



AN ANALYSIS OF TRAFFIC ACCIDENT RATES ON THE UJUNG TANJUNG–BAGAN SIAPI API ROAD SECTION (KM 6–KM 60), ROKAN HILIR REGENCY, RIAU PROVINCE

ANALISIS TINGKAT KECELAKAAN LALU LINTAS PADA JALAN UJUNG TANJUNG–BAGAN SIAPI API (KM 6–KM 60), KABUPATEN ROKAN HILIR, PROVINSI RIAU

Abdul Kudus Zaini¹, Rahmad Kurniawan², Vella Anggreana³

Civil Engineering Program, Faculty of Engineering Islamic University of Riau, Indonesia

Email: abdulkuduszaini@eng.uir.ac.id

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Abstract

Traffic accidents are unforeseen and unintentional incidents involving vehicles or other road users, leading to human casualties (including minor injuries, serious injuries, or fatalities) and property damage. This study aims to analyze accident rates by examining contributing factors such as causative elements, accident black spots, and the impact of road user characteristics, including age, occupation, and driver condition. The research employed an observational method, involving direct field surveys along the Ujung Tanjung–Bagansiapiapi road section in Rokan Hilir. The findings revealed that human factors were the predominant cause of accidents, accounting for 61 incidents, while road-related factors contributed to 5 accidents. The age group most affected by accidents was 21–25 years, which resulted in 25 fatalities. Additionally, the study identified two critical black spots: the Jumrah Ujung Tanjung section, with an accident rate of 0.310, and the Tanah Merah Jumrah section, with an accident rate of 0.274. To mitigate accident rates, it is crucial to enhance road safety by installing traffic signs and other supporting infrastructure.

Keywords: *Traffic Accident, Accident Rate, Black Spot*

INTRODUCTION

The Ujung Tanjung–Bagansiapi-api road section is located in Riau Province, providing a vital link between the eastern region and the western province of North Sumatra, specifically the city of Dumai. Rokan Hilir Regency spans an area of 8,881.59 km² (or 888,159 hectares), characterized by its diverse geographical features, including numerous rivers and islands. The Rokan River—the largest in the region—flows 350 kilometers, stretching from its mouth in Rokan Hilir to its source in Rokan Hulu. Historically, Ujung Tanjung served as the initial capital when the Rokan Hilir Regency was established. However, Bagansiapi-api is now the official capital of the regency. Ujung Tanjung remains an important village, located adjacent to the Tanah Putih District within Rokan Hilir Regency, Riau Province.

OBJECTIVES

The objectives of this research are presented below.

- a. To evaluate the accident rate concerning traffic volume and the length of each road segment, and to propose effective solutions based on the findings.
- b. To identify critical accident-prone segments (black spots and black sites) along the road.



- c. To assess the impact of road users, particularly drivers, on accident frequency, considering factors such as age, occupation, education, and driving conditions.

LITERATURE REVIEW

Pignataro (1973) asserted that most traffic accidents result from a combination of factors, including driver or pedestrian behavior, road conditions, adverse weather, and poor visibility. Carter and Homburger (1978) defined an accident as an event occurring during traffic movement, caused by a failure in the traffic system, which encompasses the driver (human factors), the vehicle, the road infrastructure, and the surrounding environment. Errors in this context can be attributed to deviations (from established standards or regulations) or human negligence. NAASRA (1988) highlighted that traffic accidents can occur in various locations, such as intersections, road segments, bridges, rural areas, and urban zones, emphasizing the importance of identifying areas with high accident frequencies or those deemed accident-prone. Priyanto (1997) noted that the causes of traffic accidents should be examined through a multi-causal approach, considering three main factors: human, vehicle, and road or environmental conditions. Furthermore, Austroads (1994) defined a road safety audit as a formal evaluation process for existing and planned road or traffic projects. It also can be specific projects that involve interactions with road users. This audit is conducted by an independent, qualified examiner, who assesses the potential risks of accidents and evaluates the safety performance of the project.

METHODS

The research was conducted using a combination of primary and secondary data collection methods, with a focus on traffic accident events. The data examined in this study included the following:

1. Secondary data collected over five years (2015–2019), as follows:
 - a. Traffic accident data, including both general information and detailed reports or accident documentation.
 - b. Data on the road sections being studied, including their length.
 - c. Average daily traffic (ADT) data.
2. Identification and analysis of issues related to traffic accidents at locations designated as accident-prone areas.
3. Evaluation of mitigation measures for addressing accident-prone areas.

RESEARCH LOCATION

This study focused on the following road sections: the Bagansiapi-api–Batu 6 section (6 km), the Batu 6–Bantayan section (6 km), the Bantayan–Tanah Merah section (8 km), the Tanah Merah–Jumrah section (20 km), and the Jumrah–Ujung Tanjung section (20 km). The total length of the road sections under investigation was 60 km.



Figure 1. Research Location



RESULTS AND DISCUSSION

1. Analysis of High Traffic Accident Rates

High traffic accident rates can be attributed to many factors, either individually or in combination. The following are key contributing factors to the observed high accident rates in the field.

- a. Human Factors
- b. Road and Environmental Factors
- c. Natural and Weather Factors
- d. Vehicle Factors

The analysis of accident rates is further conducted by examining traffic accident report data over a specified period, including weather conditions, road conditions, traffic types (e.g., angle, side, and rear collisions), vehicle types involved, driver actions, and other relevant details. The data used in this study was obtained from the accident report documents provided by the Rokan Hilir Police Station for 2019.

Table 6.1. Frequency of Traffic Accidents on the Ujung Tanjung Road Section

No.	District/Village	KM	Years					Accident Frequency
			2015	2016	2017	2018	2019	
1	Bagansiapi-api–Batu6	1–6	3	2	3	2	3	13
2	Batu 6–Bantayan	6–12	2	3	2	3	2	12
3	Bantayan–Tanah Merah	12–20	1	4	5	0	4	14
4	Tanah Merah–Jumrah	20–40	1	3	4	4	3	15
5	Jumrah–Ujung Tanjung	40–60	4	3	4	2	4	17

Source: Analysis Results, 2024

2. Traffic Volume

Table A6. 2. Road Performance Calculation for the Ujung Tanjung–Bagansiapi-api Road Section

No.	Road Section	ADT (PCU/day)	Road Length (KM)	Travel Performance (ADT × Length)
1	Bagansiapi-api–Batu 6	2999	6	17994
2	Batu 6–Bantayan	2999	6	17994
3	Bantayan–Tanah Merah	2999	8	23992
4	Tanah Merah–Jumrah	2999	20	59980
5	Jumrah–Ujung Tanjung	2999	20	59980

Source: Analysis Results, 2024

Table 6.2 shows that the highest road performance is found on the Tanah Merah–Jumrah and Jumrah–Ujung Tanjung road sections, each with a length of 20 km, resulting in a travel performance of 59,980 PCU/km/day.



3. Identification of Black Spots Based on Accident Rate

Table 6.3. The Accident Rate Calculation and the Identification of Black Spots for the Ujung Tanjung–Bagansiapi-api Road Section in Rokan Hilir Regency

No.	KM	Road Section	Number of Accidents		ADT	Accident Rate
			Total	Average		
1	1–6	Bagansiapi-api–Batu 6	13	2.6	2999	0.237
2	6–12	Batu 6–Bantayan	12	2.4	2999	0.219
3	12–20	Bantayan–Tanah Merah	14	2.8	2999	0.255
4	20–40	Tanah Merah–Jumrah	15	3	2999	0.274
5	40–60	Jumrah–Ujung Tanjung	17	3.4	2999	0.310

Source: Analysis Results, 2024

As shown in Table 6.3, the highest accident rate, indicating the black spot, is found in the Jumrah–Ujung Tanjung road section, with an accident rate of 0.310. This is followed by the Tanah Merah–Jumrah road section, with an accident rate of 0.274. Based on these results, it can be concluded that the black spots are located between kilometers 20–40 and 40–60.

4. Identification of Black Sites Based on Accident Rate

Table 6.4. The Accident Rate Calculation of Black Sites for the Ujung Tanjung–Bagansiapi-api Road Section in Rokan Hilir Regency (2015–2019)

No.	Road Section	Number of Accidents		ADT (PCU/day)	Road Length (KM)	Accident Rate
		Total	Average			
1	Bagansiapi-api–Batu 6	13	2.6	2999	6	0.039
2	Batu 6–Bantayan	12	2.4	2999	6	0.036
3	Bantayan–Tanah Merah	14	2.8	2999	8	0.031
4	Tanah Merah–Jumrah	15	3	2999	20	0.013
5	Jumrah–Ujung Tanjung	17	3.4	2999	20	0.015

Source: Data Analysis, 2024

The analysis reveals that the highest accident rate among the studied black sites is 0.039, occurring on the Bagansiapi-api–Batu 6 road section, which spans 6 km and recorded 13 accidents. According to the theory proposed by Abd. Kudus, a black site is defined as a location where the accident rate falls below a threshold value of 1, indicating significant accident risk at specific points. In this study, the critical accident rate was determined to be 0.039, confirming this section as a black site.

5. Traffic Accidents by Time of Occurrence

Table 5. A Breakdown of Traffic Accidents along the Ujung Tanjung–Bagansiapi-api Road Section by the Time of Occurrence (2015–2019)



No.	Period	Number of Accidents
1	06:00–10:00 (morning)	13
2	10:00–14:00 (midday)	17
3	14:00–18:00 (afternoon)	16
4	18:00–22:00 (evening)	14
5	22:00–02:00 (late night)	8
6	02:00–06:00 (early morning)	3
Total		71

Source: Data Analysis, 2024

The results indicate that the highest incidence of traffic accidents occurred during midday (10:00–14:00), accounting for 17 cases, followed by the afternoon period (14:00–18:00) with 16 cases. This trend is attributed to increased traffic volumes during these periods, as observed in the traffic activity along the Ujung Tanjung–Bagansiapi-api road section. Detailed accident reports from the Rokan Hilir Police Department reveal that the morning and early afternoon periods coincide with peak traffic activity, likely contributing to the high number of incidents. Over the analyzed 24-hour period, a total of 71 accidents were recorded, underscoring the need for targeted interventions to improve safety during high-traffic times.

6. Traffic Accident by Victims

Table 6. A Breakdown of Traffic Accidents along the Ujung Tanjung–Bagansiapi-api Road Section by Victims (2015–2019)

No.	Years	Fatalities	Serious Injuries	Minor Injuries
1	2015	3	2	12
2	2016	6	11	16
3	2017	3	6	7
4	2018	1	7	9
5	2019	5	6	5
Total		18	32	49
Grand Total		99		

Source: Analysis Results, 2024

Contributing Factors to Traffic Accidents

Traffic accidents along the Ujung Tanjung–Bagansiapi-api road segment are primarily influenced by the interaction of human, vehicle, road, and environmental factors.

a. Human Factors

The analysis indicates that many traffic accidents in this segment result from inadequate compliance with traffic regulations. Specifically, driver health or physical conditions were implicated in six reported cases. Furthermore, motorcycles were identified as the most frequently involved vehicle type, accounting for 23 accidents. This makes motorcyclists a significant contributor to traffic incidents on this road segment.

b. Vehicle Factors

Vehicle-related issues are another critical factor in traffic accidents. Accidents often occur when vehicles are not roadworthy due to poor technical maintenance or when they are used improperly. Motor vehicles, in particular, are frequently involved in accidents, whether as the cause or the victim.



c. Road Factors

Although road conditions can contribute to traffic accidents, the data in this study does not identify road-related factors as a direct cause of any reported incidents.

CONCLUSIONS

1. The analysis reveals that the predominant cause of traffic accidents along the Ujung Tanjung–Bagansiapi-api road segment in Riau Province is attributed to human factors, accounting for 61 incidents. These incidents were primarily caused by driver fatigue, drowsiness, lack of attention while crossing the road, excessive speed in high-traffic areas, and loss of vehicle control. Road conditions were identified as a secondary contributing factor, with 5 recorded incidents linked to slippery surfaces, uneven terrain, or damaged and potholed roads. Additionally, an age-based analysis of accident victims indicates that drivers aged 21–25 years are the most affected group, with 25 fatalities out of a total of 99 victims.
2. The findings further identify two locations along the Ujung Tanjung–Bagansiapi-api road segment as high-risk zones based on the highest accident rates.

Recommendations

1. It is essential to improve the geometric design of the road, addressing any physical deficiencies to ensure its suitability for various types of vehicles. Additionally, supporting infrastructure that promotes road safety should be developed so that vehicles passing through this section experience a sense of security, comfort, and uninterrupted traffic flow.
2. Law enforcement should be further strengthened, and adherence to established procedures should be enhanced to prevent any violations from occurring.
3. Drivers should ensure their vehicles undergo a thorough inspection before embarking on any journey, whether short or long. The condition of the vehicle is crucial to prevent potential issues during the trip. If any problems arise, they should be swiftly addressed to mitigate any safety risks.

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