Accident Model of Car in Urban Area of Surabaya

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Abstract: ***The amount of private transportation more than mass transportation is one of the factors causing high traffic density. The interest of the Indonesian population to use mass transportation is still low, consequently many still choose to use private transportation. This mode of personal transportation is not effective because the load factor is low that is about 1 to 5 people per vehicle on the roads. The main purpose of the research was to create accident model of car in urban area. The research used generalized linear model (GLM) method. The results showed that the car drivers in Surabaya are often involved in accidents are male and aged in the range of 15 to 25 years. Geometric characteristic of roads in Surabaya City are wide of lane: 7.4 to 28.0, number of lanes: 2 - 6, shoulder width: 0 to 3 m, speed: 19.55 to 55.88 km per hour, vehicle volume: 1845,83 pcu per hour to 12594,03 pcu per hour. Model car accidents in several segments of Surabaya that formed: McA = 0.00225FLOW1, 030.EXP (.0034 Speed).***

Keywords: Accident-Model, Driver, Urban-Area, Generalized-Linear-Model,

I. INTRODUCTION

Traffic accidents can be caused by various factors, namely human factor, vehicle factor, road factor, and environmental factors (Wiranto et al, 2014). According to The Law No. 22 of 2009 article 229, traffic accidents are classified into several categories, namely minor traffic accidents, moderate traffic accidents, and heavy traffic accidents. Different models of accident opportunities of private car drivers is due to several things, including the differences in characteristics of drivers, and also characteristic of the study area, especially the condition and geometric of the existing road (Ambarwati et al, 2010).

All significant variables for trucks (head on, rear-end, side, sidewipe and other types of accidents, run-off road collisions, collision with pedestrians) reduce minor injuries per vehicle total, except for good weather conditions. The same is true for buses as well, however, the weather conditions are not found to be statistically significant. Cedera ringan per total kendaraan meningkat dalam kondisi cuaca baik dan di daerah terbangun (Yannis George et al, 2017). The average speed change affects traffic accident rate per mile. The highest probability of accidents was observed in 5 minute intervals, where the average speed is reduced from nearly 110 to 85 km per hour. Furthermore, high accident probability is obtained when the average speed increases from 65 to 90 km per hour. The accident rate was observed higher in sunny weather than in overcast weather (Masayoshi Tanishita and Bert van Wee, 2017).

There are some research related to accident of vehicles such as Petr Pokorny (2017) mentioned that to make urban transportation safe, sustainable and safer cycling environments, we need to understand why, where, when and under what situations accidents between trucks and bikes occur. The driver's seat is clearly the safest sitting position, the urban area seems to come from less serious accidents than in rural areas, and women tend to be more seriously or fatally injured than men (Rui Garrido et al, 2014). Another research identified six safety-oriented cycling practices and finds evidence that at least one practice, predictability, can protect against the involvement of traffic accidents. It also doubted the value of protective vigilance and prudence (MW Hoglund, 2017). Factors that positively affect the severity of accidents include: the number of vehicles involved in accidents, peak hour traffic time, and low visibility. The difference between HS and MC accidents is identified, the most important being the involvement of heavy vehicle (HGV) and driver fatigue, which is more important in increasing the severity of HS accidents (P. Michalaki et al, 2015).

II. PROBLEM STATEMENT

Cars can lead to greater traffic accident severity than motorcycles. Traffic accidents caused by automobile vehicles amounted to 192 incidents of accidents from 845 incidents in Surabaya with the condition of 31 people died and 21 people severely injured.

III. THE AIM OF RESEARCH

This research is expected to play a role in reducing dependence of Fuel (BBM) requirement. The promotion of safe use of public transport is a crucial part of improving accessibility for the poor, and reducing deaths from traffic accidents per year, and increasing the potential for public transport. The goals of the research are:

1. To identify characterictic of driver in urban area of Surabaya.
2. To identify accident characteristic of car in urban area of Surabaya.
3. To create accident model of car in urban area of Surabaya.

IV. METHOD OF RESEARCH

The location of this study was conducted in Surabaya, East Java, Indonesia. Determination of the location is based on the consideration that in the location there is a high accident case. The road sections also the location of the geometric survey, the volume of vehicles, and spot speed.

The research divided into 4 steps: preparation, data collection, data analysis, discussion, and conclusion (Figure 1). Firstly, the literature study was conducted to be used as reference in the implementation of the study at the preparation stage.

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In this stage also determined the intent and purpose of the study undertaken, as well as determine the related objects used for research. Secondly, the data collection stage is primary data and secondary data that support the study. Primary data were obtained from geometric survey, traffic volume survey, and spot speed survey that were used as study sites in Surabaya.

While the secondary data obtained from related agencies namely, Department of Transportation, Public Works Department, East Java Regional Police, Central Bureau of Statistics, and others. Thirdly, the data analysis stage is to analyze the data required in accordance with the specified study objectives. Data analysis was performed in the form of descriptive analysis of accidents that happened to drivers, and modeling of GLM (generelized linear model) to accidents model involving cars in Surabaya City. Finally, the preparation of the discussion and the conclusion is the last stage that presents the results of studies that have been done.

Figure 1. Research Framework

While k and β are parameters to be estimated, and x is an explanatory variable (Bolla et al, 2014).

V. ANALYSIS AND DISCUSSION

Based on the acquisition of secondary data in the form of accident data from East Java Police, it is found that the time span of many accidents is at 12:00 pm to 17:59 pm with an accident rate of 33.6 per cent.

Table 1. Time of Car Accident in Urban Area of Surabaya City

No	Time	Total	%
1	06.00-11.59 am	1292	33.2
2	12.00-17.59 pm	1307	33.6
3	18.00-23.59 pm	1185	30.4
4	00.00-05.59 am	111	2.8
	Total	3895	100

Source: Secondary Data, 2017

Table 2 shows that the geometric condition of the straight road is the most frequent occurrence of accidents involving the driver of the car. In the geometric condition is encountered percentage of 84.5%. Accidents that occurred in the city of Surabaya is a type of double accident (79.7%), where accidents occur due to a collision of two parties, either between cars with other motor vehicles, cars with non-motorized vehicles, and cars with pedestrians.

Table 2. Time of Car Accident in Urban Area of Surabaya City

No	Geometric	Total	%
1	Straight	3292	84.5
2	Intersection (T)	241	6.2
3	Intersection (X or +)	328	8.4
4	Roundabout	34	0.9
	Total	3895	100

Source: Secondary data, 2017

The results of the analysis that has been conducted, the accident prediction model that can be formed is as follows: McA = 0.00225FLOW1,030.EXP (.0034 Speed). The above model can be used on the road segment with the following characteristics:

Location: Urban Road
Range Width of Lane: 9.0 - 28.0 m
Range of Number of Lines: 2 - 6
Shoulder Width Range: 0 - 3 m
Speed Range: 19.55 - 51 km per hour
Vehicle Volume Range: 1845,83 - 9675,23 pcu per hour

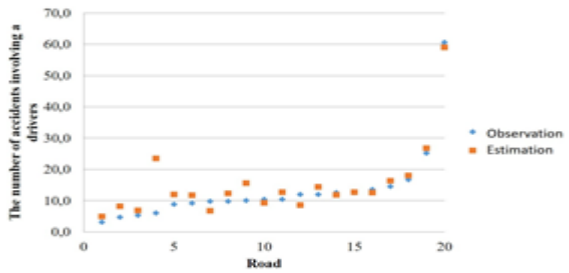

Figure 2. Comparison of observational crash data and model estimation data

An examination of the final model is to compare model estimation values with actual data. The expected model is a model that can produce approximate values close to the observed value (Figure 2).

VI. CONCLUSION

Influence Volume Changes:

Based on the analysis, increased traffic volume on urban roads affects the increasing number of automobile accidents. If the traffic volume increases by 10%, then the approach model with GLM predicts an increase in the number of car accidents by 9.08%.

The figure is derived from the equation McA = 0.00225FLOW1,030..

Effect of Speed Changes:

Increasing the speed of traffic on the road segment affects the increasing number of car accidents. Each increase in speed 5 km per hour then there will be an increase in the number of car accidents by 15.63 per cent. The figure is derived from the equation McA= 0.00225 e (.0034 Speed).

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