



**REVIEW OF SPEED LIMIT FOR FR222 ACCESS ROAD TO GAMBANG TOLL**

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## ABSTRACT

This thesis presents a review of speed limit on a straight road that relate with road accidents. The main objectives of this study are to investigate excessive speed that can cause road accidents and to recommend appropriate measures for road safety improvement. This study focused on the straight road which is along MEC Highway start from FR222 Access Road to Gambang Toll. This spot speed study was conducted in six days by using radar gun to record the speed based on type of vehicles that passing through on this road. The type of road on this location is Federal Road and area type is Rural categorized as R5. From this study, the result that have obtained able to show the 15<sup>th</sup>, 50<sup>th</sup>, 85<sup>th</sup>, and 95<sup>th</sup> speed percentile from the cumulative frequency distribution curves graph. The speed limit that has been set by Department of Work (JKR) on this road is 90 km/hr. The result of this study shows that the highest frequency of vehicle most in speed group 90 – 99 km/hr. Speed limit that have been obtained from six points on this location of study are 103.62km/hr, 93.80km/hr, 98.46km/hr, 101.67km/hr, 99.74km/hr, and 86.02km/hr. The average speed that obtained at six points on this study location is most over the speed limit allowed. The number of drivers that drive over the speed limit is more than the number of drivers that drive under the speed limit. This situation occur maybe due to nonexistence of speed limit signboard and condition of straight road that make drivers tend to drive at excessive speed that can cause road accidents. Suggestions to placement the speed limit signboard, warning to slow down speed signboard and Automated Enforcement System (AES) have been proposed for road safety and accident free in Malaysia.

## ABSTRAK

Tesis ini membentangkan tentang kajian semula had laju di jalan raya yang lurus yang mempunyai hubungkait dengan kemalangan jalan raya. Tujuan utama kajian ini adalah untuk mengkaji halaju yang berlebihan mengakibatkan kemalangan jalan raya dan mencadangkan langkah-langkah yang sesuai untuk penambahbaikan aspek keselamatan jalan raya. Kajian ini tertumpu di atas jalan raya yang lurus iaitu di sepanjang Lebuhraya MEC bermula dari Jalan Masuk FR222 hingga Tol Gambang. Kajian had laju setempat ini dijalankan selama 6 hari dengan menggunakan kaedah radar tembak bagi mendapatkan had laju setempat mengikut jenis-jenis kenderaan yang melalui di lokasi kajian. Jenis jalan di lokasi kajian ini ialah jalan persekutuan dan kawasan jenis luar bandar yang dikategorikan sebagai R5. Daripada kajian ini, hasil yang diperolehi dapat menunjukkan peratusan kelajuan 15, 50, 85, dan 95 dari graf lengkungan taburan kekerapan kumulatif. Had laju yang ditetapkan oleh Jabatan Kerja Raya (JKR) untuk jalan ini adalah 90km/j. Keputusan kajian ini menunjukkan kekerapan tertinggi kenderaan kebanyakannya berada di dalam kelas kelajuan 90 - 99km/j. Had laju yang diperolehi dari 6 poin di lokasi kajian ini ialah 103.62km/j, 93.80km/j, 98.46km/j, 101.67km/j, 99.74km/j, and 86.02km/j. Had laju purata setempat yang diperolehi di setiap poin di lokasi kajian kebanyakannya melebihi had laju yang dibenarkan. Bilangan pemandu yang memandu melebihi had laju adalah lebih tinggi berbanding dengan bilangan pemandu yang memandu dibawah had laju yang ditetapkan. Keadaan ini berlaku mungkin kerana ketiadaan papan tanda had laju di lokasi kajian dan keadaan jalan raya yang lurus yang membuatkan pemandu cenderung untuk memandu secara halaju yang berlebihan dan boleh menyebabkan berlakunya kemalangan jalan raya. Cadangan untuk meletakkan papan tanda had laju, papan tanda amaran mengurangkan kelajuan dan Sistem Penguatkuasaan Automatik (AES) sebagai perangkap had laju telah dicadangkan bagi keselamatan jalan raya dan bebas kemalangan di Malaysia.

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**LIST OF SYMBOLS**

<b>S</b>	<b>Mean Speed of Group</b>
<b>n</b>	<b>Number of Vehicle in Group</b>
<b>95<sup>th</sup></b>	<b>95 Speed Percentile</b>
<b>85<sup>th</sup></b>	<b>85 Speed Percentile</b>
<b>50<sup>th</sup></b>	<b>50 Speed Percentile</b>
<b>15<sup>th</sup></b>	<b>15 Speed Percentile</b>

**LIST OF ABBREVIATIONS**

FR222	Federal Road 222
R5	JKR Standard Rural 5
R6	JKR Standard Rural 6
KK4	Residential College Students 4
JKR	Public Works Department of Malaysia
PDRM	Royal Malaysian Police
JPJ	Department of Road Transport
Min	Minimum
AES	Automated Enforcement System
MIROS	Malaysian Institute of Road Safety Research
JKJR	Road Safety Department

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 PROJECT BACKGROUND**

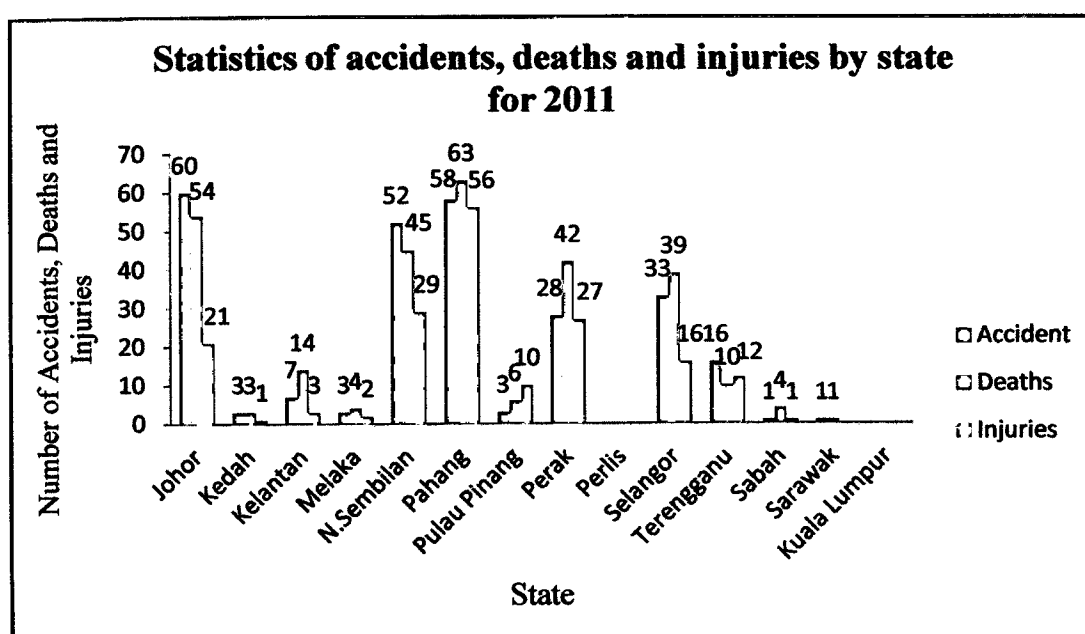
Nowadays, we can see that the accident rate is still increasing although the various campaigns, enforcement and operations have been carried out. There are several factors that contribute to road accidents such as human factors, vehicle and road conditions. One of the cause road accidents occur is driving at excessive speed. Based on the statistics of accident, injuries and deaths graph for the year 2011, the statistic shows that the state of Pahang has the highest percentage of accidents compare with other states as shown in Figure 1.1.

Therefore, we must study the causes of road accidents in Pahang to reduce the accident rate in Malaysia. So, this study will be focused along MEC Highway start from Federal Road 222 (FR222) Access Road until Gambang Toll. Among the cases of road accidents that occurred along the FR222 Access Road until the Gambang Toll is on 24 January 2009, where the accident occurred at in front of the Chancellery of Universiti Malaysia Pahang (UMP). This accident involves a female student from UMP where the student is dead at the location of incident. The cause of this accident is due to the negligence of pedestrians and drive at excessive speed.

The second accident occurred on 1<sup>st</sup> February 2010 at in front of the Residential College Students 4 (KK4) where two UMP students from Faculty of Chemical and Natural Resources have seriously injured. This accident involving a motorcycle and a taxi where the taxi driver, who speeds up neglecting the danger signs about pedestrian is the major cause for this accident. From this accident, we

can say that the attitude of road users who are not prudent and failed to obey the road regulations can contribute to the increasing of accident rate. In addition, there is no speed limit signboard as a warning to slow the speed of vehicles along MEC Highway. So, this issue can be say that the nonexistence of speed limit signboard also as the cause of road accidents occurred.

To avoid the road accident recurring, some case study should be done to gain the best alternative to reduce accidents rate. Base on the results obtained from this study, road accident rates can be minimized with certain suggestions.

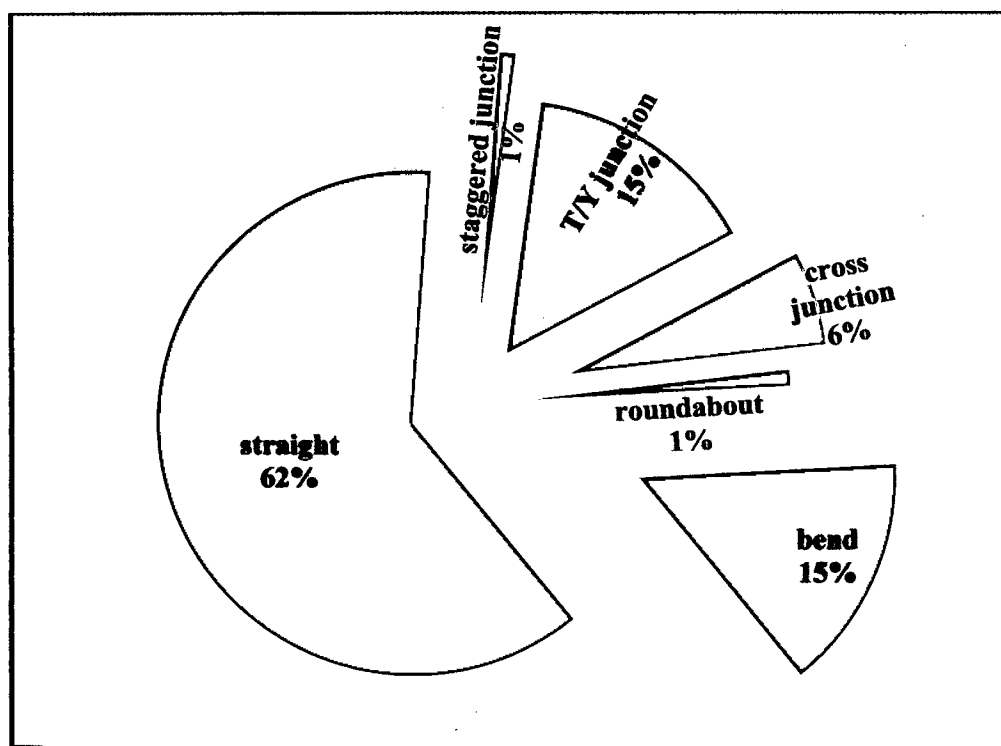


**Figure 1.1:** Statistics of Accidents, Injuries and Deaths by States (2011)

(Source: <http://roadsafety.jkr.gov.my>)

## 1.2 PROBLEM STATEMENT

Along the MEC Highway start from FR222 Access Road to Gambang Toll, there is no speed limit posted. This situation can contribute to road accidents because driver tend to drive over the speed limit. Although the speed limit has been set by the Public Works Department of Malaysia (JKR), but the drivers are still drives at excessive speed without compliance the speed limit allowed. Besides that, accidents are usually easy to occur on the straight road because most drivers tend to accelerate at higher speed and eventually their lost control. This statement strengthened with statistical report road accident for 2005 from Royal Malaysian Police (PDRM) as shown in Figure 1.2, where a straight road has a higher percentage compare to other types of road. In a driving simulation study, (Desmond and Matthews, 1996) observed that driving performance decreases faster on straight road sections than on curves. Therefore, the analysis of this study should be done on a straight road as one alternative to reduce road accidents caused by speeding.



**Figure 1.2:** Road Accident by Road Type (2005)

*(Source: Statistical Report Road Accident, Royal Malaysian Police. 2005)*

### **1.3 PROJECT OBJECTIVES**

- i. To review the speed limit that aims to know the driver compliance toward speed limit set by Department of Public Works (JKR).
- ii. To study operating speed on the straight road along MEC Highway that aims to reduce road accident rates.

### **1.4 RESEARCH QUESTIONS**

- i. Does road accidents rate can be reduced by reviewing the speed limit?
- ii. Does a road user know the speed limit that has been set without a signboard?

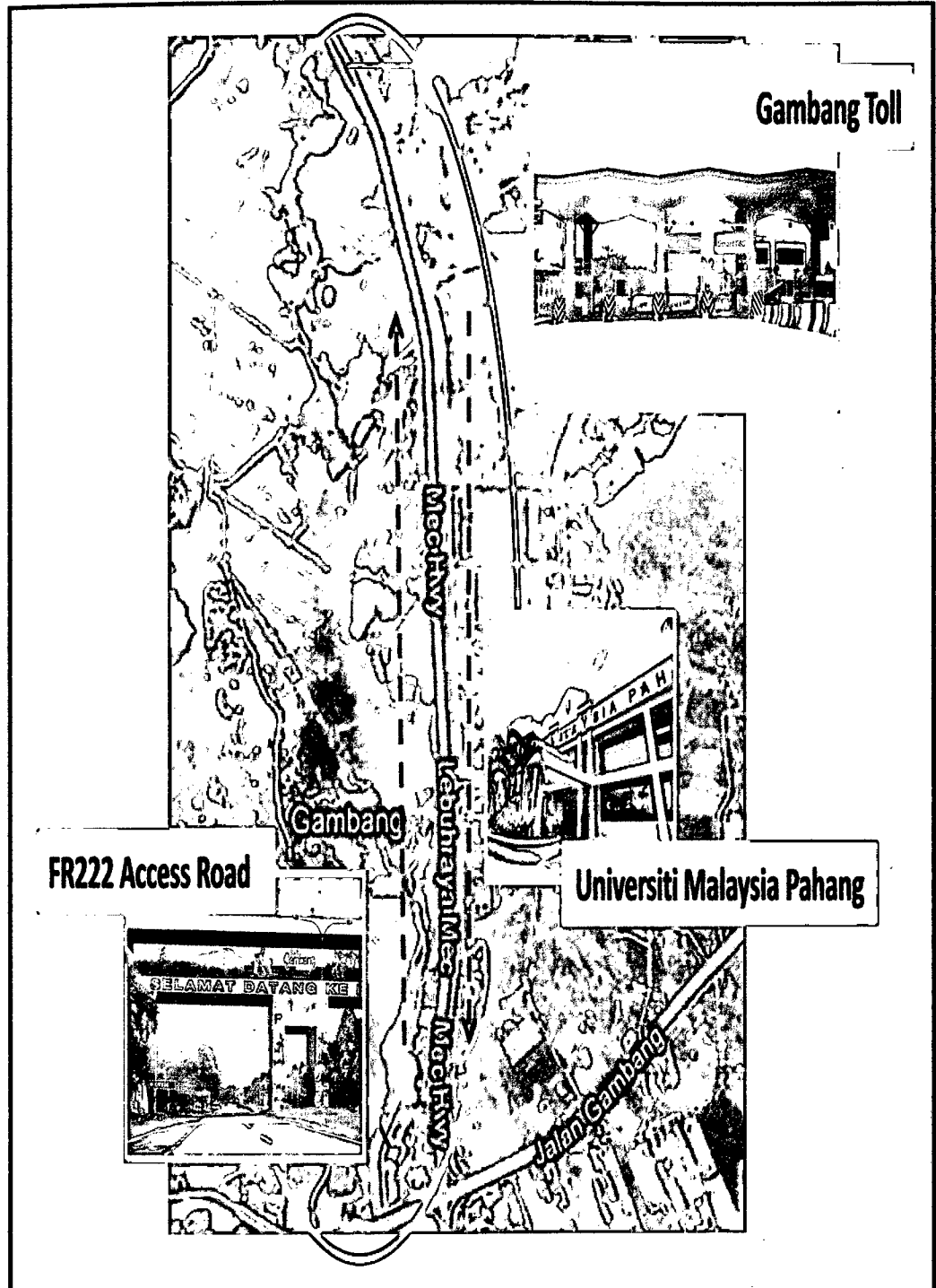
### **1.5 EXPECTED OUTCOMES**

- i. Able to review speed limit with see the driving compliance toward speed limit that have been set by JKR.
- ii. Propose design speed on a straight road along MEC Highway.
- iii. Come out with several suggestions based on the result of this study as to reduce road accidents rates.

### **1.6 SCOPE OF STUDIES**

This study will be focused on a straight road as a specified location where the location of this study is along the MEC Highway start from FR222 Access Road until Gambang Toll as shown in Figure 1.3.





**Figure 1.3:** Location of study with direction from FR222 Access Road to Gombang Toll.

Scope of this study is divided into three levels which are preliminary studies, detailed studies and suggestion.

### **1.6.1 Preliminary Studies**

This stage involves the process of gathering data and information related to road accidents. The information obtained will facilitate research to overcome the cause of accident.

### **1.6.2 Detailed Studies**

This stage involves the process of identifying the causes of accidents by spot speed study. Evaluation is focused on the local speed of vehicles in the location of study.

### **1.6.3 Suggestions**

In this stage, several suggestions will be recommended based on the result of studies which have been conducted. The proposed suggestion is to minimize the number of accidents at the location of the study.

## **1.7 SIGNIFICANT OF STUDIES**

- i. This study can reduce accident rate and improve road safety by produced speed limit.
- ii. The results of this study can be used by the government such as the Royal Malaysian Police (PDRM), Department of Road Transport (JPJ) and Department of Public Works (JKR) to determine the design speed.
- iii. Also can be used by the engineer to designing the road geometry and the determination of speed limits to road conditions are safe, effective and economical to use.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

In this chapter will discuss about article and journal that have been study as a secondary sources. There are ten articles and journals that have been read and will be summarized into a table. The table contains problem statement, project objectives, project methodology, result and analysis, conclusion and recommendation. Most of the selected articles and journals are related to spot speed study, speed, attitude of road user and speed limit. Among the articles and journals that have been reviewed are:

- Attitudes and Road Accident Risk.
- Attitudes towards Current and Lowered Speed Limits in Australia.
- Evaluation of Traffic Characteristics.
- Exploration of 85th Percentile Operating Speed Model on Crest Vertical Curve Two-Lane Rural Highways.
- Freeway Speed Limits and Traffic Fatalities in Washington State.
- Influence of Drivers' Comprehension of Posted Signs on Their Safety Related Characteristics.
- Monotony of Road Environment and Driver Fatigue A Simulator Study.
- Nationwide Survey on the Posting Of Minimum Speed Limit Signs on Interstate Freeways.
- Speed, Speed Limits and Road Traffic Accidents Under Free Flow.
- Traffic Speeds Associated with Implementation of 80 Mph Speed Limits of West Texas Rural Interstates.

Table 2.1: Attitudes and Road Accident Risk

Problem Statement	Study/Project Objectives	Study/Project Methodology	Data Collection / Experimental Setup	Results & Analysis	Conclusion & Recommendation	Reference
Both the relation between attitudes and behavior, and the relation between behavior and accidents is uncertain. Accident risk varies by human factors, road factors, vehicle factors, time, etc. (Bjornskau, 1993; IIHS, 1992).	The main objective of this study is to find out whether attitudes are of importance to road safety.	The study was carried out by mail in two phases. In the first phase license holders were given structured questionnaires containing 56 statements about traffic to which they should state their opinion in terms of 'acceptable' - 'not acceptable' or 'agree' - 'disagree'. The 56 attitudinal questions concerning traffic matters were selected both to cover important aspects of road safety, and also to cover violations of the traffic code. Efforts were made to obscure in neutral language what otherwise could have been considered questions demanding 'right' and 'wrong' answers. A pilot study showed that answers to questions about drinking and driving differed very little in the driver population; consequently this aspect of road safety was not emphasized, despite the fact that drunken driving is known to increase accident risk.  In the second phase 2 years later, those who answered the first questionnaire were asked about accidents and number of kilometers driven during the period between the first and the second questionnaires.	Questionnaire survey for 7425 driver's license holders, or approximately 50% of the original sample answered both phases of the study, 4420 men, (59.5%) and 3004 women (40.5%).	The study analyze about: <ul style="list-style-type: none"> <li>• General attitudes towards traffic safety</li> <li>• Attitudes towards speed</li> <li>• Attitudes toward drinking and driving</li> <li>• Consideration for other road users</li> <li>• Responsibility</li> <li>• Characterization of oneself as a driver</li> <li>• Age of driver</li> <li>• Gender</li> <li>• Annual mileage</li> </ul>	It can be concluded that age and annual mileage seem to be more important to accident risk than attitudes. The relation between attitudes and accident risk is, however, not a clear cut one, but seems to be part of a complex web of relations between demographic variables such as age and gender, behaviour variables such as annual mileage and, most likely, many others.	Ssum, T. (1995). Attitudes and Road Accident Risk. <i>Accid. Anal. And Prev.</i> , Vol. 29, No. 2, Pp. 153--159, 1997.

**Table 2.2: Attitudes towards current and lowered speed limits in Australia**

Problem Statement	Study/Project Objectives	Study/Project Methodology	Data Collection / Experimental Setup	Results & Analysis	Conclusion & Recommendation	Reference
<p>Australian speed limits have traditionally been set at the speed that 85% of drivers would choose when driving along a particular road section, but many now believe that this criterion is becoming a barrier to achieving the crash injury reduction targets posed by road safety strategies.</p>	<ul style="list-style-type: none"> <li>To gain an understanding of the Australian community's attitudes towards both the current and proposed lower speed limits, across urban and rural road types.</li> <li>To identify subgroups in the population as targets for future road safety campaigns and interventions, designed to reduce speeding and/or increase community acceptance of the existing or lowered speed limits.</li> </ul>	<p><b>Participants</b></p> <ul style="list-style-type: none"> <li>Respondent samples for four Australian states were stratified according to the following three criteria which are gender, age and area of residence. The overall target sample size was 1200.</li> </ul> <p><b>Online survey</b></p> <ul style="list-style-type: none"> <li>The survey consisted of six blocks of questions. Finally, in the sixth block, respondents were asked to provide more information about their driving behaviour as well as their socio-economic status</li> </ul>	<ul style="list-style-type: none"> <li>The contractor which administered the online survey in each of the four jurisdictions used its own online panel for participant recruitment, which contained over 140,000 members. Online panellists who were at least 18 years of age were sent an email containing a URL link to the survey, and their unique user ID and password.</li> <li>The survey was conducted over a three-week period, with a second 'reminder' email sent out to panellists after two weeks to assist in fulfilling the sample quotas.</li> </ul>	<p>Most respondents were able to correctly identify the speed limit for local residential streets and major urban arterials, although their knowledge of rural speed limits was considerably lower.</p>	<p>Given that the findings indicated that many people did not know what the speed limits were in rural areas and only 8% correctly identified the speed limits across each of the four investigated road types.</p>	<p>Lahaussé, J.A. Nes, N.V. Fiides, B.N. and Keallid, M.D. 2010. Attitudes towards current and lowered speed limits in Australia. Accident Analysis and Prevention 42 (2010) 2108–2116.</p>

Table 2.3: Evaluation of Traffic Characteristics: A Case Study

Problem Statement	Study/Project Objectives	Study/Project Methodology	Data Collection / Experimental Setup	Results & Analysis	Conclusion & Recommendation	Reference
<p>This particular area doesn't contain any signboards about speed limit and some of the drivers over exceed the speed limit (100 km/h).</p>	<p>The objectives of this study are:</p> <ul style="list-style-type: none"> <li>To get traffic characteristics from the Jalan Skudai-Pontian include spot speed and flow.</li> <li>To determine the level of service for streets, document congestion and quantify the need for street improvements.</li> </ul>	<p><i>Counter</i></p> <ul style="list-style-type: none"> <li>A Counter meter is a commonly used to take the number. In this method, the observer stay at the point of interest and count the vehicles with the help of hand tallies using counter meter</li> </ul> <p><i>Radar Meter</i></p> <ul style="list-style-type: none"> <li>A radar meter is a commonly used device for directly measuring speeds in spot speed studies.</li> </ul>	<ul style="list-style-type: none"> <li>For this project the most important traffic characteristics to be collected from the "Jalan Skudai Pontian" include spot speed and flow.</li> <li>Data was collected manually during non-peak hour with short interval of 15 minutes and for each type of vehicles like cars, two wheelers, buses, utilities, trucks, multi axle trucks.</li> </ul>	<ul style="list-style-type: none"> <li>The maximum speed on the road is equal to 90.</li> <li>The most part of vehicles moved with average speed 60 km/h – 140 vph</li> <li>During 1 hour the number of vehicle passed observation point is 2080 that also is equal to 2697.5 pcu.</li> </ul>	<p>As traffic volumes increase and public financial resources decrease, targeting improvement projects to anticipate growth patterns is critical.</p>	<p>Roshandeh, A.M. Nesheli, M.M. and Puan, O.C. 2009. Evaluation of Traffic Characteristics: A Case Study. International Journal of Recent Trends in Engineering, Vol. 1, No. 6, May 2009.</p>

**Table 2.4:** Exploration of 85<sup>th</sup> Percentile Operating Speed Model on Crest Vertical Curve Two-Lane Rural Highways

Problem Statement	Study/Project Objectives	Study/Project Methodology	Data Collection / Experimental Setup	Results & Analysis	Conclusion & Recommendation	Reference
<p>In Malaysia, accidents in rural highway linked with the problem of inconsistencies on the operating speed and geometric design of highways. The concept of design consistency is one of the several tools used by highway designers to improve roadway safety.</p>	<p>The purpose of this study:</p> <ul style="list-style-type: none"> <li>To develop a set of geometric design standard for an 85<sup>th</sup> percentile speed on the crest vertical curve that reflective on Malaysian two-lane rural highways conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Spot Speed Method using laser gun detector.</li> <li>This study is focused on the 85<sup>th</sup> percentile operating speed for vertical alignments along upgrade of two lane highway at rural area at Lenggang to Sauk, Perak based on R5 road.</li> <li>Research process includes the data collection from the field work, analysis the 85<sup>th</sup> percentile operating speed and developing the new model of speed based on the case study.</li> <li>Multiple linear regression analysis was conducted to develop the 85<sup>th</sup> percentile speed (<math>V_{85C}</math>) model by combination of all data under different types of the crest vertical curves alignment.</li> </ul>	<ul style="list-style-type: none"> <li>The speed data were collected at every 15 minutes in one and half hour for every curve.</li> <li>The total number of hours speed data that were collected about ten hours.</li> <li>The speed of different type of vehicles was collected by observation value using laser radar meter detector.</li> <li>The observations of speed are recorded at three points along the curve, which is in beginning point curve, middle point curve, and end of the curve.</li> </ul>	<ul style="list-style-type: none"> <li>Histogram was generated for <math>V_{85}</math> speed</li> <li>analysis was carried out using Minitab</li> <li>K-value (<math>K</math>) are very significant independent variable for predicting <math>V_{85}</math> where the P-value is less than 0.05 means that the predictor is significant for both independent parameters</li> </ul>	<p>The 85<sup>th</sup> percentile operating speed on crest vertical curve at beginning curve (<math>V_{85C}</math>) linear regression models for Malaysian rural highway traffic have been successfully developed in this study.</p>	<p>Abbas, S.K.S. Adnan, M.A. and EnduT, I.R. 2010. Exploration of 85<sup>th</sup> Percentile Operating Speed Model on Crest Vertical Curve Two-Lane Rural Highways. Proceeding of Malaysian Universities Transportation Research Forum and Conferences 2010 (MUTRFC2010), 21 December 2010, Universiti Tenaga Nasional. ISBN 978-967-5770-08-1</p>

Table 2.5: Freeway Speed Limits and Traffic Fatalities in Washington State

Problem Statement	Study/Project Objectives	Study/Project Methodology	Data Collection / Experimental Setup	Results & Analysis	Conclusion & Recommendation	Reference
In 1987 individual states in the USA were allowed to raise speed limits on rural freeways from 55 to 65 mph. Analyses of the impact of the increased speed limits on highway safety have produced conflicting results.	To determine if the 1987 speed limit increase on Washington State's rural freeways affected the incidence of fatal crashes or all crashes on rural freeways, or affected average vehicle speeds or speed variance	The speed data were taken from the annual speed studies conducted by Washington State Department of Transportation (WADOT).	As part of compliance with the federally mandated speed limits, WADOT monitored traffic at locations chosen within 33 randomly selected 5-mile segments of all 55 mph highways in the state. The number of freeway monitoring stations varied each year from as few as 12 to as many as 19.	<p>The incidence of fatal crashes more than doubled after 1987, compared with what would have been expected if there had been no speed limit increase.</p> <p>This resulted in an excess of 26.4 deaths per year on rural freeways in Washington State. The total crash rate did not change substantially.</p> <p>Average vehicle speed increased by 5.5 mph. Speed variance was not affected by the speed limit increase.</p>	<p>The speed limit increase was associated with a higher fatal crash rate and more deaths on freeways in Washington State.</p>	Ossiander, E.M. and Cummings, P. 2000. Freeway speed limits and traffic fatalities in Washington State. Accident Analysis and Prevention 34 (2002) 13-18.