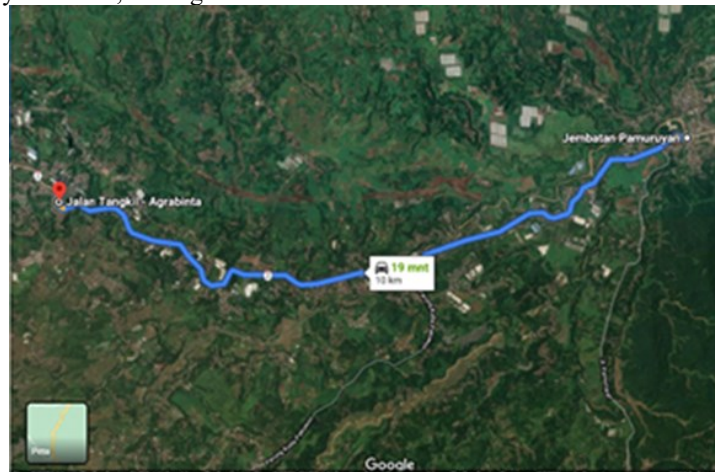


Figure 1. Research Location

Research flow chart

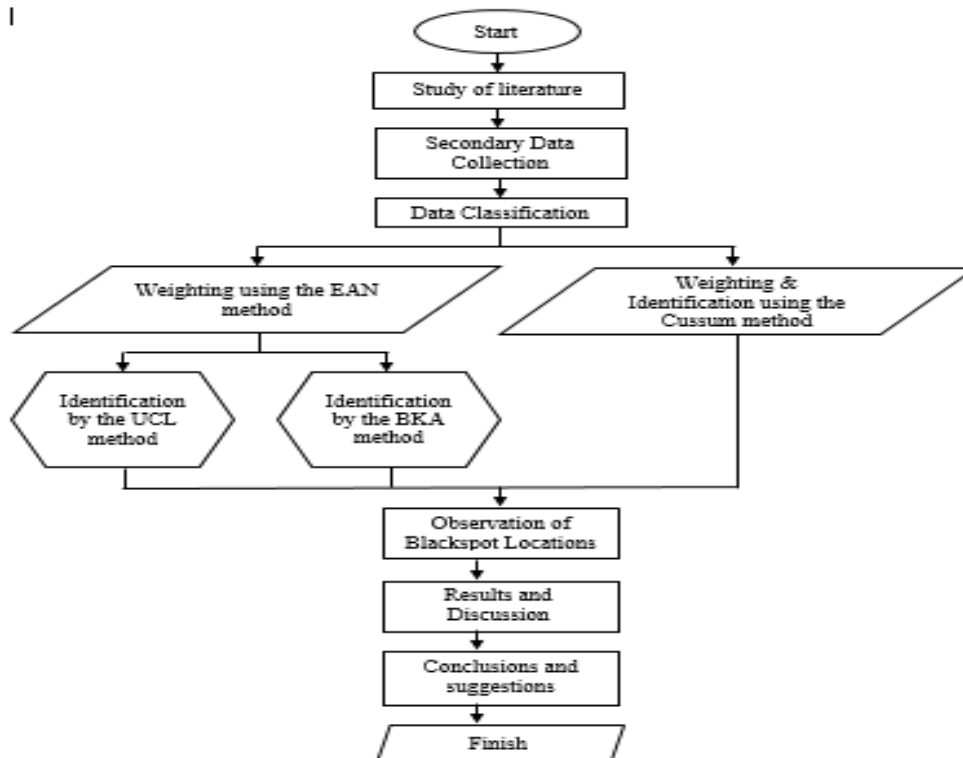


Figure 2. Research flow

RESULTS AND DISCUSSION

Based on the number of traffic accidents

The number of traffic accidents on Suryakencana Street, Des. Pamuruyan, Kec. Cibadak - Raya Ciutara Street, Des. Pondok Kaso Landeuh, Kec.Parung Kuda, from 2018 to 2020 experienced an up and down graph.

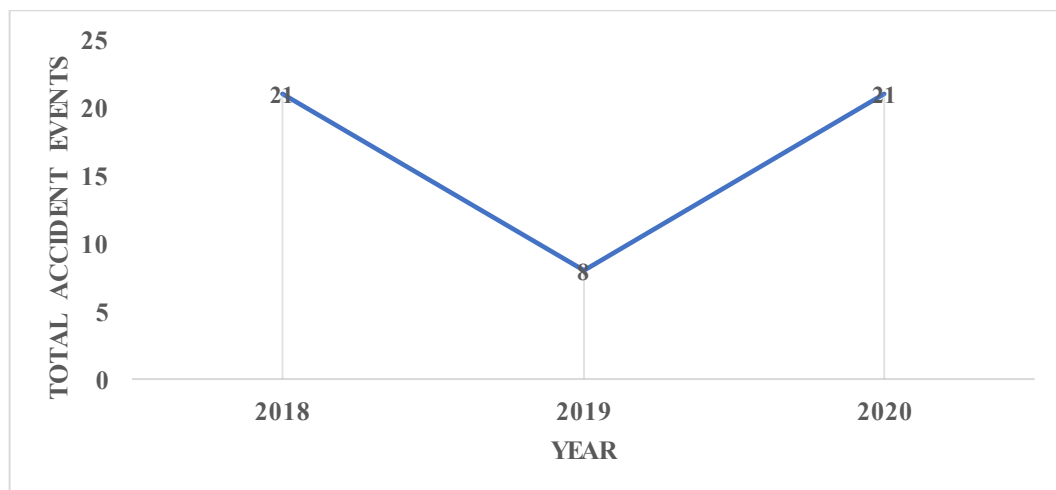


Figure 3. Number of Traffic Accidents

Road User Engagement

From 2018 to 2020 on Suryakencana Street, Des. Pamuruyan, Kec Cibadak - Raya Ciutara Street, Des. Pondok Kaso Landeuh, Kec. Parung Kuda, showed that the most involved types of vehicles were motorbikes with 47 vehicles, 17 large trucks, 16 pedestrians, 13 mini buses, small trucks and pick-up / colt boxes respectively 7 vehicles and 1 bus each can be seen in Figure 4.

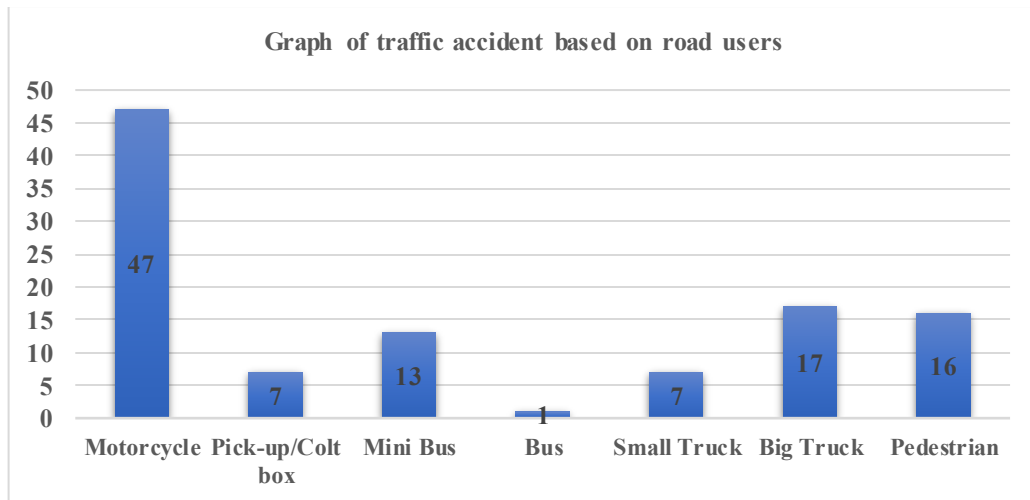


Figure 4. Road User Engagement

Fatalities

In the Suryakencana Street section, Pamuruyan Village, Cibadak District - Raya Ciutara Street, Pondok Kaso Landeuh Village, Parung Kuda District from 2018 to 2020, 33 people died, 12 were seriously injured, and 35 people were slightly injured seen on figure 5.

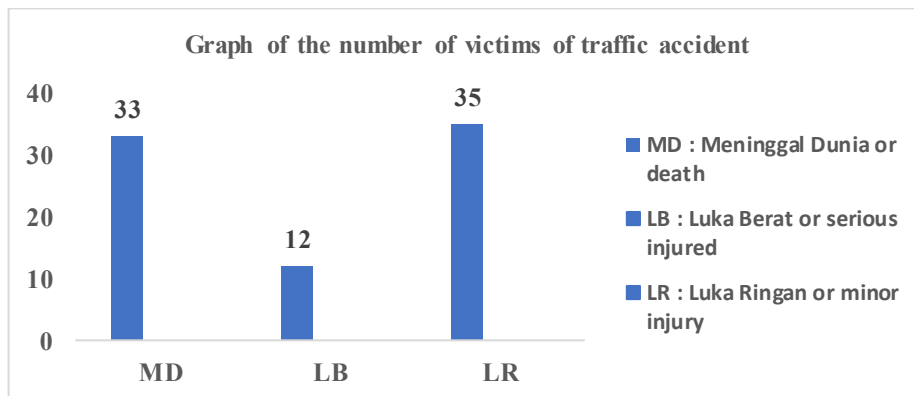


Figure 5. Fatalities Level

Time of Accident (Hours)

The results of the analysis based on the time of the accident can be seen in Figure 6 that the highest accidents occurred during busy hours, namely 06.00 - 12.00 hours with a total of 22 accidents (44%). Whereas the time for the least number of accidents was in the early morning hours between 00.00 - 06.00 with 5 accidents, data can be seen in Figure 6.

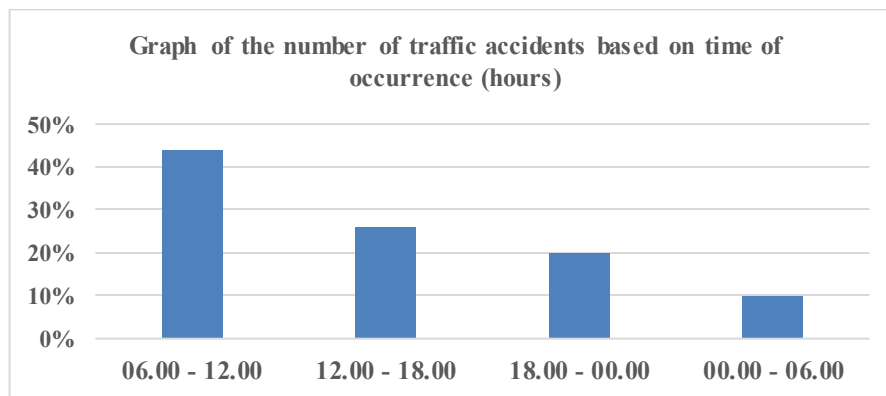


Figure 6. Time of Traffic Accident

Weighting Analysis Using the EAN (Equivalent Accident Number) Method

After the accident data is obtained from the Satlantas Polres Sukabumi Regency, the data on victims of death, serious injuries, and minor injuries is divided based on the location of the incident or each STA, then weighting is applied to the EAN method. STA which has an EAN value large can be identified as a Blackspot if the value of EAN exceeds the value of the Upper Crisis Limit or Upper Control Limit. The results of the EAN weighting can be seen in table 3 below:

Table 3. Weighting Results of EAN

NO	Station	VICTIM			Accident Rate EAN	Ranking
		MD	LB	LR		
1	STA 0,000 - 1,000	7	0	3	93	1
2	STA 1,000 - 2,000	4	0	1	51	6
3	STA 2,000 - 3,000	2	3	2	39	8
4	STA 3,000 - 4,000	4	2	5	69	4
5	STA 4,000 - 5,000	4	2	6	72	3
6	STA 5,000 - 6,000	5	2	4	78	2
7	STA 6,000 - 7,000	0	0	0	0	10
8	STA 7,000 - 8,000	2	3	3	42	7
9	STA 8,000 - 9,000	3	0	9	63	5
10	STA 9,000 - 10,000	2	0	2	30	9
AMOUNT		33	12	35	537	

Analysis of Accident Prone Areas with BKA (Batas Kritis Atas)

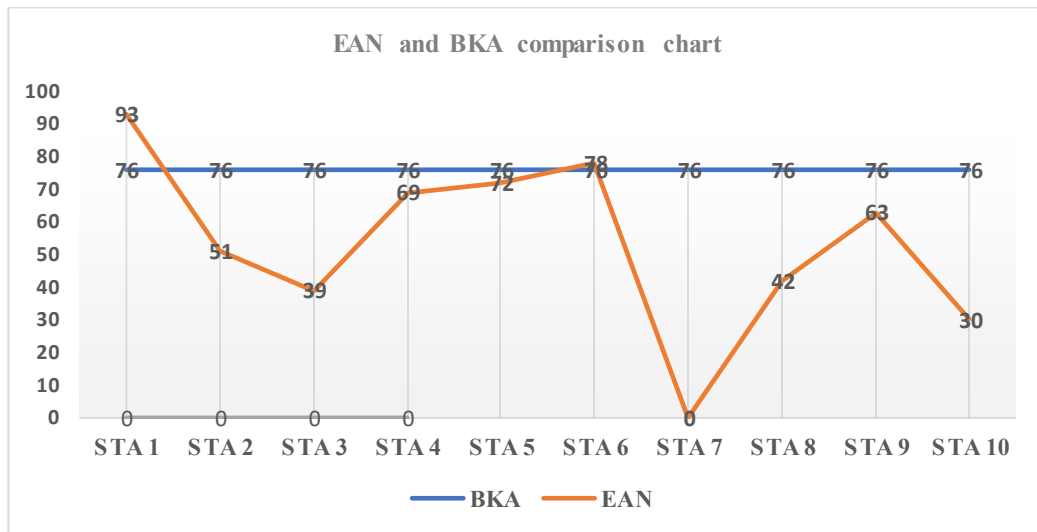


Figure 7. Value of EAN to BKA

Figure 7 above explains that STA 1 with EAN 93 and STA 6 with EAN 78 are identified as blackspots because they have a higher EAN than BKA.

Analysis of Accident Prone Areas with Upper Control Limit (UCL)

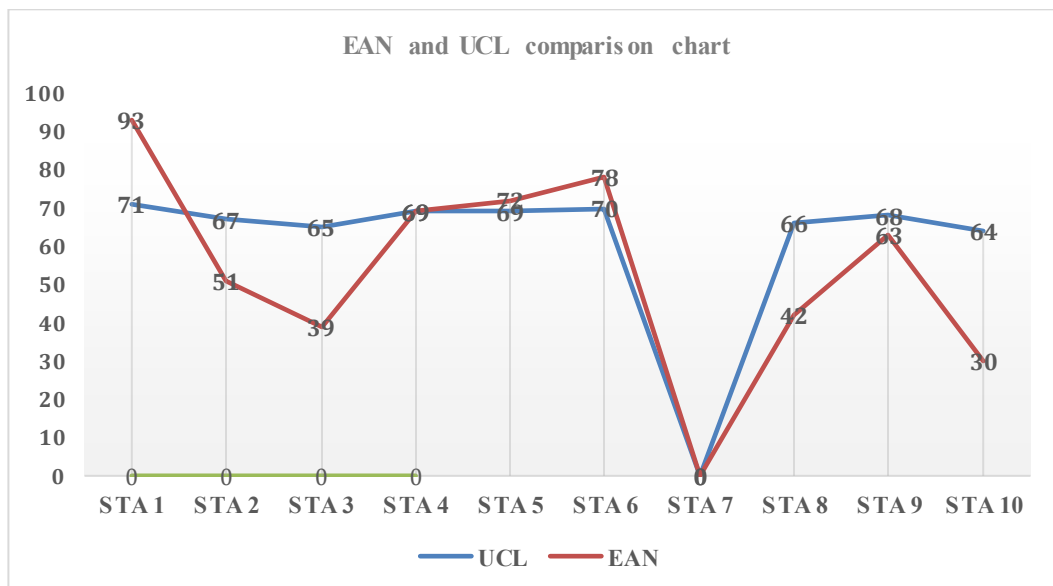


Figure 8. Comparison of EAN and UCL

Figure 8 above explains that the STA which has an EAN value greater than the UCL value is STA 1 with an EAN value of 93 from the UCL value of 71, and STA 5 with an EAN value of 72, and a UCL value of 69, then STA 6 with an EAN value of 78 from the UCL value of 70. The results of the analysis using this method, there are 3 STAs that have an EAN value greater than the BKA value so that the 3 STAs on the road are categorized as accident-prone STAs according to UCL.

Blackspot Analysis Using the Cussum Method

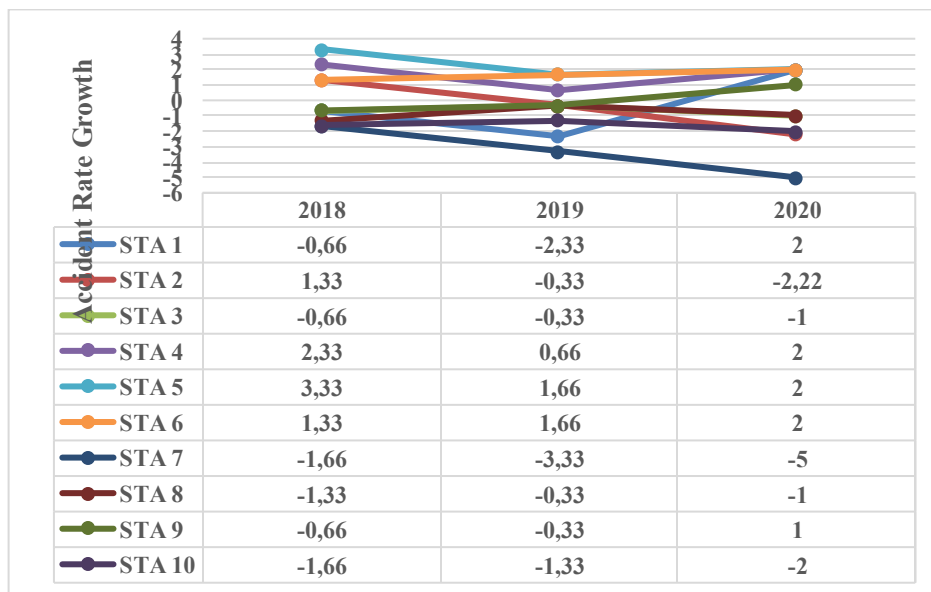


Figure 9. Graph of Blackspot Analysis Using the Cussum Method

Based on the results of the analysis with the Cussum method, the identified points / STA prone to traffic accidents on Suryakencana Street, Cibadak – Raya Ciutara Street, Cicurug are located at STA 1, STA 4, STA 5, STA 6, and STA 9.

Existing Condition

After the blackspot identification process, direct observations were made in the field to find out problems related to road facilities and utilities as well as driver behaviors that were considered dangerous and resulted in traffic accidents. STA 1 starts from JL. Surya Kencana (Pamuruyan Bridge) – JL. Siliwangi (Ongkrak gas station). This area has a road length of approximately 1 km, geometrically there are climbs and descents combined with bends, in the middle of this area or approximately 0.500 km from the Pamuruyan bridge there is a Cikidang-Plabuhan Ratu intersection, on the edge of the road there are clinics, schools, and shops. which shows that this area is a fairly crowded area during peak hours, in addition to the existence of high schools, intersections, and other public facilities, this area has quite a lot of pedestrians and public transportation waiting for prospective passengers. The following is the existing condition of STA 1 on the JL road section. Surya Kencana (Pamuruyan Bridge) – JL. Siliwangi (Ongkrak gas station) as follows:



Figure 10. Existing Condition of STA 1

Finding problems related to road facilities, driver behavior and the surrounding community based on observations at STA 1, among others, there are bumpy roads and potholes, project vehicles or factory logistics carriers entering and leaving the road area making the roads dirty with sand and soil, zebra crossings or bridges. This road crossing can endanger public road pedestrians, guardrails are no longer feasible, and also other problems such as piles of household garbage on the side of the road, which is dangerous if garbage is spilled onto the highway and is run over by two-wheeled vehicles, invisible roadside lines. There are quite a lot of street lights but only a few work, some are even blocked by tree branches,

CONCLUSION

This study has identified the characteristics of areas that often occur in traffic accidents. From the results of survey data processing using the EAN method, it was found that the BKA crisis limit (Upper Control Limit) at STA 1 with EAN 93, and STA 6 with EAN 78 had an EAN value higher than the BKA determination value of 76. This means that The area is an accident-prone area. At the UCL crisis limit (Upper Control Limit), it is known that STA 1 with EAN 93 is higher than UCL 71, STA 5 with EAN 72 is higher than UCL 69, and STA 6 with EAN 78 is higher than UCL 70 based on the blackspot point determination. Meanwhile, using the Cussum method, it was identified that STA 1, STA 4, STA 5, STA 6, and STA 9 on the Jl. Surya Kencana, Pamuruyan Village, Cibadak District – Jl. Raya Ciutara, Pondok Kaso Landeuh Village, Parung Kuda District is an accident-prone area (Blackspot). The results of the observations show that in accident-prone areas there is a lack of complete infrastructure and road markings, therefore it is recommended to related parties to avoid adding border lines to road bodies, adding accident-prone warnings, procuring non-permanent roads, repairing damaged roads in segment Jl. Surya Kencana, Pamuruyan Village, Cibadak District – Jl. Raya Ciutara, Pondok Kaso Landeuh Village, Parung Kuda District in an area that is an accident-prone area (Blackspot). Apart from that, it is necessary to increase supervision by taking firm action against traffic violators. The public needs to be aware of driving to obey the existing traffic rules for the sake of mutual safety.

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