Analysis of Black Spots on Jl. Raya Kakap Kubu Raya District With Z-Score Method

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<th>ABSTRACT</th>
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<td>Kebu Raya is a district in West Kalimantan Province. It is directly adjacent to Pontianak City, the province's capital. This condition increases mobility and vehicle traffic, resulting in a relatively high accident rate. Traffic accident data came from the Kebu Raya Regency Police Station, and field observations obtained data on road condition and completeness. The analysis methods used are weighting, Z-Score, and CUSUM (Cumulative Summary). The number of accidents in Jalan Raya Kakap during 2020 - 2022 amounted to 26 incidents. The characteristics of traffic accidents on Jalan Raya Kakap for three years (2020 - 2022) are that victims with minor injuries are more than victims of death and serious injuries, namely seven victims in 2020, 8 victims in 2021, and 18 victims in 2022. STA points 0 - 1 have the highest number of accidents during the 3-year period, which is 152 STA points. 2-3 by 129, and point STA. One black spot falls into the high accident vulnerability category: point STA. 0-1. Two black spots fall into the high accident vulnerability category: STA points. 2-3 and STA. 7-8. Four black spots fall into the medium category. Three black spots fall into the low category. Moreover, four points are categorized as not accident-prone.</td>
<td>* Corresponding Author <a href="mailto:heriazwansyah@civil.untan.ac.id">heriazwansyah@civil.untan.ac.id</a> Citation: Azwansyah, H. (2024). Analysis Black Spots on Raya Kakap Road Kubu Raya District With Z-Score Method. Jurnal Teknik Sipil (JTS) Vol. 24, 2. p.957-963. <a href="https://doi.org/10.26418/jts.v24i2.72389">https://doi.org/10.26418/jts.v24i2.72389</a> Submitted: 04 November 2023 Accepted: 03 June 2024 Revised: 28 May 2024 Published: 03 June 2024 Publisher's Note: JTS stays neutral about jurisdictional claims in published maps and institutional affiliations</td>
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| Keywords: Weighting Method, Z-Score, Accident Rate, Black Spot, Jl. Raya Kakap. |

1. Introduction

An unexpected and unintentional event on a road involving one or more vehicles that results in human injury or property damage is typically referred to as a traffic accident. According to the World Health Organization, an incident involving at least one vehicle on the road resulting in injury, property damage, or financial loss to the owner qualifies as a traffic accident (Anisarida & Santosa, 2019).
Traffic accidents are a critical traffic issue that demands strict consideration. Therefore, a thorough investigation of the causes of such accidents is crucial. The outcomes of this research will lead to developing strategies that can effectively minimize these accidents. The study of accidents can also utilize traffic accident data (Lestari & Anjarsari, 2020).

In several developing countries, the number of deaths caused by road traffic accidents continues to increase every year. Developing countries make up around 90% of worldwide traffic accidents ((Suwarto & Nugroho, 2019). Road safety is a pressing concern in developed countries, and it is essential to reduce the frequency of accidents (Fahza & Widyastuti, 2019). Safety is a factor needed by every human being, including safety in transportation (Ruktiningsih, 2017). The government acts as a watchdog, assuming responsibility for the safety of road users and preventing accidents.

Traffic accidents are a vital road safety indicator (Putra et al., 2021). Traffic accidents are a significant problem for the community (Sugiyanto & Fadli, 2016). Traffic accidents pose a significant issue for the community. To enhance transportation safety, one can identify and manage accident-prone areas. So far, accident prevention anticipation has been carried out by looking at accident data that has occurred. Meanwhile, an event that almost causes an accident escapes observation and is considered a regular occurrence (Suhadi & Rangkuti, 2019). The government must furnish quality traffic provisions to minimize traffic accidents. Efforts to enhance safety also consist of general proposals for improvement and are limited to the findings of current analytical calculations and evaluations of locations susceptible to accidents (Lestari et al., 2022).

Traffic safety is a crucial aspect of traffic engineering to ensure safe, comfortable, and cost-effective traffic engineering objectives (Azizah et al., 2021). Additionally, transportation safety is a global concern (Oktopianto et al., 2021). Analyzing road safety can help identify appropriate strategies for addressing areas with a high incidence of traffic accidents (Oktopianto et al., 2021). Traffic accidents are a crucial matter that necessitates study regarding causation, outcomes, and management (Oktopianto & Pangesty, 2021).

Raya Kakap Road is one of the main roads in Kubu Raya Regency, and it has direct access to Pontianak City, the capital of West Kalimantan Province. The status of this road is a provincial road. This road has about 13 stations and spans from Pontianak City to Kubu Raya Regency. The Snapper Highway is one of the roads with many fatal accidents. Therefore, it is essential to study traffic accidents on this road.

2. Materials and Methods

Traffic accidents are a severe problem that must be addressed. Therefore, it is essential to research existing traffic accident data (Lestari & Anjarsari, 2020). Road traffic accidents are caused by several factors related to the traffic system: road users, road environment, and vehicles (Oktopianto et al., 2021). According to Kartika (2009), the characteristics of traffic accidents can be classified into several types of collisions: front hit, rear hit, side hit, cornered hit, consecutive hit, hit-and-run, and lost steering wheel. Many characteristics are related to the influence of the severity of traffic accident victims, namely in terms of age, gender, profession of the victim, type of collision, type of vehicle, and time of accident (Septianingtyas & Mukti, 2019). Traffic accident victims, namely humans who become victims due to accidents based on classification, are divided into 3 (three) types: fatal (death), serious injury, and minor injuries (Aryatama & Widhiarto, 2020).

Traffic accident-prone locations are locations where traffic accidents often occur with specific benchmarks. Namely, there are starting points and endpoints, which include sections (sections of traffic accident-prone lanes) or nodes (intersections), each with a particular length or residue. Road sections within the city are determined to a maximum of 1 (one) kilometer, and outside the city, a maximum of 3 (three) kilometers are determined, and nodes (intersections) with a radius of 100 meters. The grouping of locations prone to traffic accidents, according to the Land Transportation Training Center (1998), includes: (Al Qubro et al., 2022)
1. Black sites or sections are prone to traffic accidents.
2. A black spot is a point on a section prone to traffic accidents (0.03 Sta–1.0 star)
2.1. Study Area
This study took the main road in Kubu Raya Regency, Jl. Raya Kakap. This road is one of the direct access roads to the capital of Kalimantan Barat Province, Pontianak City.

Figure 1. Researched Roadmap

Here is a brief explanation of the Raya Kakap Road:
1. Raya Kakap Road has the status of a provincial road
2. Road type Collector 1
3. Types of Asphalt pavements
4. The road section to be analyzed is at the initial coordinates -0.042510, 109.281749, and the final coordinates -0.060444, 109.175185.
5. Total accident incidents: 31 incidents, identified: 27 incidents and four incidents not identified location.
6. The starting point analyzed is Sta 0, and the end is Sta 13 because it is under the jurisdiction of the Kubu Raya Regency.

2.2. Data
The data used in this study are traffic accident data from the Pontianak City Resort Police (Pontianak Polresta), road maps, and road conditions and equipment for 2020-2022.

2.3. Analysis Method
2.3.1. Accident Rate
Accident rates were calculated per road segment. The accident rate calculations were made in tabular form. The first calculation for this accident rate is the number of human casualties by weighting the secondary data on the number of human casualties, including fatalities, serious injuries, and minor injuries. The weighting is taken from the results of the Transport Research Laboratory (1997): the death toll is multiplied by a weight of 3, the severely injured toll is multiplied by a weight of 2, and the lightly injured toll is multiplied by a weight of 1. The three weighting criteria for accident victims are summed up to obtain the weight of each accident victim.

After obtaining the weighted number of human victims, the number of accidents will be looked at by weighing each secondary data, namely the number of human victims, the number of perpetrators of accidents, and the number of accidents. The weighting is taken from the results of the Transport Research Laboratory (1997), namely the number of human victims multiplied by a weight of 12, the number of accident perpetrators multiplied by a weight of 3, and the number of accidents multiplied by 1. The number of accidents per year per road segment is obtained from the three weighted criteria.
2.3.2. Z-Score Method

Z-Score is a z number or a standard number or standard number. The number z is found from a sample of size n, data X, X, X ....... X with the average X at standard deviation S, so that new data can be formed, namely z, z, z ............ Zn with an average of 0 standard deviations 1.

The z value can be found with the following formula (Hasanuddin, 2023):

a. Find the average of the data

\[ \bar{X} = \frac{\sum X}{n} \] .................................................................(1)

\( \bar{X} \) : Average\n\( n \) : number of road segments

b. Finding standard deviation

\[ S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}} \] ..............................................................................................................(2)

\( S \) = Standard deviation

c. Find the value of \( Z_i \)

\[ Z_i = \frac{(X_i - \bar{X})}{S} \] ................................................................................................................(3)

\( Z_i \) : the z-score value of the accident at location i\n\( S \) : standard deviation\n\( X_i \) : Amount of data at location i\n\( \bar{X} \) : average\n\( i \) : 1, 2, 3, 4, ..., n

<table>
<thead>
<tr>
<th>No</th>
<th>Criteria</th>
<th>Status of Insecurity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Z-Score &lt; 0</td>
<td>Not prone</td>
<td>Incidental events, minor injuries</td>
</tr>
<tr>
<td>2</td>
<td>0 &lt; Z-Score &lt; 1</td>
<td>Low</td>
<td>A rare occurrence, no deaths</td>
</tr>
<tr>
<td>3</td>
<td>1 &lt; Z-Score &lt; 2</td>
<td>Medium</td>
<td>Sometimes, it happens, and sometimes, some victims have died</td>
</tr>
<tr>
<td>4</td>
<td>2 &lt; Z-Score &lt; 3</td>
<td>High</td>
<td>Often occurs, and sometimes there are deaths and serious injuries</td>
</tr>
<tr>
<td>5</td>
<td>3 &lt; Z-Score</td>
<td>Very High</td>
<td>It always happens; there are often deaths and serious injuries</td>
</tr>
</tbody>
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3. Result and Discussion

The number of accidents on the Big Highway is increasing yearly, from 3 incidents in 2020 to 9 incidents in 2021 and 14 incidents in 2022. The number of accidents in these three years continues to increase relatively significantly, so this needs attention from various related parties.
Violence is an event that takes many victims. Some suffered minor injuries and severe injuries and even died. Data on victims of traffic accidents on the Big Highway from 2020 to 2022 shows that the death toll has fluctuated. Where in 2020, there were no deaths; in 2021, there were four people; and in 2022, there were three deaths. The large number of human casualties in traffic accidents on the Big Highway can be seen in Table 2.

<table>
<thead>
<tr>
<th>Year</th>
<th>Victims Died</th>
<th>Serious Injuries</th>
<th>Minor Injuries</th>
<th>Number of victims Per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2021</td>
<td>4</td>
<td>4</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>2022</td>
<td>3</td>
<td>1</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td>6</td>
<td>31</td>
<td>44</td>
</tr>
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Based on Table 2 and Figure 3, it can be seen that one point falls into the very high accident vulnerability category, namely STA. 0-1. There are two points in the high accident vulnerability category, namely STA. 2-3 and STA. 7-8. There are four points in the medium category. There are three points in the low category. There are four points in the category of not being prone to accidents.
4. Conclusion

The number of accidents on Jl. Raya Kakap during 2020 - 2022 amounted to 26 events, increasing every year from 3 events in 2020, then in 2021, it rose to 9 events, and in 2022, it also rose to 14 events. The characteristics of traffic accidents on Jalan Raya Kakap for three years (2020 - 2022) are that victims with minor injuries are more than victims of death and serious injuries, namely seven victims in 2020, 8 victims in 2021, and 18 victims in 2022. Point STA 0 - 1 has the highest number of accidents during the 3-year period, which is 152, then point STA. 2-3 by 129, and point STA. 7-8 by 110. One black spot in the category of accident vulnerability is STA. 0-1. There are two black spots in the high accident vulnerability category, namely STA. 2-3 and STA. 7-8. There are four black spots in the medium category. There are three black spots in the low category. There are four points in the category of not being prone to accidents.

5. Acknowledgement

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6. Author’s Note

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7. References


