JOURNAL OF WORLD SCIENCE
https://jws.rivierapublishing.id/index.php/jws
Volume 2 No. 6 June 2023
P-ISSN: 2828-8726
E-ISSN: 2828-9307

ACCIDENT-PRONE LOCATIONS ON NATIONAL ROADS IN KUPANG DISTRICT, EAST NUSA TENGGARA PROVINCE

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ABSTRACT
This study aimed to identify and formulate recommendations for improvements to Accident-Prone Locations (LRK) in Kupang Regency, East Nusa Tenggara Province. The approach methodology used includes collecting secondary data on accidents from the police and primary data through field surveys to analyze and rank the severity of accidents. The ranking is done through the value of the Equivalent Accident Number (EAN) and Upper Limit Control (UCL). The analysis results show that there are 18 points of Accident Prone Locations on the national road in Kupang Regency. These namely locations have an EAN value above the BKA and UCL values. A motorcycle is the dominant type of vehicle involved in an accident, and the dominant cause of accidents is the driving factor. The formulation of recommendations for improvement was carried out for 3 locations with the highest EAN values, namely Jl. Oesapa-Oesao Km 5, Km 1 and Km 4. For these three locations, the necessary treatment recommendations were formulated. This research has implications in helping identify and prioritize the most accident-prone locations. The study can also encourage the development or improvement of roads, sidewalks, street lighting, traffic signs, or other necessary infrastructure elements to enhance traffic safety in LRK.

Keywords: accident-prone locations, national roads, kupang district.

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INTRODUCTION

Almost everyone in Indonesia has motorized vehicles, both in the category of two-wheeled and four-wheeled motorized vehicles (cars). This is what causes every day and even every year, the volume of vehicles increases and makes it a factor of traffic density (Sitanggang & Saribanon, 2018). This traffic density is one of the causes of accidents, although there are also many other contributing factors (Sugiyanto & Fadli, 2017). Based on the results of previous research, it was stated that the main causative factor causing accidents was the human factor, the motorbike rider himself (Sulistyowati & Susetiyono, 2023). It is proven by the results of his research to get percentage of the aspect of two-wheeled road users is 59%, and the rest are four-wheeled vehicle drivers (Intari et al., 2019).

Factors that cause traffic accidents are vehicle factors and road conditions (Dewantoro & Setiawan, 2021) ; (Dewantoro & Setiawan, 2021). In line with previous research, the factors causing accidents were environmental and natural conditions that did not support (Carina, 2017). It can also be seen that the conditions on the highway are not good; for example, there are very large potholes, and sometimes users drive too fast, causing them to enter potholes and accidents occur (Feryanti & Mulyono, 2019) ; (Bobade et al., 2015). The definition of a traffic accident, according to Law No. 22 of 2009, is an incident on the road that is unexpected and unintentional, involving vehicles with or

without other road users resulting in human casualties and property loss (Bolla et al., 2015). In line with previous studies, accidents occur unexpectedly, also unplanned, and not an expectation that usually occurs on the highway caused by human negligence, which results in injury, illness, and loss to humans, vehicles, and the environment (Ramlan et al., 2023). In this case, the victim is the human driver himself who is divided into the following categories: 1) the victim died or died (fatally killed); 2) victims of serious injuries; and 3) victims of light injuries (slight injuries) (Ramlan et al., 2023).

According to data from the Indonesian National Police, in Indonesia, an average of 3 people die every hour due to road accidents (Kominfo, 2017). This often happens, especially in Kupang Regency, the capital city of East Nusa Tenggara Province. Kupang Regency is a district or city that has the second highest number of accidents, after Kupang City, in East Nusa Tenggara Province. The number of accidents in Kupang Regency during 2019, 2020, and 20121 were 201, 139, and 142 (Bolla et al., 2015). The results of previous research stated that the Timor Raya road section is one of the roads with the largest traffic accident case categories and victims (Bolla et al., 2015).

Based on the things that have been explained above, this research is part of the Determination of Points and Recommendations for Accident-Prone Locations (LRK) Improvements in East Nusa Tenggara Province carried out by the Directorate of Land Transportation Safety, Directorate General of Land Transportation, Ministry of Transportation.

National Road in NTT Province

National roads in NTT Province according to the Decree of the Minister of Public Works and Public Housing (PUPR) Number: 248/KPTS/M/2015 Concerning Designation of Road Sections in the Primary Road Network According to their Functions The length of National Roads is 1,857.91 km consisting of Primary Arterial roads along 1,052.33 km and 805.58 km of Primary Collector 1 roads, as shown in Table 1 and Figure 1. There are 4 (four) national road sections that cross the Kupang district, consisting of out-of-town and urban roads. The road width on the national road section that crosses the city of Kupang varies between 6 m-12 m.

Table 1 Characteristics of the Kupang Regency National Road Section

No Section	Kupang District National Road Name	Length (Km)	Outer City / Urban Roads	Road Function	Road Width (m)	Road Type
27 11 K	OESAPA-OESAO	3.49	Urban	AP	12	4/2 UD
27	OESAPA-OESAO	12.83	Out of town	AP	6.5	2/2 UD
28	OESAO-BUTTLE	41.98	Out of town	AP	6	2/2 UD
29	ASS-BAPUPUTIH	7.02	Out of town	AP	6	2/2 UD

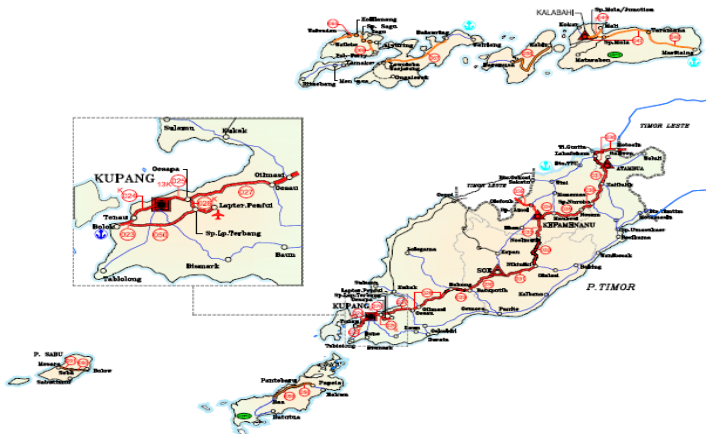

Figure 1. Road Network in NTT Province

Accident Prone Locations

Referring to Guidelines Pd T-09-2004-B concerning Handling Traffic Accident-Prone Locations (Region, 2004). A location is declared a traffic accident-prone location if it has several conditions. These conditions include:

a. high accident rate
b. data on accidents (accidents) for at least two consecutive years, preferably three consecutive years.
c. Accident locations are relatively stacked,
d. accident locations in the form of intersections or road segments (100-300) m long for urban roads and 1 km long road segments for inter-city roads.
e. accidents that occur in space and relatively the same period
f. has a cause of accidents with specific factors.

Equivalent Accident Number (EAN) is the number used to grade the weighting accident; this value is based on the value of an accident with damage or loss of material. EAN is a numerical economic scale to weigh the degree of accidents. It is calculated by comparing the estimated economic loss caused by various degrees of accident.

The technique of identifying the ranking of accident sites is carried out by determining the Weighted Accident Number (WAN). The accident has several types or degrees based on the victim's severity, so the accident number needs to be weighted by the equivalent accident number to become a WAN. The equivalent accident number (EAN) formula is as follows;

EAN = 12FAT + 3SVI + 3MNI + 1PDO. **(1)**

EAN = Equivalent Accident Number
FAT = death victims or fatalities
SVI = serious injuries or severe injuries
MNI = slight or minor injuries
PDO = property damaged only

Quality control statistics as UCL (Upper et al.) chart control is calculated using the following formula:

UCL = λ+ ΨX. [(λ/m) + (0.829/m) + 0.5m] $^{0.5}$ **(2)**

Where:

UCL = Upper Limit Control
λ = Average EAN of all road sections reviewed
Ψ = probability factor
= 2,576 for a 99% confidence level
m = EAN of the road section reviewed

The Upper Control Limit line (BKA) is a fixed value for the entire road section. A segment of a road section with EAN above the UCL line is defined as a traffic accident black spot location. UCL line value is calculated using the following formula:

BKA = C+3. $\sqrt{C}$ **(3)**

C = Average EAN of all road sections reviewed

Based on the description above, the research aims to identify the existence of Accident-Prone Locations in Kupang Regency and recommendations for handling them.

METHODS

This section will explain the method or work steps from research on Accident-Prone Locations on National Roads in Kupang Regency, East Nusa Tenggara Province. This research began with literature studies from various sources and related literature, searching for and reviewing relevant studies and continuing to collect data on accidents that occurred according to the research location. This stage is to collect all the data planned following the research objectives to be carried out. Next, calculate the equivalent number of accidents and then do the ranking and determine the location considered an accident-prone location. After that, processing and analyzing the data according to the category of analysis of the causes of accidents and an inventory of geometric and environmental conditions is then used as an analysis related to handling accident-prone locations. Moreover, the last stage is to provide conclusions and some suggestions. In this section, the research method is presented in Figure 2 below.

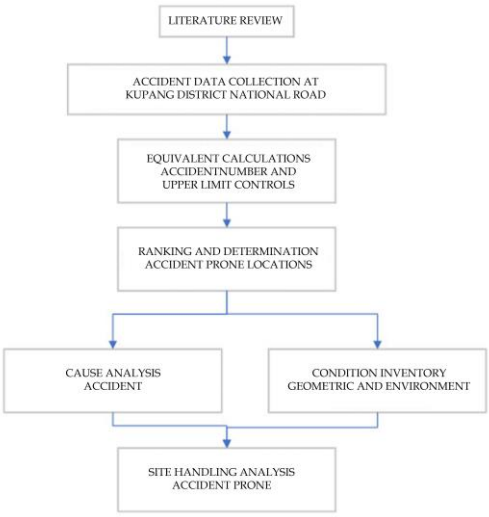

Figure 2. Research Flow

RESULTS AND DISCUSSION

Identification of Accident Prone Locations (LRK)

Recapitulation of the number of accidents on the Kupang district national road segment based on data from the Indonesian National Police for the last three years broken down per road section per km and the EAN calculation is presented in Table 2. Based on the results of the EAN calculation for all sections, the average EAN value can be calculated, which is 99. Based on the average EAN value, the Upper Limit value can be calculated as follows:

Upper Limit (BKA) =C+3 √C
= 176 + 3X√176
=216

line value is calculated per road section per km calculated as follows.

UCL line = λ+ Ψ ×√([(λ⁄m) + ((0.829)⁄m) + (1⁄2×m))
=176+2,576. √([(176⁄m) + ((0.829)⁄m) + (1⁄2×m))

m = Accident rate on the section under review (EAN)

The calculation results of BKA and UCL on the Kupang regency national road sections broken down per road section per km are presented in Table 2 and Figure 1.

The ranking of the EAN values for the Kupang district national roads is presented in Table 2. The table shows that 18 points of Accident Prone Locations have an EAN value above the BKA and UCL values.

Table 2. Ranking of EAN Values on Kupang Regency National Road Sections

STREET NAME	MD	LB	LR	KR	Total	EAN	UCL line
JL. OESAPA-OESAO KM. 5	5	5	23	0	33	715	225
JL. OESAPA-OESAO CITY KM. 1	5	5	11	1	22	656	223
JL. OESAPA-OESAO KM. 4	5	2	8	0	15	580	220
JL. OESAPA-OESAO KM. 12	5	0	7	0	12	535	219
JL. OESAPA-OESAO KM. 7	3	5	8	0	16	440	215
JL. OESAO-BOKONG KM. 3	3	3	8	0	14	400	213
JL. OESAPA-OESAO KM. 14	3	1	7	0	11	355	211
JL. OESAPA-OESAO KM. 13	3	0	6	0	9	330	210
JL. OESAO-BOKONG KM. 15	3	0	3	0	6	315	209
JL. OESAPA-OESAO KM. 16	1	6	8	0	15	260	206
JL. OESAPA-OESAO KM. 6	1	5	11	1	18	256	206
JL. OESAPA-OESAO CITY KM. 3,29	2	1	5	0	8	245	205
JL. OESAPA-OESAO KM. 11	2	0	8	1	11	241	205
JL. OESAPA-OESAO KM. 9	2	1	4	0	7	240	205
JL. OESAO-BOKONG KM. 6	2	0	7	0	9	235	204
JL. OESAO-BOKONG KM. 11	2	1	2	0	5	230	204
JL. OESAO-BOKONG KM. 9	2	1	2	0	5	230	204
JL. OESAO-BOKONG KM. 8	2	0	4	1	7	221	204
JL. OESAPA-OESAO CITY KM. 3	1	3	9		13	205	203
JL. OESAO-BOKONG KM. 35	2				2	200	202
JL. OESAO-BOKONG KM. 22	1	3	7	2	13	197	202
JL. OESAO-BOKONG KM. 1	1	4	3		8	195	202
JL. OESAO-BOKONG KM. 7	1	3	6		10	190	202
JL. OESAO-BOKONG KM. 4	1	2	6		9	170	200
JL. OESAO-BOKONG KM. 14	1	1	6		8	150	199
JL. BUTONG-PUTIH STONE KM. 7	1	2	1		4	145	199
JL. OESAO-BOKONG KM. 25	1	1	4		6	140	198
JL. OESAPA-OESAO KM. 15	1	1	3	1	6	136	198
JL. OESAPA-OESAO CITY KM. 2	1	1	3	1	6	136	198
JL. BUTONG-PUTIH STONE KM. 6	1	1	2		4	130	197
JL. OESAO-BOKONG KM. 5	1		6		7	130	197
JL. OESAO-BOKONG KM. 27	1	1	1		3	125	197
JL. OESAO-BOKONG KM. 38	1	1			2	120	197
JL. OESAO-BOKONG KM. 41	1	1			2	120	197
JL. OESAO-BOKONG KM. 16	1		3	1	5	116	196
JL. OESAO-BOKONG KM. 2	1		3		4	115	196
JL. OESAO-BOKONG KM. 23	1		2	1	4	111	196
JL. OESAO-BOKONG KM. 17	1		2		3	110	196
JL. OESAO-BOKONG KM. 33	1		2		3	110	196

STREET NAME	MD	LB	LR	KR	Total	EAN	UCL line
JL. OESAO-BOKONG KM. 37	1		2		3	110	196
JL. OESAO-BOKONG KM. 40	1		2		3	110	196
JL. OESAO-BOKONG KM. 18	1				1	100	195
JL. OESAPA-OESAO KM. 8		4	4		8	100	195
JL. OESAO-BOKONG KM. 26		3	3		6	75	193
JL. OESAO-BOKONG KM. 10		3	2		5	70	192
JL. BUTONG-PUTIH STONE KM. 5		2	3		5	55	191
JL. OESAO-BOKONG KM. 12		2	1		3	45	190
JL. OESAO-BOKONG KM. 29		2	1		3	45	190
JL. OESAPA-OESAO KM. 10		1	5		6	45	190
JL. OESAPA-OESAO KM. 16,3		1	3		4	35	189
JL. OESAO-BOKONG KM. 13		1			1	20	188
JL. OESAO-BOKONG KM. 31		1			1	20	188
JL. BUTONG-PUTIH STONE KM. 2			2		2	10	189
JL. OESAO-BOKONG KM. 24			2		2	10	189
JL. OESAO-BOKONG KM. 30			1	1	2	6	191
JL. BUTONG-PUTIH STONE KM. 1			1		1	5	192
JL. OESAO-BOKONG KM. 20			1		1	5	192
JL. OESAO-BOKONG KM. 32			1		1	5	192
JL. OESAO-BOKONG KM. 39			1		1	5	192
Average						176	
BKA						216	

Based on the ranking of the 18 accident-prone locations in Table 2, the 3 locations with the highest EAN numbers were handled, namely:

1. Jl. Oesapa-Oesao Km 5
2. Jl. Oesapa-Oesao Km 1
3. Jl. Oesapa-Oesao Km 4

LRK Handling Recommendations

a. Jl. Oesapa-Oesao Km 5, Kupang Regency

Operational speed on Jl. Oesapa-Oesao Km 5, an inter-city road, is relatively low (40 km/hour). Still, data on motorcycle traffic accidents that occur late at night or early in the morning show that when an accident occurs, the vehicle/motorcycle is driven at high speed.

Regulation of the Minister of Transportation of the Republic of Indonesia Number PM 111 of 2015 concerning Procedures for Setting Speed Limits states that the speed limit on inter-city roads: is a maximum of 80 km/hour. Based on PM 111 of 2015, as long as the location is prone to accidents on inter-city roads, the speed is limited to a maximum of 60 km/hour. Summary of causes and treatments for LRK-01 Jl. Oesapa-Oesao Km 5 and volume analysis are presented in Table 3 and Table 4. The treatment plan is presented in Appendix 1.

Table 3. Causes of Accidents and Handling on Jl. Oesapa-Oesao Km 5

Reason	Condition of Facilities and Infrastructure	Handling Proposal
High speed Irregular driving in lanes and lanes of traffic (zig-zag) Lack of concentration Lack of lighting Dominated by motorbikes Possible driver drowsiness (because predominant accidents occur at night and early in the morning)	Center markings and edge markings are faded PJU light intensity is small/dim There are no signs at the intersection yet There are no accident-prone warning signs There are no bridge warning signs	Procurement and installation of signs prohibiting walking because it is mandatory to stop on the access road (Table III 1a) measuring 75 x 75 cm Procurement and installation of signs prohibiting driving vehicles at speeds that exceed what is written (Table III4h) measuring 75 x 75 cm Procurement and Installation of Maximum Speed Prohibition Limit Sign 60 Km/hour (Table III 7a) size 75 cm. Procurement and installation of warning signs reading Prone to Accident (Table II9) measuring 1200 x 2000 mm Procurement and Installation of Priority Four Intersection Warning Signs (Table II 4b2) size 75 x 75 cm Procurement and Installation of Bridge Warning Signs Table II 1w size 75 x 75 cm Procurement and Installation of Traffic Signs on the road measuring 75X75 cm, Crossing Direction Signs (Table V 5e) Procurement and installation of solar cells for street lighting Procurement and Installation of Rumble Stripe/Rumble Stripe Procurement and installation of crossing markings Installation of edge markings Installation of dotted center markings

Table 4. Accident Handling Volume Jl. Oesapa-Oesao Km 5

Job Name	Amount	Unit
Procurement and installation of signs prohibiting walking because it is mandatory to stop on the access road (Table III 1a) measuring 75 x 75 cm	5	fruit
Procurement and installation of signs prohibiting driving vehicles at speeds that exceed what is written (Table III4h) measuring 75 x 75 cm	2	fruit
Procurement and Installation of Maximum Speed Prohibition Limit Signs 60 Km/hour (Table III 7a) size 75 cm	2	fruit
Procurement and installation of warning signs reading Prone to Accident (Table II9) measuring 1200 x 2000 mm	2	fruit
Procurement and Installation of Priority Four Intersection Warning Signs (Table II 4b2) size 75 x 75 cm	3	fruit
Procurement and Installation of Bridge Warning Signs Table II 1w size 75 x 75 cm	2	fruit
Procurement and Installation of Traffic Signs on the road measuring 75X75 cm, Crossing Direction Signs (Table V 5e)	4	fruit
Procurement and installation of solar cells for street lighting	6	fruit
Procurement and Installation of Rumble Stripe/Rumble Stripe	4,5	m2
Procurement and installation of crossing markings	33.50	m2
Installation of edge markings	158.88	m2
Installation of dotted center markings	29.79	m2

Jl. Oesapa-Oesao City Km 1, Kupang Regency

Summary of causes and treatments for LRK-01 Jl. Oesapa-Oesao Km 1 and volume analysis are presented in Table 5 and Table 6. The treatment plan is presented in Appendix 2.

Table 5. Accident Causes and Handling Jl. Oesapa-Oesao City Km 1

Reason	Condition of Facilities and Infrastructure	Handling Proposal
High speed Irregular driving in lanes and lanes of traffic (zig-zag) Lack of concentration Lack of lighting Dominated by motorbikes Possibility of the driver falling asleep or not seeing clearly (because the majority of accidents occur at night) Driver under the influence of alcohol	There are no speed limit markers. Center markings and edge markings are faded PJU light intensity is small/dim There is no zebra crossing at the pedestrian concentration area (church) There are no signs at the intersection yet	Procurement and installation of Prohibition Signs continue because it is mandatory to stop on the access road (Table III 1a) measuring 75 x 75 cm. Procurement and installation of signs prohibiting driving vehicles on signs that are written (Table III4h) measuring 75 cm Procurement and Installation of Maximum Speed Prohibition Limit Sign 40 Km/hour (Table III 7a) size 75 cm. Procurement and installation of warning signs reading Prone to Accident (Table II9) measuring 1200 x 2000 mm Procurement and Installation Wednesday warning Warning Three Sided Right Junction Table II 4b9 size 75 x 75 cm Procurement and installation of a three-sided right-sided intersection warning sign (Table II4b17) measuring 75 x 75 cm Procurement and installation of left three-sided intersection warning signs Table II 4b8 size 75 x75 cm Procurement and installation of warning signs for multiple triple intersections on the right side Table II 4b15 size 75 x 75 cm Procurement and Installation of Left Side Multiple Three Junction Warnings Table II 4b14 size 75 x 75 cm Procurement and Installation of Multiple Three Junction Warnings Right and Left Sides Table II 4b11 size 75 x 75 cm Procurement and Installation of Left Three Junction Warnings Table II 4b16 Procurement and Installation of Traffic Signs on the road measuring 75X75 cm, Crossing Direction Signs (Table V 5e) Procurement and Installation of Rumble Stripe/Rumble Stripe Procurement and installation of crossing markings Installation of edge markings along Installation of dotted center markings

Table 6. Accident Handling Volume Jl. Oesapa-Oesao Km 1

Job Name	Amount	Unit
Procurement and installation of Prohibition Signs continue because it is mandatory to stop on the access road (Table III 1a) measuring 75 x 75 cm	12	fruit
Procurement and installation of signs prohibiting driving vehicles on signs that are written (Table III4h) measuring 75 cm	2	fruit
Procurement and Installation of Maximum Speed Prohibition Limit Signs 40 Km/hour (Table III 7a) size 75 cm	2	fruit
Procurement and installation of warning signs reading Prone to Accident (Table II9) measuring 1200 x 2000 mm	2	fruit

Job Name	Amount	Unit
Procurement and Installation Wednesday warning Warning Three Sided Right Junction Table II 4b9 size 75 x 75 cm	1	fruit
Procurement and installation of a three-sided right-sided intersection warning sign (Table II4b17) measuring 75 x 75 cm	2	fruit
Procurement and installation of left three-sided intersection warning signs Table II 4b8 size 75 x75 cm	1	fruit
Procurement and installation of warning signs for multiple triple intersections on the right side Table II 4b15 size 75 x 75 cm	2	fruit
Procurement and Installation of Left Side Multiple Three Junction Warnings Table II 4b14 size 75 x 75 cm	1	fruit
Procurement and Installation of Multiple Three Junction Warnings Right and Left Sides Table II 4b11 size 75 x 75 cm	3	fruit
Procurement and Installation of Left Three Junction Warnings Table II 4b16	1	fruit
Procurement and Installation of Traffic Signs on the road measuring 75X75 cm, Crossing Direction Signs (Table V 5e)	2	fruit
Procurement and Installation of Rumble Stripe/Rumble Stripe	3,6	m2
Procurement and installation of crossing markings	26.80	m2
Installation of edge markings	187,92	m2
Installation of dotted center markings	35,235	m2

Jl. Oesapa-Oesao Km 4, Kupang Regency

Summary of causes and treatment on Jl. Oesapa-Oesao Km 4 and volume analysis are presented in Table 7 and Table 8. Treatment plans.

Table 7. Accident Causes and Handling LRK-03 Jl. Oesapa-Oesao Km 4

Reason	Condition of Facilities and Infrastructure	Handling Proposal
a. High speed b. Irregular driving in lanes and lanes of traffic (zig-zag) c. Lack of concentration d. Lack of lighting e. Dominated by motorbikes f. Possibility of the driver falling asleep or not seeing clearly (because the majority of accidents occur at night)	a. There are no speed limit markers b. Center markings and edge markings are faded c. PJU light intensity is small/dim d. There are no signs at the intersection yet b. There are no warning signs for accident-prone locations	Procurement and installation of signs prohibiting walking because it is mandatory to stop on the access road (Table III 1a) measuring 75 x 75 cm Procurement and installation of signs prohibiting driving vehicles on signs that are written (Table III4h) measuring 75 cm Procurement and Installation of Maximum Speed Prohibition Limit Sign 60 Km/hour (Table III 7a) size 75 cm. Procurement and installation of warning signs reading Prone to Accident (Table II9) measuring 1200 x 2000 mm Procurement and Installation Wednesday warning Warning Three Sided Right Junction Table II 4b9 size 75 x 75 cm Procurement and Installation of Priority Four Intersection Warning Signs Table II 4b2 size 75 x 75 cm

	Procurement and Installation of Traffic Signs on the road measuring 75X75 cm, Crossing Direction Signs (Table V 5e) measuring 60 x 75 cm
	Procurement and installation of multiple triple intersection warnings on the right and left sides Table II 4b11 size 75 x75 cm
	Procurement and installation of Rumble stripe/rumble stripe
	Installation of edge markings
	Installation of dotted center markings

Based on the table above, it can be seen that the cause of accidents is dominated by the human factor, namely the vehicle users themselves; this is in line with previous research that human negligence is the main factor causing accidents to occur on the highway (Ichbal Maulana, 2023); (Kaur & Kaur, 2017); (Mohan & Landge, 2017). These results prove that the analysis of the causes of accidents occurs not only due to environmental factors or road conditions.

Table 8. Accident Handling Volume Jl. Oesapa-Oesao Km 4

Job Name	Amount	Unit
Procurement and installation of signs prohibiting walking because it is mandatory to stop on the access road (Table III 1a) measuring 75 x 75 cm	4	fruit
Procurement and installation of signs prohibiting driving vehicles on signs that are written (Table III4h) measuring 75 cm	1	fruit
Procurement and Installation of Maximum Speed Prohibition Limit Signs 60 Km/hour (Table III 7a) size 75 cm	2	fruit
Procurement and installation of warning signs reading Prone to Accident (Table II9) measuring 1200 x 2000 mm	2	fruit
Procurement and Installation Wednesday warning Warning Three Sided Right Junction Table II 4b9 size 75 x 75 cm	1	fruit
Procurement and Installation of Priority Four Intersection Warning Signs Table II 4b2 size 75 x 75 cm	2	fruit
Procurement and Installation of Traffic Signs on the road measuring 75X75 cm, Crossing Direction Signs (Table V 5e) measuring 60 x 75 cm	2	fruit
Procurement and installation of multiple triple intersection warnings on the right and left sides Table II 4b11 size 75 x75 cm	2	fruit
Procurement and Installation of Rumble Stripe/Rumble Stripe	4,5	m2
Installation of edge markings	120,24	m2
Procurement and Installation of Left Three Junction Warnings Table II 4b16	1	fruit

Based on the table above, it can be concluded that in order to deal with accident-prone areas, there is not a little that must be done, and material and non-material costs are incurred. This must also be prioritized, like the procurement and installation of various signs. This aligns with the previous statement that the material costs incurred were enormous, not only hundreds of millions but up to billions of rupiah (Oktopianto et al., 2021). This was proven when the loss in the value of the vehicle or material damage due to traffic accidents, there were costs that had to be incurred from 2015 to 2016, which amounted to IDR 511,900,006.00. Therefore it is very important to carry

out road audits and maintenance daily to minimize the costs incurred when replacing damaged material due to traffic accidents (Narendra & Amrina, 2023).

CONCLUSION

A motorcycle is the dominant type of vehicle involved in an accident in Kupang Regency, NTT Province. The dominant cause of accidents is the driver factor, namely: they occur at high speeds, especially when they occur at night; disorderly driving in traffic lanes and lanes (zig-zag); the driver lacks concentration; the possibility of the driver falling asleep (because the predominant accidents occur at night and early in the morning); driving under the influence of alcohol. Road factors that cause accidents are Hardened shoulders causing the road width to be unequal (not continuous), endangering road users because there is no road narrowing signs/markings; insufficient lighting (the amount of public street lighting/PJU is sufficient, but the light is not strong enough); lack of crossing facilities for pedestrians. Because the dominant accidents occurred at night and early, the lack of PJU lighting caused dark conditions.

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