

Road Accident Analysis: A Case Study of Federal Route FT024 Yong Peng- Parit Sulong

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Abstract. Traffic accidents are considered as an unplanned and unfortunate event which is a serious concern to the community as well as the authority. An accident-counter measure can reduce the rate of road accidents by initially identifying critical locations. The total of road accidents along FT 024 between 2009 and 2012 is 907 cases. Road accidents during the same period range between 24 % and 26 % each year. These accidents killed 34 people and injuring another 101 people. This research aims to identify factors that may contribute to the cause of accidents and to study the effects of speed, volume and road geometry on road accidents. In this study, the locations labelled as *km 1*, *km 2*, *km 4*, *km 8*, *km 5* and *km 14* of Federal Route FT 024 Yong Peng – Parit Sulong were selected as the study-case sections based on Accident Point Weightage of ranking, in which each location has different road characteristics. Speed study was carried out at selected road sections to evaluate the influence of speed upon road accidents; and traffic volume count was conducted at the same selected road sections to determine the existing condition of the route. Besides, road geometry observations and measurements were also conducted at selected sections, they were also studied to evaluate influence of road designs upon road accidents. The extracted data were analyzed by using regression analysis on different variables to evaluate the relationship between accident Weightage point and other dependent variables that were considered to have considerable effects upon road accidents such as mean speed, volume, shoulder width, lane width and access point. P value below 0.05 was considered as statistically significant. After conducting data analysis, this study showed that the number of road accidents increases with the increment of speed and access point. On the other hand, volume has no strong relationship to road accidents which means that it may not have an effect on accidents. Moreover, based on the assumptions made by the researchers and project supervisors, road safety index development is important for the selected road sections along FT 024 to improve the road conditions in terms of safety and also to propose improvements at the selected locations in order to reduce accident rate.

1 Introduction

Road traffic accident is defined as “An accident that as accident which took place on the road between two or more objects; resulted in one or more persons being died or injured, and at least one moving vehicle was involved [1, 2]. Thus, RTA is collisions between road vehicles; between automobiles and pedestrians; between road vehicles and animals; or between road vehicles and geographical or

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architectural obstacles. Road traffic accidents (RTAs) have turned out to be a huge worldwide public health problem killing nearly 1.2 m people yearly and injuring about 4 times this number throughout the same period of time [3]. Almost 85% of all road accidents that have caused loss of lives in the world occur in developing countries [4]. Amongst the developed countries such as Britain, Japan and the United States of America, traffic related death rate (per 100,000 citizen per year) has reached 12.3, 3.85 and 3.59 respectively in the year 2009 [5, 6, 7].

One of the issues discussed on traffic in Malaysian highways is road accidents. The past thirty four years have seen a rapid increment of road crashes in Malaysia. Amidst a large volume of traffic on the road, accidents involving different kinds of vehicles inevitably happen. Globally, the number of people killed in road traffic crashes yearly is estimated at nearly 1.2 million. To top it all, the number of injuries could be as high as 50 million – a combined population of five large cities in the world [8].

Many research studies that incorporated different aspects of road traffic accidents have been performed by various workers at different durations across the world [9-16]. according to the official statistic of Federal Route 024; FT024 (Yong Peng-Muar/Yong Peng-Parit Sulong) experienced 1,033, 2,764 and 925 road accidents between the years 2007 to May 2010 respectively; killing 169 people and injuring 539 people accordingly. This study will be conducted to investigate and refresh the issues that cause traffic accidents along FT024. Till date there are a limited number of studies that have been conducted on Federal Route F024 Yong Peng – Parit Sulong. Therefore, realizing the need to create a baseline info on RTAs, the current research was conducted on the aforesaid reasons. This study will also be concentrating on the relationships between road condition, traffic speed, flow and accident rates to help in identifying hazardous locations, which needs treatments as well as a ranking on the black spot locations along FT024 Yong Peng – Parit Sulong.

2 Analysis of Accident Data

The data for this research were collected from Batu Pahat Traffic Police Station. The accident records were collected from the year 2009 to 2012 (4 Years). The purpose of the preliminary analysis of the traffic accident data is to determine the breadth of accident problem. At this stage, the general trends and statistics of accidents were established as shown in the Figure 1. The total number of road accidents occurred along FT024 between 2009 and 2012 is 907 cases. Figure 1 shows the highest number observed was in 2011 with 242 cases, followed by the year 2012 and 2010 with 226 and 220 accident cases respectively. The lowest number of accidents is in the year 2009 with 219 cases with a total of 34 persons lost their lives. From Figure 2, the year 2009 recorded the highest number of deceased road users (n=12), the second highest is in the year 2011 and 2010 with 11 and 6 deceased road users respectively. Generally, it could be concluded that there was a slight increase in the number of road accidents along Federal Route F024 Yong Peng – Parit Sulong from 2009 to 2011 and then, it dropped in 2012.

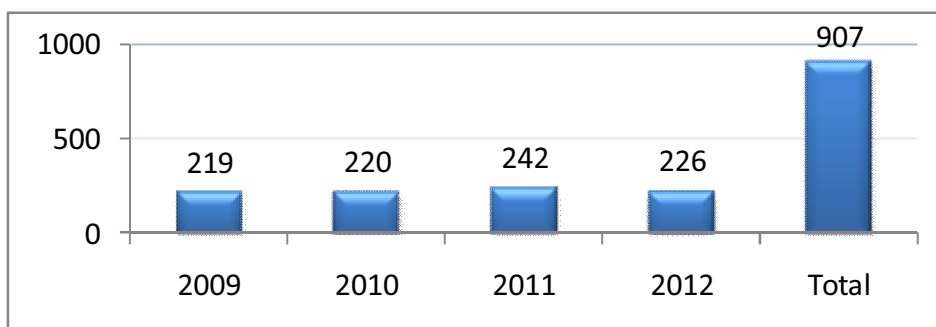


Figure 1. Accident frequency at FT 024, 2009-2012.

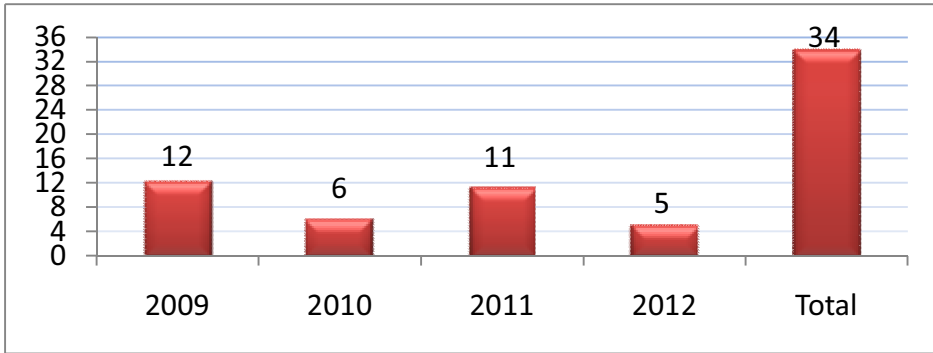


Figure 2. Fatal accidents at FT024, 2009-2012.

2.1 Percentage of road accidents according to seriousness

Figure 3 shows the breakdown of road accidents between 2009 and 2012 according to the seriousness of the accidents. Most accidents resulted in only slight damages, which accounts for 85.12% of the total number of accidents; that equals to 772 cases. Accidents that have caused serious injuries accounts for 0.33%, whilst those that have caused fatalities and non-serious injuries accounts for 3.75 % and 10.8 % respectively

2.2 Yearly road accidents frequency according to seriousness

From Figure 4, there is a huge difference in frequencies between slight-damage-only accidents and the other categories. Generally, fatal and serious injuries accidents reflect a dropping trend in terms of frequencies between 2009 and 2012. Moreover, there is a dramatic increase in the non-serious-injury cases in terms of frequencies. This is due to the increased frequency of non-serious-injury-only accidents from 12 to 41 cases between 2009 and 2012. Due to the increasing trend of non-serious-injury-only accidents, the overall frequency of all road accidents has increased between 2009 and 2011 and later, dropped in 2012.

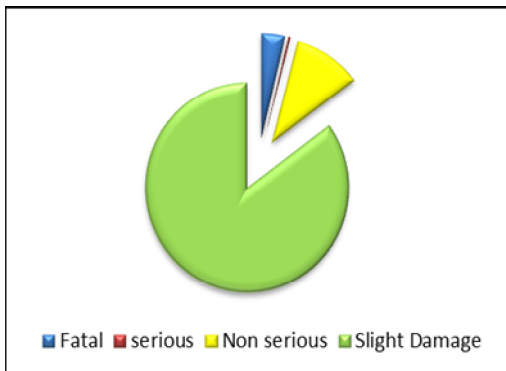


Figure 3. Percentage of road accidents according to seriousness at FT 024.

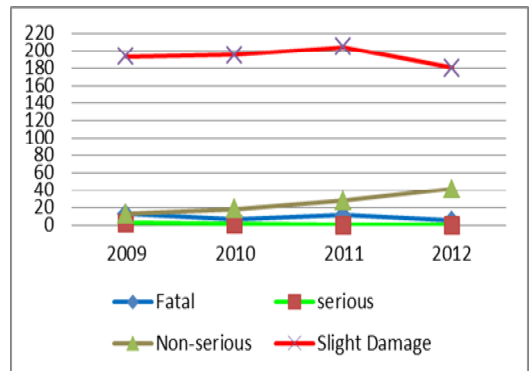


Figure 4. Breakdown of road accidents according to seriousness at FT 024 by year.

2.3 Ranking of the top ten accidents section

Table 1 shows the top ten worst accident sections at F024. The analysis was based on the data compiled over four years starting from 2009 to 2012 by using the accident-point weightage (APW) formula. Km 5 recorded the highest APW with 43.2 and the second highest was Km 2 with 39.6. These were followed by km 8 with 34 APW while the lowest was at km 9 and km 10 with 18 and 17.8 APW respectively. Generally, it can be concluded that Km 5 has highest number of fatalities.

Table 1. Analyses for Top Ten Accidents Ranking by Weightage (APW) at FT024, 2009-2012.

Sections	Type of road accident				Total	APW	rank
	Fatal	Serious	non-Serious	Slight Damage			
KM 5	6	0	0	36	42	43.2	1
KM 2	2	0	9	102	113	39.6	2
KM 8	2	0	9	74	85	34	3
KM 14	3	0	5	33	41	28.6	4
KM 9	3	0	2	25	30	24.6	5
KM 4	2	0	2	53	57	24.2	6
KM 11	2	0	5	26	33	21.2	7
KM 7	1	1	5	31	38	19.2	8
KM 26	0	1	7	47	55	18	9
KM 13	2	0	1	25	28	17.8	10

2.4 Relationship amongst variables

Based on the accident point weightage (APW) calculated, and referring to the correlation coefficient obtained amongst the variables, P value below 0.05 was considered as statistically significant between APW and other variables. Figure 5 and 6 show that mean speed rate has the highest correlation with APW; 0.79, which means as the speed increases the APW increases this is followed by the access point; 0.77.

Regarding lane width, the negative sign in the correlation coefficient shows that the width of the lane relates to APW inversely as shown in Figure 7. This means that when lane width increases the APW reduces. Figure 8 shows that volume also has no strong coefficient with APW, this means it may not have directly affect the accident point weightage.

	APW	Mean Speed	Volume	Lane width	Shoulder width	Access Point
APW	1					
Mean Speed	0.793547162	1				
Volume	0.425012185	-0.080000331	1			
Lane width	-0.616954895	-0.966015654	0.227573899	1		
Shoulder width	-0.251779414	0.010374278	0.19034486	-0.187148979	1	
Access Point	0.775493866	0.374366415	0.891714163	-0.207514339	0.1124203	1

Figure 5. Correlation amongst variables

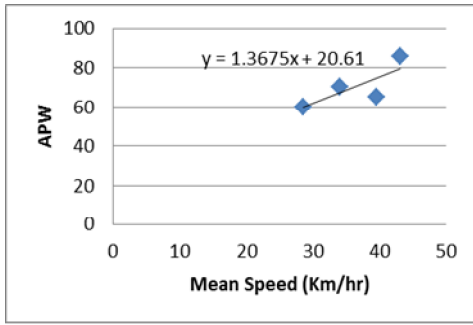


Figure 6. Relationship between APW and Mean Speed

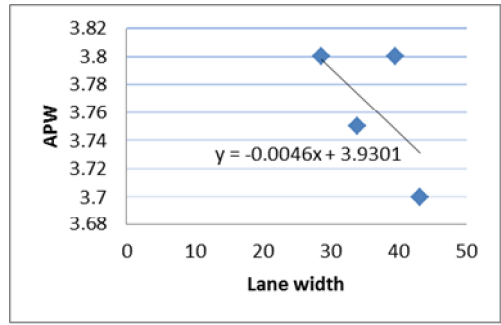


Figure 7. Relationship between APW and Lane width

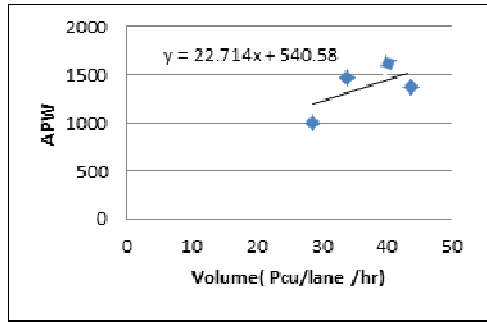


Figure 8. Relationship between APW and volume.

From the result of this study, it is noted that the factors which contribute to accidents at Federal Route 024 are: Vehicle speed and Number of access points. The effect of each contributory factor on the number of road accidents are as follows: (i) Speed increase contributes to accident increases, and (ii) A greater number of access points per length increases accidents.

3 Road Safety Development Index

The index covers all relevant parameters of road safety in selected sections at FT024 including infrastructure, which researchers and project supervisors have developed as a method to classify the Road Safety Index (RSDI) based on the observed data and analyzed parameters. These data were then given a range based on the assumptions made by the researchers and project supervisors. The following Table 2 demonstrates the ranges and assumptions for the Road Safety Index in accordance with “A Guide Geometric Design of Road “(REAM Manual, 2002)

Table 2. Index in relation to road conditions

No	RSDI range	Remarks for Section observation
1	Less than 20%	Inadequate
2	20% to 40%	Poor
3	40% to 60%	Average
4	60% to 80%	Good
5	More than 80%	Excellent

Speed study showed that the mean speed at Km 1, Km 2 and Km 8 were 60.04 , 61.18 and 70.21 respectively while Km 4 recorded a speed of 76.21 km/hr. Apart from that, as outlined in Arahan Teknik Jalan JKR (JKR Road Technical Specifications) the total capacity for a two-lane tow way is 2800 pcu/hr/lane. However, from the result gained in the study, the maximum peak hour at Km 1, Km 2, Km 4 and Km 8 hauled a traffic of 1851 pcu/lane/hr, 1788 pcu/lane /hr, 1441 pcu/lane/hr and 1477 pcu/lane/hr respectively.

Accordingly, referring to Table 2, we can evaluate the condition of the selected kilometers in their more specific aspects, as shown in Table 3. The road sections were labelled as poor, average and excellent in terms of speed, volume, lane width and shoulder width respectively. Based on these results, we can take the necessary measures to reduce speeding at the areas. Regarding the road shoulder in this area, it may need widening or redesigning in terms of their geometry

Table 3. Road safety development index.

Sections	Rating parameters			
	Speed	Volume	Lane Width	Shoulder Width
Km1	Poor	Average	Excellent	Average
Km2	Poor	Average	Excellent	Poor
Km4	Average	Good	Excellent	Good
Km 8	Poor	Good	Good	Good

4 Conclusions

This research is successful in achieving its aim to study the effects of speed, volume and road geometry on road accidents along Federal Route 24 (FT 024). Reviews of previous studies have revealed that most, if not all past researches have only involved a few sections of a location. This research, however, has established a relationship between road accidents with traffic volume and speed along selected sections of the route from Yong Peng to Parit Sulong.

In conclusion, this research has found that the peak hours and the normal hours of the sections mentioned above display differences in terms of traffic volume and speed. At peak hours the sections recorded a higher traffic volume compared to the normal hours due to the road activities; except at the Plaza Toll which recorded a higher traffic volume during peak hours. The summary of the study results shows that there is no direct relationship between accident rate and traffic volume. The initial results show that speed and access point have positive relationships with road accidents. The results have shown that the increase of speed and access point would also trigger an increase in the Frequency of road accidents.

Besides, the Road Safety index as discussed in this research has been found to be very effective as a tool to evaluate the condition of each road section in terms of road safety. This will help to improve on the results of the analysis, particularly for road geometry in future. It is hoped that further research to improve the existing Road Safety Index will evaluate better safety measures for road users.

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