

Analysis of Traffic Safety Levels in Tanah Laut Regency

Hafsha Yanti Siregar

Program Studi Teknologi Rekayasa Konstruksi Jalan dan Jembatan, Politeknik Negeri Tanah Laut,
Kalimantan Selatan

Koresponden email: hafsha@politala.ac.id

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Abstract

Traffic accidents are a serious problem that affects the safety of road users, economic losses, and the quality of life in society. Tanah Laut Regency, as one of the areas experiencing rapid mobility growth, faces various challenges in maintaining traffic safety levels. The objective of this study is to evaluate the level of traffic safety on the highways in Tanah Laut Regency, represented by accident rates based on population size, road length, and severity indices. The calculation method follows the approach developed by Pignataro (1973), using data on the number of accidents and casualties recorded in Tanah Laut Regency. The results show that the accident rate per population will increase from 11.176 in 2020 to 26.640 in 2023, and then decrease to 25.903 in 2024. In terms of road length, the rate increased from 0.019 in 2020 to 0.047 in 2023, then decreased slightly to 0.046 in 2024. However, the severity index shows a decrease from 0.872 in 2020 to 0.696 in 2022, followed by an increase to 0.759 in 2023 and then a slight decrease to 0.717 in 2024. This indicates a decline in the road safety level in Tanah Laut Regency, and highlights the need for serious efforts by the Tanah Laut Regency Government, involving all relevant stakeholders, to address this issue.

Keywords: *traffic safety, traffic accidents, accident rate, severity index, tanah laut regency*

Abstrak

Kecelakaan lalu lintas merupakan permasalahan serius yang berdampak pada keselamatan pengguna jalan, kerugian ekonomi, dan kualitas hidup masyarakat. Kabupaten Tanah Laut sebagai salah satu daerah dengan pertumbuhan mobilitas yang pesat menghadapi berbagai tantangan dalam menjaga tingkat keselamatan lalu lintas. Penelitian ini bertujuan untuk mengetahui tingkat keselamatan lalu lintas di jalan raya Kabupaten Tanah Laut, yang direpresentasikan dalam angka kecelakaan berbasis jumlah penduduk dan panjang jalan serta indeks severitas. Metode perhitungan menggunakan metode yang dikembangkan oleh Pignataro (1973), dengan menggunakan data jumlah kecelakaan dan korban yang tercatat di Kabupaten Tanah Laut. Hasil penelitian menunjukkan bahwa tingkat kecelakaan berbasis jumlah penduduk meningkat dari 11,176 pada tahun 2020 menjadi 26,640 pada tahun 2023, kemudian menurun menjadi 25,903 pada tahun 2024. Ditinjau dari panjang jalan, angka kecelakaan meningkat dari 0,019 pada tahun 2020 menjadi 0,047 pada tahun 2023, lalu menurun menjadi 0,046 pada tahun 2024. Namun, indeks severitas menunjukkan penurunan dari 0,872 pada tahun 2020 menjadi 0,696 pada tahun 2022, diikuti oleh peningkatan menjadi 0,759 pada tahun 2023, lalu menurun menjadi 0,717 pada tahun 2024. Hal ini menunjukkan adanya penurunan tingkat keselamatan lalu lintas di Kabupaten Tanah Laut, sehingga diperlukan upaya serius dari Pemerintah Kabupaten Tanah Laut, dengan melibatkan seluruh pemangku kepentingan untuk menangani permasalahan ini.

Kata Kunci: *keselamatan lalu lintas, kecelakaan lalu lintas, angka kecelakaan, indeks severitas, kabupaten tanah*

1. Introduction

Traffic safety is a crucial aspect of urban transportation systems, as it is directly related to road users' safety, mobility efficiency, and the social and economic impacts of traffic accidents [1]. Cities experiencing rapid mobility growth often face an increased risk of accidents due to high vehicle volumes, driver behavior, and suboptimal road infrastructure conditions [2]. Tanah Laut Regency, with its steadily growing population, faces serious challenges in traffic safety. In 2024, the population reached 366,757 people, up from 364,117 in 2023 [3]. This population increase correlates with the rising number of vehicles and traffic movements each year, contributing to a higher incidence of traffic accidents. According to data from the Tanah Laut Police Department, South Kalimantan (2024), the number of traffic accidents in Tanah Laut Regency rose from 39 cases in 2019 to 95 cases in 2024 [4]. In comparison, Australia recorded 1,300 traffic-related fatalities in 2024. Sweden, with 206 deaths in 2020, remains one of the countries with the lowest

accident rates in the world. Meanwhile, Indonesia reported 220,647 traffic accident cases in 2024, resulting in 22,970 fatalities.

The main factors contributing to traffic accidents include road geometry conditions, driver negligence, and inadequate lighting and traffic signs at several accident-prone locations [5]. Traffic and road transportation safety refers to a state in which individuals are protected from accident risks while traveling, caused by vehicles, roads, and/or the surrounding environment. In general, traffic safety is determined by three key factors: motor vehicle drivers, the vehicles used, and road and environmental conditions [6]. According to the Road and Transport Authority NSW (2016), road safety is influenced by user behavior, vehicle conditions, road infrastructure, and the surrounding environment. The primary goal of traffic safety is to prevent accidents while ensuring security, comfort, and transportation efficiency. Traffic safety programs focus on reducing accident rates and their impacts, as accidents result in losses for victims and their families. Additionally, the increasing volume, speed, and variety of vehicles contribute to higher accident risks [7].

The high number of traffic accidents in Tanah Laut Regency throughout 2024 has prompted PT Jasa Raharja, South Kalimantan Branch, to reinitiate the Traffic Communication Forum (FKLL). A total of 95 accidents were recorded, resulting in 55 fatalities, with the majority being underage children. FKLL is expected to help reduce the number of accidents and improve traffic safety. This situation reflects a low level of road safety, highlighting the need for special attention and strategic measures for improvement [8].

2. Material and Methods

2.1 Research Location

The research location is in Tanah Laut Regency, South Kalimantan Province, with a focus on road traffic accidents to determine the traffic accident rate in Tanah Laut Regency based on population size and road length.

2.2 Data Collection Techniques

The required data includes the number of traffic accidents over the past five years from the Traffic Accident Unit of the Tanah Laut Police Department, as well as population and road length data for the same period from BPS Tanah Laut. This study does not discuss vehicle involvement or the criteria of accident victims and perpetrators.

2.3 Data Processing

The data is processed using the formula proposed by Pignataro (1973). The processed data is then analyzed and discussed using traffic theories to calculate the road traffic accident rate in Tanah Laut Regency, South Kalimantan Province. The processing of traffic accident data is carried out through tabulation using Microsoft Excel to facilitate the analysis of accident figures in Tanah Laut Regency, South Kalimantan Province.

2.4 Data Analysis

Transportation

Transportation is the process of moving people, goods, or services from one place to another using various modes, such as land, sea, and air [9]. It plays a crucial role in a country's economic, social, and infrastructure development [10]. An increasing population leads to a growing demand for goods and services, which in turn escalates transportation needs. Additionally, regional and urban development fosters the growth of activity centers and residential areas, further increasing the demand for mobility [11].

Road Traffic Safety

Road traffic safety is a condition in which road users, both drivers and pedestrians, can move safely without the risk of accidents that endanger lives or cause material losses [12]. It encompasses various aspects, including compliance with traffic regulations, safe infrastructure design, and responsible road user behavior [13]. The rapid population growth and increasing demand for transportation services necessitate the enhancement of safety measures as a guideline in providing transportation services, both in terms of quantity and quality. Road transportation safety is closely linked to highway engineering and several other fields. In general, five key aspects of highway engineering relate to safety: design, planning, implementation, operation, and maintenance. Additionally, two other engineering fields play a role—vehicle and material engineering as well as several non-engineering disciplines, including economics, psychology, health, law, education, and social sciences.

According to data from the National Criminal Information Center (Pusiknas) of the Criminal Investigation Agency (Bareskrim) of the Indonesian National Police, a total of 148,798 traffic accident cases were reported in 2023. Of these, 94.63% (140,812 cases) were caused by human factors. Additionally, 5,320 cases (3.57%) were due to vehicle-related issues; 1,232 cases (0.82%) resulted from road conditions, such as damaged, potholed, wavy, or winding roads; and 155 cases (0.10%) were attributed to natural factors such as fog, floods, and others. Meanwhile, 1,279 cases (0.85%) had unknown causes. The police also recorded that the total number of traffic accidents in 2023 resulted in 218,892 victims. Among them, 180,739 sustained minor injuries, 22,190 lost their lives, and 15,963 suffered severe injuries [14].

Road factors are related to physical quality, comfort/smoothness, and road completeness and regulations, such as markings, medians, signs, and traffic lights. Improvements in road infrastructure, such as adding lighting and widening road shoulders, have been proven to reduce accident rates in various countries. Vehicle factors include roadworthiness and completeness, such as the use of seat belts and airbags. In Indonesia, vehicle-related issues have significantly contributed to accidents on toll roads, with major causes including tire blowouts and brake failures. Environmental factors, such as weather and road lighting conditions, also influence accidents, although their contribution is relatively smaller compared to other factors. Overall, efforts to improve traffic safety should focus on enhancing driver behavior, improving road infrastructure quality, ensuring vehicle roadworthiness, and considering environmental factors to significantly reduce accident rates.

Traffic Accidents

A traffic accident is an unexpected and unintentional event involving a vehicle, with or without other road users, resulting in human casualties (minor injuries, serious injuries, or fatalities) and property damage [15].

According to Jasa Marga, the criteria for traffic accident victims are as follows:

- a. **Minor Injuries:** Victims sustain injuries that do not endanger their lives and do not require further medical treatment or hospitalization. Examples include small cuts with minimal bleeding, burns, mild sprains without complications, and victims who remain conscious without fainting or vomiting.
- b. **Serious Injuries:** Victims suffer injuries that may endanger their lives and require immediate medical attention or hospitalization. Examples include injuries causing a decline in the victim's condition, such as head or upper body trauma, bone fractures with complications accompanied by severe pain and heavy bleeding, or injuries affecting internal organs.
- c. **Fatalities:** A victim is declared deceased when physical signs of death are present. Fatalities include those who die at the accident scene, during transportation to the hospital, or while receiving medical treatment at the hospital.

Traffic accidents vary in both occurrence and contributing factors. Based on the nature of the incident, traffic accidents can be categorized as follows:

- a. **Single-Vehicle Accident:** An accident involving only one vehicle.
- b. **Two-Vehicle Accident:** An accident involving two vehicles.
- c. **Multiple-Vehicle Accident (Pile-Up):** An accident involving three or more vehicles.

According to Hobbs (1995) [16], the severity of accidents can be classified into four categories:

- a. **Minor Accident:** An accident that does not require hospital treatment.
- b. **Small Accident:** An accident that requires hospital treatment.
- c. **Fatal Accident:** An accident that results in the death of the victim.
- d. **Other Accidents:** Accidents that only cause material losses.

Accident data collection is carried out in several stages, including classification based on the type of accident, victim condition, accident-related costs, and accident location. This process provides an overview or description of the accidents. The collected data is then analyzed to determine several parameters used to assess the level of traffic safety in a given area. Pignataro (1973), as cited in Andung Yunianta (2011), states several methods for calculating and analyzing traffic accidents, as outlined below:

- a. **Accident Rate per 100,000 Population**

This metric represents the number of traffic accidents occurring in a specific area per 100,000 residents. It is used to assess the relative risk of accidents within a given population size.

$$AR = \left(\frac{A \times 100.000}{P} \right) \quad (1)$$

b. Accident Rate Based on Road Length

This metric represents the number of traffic accidents per unit length of road in a specific area. It is used to assess road safety by considering the number of accidents relative to the total road length.

$$AR = \left(\frac{A}{L} \right) \quad (2)$$

c. Accident Severity Index

$$SI = \left(\frac{FI + (\text{Weight Factor} \times \text{Serious Injuries}) + (\text{Weight Factor} \times \text{Minor Injuries})}{A} \right) \quad (3)$$

Explanation:

- AR : Accident Rate
- A : Number of accidents in one year
- P : Population
- L : Road length (km)
- SI : Severity Index
- FI : Fatalities Injury

The weight factor is assigned based on the severity of injuries:

- Fatalities = 1.0
- Serious injuries = 0.5
- Minor injuries = 0.1

3. Results and Discussion

Tanah Laut is one of the regencies in South Kalimantan Province. The population based on statistical data from Tanah Laut Regency from 2020 to 2024 is as follows:

Table 1. Population of Tanah Laut Regency (2020-2024)

Year	Jiwa Population (People)
2020	348,966
2021	354,340
2022	361,044
2023	364,117
2024	366,757

Source: BPS Tanah Laut Regency, 2024

Based on the available data, the total road length in Tanah Laut Regency has remained unchanged at 2,044 km from 2022 to 2024. This can be seen in **Table 2** below:

Table 2. Road Length of Tanah Laut Regency (2020-2024)

Year	Road Length (km)
2020	2,010
2021	2,010
2022	2,044
2023	2,044
2024	2,044

Source: BPS Tanah Laut Regency, 2024

The traffic safety conditions in Tanah Laut Regency are represented by the number of accidents that occur in the region. This can be seen in the table below:

Table 3. Number of Accidents, Victims, and Losses Due to Traffic Accidents in Tanah Laut Regency

Year	Number of Traffic Accidents	Fatalities	Serious Injuries	Minor Injuries	Losses (Million IDR)
2020	39	29	5	25	61,200,000
2021	84	58	7	70	223,100,000
2022	89	52	1	94	344,000,000
2023	97	60	12	76	317,100,000
2024	95	55	13	66	308,000,000

Source: Traffic Accident Data, Tanah Laut Regency Police, 2024

Based on the table above, the number of accidents has increased from 2020 to 2023, with a rising number of fatalities. This indicates that the severity level of accidents is also increasing. Based on the data above, data processing is carried out by calculating the accident rate based on population, road length, and severity index using the formulas proposed by Pignataro (1973). The results can be seen in the tables below:

Table 4. Analysis Results of Accident Rate Based on Population

Year	Population (People)	Number of Traffic Accidents	Accident Rate
2020	348,966	39	11.176
2021	354,340	84	23.706
2022	361,044	89	24.651
2023	364,117	97	26.640
2024	366,757	95	25.903

Based on the results in **Table 4**, it is evident that the number of accidents per population increased from 2020 to 2023. This indicates that the number of accidents in Tanah Laut Regency has risen in line with the growing population. Meanwhile, the number of accidents per road length increased from 0.019 in 2020 to 0.047 in 2023 but decreased in 2024. This indicates that traffic accidents increased as the road length in Tanah Laut Regency expanded. This trend is shown in **Table 5** below.

Table 5. Analysis Results of Accident Rate Based on Road Length

Year	Road Length (km)	Number of Traffic Accidents	Accident Rate
2020	2,010	39	0,019
2021	2,010	84	0,042
2022	2,044	89	0,044
2023	2,044	97	0,047
2024	2,044	95	0,046

The severity of traffic accidents is represented by the severity index, which reflects the harshness of an accident as indicated by the number of fatalities relative to the total number of accidents. Based on the calculations in **Table 6** below, the severity index decreased from 0.872 in 2020 to 0.717 in 2024. This indicates that the traffic accidents that occurred involved increasingly severe impacts, suggesting that the vehicle speeds at the time of the accidents were relatively high.

Table 6. Analysis Results of the Traffic Accident Severity Index in Tanah Laut Regency

Year	Number of Traffic Accidents	Fatalities	Severe Injuries	Minor Injuries	Severity Index
2020	39	29	5	25	0.872
2021	84	58	7	70	0.815
2022	89	52	1	94	0.696

Year	Number of Traffic Accidents	Fatalities	Severe Injuries	Minor Injuries	Severity Index
2023	97	60	12	76	0.759
2024	95	55	13	66	0.717

Based on the calculations above, it can be seen that the accident rate per population has increased, as has the accident rate based on road length. According to the severity index, its value decreased from 0.872 in 2020 to 0.696 in 2022, but then increased to 0.759 in 2023 and 0.717 in 2024, indicating that the level of traffic safety in Tanah Laut Regency is progressively declining. Therefore, in accordance with the mandate of Law No. 22 of 2009, the Tanah Laut Regency Government should immediately develop a General Traffic and Road Transport Safety Plan that is tailored to the local conditions of Tanah Laut Regency by involving all stakeholders in the region.

4. Conclusion

Based on the description above, the following conclusions can be drawn:

1. The road length in Tanah Laut Regency did not increase from 2022 to 2024, remaining at 2,044 km.
2. The number of traffic accident incidents in Tanah Laut Regency increased from 39 in 2020 to 95 in 2024.
3. The accident rate per population in Tanah Laut Regency increased from 11,176 in 2020 to 25,903 in 2024, indicating that the rising population is accompanied by an increase in traffic accidents.
4. The accident rate based on road length decreased from 0.047 in 2023 to 0.046 in 2024, suggesting a slight decline in the number of traffic accidents.
5. Based on the severity index, the value decreased from 0.872 in 2020 to 0.696 in 2022, but then increased to 0.759 in 2023 and 0.717 in 2024, which indicates that the level of traffic safety in Tanah Laut Regency is declining further.

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