Analysis Correlation Study of Traffic Accident Characteristics on the Sungai Limau Road Section, Padang Pariaman Regency

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ABSTRAK

Sungai Limau Highway Section, Padang Pariaman Regency Is an accident event that often occurs because this road section as a connecting route between the city of Pariaman and Agam regency and at the same time becomes a tourist spot adjacent to the coast causing a negative impact on public opinion and the security of private property, so as to suppress accidents, especially heavy accidents, The main factors causing accidents as well as knowing the relationship and impact on the severity of accidents need to be analyzed. This study aims to analyze the main causes and see the correlation relationship with the main factors that cause traffic accidents on the Limau river road, Padang Pariaman Regency. This study used data on the number of accidents that occurred in 2021, 2022, 2023 with a total of 95 accidents. The data analysis method used in this study is a correlation test to determine the linear relationship between each accident variable and the AEK (Accident Equivalent Number) technique for the examination of the most severe accidents. The results of the analysis showed that the main factors that resulted in traffic accidents on the Sungai Limau Road Section of Padang Pariaman Regency, namely drivers, most occurred on Mondays, often occurred at bright times from 06:00 to 19:00, vehicles were dominant motorcycles, and accidents often occurred in Kuranji Hilir. In the 2021-2023 time frame, the highest traffic level on the Sungai Limau road section of Padang Pariaman Regency occurred in 2022 with the equivalent number of accidents of 325.

INTRODUCTION

Traffic accidents are complex and unpredictable events and their severity which are influenced by factors of environmental and road conditions, vehicle characteristics, mental and physical condition of road users, personal characteristics of drivers, presence of passengers, traffic flow conditions and so on [1]. Suhadi and Rangkuti, stated that in general, there are four factors that often cause traffic accidents, namely human, vehicle, road, and environmental factors that need to be identified for the best action in realizing improved road safety and reducing accidents [2]. Predicting the severity and likelihood of accidents and their characteristics is not an easy task, because of the complexity of the factors that occur accidents and often take casualties Moreover, this fact often occurs on urban roads, so serious analysis is needed to anticipate and reduce the number of accidents that occur [3].

The magnitude of the negative impact of traffic accidents on public opinion and safety anticipate and reduce the number of accidents that occur [3]. The magnitude of the negative

impact of traffic accidents on public opinion and the safety of private property also needs to be watched out by traffic administration and academics in the field of traffic safety. In addition, rudimentary accident prevention and emergency rescue tools are provided, thus weakening the ability in traffic accident prevention. Therefore, it is necessary to conduct in-depth research into serious heavy traffic accidents. Exploring the factors of serious accidents and taking effective measures against the prevention of thin behavior in reducing the increase in traffic accidents in addition to improving road safety. This is due to a lack of attention to the driver's behavior when on the road.

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Driver behavior is considered as the main contributing factor to traffic accidents revealed by Fahmi [4]. Some experts such as Oktopianto et al. and Hartoyo et al., believe that illegal behavior of drivers has a significant impact on the traffic safety of road users [5] [6]. For example, Mubalus, has verified that seat belt use is positively correlated with a driver's age and education level, in addition to vehicle conditions, road conditions, environmental conditions, and social and economic factors being taken into consideration to study the impact of fatal traffic accidents [7].

The increase in transportation in Indonesia has increased the damage to road flow due to the significance of accidents that occur. Road traffic fatalities reported in 2023 in Indonesia amounted to 1,908 with the death toll with an average of 60 people per day dying [8]. As for the Sungai-Limau road section of Padang Pariaman Regency in the last three years, in 2021 there were 32 accidents, in 2022 there were 37 accidents and in 2023 there were 26 accidents and the most locations occurred in the Kuranji Hilir, Pilubang and Koto Tinggi areas. Sungai Limau road section is one of the roads that can connect the city of Pariaman and Agam Regency. However, this section of road often experiences traffic accidents that claim lives.

Factors that cause traffic accidents according to Enggarasi and Sa'diyah are human error, drivers, roads, motor vehicles and nature. The characteristics of accidents are classified by the location and time of the accident [9]. Driver negligence and vehicles in poor condition are the main causes of traffic accidents. Ignoring signs and traveling at high speeds are examples of irresponsible drivers. Meanwhile, vehicle factors relate to lack of maintenance by the driver, which can cause damage to the vehicle [10]. Meanwhile, according to Iqbal et al., the state of transportation infrastructure, human error, environmental variables, and weak traffic enforcement are potential causes of traffic accidents. But human carelessness is the main cause of the high rate of traffic accidents. Drivers of the working-age population, in particular, need to be very careful on the road. Evidence suggests that inexperienced drivers are more likely to be involved in collisions than their more experienced counterparts [11]. Therefore, it is important to conduct research related to traffic accidents. In this study, the appropriate theory to use is correlation theory which explains the linear relationship between the variables studied. The purpose of this study is to determine the main causes of accidents and the characteristics of traffic accidents and see the correlation relationship with the main factors causing traffic

accidents. This research is limited to a time period of 3 years from 2021 to 2023 and a road length of 9 KM. It is hoped that this research can provide knowledge to the public related to traffic accidents.

METHOD

This study was conducted with descriptive statistics to describe the location of the accident on the Sungai Limau road section of Padang Pariaman Regency. The data used is with primary data through surveys and documentation. Secondary data is taken using data from organizations such as location maps, accident rates from 2021 to 2023, number of casualties, and causal aspects of accidents. The data analysis technique carried out is to use a correlation test to find out the linear entanglement between variables. In finding the high rate of accidents, researchers used techniques AEK (*Accident Equivalent Number*).

$$AEK= 12MD + 3 (LB+LR) + K \text{.. (1)}$$

Information:
MD = Death toll (fatality)
LB = Number of seriously injured (people)
LR = Number of minor injuries (people)

RESULTS AND DISCUSSION

Accident characteristics
This research took place on the Sungai Limau road located in Padang Pariaman Regency, with the aim of determining various driver violations that contribute to traffic accidents. The total traffic accidents on the Sungai Limau road section of Padang Pariaman Regency from 2021-2023 always experience ups and downs every year. These ups and downs are due to the increasing population of vehicle owners, while the expansion of road infrastructure and facilities may not keep pace with the growth.

Table 1. Total traffic accidents from years 2021-2023 (Polres Pariaman, 2024)

Year	2021	2022	2023
Number of Accidents	32	37	26

Based on Table 1, it can be seen that the total traffic accidents on the Sungai Limau road section of Padang Pariaman Regency that occurred from 2021-2023, this analysis aims to investigate the prevalence of accidents and understand the underlying factors that contribute to these incidents. Based on the accident data presented in Table 1, it can be seen that the Sungai Limau road of Padang Pariaman Regency experienced a total of 95 incidents between 2021 and 2023. Specifically, 32 accidents were recorded in 2021, 37 accidents in 2022, and 26 accidents in 2023.

Analysis of the Relationship of the Number of Accidents Based on the Type of Accident Victim with the Time of Incident

Tabel 2. Accidents Based on Number of Accidents

Variabel	Accident Clock 06.00 – 19.00	Accident Clock 19.00 – 06.00
Death Toll	0.722	0.953
Seriously Injured Victims	0.300	0.069
Minor Injuries	0.512	0.281

The results of the analysis showed that the significance value (Sig. 2-tailed) of the Death Victim with the Accident Hour 06.00-19.00 was 0.722 and this value was greater than 0.050 (0.722 > 0.050), so it can be concluded that there was no significant relationship between the Death Toll and the Accident Hour 06.00-19.00. The significance value (Sig. 2-tailed) of Seriously Injured Victims with Accident Hours 06.00-19.00 is 0.300 and this value is greater than 0.050 (0.300 < 0.050), so it can be concluded that there is no significant relationship between Serious Injuries and Accident Hours 06.00-19.00. Value signifikansi (Sig. 2- tailed) Minor Injuries with Accident Hours 06.00-19.00 is 0.512 and this value is greater than 0.050 (0.512 > 0.050), so it can be concluded that there is no significant relationship between Minor Injuries and Accident Hours 06.00-19.00.

The results of the analysis showed that the significance value (Sig. 2-tailed) of the Death Victim with the Accident Hour of 19.00-06.00 was 0.953 and this value was greater than 0.050 (0.953 > 0.050), so it can be concluded that there was no significant relationship between the Death Toll and the Accident Hour of 19.00-06.00. The significance value (Sig. 2-tailed) of Seriously Injured Victims with Accident Hours 19.00-06.00 is 0.069 and this value is greater than 0.050 (0.069 > 0.050), so it can be concluded that there is no significant relationship between Serious Injuries and Accident Hours 19.00-06.00. The significance value (Sig. 2- tailed) of Minor Injuries with Accident Hours 19.00-06.00 is 0.281 and this value is greater than 0.050 (0.281 > 0.050), so it can be concluded that there is no significant relationship between Minor Injuries and Accident Hours 19.00-06.00.

Analysis of the Relationship of the Number of Accidents Based on the Age of Suspects and Victims with the Type of Victim

Table 3 Accidents By Age

Variabel	Die	Severe Injuries	Minor injuries
Age <7 years	-	-	-
Age 7-9 years	-	-	-
Age 10-15 years	0.945	0.033	0.179
Age 16-30 years	0.746	0.275	0.488
Age 31-40 years	0.161	0.861	0.927
Age 41-50 years	0.554	0.425	0.212
Age >51 years	0.978	0.000	0.212

The results of the analysis showed that the relationship between the age of <7 years and the deceased, the relationship between the age of 7-9 years with the deceased could not be analyzed because there was a constant value. The significance value (Sig. 2-tailed) of 10-15 years of age with death toll is 0.945 and this value is greater than 0.050 (0.945 > 0.050), so it can be concluded that there is no significant relationship between 10-15 years old with death toll. The significance value (Sig. 2-tailed) of 16-30 years of age with the Death Toll is 0.746 and this value is greater than 0.050 (0.746 > 0.050), so it can be concluded that there is no significant relationship between the age of 16-30 years with the Death Toll. The significance value (Sig. 2-tailed) of 31-40 years of age with death toll is 0.161 and this value is greater than 0.050 (0.161 > 0.050), so it can be concluded that there is no significant relationship between the age of 31-40 years with the death toll. The significance value (Sig. 2-tailed) of 41-50 years of age with the death toll is 0.554 and this value is greater than 0.050 (0.554 < 0.050), so it can be concluded that there is no significant relationship between the age of 41-50 years with the death toll. The significance value (Sig. 2-tailed) of >50 years of age with the death toll is 0.978 and this value is greater than 0.050 (0.978 < 0.050), so it can be concluded that there is no significant relationship between the age of >50 years and the death toll.

The results of the analysis showed that the relationship between the age of <7 years and the seriously injured, the relationship between the age of 7-9 years with the world's seriously injured victims could not be analyzed because there was a constant value. The significance value (Sig. 2-tailed) of 10-15 years of age with serious injuries is 0.033 and this value is smaller than 0.050 (0.033 < 0.050), so it can be concluded that there is a significant relationship between 10-15 years of age and seriously injured victims. The significance value (Sig. 2-tailed) of 16-30 years of age with serious injuries is 0.275 and this value is greater than 0.050 (0.275 > 0.050), so it can be concluded that there is no significant relationship between 16-30 years of age and seriously injured victims. The significance value (Sig. 2-tailed) of 31-40 years of age with serious injuries is 0.861 and this value is greater than 0.050 (0.861 < 0.050), so it can be concluded that there is no significant relationship between the age of 31-40 years with serious injuries. The significance value (Sig. 2-tailed) of 41-50 years old with Severe Injuries is 0.425 and this value is greater than 0.050 (0.425 > 0.050), so it can be concluded that there is no significant relationship between 41-50 years old and seriously injured. The significance value (Sig. 2-tailed) of >50 years of age with serious injuries is 0.00 and this value is smaller than 0.050 (0.00 > 0.050), so it can be concluded that there is a significant relationship between the age of >50 years and serious injuries.

The results of the analysis showed that the relationship between the age of <7 years and the slightly injured victims, the relationship between the age of 7-9 years with the lightly injured victims could not be analyzed because there was a constant value. The significance value (Sig. 2-tailed) of 10-15 years of age with minor injuries is 0.179 and this value is greater than 0.050 (0.179 > 0.050), so it can be concluded that there is no significant relationship between the age of 10-15 years with minor injuries. The significance value (Sig. 2-tailed) of 16-30 years of age with minor injuries is 0.488 and this value is greater than 0.050 (0.488 < 0.050), so it can be concluded that there is no significant relationship between 16-30 years of age and minor injuries. The significance value (Sig. 2-tailed) of 31-40 years of age with minor injuries is 0.927 and this value is greater than 0.050 (0.927 > 0.050), so it can be concluded that there is no significant relationship between 31-40 years of age and minor injuries. The significance value (Sig. 2-tailed) of 41-50 years of age with minor injuries is 0.212 and this value is greater than 0.050 (0.212 > 0.050), so it can be concluded that there is no significant relationship between the age of 41-50 years with minor injuries. The significance value (Sig. 2-tailed) of Age >50 years with Minor Injuries is 0.212 and this value is greater than 0.050 (0.212 > 0.050), so it can be concluded that there is no significant relationship between the Age of >50 years and Minor Injuries.

Analysis of the relationship between the number of accidents based on the type of accident that occurred with the type of victim

Table 4. Accidents by Accident Type

Variabel	Die	Severe Injuries	Minor injuries
Single Accident	0.766	0.212	0.000
Crashing Fixed Objects	-	-	-
Crashing Pedestrians	0.312	0.667	0.454
Front- Front Collision	0.722	0.300	0.512
Front- Rear Collision	0.234	0.788	1.000
Front-Side Collision	0.722	0.300	0.512
Side Crash- Side	-	-	-
Consecutive collisions	-	-	-

The results of the analysis show that the relationship between Hitting Fixed Objects and Fatalities, the relationship between side-and-side Collisions with Death Victims, and the relationship between consecutive Collisions and Death Victims cannot be analyzed because there is a constant value. As for the relationship between Single Accidents and Death Victims, the relationship between pedestrians and Death Victims is the relationship between front-front collisions with Death Victims, the relationship between front-rear collisions with Death Victims, and the relationship between front-side collisions with Death Victims has a significance value (Sig. 2-tailed) greater than 0.050, so it can be concluded that there is no significant relationship between Single Accidents with the Death Victim, there is no significant relationship between the front-front collision and the Death Victim, there is no significant relationship between the front-rear Hit and the Death Victim, and there is no significant relationship between the front-side collision and the Death Victim.

The results of the analysis show that the relationship between Hitting Fixed Objects and Seriously Injured Victims, the relationship between side-and-side Collisions with seriously injured Victims, and the relationship between consecutive Collisions with Seriously Injured Victims cannot be analyzed because there are constant values. As for the relationship between Single Accidents and Seriously Injured Victims, the relationship between pedestrians and Seriously Injured Victims is the relationship between front-front collisions with Seriously Injured Victims, the relationship between front-rear Collisions with Seriously Injured Victims, and the relationship between front-side collisions with serious injuries the world has significance value (Sig. 2-tailed) is greater than 0.050, so it can be concluded that there is none a significant relationship between a single accident and a serious injury, no significant relationship between front-front collisions and seriously injured, no significant relationship between front-rear collisions and seriously injured, and no significant relationship between front-side collisions and seriously injured.

The results of the analysis showed that the relationship between Hitting Fixed Objects and Minor Injuries, the relationship between side-and-side Collisions with Minor Injuries, and the relationship between Consecutive Collisions with Minor Injuries could not be analyzed because there was a constant value. The relationship between Single Accidents and Minor Injuries has a significance value (Sig. 2-tailed) smaller than 0.050 so that it can be concluded that there is a significant relationship between Single Accidents and Minor Injuries. The relationship between pedestrians and minor injuries is the relationship between front-front collisions with minor injuries, the relationship between front-rear hits and minor injuries, and the relationship between front-side collisions with minor injuries has a significance value (Sig. 2-tailed) greater than 0.050, so it can be concluded that there is no significant relationship between Single Accidents and minor Injuries, there was no significant relationship between front-front collision and minor injuries, no significant relationship between front-rear collisions and minor injuries, and no significant relationship between front-side collisions and minor injuries.

Analysis of the relationship between the number of accidents based on the type of accident that occurred with the factors causing the accident

Table 5. Number of accidents based on accident causal factors

Variable	Accident Clock 06.00 – 19.00	Accident Clock 19.00 – 06.00
Single Accident	0.512	0.281
Crashing Fixed Objects	-	-
Crashing Pedestrians	0.967	0.735

Front- Front Collision	0.000	0.231
Front- Rear Collision	0.488	0.719
Front-Side Collision	0.000	0.231
Side Crash- Side	-	-
Consecutive collisions	-	-

The results of the analysis showed that the relationship between Hitting Fixed Objects with Accident Hours 06:00-19:00, the relationship between side-side Collisions with Accident Hours 06:00-19:00, and the relationship between Consecutive Collisions with Accident Hours 06:00-19:00 cannot be analyzed because there are constant values. The relationship between front-front hit and front-side hit with Crash Hour 06.00-19.00 has a significance value (Sig. 2-tailed) smaller than 0.050, so it can be concluded that there is a significant relationship between front-front hit and front-side hit with Accident Hour 06.00-19.00. The relationship between hitting pedestrians and front-rear collisions with Accident Hours 06.00-19.00 has a significance value (Sig. 2-tailed) greater than 0.050, so it can be concluded that there is no significant relationship between hitting pedestrians and front-rear collisions with Accident Hours 06.00-19.00.

The results of the analysis showed that the relationship between Hitting Fixed Objects with Accident Hours 19.00-06.00, the relationship between side-side Collisions with Accident Hours 19.00-06.00, and the relationship between Consecutive Collisions with Accident Hours 19.00-06.00 could not be analyzed because there were constant values. The relationship between Hitting Pedestrians, front-front hits, front-rear hits, and front-side collisions with Accident Hours 19.00-06.00 has a significance value (Sig. 2-tailed) greater than 0.050, so it can be concluded that there is no significant relationship between Hitting pedestrians, front-front hits, front-rear hits, and front-side collisions with Accident Hours 19.00-06.00.

Analysis of the relationship between the number of accidents based on the type of accident that occurred with the causal factor

Table 6. Number of accidents by accident type

Variable	Factors Causing Drivers	Factors Causing Vehicle Condition	Factors Causing Road Conditions	Causative Factors of Environmental Conditions
Single Accident	0.367	-	-	-
Crashing Fixed Objects	-	-	-	-
Crashing Pedestrians	0.821	-	-	-
Front- Front Collision	0.146	-	-	-
Front- Rear Collision	0.633	-	-	-
Front-Side Collision	0.146	-	-	-
Side Crash- Side	-	-	-	-
Consecutive collisions	-	-	-	-

The results of the analysis show that the relationship between Hitting a Fixed Object with the Driver, the relationship between side-and-side Collisions with the Driver, and the relationship between Consecutive Collisions with the Driver cannot be analyzed because there is a constant value. The relationship between Hitting pedestrians, Front-front hit, front-rear hit, front-side collision with Driver Causative Factors has a significance value (Sig. 2-tailed) greater than 0.050, so it can be concluded that there is no significant relationship between Hitting pedestrians, front-front hit, front-rear hit, front-side collision with Driver Causative Factors.

The results of the analysis show that the relationship between Single Accident, hitting a fixed object, hitting a pedestrian, front-front hit, front-rear hit, front-side hit, side-side hit, and consecutive collision with Vehicle Condition Causative Factors cannot be analyzed because the vehicle condition value is constant.

The results of the analysis showed that the relationship between Single Accident, hitting fixed objects, hitting pedestrians, front-front hit, front-rear hit, front-side hit, side-side hit, and consecutive collision with Road Condition Causative Factors could not be analyzed because the road condition value was constant.

The results of the analysis show that the relationship between Single Accident, hitting a fixed object, hitting a pedestrian, front-front hit, front-rear hit, front-side hit, side-side hit, and consecutive collision with Environmental Conditions Causative Factors cannot be analyzed because the value of environmental conditions is constant.

Analysis of the relationship between the number of accidents based on the causal factors of accidents with the location
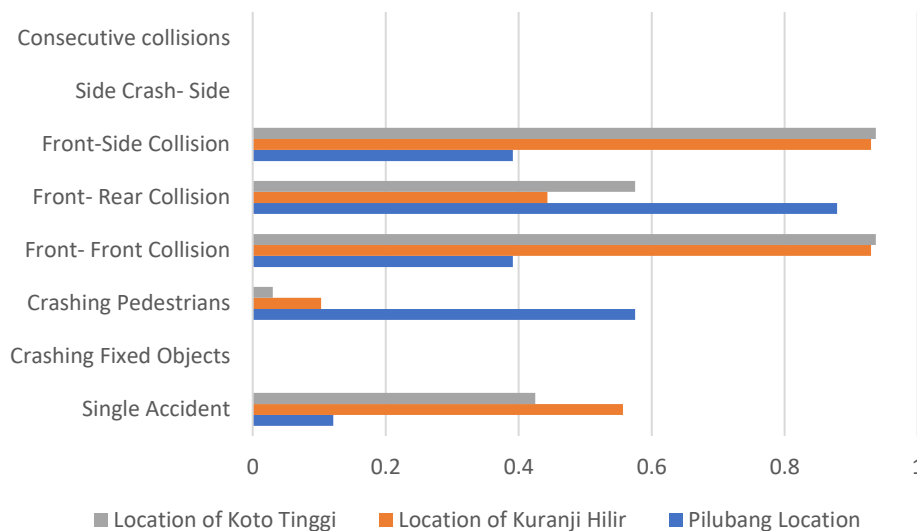

Figure 1. Number of accidents based on accident causal factors

The results of the analysis showed that the relationship between Hitting Fixed Objects with the Location in Pilubang, the relationship between side-and-side Collisions with the Location in Pilubang, and the relationship between Consecutive Collisions with the Location in Pilubang could not be analyzed because there was a constant value. The relationship between single accidents, pedestrian hits, front-front hits, front-rear hits, and front-side collisions with the Location in Pilubang has a significance value (Sig. 2-tailed) greater than 0.050, so it can be concluded that there is no significant relationship between single accidents, hitting pedestrians, front-front hits, front-rear hits, and front-side collisions with the Location in Pilubang.

The results of the analysis showed that the relationship between Hitting Fixed Objects with Locations in downstream Kuranji, the relationship between side-and-side Collisions with Locations in downstream Kuranji, and the relationship between Consecutive Collisions with Locations in downstream Kuranji could not be analyzed because there were constant values.

The relationship between single accidents, pedestrian hits, front-front hits, front-rear hits, and front-side collisions with the Location in Lower Kuranji has a significance value (Sig. 2-tailed) greater than 0.050, so it can be concluded that there is no significant relationship between single accidents, hitting pedestrians, front-front hits, front-rear hits, and front-side collisions with the Location in Lower Kuranji.

The results of the analysis showed that the relationship between Hitting Fixed Objects with Locations in Koto high, the relationship between side-and-side Collisions with Locations in Koto high, and the relationship between Collision streaks with Locations in Koto high could not be analyzed because there were constant values. The relationship between single accidents, hitting pedestrians, front-front hits, front-rear hits, and front-side collisions with the Location in Koto Tinggi has a significance value (Sig. 2-tailed) greater than 0.050, so it can be concluded that there is no significant relationship between single accidents, hitting pedestrians, front-front hits, front-rear hits, and front-side collisions with the Location in Koto Tinggi.

Analysis of the relationship between the causal factors of accidents with the location of Kuranji Hilir The analysis of the relationship between the number of accidents based on causal factors

Table 7. Number of accidents based on accident causal factors

Variable	Pilubang Location	Location of Kuranji Hilir	Location of Koto Tinggi
Driver	0.246	0.924	0.791
Vehicle Condition	-	-	-
Road Conditions	-	-	-
Environmental Conditions	-	-	-

The results of the analysis showed that the driver's causative factor had a significance value (Sig. 2-tailed) greater than 0.050 so that it can be concluded that there is no significant relationship between the driver's causative factor and the location of Pilubang. As for the causative factors of vehicle condition, road conditions with the accident site in Pilubang cannot be analyzed due to the constant value.

The results of the analysis showed that the driver's causative factor had a significance value (Sig. 2-tailed) greater than 0.050 so that it could be concluded that there was no significant relationship between the driver's causative factor and the location of Kuranji downstream. The factors causing the condition of vehicles, roads, and the environment with the accident site in Kuranji Hilir cannot be analyzed because of the constant value.

The results of the analysis showed that the driver's causative factor had a significance value (Sig. 2-tailed) greater than 0.050 so that it could be concluded that there was no significant relationship between the driver's causative factor and the location of the high Koto. The factors causing vehicle conditions, road conditions, and environmental conditions with the accident site in Koto Tinggi cannot be analyzed because of the constant value.

CONCLUSION

Accidents that occur on the lime river road section of Padang Pariaman Regency can be caused by various factors causing accidents, so to reduce the number of accidents, it is necessary to analyze the main factors that have the potential to cause accidents, especially heavy accidents. Based on the results of the analysis of traffic accidents on the limau river road section of Padang

Pariaman Regency, the following conclusions can be drawn:

There are several aspects that can cause accidents, namely driver factors, vehicle conditions, road conditions and environmental conditions. The main aspect of causing accidents on the Padang Pariaman Regency lime river road section is the driver factor with a percentage of 100%, this means that as many as 100% of accidents that occur are caused by the driver's physical and mental condition, including fatigue, lack of sleep, or health problems, can affect their ability to drive safely.

Traffic accidents that occur on the limau river road section of Padang Pariaman Regency mostly result in minor injuries, often occur on Mondays, often occur during the hours of the incident 06.00 to 19.00, most accidents occur on motorcyclists and private cars, most accidents are experienced by drivers and victims aged between 16-30 years, the type of accident that often occurs is front-front hits, accidents often occur in Kuranji Hilir on sections 3-6 Km.

After conducting a correlation test using the SPSS program, it was found that not all accidents have a significant relationship with all incident parameters and the high level of accidents using the Accident Equivalent Rate (AEK) method shows that the most dominant occurred in 2022 with an accident equivalent number of 372. In addition, the results of the analysis also show that the equivalent number of accidents on the Sungai Limau road in Padang Pariaman Regency fluctuates every year.

For further research, you can examine the development of vehicles against traffic accidents and conduct an LHR (Average Daily Traffic) survey to calculate vehicle safety in accident-prone locations.

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