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ROAD ACCIDENTS CHARACTERISTICS ANALYSIS USING MINOR STATISTICS TEST (CASE STUDY: RAMA SETIA ROAD, BANDA ACEH)

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This study aims to analyze the most dominant road accident characteristics inside Rama Setia road segment so that the vehicle type with highest involvement in road accident will obtained inside the observed site. The study performed using mean and standard deviation parameters as explanatory variables with road accidents proportion method which recommended from Public Works Department as the analytical variable. Analysis results obtained from these two variables would be tested using Two-Tail Test comparative hypothesis from the road accident categories in Rama Setia road segment as the observed site and another major roads in Banda Aceh as the control zone. The results of hypothesis tests are statistically analyzed using Normal Distribution Test with significance level of 5% (Z_{table} value = 1.640). Of all the road accident characteristics analyzed with Normal Distribution Test, it can be concluded that there are similarities between the characteristics of the road accident cases in Rama Setia road and the characteristics of the road accident which occurred in another major roads in Banda Aceh city. These results also confirmed that the method of mean and standard deviation mean parameters have identical results to Rizki's research (2012) whom using the proportion crash method.

Keywords: Road Accident Characteristics Analysis, Mean and Standard Deviation Parameters, Motorcycle

1. INTRODUCTION

Traffic accidents are a serious problem that requires treatment in view of the amount of loss caused, either fall injuries to the victim deceased or/and the losses in terms of material. Accident are the result of error or not well-operated one of the few elements of the traffic that are; road systems, vehicles, road users, and the environment (Wedha 2001). The number of traffic accidents died in Indonesia in the last two decades, reaching an average of 10,000 casualties per year (Anonymous 2004). In Aceh, a total of 732 cases of traffic accident occurred in Aceh during the period of January 2012 to July 2012. Of those cases, 363 people, or an average of two people killed on the highway in a single day. The death toll at most in the traffic accident was recorded in the district of Pidie as many as 47 people. While the least place of traffic accident case recorded in the city of Sabang where only one traffic accident occured in the past six months, and no casualties (Based on interviews with the Director of Traffic Police (Dirlantas), Senior Police Commissioner, Sedyantoro, quoted back from the daily Serambi Indonesia news; July 11, 2012 edition). Basically, the road accident occurred on a combination of road users (human), vehicles, roads, and environment in one traffic system. These elements either individually or in combination can cause road accidents. Therefore, it is necessary to conduct the analysis step to identify the causes of traffic accidents in the accident-prone areas that are useful for safer regulation of traffic system.

This study has four performance indicators such as, the effect of the existing condition (geometric designs of road), the influence of time of occured accident, the current existing traffic on the road, and the operational speed of passing vehicles on the road. Handling procedures which included in this study only includes parts such as the preparation of the traffic accident data collection system (3-L), the stage of identification of accident-prone locations, and the data analysis stage in accordance with the instructions of the Guidelines for Handling Traffic Accident Prone Location, Department of Public Works (In Indonesian language, Pedoman Penanganan Lokasi Rawan Kecelakaan Lalu Lintas Departemen PU).

The results of this study in terms of the characteristics of a traffic accident on Rama Setia Road displayed that all traffic accidents involving motorcycle. The accidents occurred among motorcycle, the motorcycle with passenger cars, as well as between the motorcycle with pedestrians. It can be concluded, the motorcycle is the most dominant type of vehicle in case of a traffic accident on Rama Setia Road, Banda Aceh. Then, assuming the form of the use of parameters mean and standard deviation as an explanatory variable of the data sample and the population have identical results using the proportion of accidents recommended by the Department of Public Works that serves as a variable analysis. With these results, the method of analysis of the characteristics of traffic accident with parameters mean and standard deviation were used in this study can be used for roads that have small traffic volume.

2. RESEARCH METHODOLOGY

According to the type of data requirements, the data collection methods in data collection are separated into two types, namely primary data and secondary data collection. In this study, secondary data serves as the main data and a primary serves as supporting data. Primary data is the data obtained by directly collecting at the location which become the object of research. Secondary data is the data which retrieved based on the values that already determined by Department of Public Works regulation, as well as data derived from Banda Aceh Police. The primary data or data derived from field includes road geometrical existing condition, environmental condition, side friction, and the volume of traffic. Primary data obtained by observation in the study site, which included observation that performed by the geometric of road segment measurements. Noting the number of lanes and the direction, determining the direction of road code (west, east, north, or south), noting the existing of street medians, road shoulders width, and median (if any). Measurements carried out at night to avoid any disturbance which will possibly affect traffic flow. Secondly, observation of environmental conditions by setting the road segment grouping, either as commercial land, residential land or areas with limited access.

Thirdly, side friction enumeration conducted on the best approach side by recording all the elements of in-out movement by pedestrians and vehicles. Lastly, traffic volume survey conducted by considering factors of the number of vehicles, the direction of movement, observation time, and rush hour periods. Each logger records all vehicles that pass through (based on each classification) for straight direction, right turn, left turn, and placing it in the provided enumeration form. Observation time done for 60 minutes each in the morning and afternoon. Current weather condition observation also noted whether it comes to sunny weather, rain, or other weather condition. Enumeration of traffic volume carried on the rush hour periods. After the data of hourly traffic volume (pcu/hour) from each observation period (morning, afternoon, evening) obtained respectively, the next step is to sum up the volume of traffic per each movement direction on each road segment. Secondary data obtained by inventorying reference data from relevant agencies including traffic accident crash data from Banda Aceh Police.

The results obtained will be used to establish the hypothesis which being tested, as well as reject the hypothesis which not consistent with the determined hypothesis in question. Statistical test of significance is obtained by comparing the observed value and the value from table with a certain α significance level for Normal Distribution Test. The Normal Distribution Test, in principle, more emphasizing on nominal value. The normal test will compare the value of the individual composition of a sample of cases in a single location (site) with the composition of the same case in another road section (control) (Sugiyono 2010). The value of observation is given by the formula:

$$Z = \frac{\bar{x} - \mu_o}{\frac{s}{\sqrt{n}}} \quad (1)$$

where:

Z = calculated Z value

$\bar{x}$ = average of x_i

μ_o = hypothesized value

s = standard deviation of the population (control)

n = number of road accidents on the site location

with condition:

1). If the observed value > from the table value, the hypothesis reject Ho and accept Hi, with inference that there is a significant difference between the number of accidents at the group in an accident-prone locations (sites) with a typical group of similar accidents on roads or in an area (control), in general.

2). If the observed value < or equal to the value of the table, then the hypothesis accept Ho and reject Hi, with the inference there is no significant difference between the number of accidents at the group in an accident-prone locations (sites) with a typical group of similar accidents on roads or in an area (control), in general. Interpretation level of significance of statistical test results are shown as in the following table:

Table 1 : Interpretation of Significance Level and Confidence Level

Significance level (%)	**Confidence level (%)**	**Interpretation**
0,1	99,9	Very acceptable
1	99	Very acceptable
5	95	Acceptable
10	90	Quite acceptable
20	80	Considerable
Source: Ministry of Human Settlement and Regional Infrastructure of Indonesia (2004)		

Z_{table} value will be taken at a significance level of 5% and a confidence level of 95%. Z_{table} value obtained from the Table of Z Normal Distribution, namely $Z_{table} = 1.960$.

3. RESULTS AND DISCUSSION

Table 2 : Number of Traffic Accident Cases on Banda Aceh City Roads on 2009 - 2011

No.	Explanation	2009	2010	2011	Total
1.	Number of Accidents with Minor Injuries	11	12	55	78
2.	Number of Accidents with Heavy Injuries	9	14	59	82
3.	Number of Accidents with Casualties	14	17	20	51
4.	Number of Accidents with Property Damage Only	3	1	4	8
TOTAL		37	44	138	219
Sources : Traffic Accidents Unit of Banda Aceh Police					

Table 3 : Property Damage of Traffic Accidents on Banda Aceh City Roads on 2009 - 2011

Explanation	2009 (IDR)	2010 (IDR)	2011 (IDR)	Total (IDR)
Property Damage Cost	66,100,000	23,970,000	43,800,000	133,870,000
Sources : Traffic Accidents Unit of Banda Aceh Police				

Table 4 : Traffic Accident Characteristics on Banda Aceh City Roads on 2009 – 2011

No.	Explanation	Number of Road Accidents			
		2009	2010	2011	Total
A. TYPE OF ACCIDENTS					
1.	Single Vehicle Accident	1	0	3	4
2.	Double Vehicle Accident	23	30	92	145
3.	Multiple Vehicle Accident	2	2	4	8
TOTAL		**26**	**32**	**99**	**157**
B. TYPE OF COLLISIONS					
1.	Motorcycle v Motorcycle	11	16	46	73
2.	Motorcycle v Passenger Car	3	10	23	36
3.	Motor Cycle v Truck	3	2	5	10
4.	Motor Cycle v Pedestrian	3	1	11	15
TOTAL		**20**	**29**	**85**	**134**
C. SEVERITY LEVEL					
1.	Causing Minor Injuries	15	15	55	85
2.	Causing Heavy Injuries	9	17	59	85
3.	Causing Casualties	14	16	22	52
TOTAL NUMBER OF VICTIMS		**38**	**48**	**136**	**222**
A. **VEHICLES INVOLVED IN ROAD ACCIDENTS**					
1.	Motorcycle	36	45	139	220
2.	Passenger Car	10	15	28	53
3.	Truck	4	2	5	11
TOTAL NUMBER OF VEHICLES		**26**	**50**	**62**	**172**
Sources : Traffic Accidents Unit of Banda Aceh Police					

From Table 4, it can be seen that almost all the characteristics of accidents has increased from year to year. On the characteristics of the type of accident, the double vehicle accident is most frequent type of accident cases. In 2009, there were 23 cases of accidents, then the case rose up to 30 accident cases in 2010 and up to 92 cases in 2011. That means, the pattern of double vehicle accident in 2011 tripled from the cases in 2009 and doubled from the year 2010.

On the characteristics of the collision type, the case of a collision between a motorcycle with a motorcycle was ranked first with 73 cases or more than a half times as much. In 2009, accidents

occurred among two-wheeled vehicles are as many as 11 cases of accidents, and afterwards, an increase of almost a half times in 2010 with 16 cases of accidents and 3 times bigger in 2011 with 46 cases of accidents.

Based on the severity level of road accident, an accident that caused the victim suffered minor injuries and serious injuries each equally caused 85 casualties (38.2%) of the total 222 victims of the crash. Rate of accidents which causing minor injuries increased from 15 to 55 over the year 2009 up to 2011, while the road accidents that cause severe injuries level increased from 17 victims to 59 victims from the period 2009 to 2011.

Motorcycle also listed as a vehicle type which mostly involved in all cases of accidents as many as 220 cases of accidents (77%) out of 284 road accident cases where vehicle involved in it. The sharp increase of accidents involving motorcycle occured by 209% from 2010 to 2011. Meanwhile, passenger cars and trucks each only increased by 13 cases (86.6%) and 3 cases or 1.5 times more frequent from 2010 to 2011.

From the data above, then a description of observed Rama Setia road which considered hazardous can be obtained and classified into type of accident, the type of collision, the severity level of road accidents, and type of vehicle which involved in road accident. The elucidation of the classification is described as follows:

3.1. Type of Accident

Table 5 : Statistical Hypothesis Testing For Type of Accident

No.	Explanation	Number of Road Accidents						Significance	Statistical Hypothesis Testing		Conclusion
		Sample			Population						
		2009	2010	2011	2009	2010	2011		Z_{table}	$Z_{observed}$	
1.	Single Vehicle Accident	0	0	0	1	0	3	5%	1.960	-	Undefined
2.	Double Vehicle Accident	2	4	9	23	30	92		1.960	-37.627	$Z_{observed} < Z_{table}$
3.	Multiple Vehicle Accident	0	1	0	2	2	4		1.960	-4.041	$Z_{observed} < Z_{table}$

3.2. Type of Collision

Table 6 : Statistical Hypothesis Testing For Type of Collision

No.	Explanation	Number of Road Accidents						Significance	Statistical Hypothesis Testing		Conclusion
		Sample			Population						
		2009	2010	2011	2009	2010	2011		Z_{table}	$Z_{observed}$	
1.	Motorcycle v Motorcycle	1	3	6	11	16	46	5%	1.960	-21.194	$Z_{observed} < Z_{table}$
2.	Motorcycle v Passenger Car	0	2	1	3	10	23		1.960	-7.965	$Z_{observed} < Z_{table}$
3.	Motorcycle v Pedestrian	1	0	2	3	1	11		1.960	-3.586	$Z_{observed} < Z_{table}$

3.3. Type of Severity Level

Table 7 : Statistical Hypothesis Testing For Type of Severity Level

No.	Explanation	Number of Road Accidents						Significance	Statistical Hypothesis Testing		Conclusion
		Sample			Population						
		2009	2010	2011	2009	2010	2011		Z_{table}	$Z_{observed}$	
1.	Causing Minor Injuries	3	2	8	15	15	55	5%	1.960	-24.427	$Z_{observed} < Z_{table}$
2.	Causing Heavy Injuries	0	3	7	9	17	59		1.960	-19.190	$Z_{observed} < Z_{table}$
3.	Causing Casualties	2	4	1	14	16	22		1.960	-48.606	$Z_{observed} < Z_{table}$

3.4. Type of Vehicle Involved In Road Accident

Table 8 : Statistical Hypothesis Testing For Type of Vehicle Involved In Road Accident

No.	Explanation	Number of Road Accidents						Significance	Statistical Hypothesis Testing		Conclusion
		Sample			Population						
		2009	2010	2011	2009	2010	2011		Z_{table}	$Z_{observed}$	
1.	Motorcycle	3	9	15	36	45	139	5%	1.960	-61.459	$Z_{observed} < Z_{table}$
2.	Passenger Car	0	2	1	10	15	28		1.960	-15.993	$Z_{observed} < Z_{table}$
3.	Truck	0	0	0	4	2	5		1.960	-	Undefined

4. CONCLUSIONS

Based on the analysis of each accident characteristics, it can be proved that the most accident types on Rama Setia road has characteristics in common with most road accident cases which occurred in any other major roads of Banda Aceh. Assessing from the type of vehicles which frequently involved in road accidents, motorcycle is the vehicle type which have the highest involvement compared to other kinds of vehicles. Also, it can be inferred that motorcycle is a vehicle that is frequently involved in traffic accidents. Therefore, the conclusion that can be drawn is the assumption of using the mean and standard deviation parameters as explanatory variables of the data sample and the population have identical results using the proportion of accidents recommended by the Department of Public Works that serves as a variable analysis (Rizki 2012).

Many risks faced by motorcycle users when the traffic accidents occured. The most fatal severity level would be loss of lives. Some road accident cases which causing casualties simply caused by the users of motorcycle who often fail to comply the important things in ensuring the safety of traffic (Limanond 2011). As an example, the motorcycle component does not meet standard safety components and requirements, accelerating the vehicle at past the safe limit, having less than adequate skills / ability to ride a motorcycle, and ignoring the attitude of adherence to traffic signs which exist.

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