ROAD SPEED PROFILE FOR ACCIDENT-PRONE AREAS IN UNIVERSITI TEKNOLOGI PETRONAS (UTP)

NOOR SHAERRA AMIERA BINTI MOHD SHARIF

CIVIL ENGINEERING

UNIVERSITI TEKNOLOGI PETRONAS

SEPTEMBER 2016

Road Speed Profile at Accident Prone-Areas in Universiti Teknologi PETRONAS (UTP)

By

Noor Shaerra Amiera binti Mohd Sharif

17649

A project dissertation submitted

in partial fulfillment of the requirement for the

BACHELOR OF ENGINEERING (Hons)

(Civil Engineering)

SEPTEMBER 2016

Universiti Teknologi PETRONAS,

32610, Bandar Seri Iskandar,

Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

Road Speed Profile at Accident Prone-Areas in Universiti Teknologi PETRONAS (UTP)

By

Noor Shaerra Amiera binti Mohd Sharif

17649

A project dissertation submitted to the

Civil and Environmental Engineering Programme

Universiti Teknologi PETRONAS

In partial fulfillment of the requirement for the

BACHELOR OF ENGINEERING (Hons)

(CIVIL ENGINEERING)

Approved by,

_____

(AP Dr Madzlan bin Napiah)

UNIVERSITI TEKNOLOGI PETRONAS

BANDAR SERI ISKANDAR, PERAK

SEPTEMBER 2016

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgments, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

_____

NOOR SHAERRA AMIERA BINTI MOHD SHARIF

ABSTRACT

Speed can be defined as a measure of two different transportation performance characteristics, mobility and safety. From the previous research, they stated that the probability of a vehicle meet with an accident is greater when the vehicle speed deviation is higher form the average speed. In UTP, road accident statistic shows that the number of accident is increasing. Thus, this research is conducted to analyze the speed profile in Universiti Teknologi PETRONAS (UTP). The methodology for this research is by fieldwork. For the fieldwork; two surveys will be conducted which are speed data collection and traffic volume data collection. Speed and its characteristics of all types of vehicles in the university will be obtained during the survey and from the traffic volume data collection, the data obtained will be analyzed by determine the peak hours for each type of vehicles and also the influence factors. The relationship between these surveys is to get the cumulative frequency and the volume of vehicles. The cumulative frequency will eventually determine the causes of accident in UTP whether it is related to speed or not. Overall, this research study is conducted to determine whether the factor of accident happen in UTP is because of speed or other factor such as geometry of the road. The data from the surveys will be used in finding the relationship between the speed and the accident in university. From the result, recommendation will be made for example if the speed is the cause of most accident, then more speed limits will be posted.

ACKNOWLEDGEMENT

Praise to Allah, I successful completed my Final Year Project for two semesters. This project would not have been possible without the guidance and the help of several individuals who in one way or another contributed and extended their valuable assistance in assisting and guiding me throughout the months.

First and foremost, I would like to give my greatest gratitude to AP Dr Madzlan bin Napiah as my Supervisor for this Final Year Project. He is such a great supervisor as he helps me a lot throughout the project. Besides, I would like to thanks to technicians for Highway Lab and the coordinators of FYP 1 and FYP 2; Dr Zulaikha and Dr Carrol respectively. They have been such a great coordinators in helping and guide us; the final year students in the process of the project.

Last but not least, I would like to dedicate my sincere gratitude to my parents for all the encouragements and supports that they gave to me. They have been great supporters for me and it really helps me to lessen my worries and problem that I faced. I also want to thanks all the people that directly or indirectly helping me during my two semesters of my Final Year Project.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

1.1 Background

Speed can be defined as the rate of movement of someone or something. In Highway and Traffic Engineering, speed is recognized as a measure of two different transportation performance characteristics, mobility and safety. The previous research stated that the probability of a vehicle meet with an accident is greater when the vehicle speed deviation is higher form the average speed. Plus, the seriousness of the accident is also higher.

The area of study for this project is Universiti Teknologi PETRONAS (UTP) that located in Seri Iskandar of Perak. Universiti Teknologi PETRONAS (UTP) is a private university owned by PETRONAS. The area of the campus is around 400 hectares. The university is located about one kilometer from the village of Tronoh. The University is accessible through Ipoh-Lumut highway which is about 25 kilometers from Ipoh and 50 kilometers from Lumut. The estimated population in Universiti Teknologi PETRONAS (UTP) is around ten thousands (10,000) students. The university has three roundabouts and the main road is a two-way-two-lane roadway. Walkway is provided along the main road for the safety of the pedestrians. The top view of the location is shown in Figure 1 and 2.

Figure 1: Satellite view of UTP

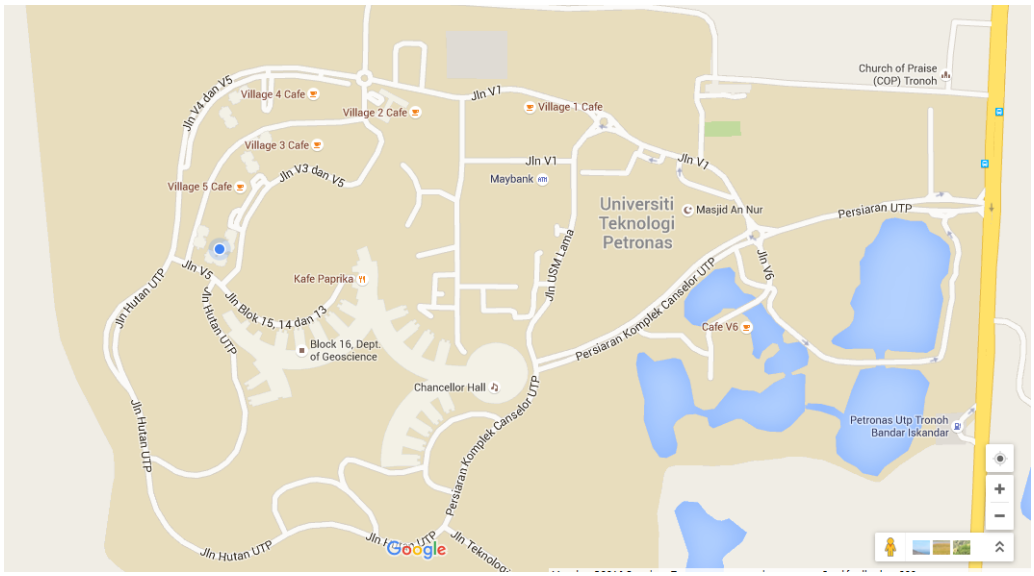

Figure 2: Map view of UTP

1.2 Problem Statement

Majority of the students and staffs in Universiti Teknologi PETRONAS (UTP) have their own vehicles whether it is a car, motorcycle or bicycle. Therefore, the number of vehicles in university is high and to take into consideration is the vehicles that come from outside as some of the university students are living outside UTP due to the accommodation problem which is the inside hostel cannot accommodate all their students. Due to the high number of vehicles, there is a possibility of the traffic congestion happen in UTP. But the most concern matter is the speed of the vehicle in university. According to UTP's Health, Safety and Environment (HSE) Department, UTP has high number of accidents from 2012 – 2015. Therefore, the road speed profile analysis is conducted to analyze and determine the speed of vehicles in UTP.

1.3 Objectives

The main objective of the project is to analyze the speed profile of the road in Universiti Teknologi PETRONAS (UTP). This main objective will be correlated to the sub-objectives such that:

a) To determine the speed characteristics of different types of vehicles.
b) To study the sufficiency and deficiency of posted speed limit.
c) To determine the causes of the accident that related to the speed.

1.4 Scope of study

For this project, the scope of study is involving the field investigation. From the field investigation, the speed data is required and will be analyze.

a) Speed data collection

   Speed data collection is conducted to estimate the distribution of speeds of vehicles in a stream of traffic at a particular location.

b) Traffic volume collection

   Traffic volume studies are conducted to collect data on the number of vehicles and pedestrians that pass a point on a highway facility during a specified time period.

CHAPTER 2

LITERATURE REVIEW

2.1 Speed

Speed is recognized as a measure of two different transportation performance characteristics, mobility and safety. A good mobility indicates that when the speed is higher leads to the lower travel times. There is general agreement that the risk of injuries and fatalities increases with speed. Therefore, the arguments about the mobility and safety objectives are unclear. The vehicle speeds is the decision of the drivers. In driving environment, the drivers interpret and respond to signals; explicit and implicit.

The factors of the speed selection are:

a) Road alignment – The position of the central line of the road on the ground.
b) Cross section
c) Roadside
d) Advisory speeds – Speed recommendation from the governing body. Refer Figure 3.

Figure 3: Advisory speed sign

e) Speed limits

Different information sources such as speed limit and roadway geometry can make the drivers interpret different signals on appropriate speed. Speed management principles and techniques can be applied to clarify and unify the information being provided to drivers and to balance safety and mobility objectives.

2.2 Speed Profiles

Speed profiles are a graphical representation of speed features plotted by location. It is very useful in studies and evaluation. The contents of speed profiles is vary but features that are commonly included are the designated design speed, operating speed and posted speed limit. Figure 4 and 5 shows the example of cumulative distribution function and speed profiles respectively.

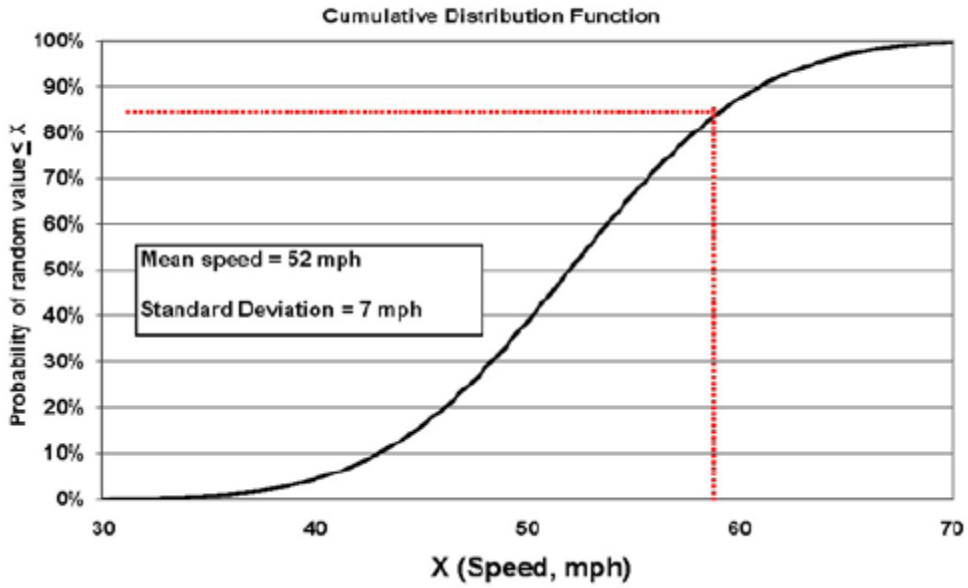

Figure 4: Example of cumulative distribution function

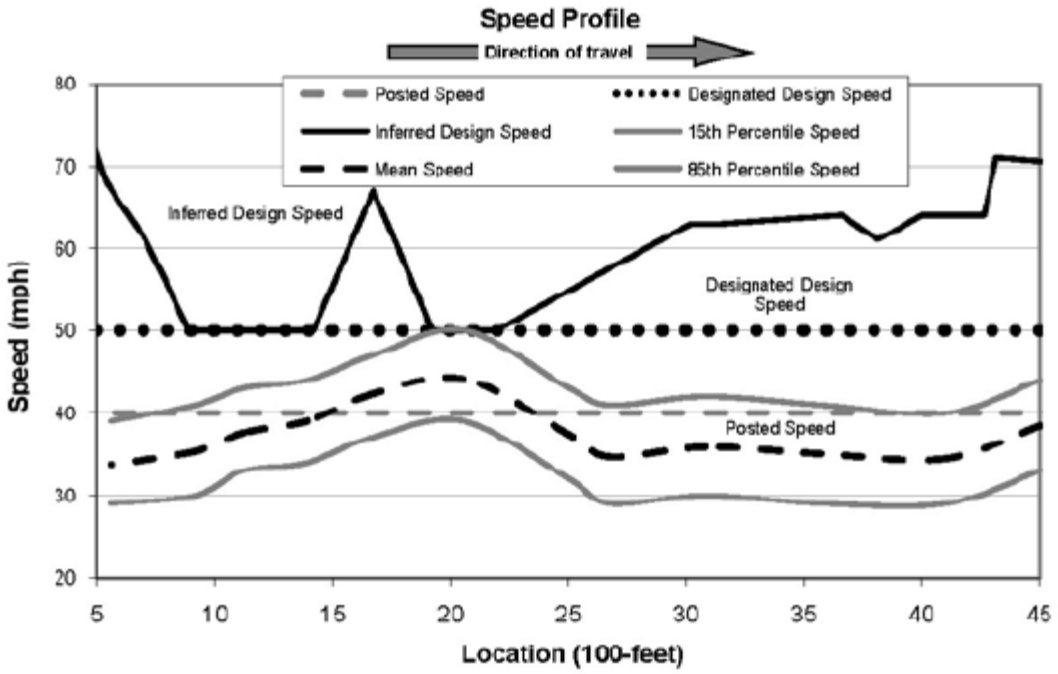

Figure 5: Example of speed profile

2.3 Speed Profile Analysis of Kerala Roads

In India, there is a research study regarding the speed profile analysis. The exact location of the research is at Kerala Roads. The research was done by Assistant Professor, Mr Bybin Paul and Assistant Professor, Dr Elson John of Mar Athanasius College of Engineering.

The motivation for the study is the high rate of increase in traffic in the roads which has a number of negative effects. They also stated that the major factors of vehicles travel speed are geometry of the road, posted speed limit, interference by heavy vehicles and the volume of traffic and surface condition.

The methodology used by Mr Bybin Paul and Dr Elson John are speed data collection and volume data collection. The research area is divided into 3 different types of road; national highways, state highways and major district roads. For every types of

highways, there are specific name of the roads; NH-49: Madurai 0- Kochi. The surveys (speed data and volume data collection) are conducted for every road of every type of road. From the data collection, the researchers come with cumulative frequency table for selected road and vehicles class. For example, cumulative frequency table for NH 49 for vehicle class – bus as shown in the Figure 6.

Table 1: Cumulative frequency table for NH 49 for vehicle class – bus

Speed Range kmph	Mid speed kmph	Frequency f	Percent frequency %f	Cumulative frequency
20-25	27.5	1	4.76	4.76
35-40	37.5	1	4.76	9.52
40-45	42.5	3	14.29	23.81
45-50	47.5	6	28.57	52.38
50-55	52.5	8	38.10	90.48
55-60	57.5	2	9.52	100
	Total	21	100	

The analysis of the speed profile was done by analyzing the speed, volume and accident data for every road. The posted speed limit also mentioned to relate the speed and the accident rate. The vehicle class also stated in the analysis so that the reader knows about the type of vehicle class that has been involved in the accident at the particular road.

Mr Bybin Paul and Dr Elson John come out with the conclusion that the speed limit posted was violated by major portion of drivers. They also conclude that their study revealed that the variety classes of roads in the research area are accident prone and the major cause is the speed.

2.4 Road Accident Statistics in UTP

Figure 7 and 8 below show the road accident statistic in Universiti Teknologi PETRONAS from 2010 until 2015 and January until July 2016 respectively.

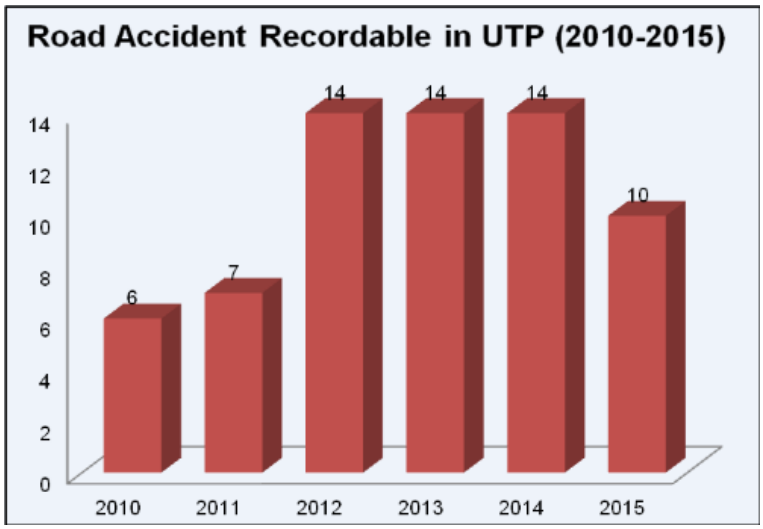

Figure 6: Total Road Accident 2010- 2015

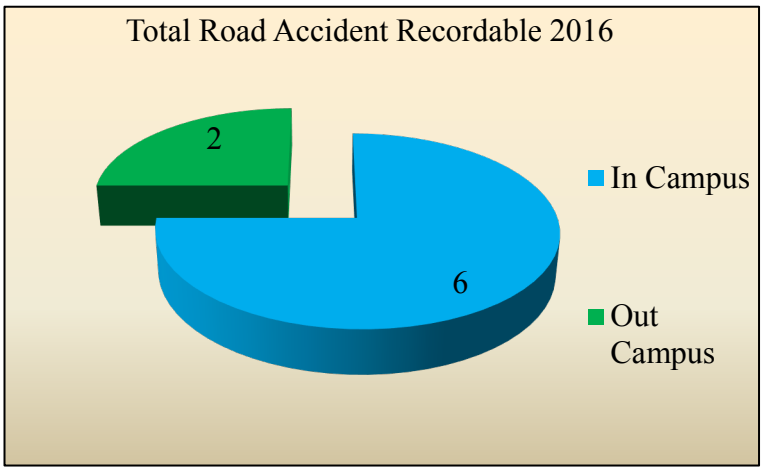

Figure 7: Total Road Accident Jan-July 2016

CHAPTER 3

METHODOLOGY

3.1 Literature Review from Desk Study

For literature review, the information is obtained from the reading material such as journals, internet articles, previous report, and textbook that are related to the traffic engineering; specifically in road speed and also the location of the study area which is Universiti Teknologi PETRONAS (UTP). The information acquired will be used wisely for the writer to come out with ideas for further investigation of the project. The previous fieldwork also important to provide the necessary information such as type of experiment that needs to be conducted for data gathering so that writer can have the ideas on how the experiment is done.

3.2 Fieldwork

From the fieldwork study, the data for the research will be collected and analysis will be done. For the fieldwork, there are two studies related to the road speed profile which are speed data collection and traffic volume data collection.

3.2.1 Speed data collection

Speed data collection will provide the speed for all the vehicles at the study area using the radar gun (meter). The radar gun is a hand-held speed meter and the function is to measure the speed of the approaching vehicles. The speed reading will be display on the screen. The Flowchart 1 shows the procedure of the speed data collection.

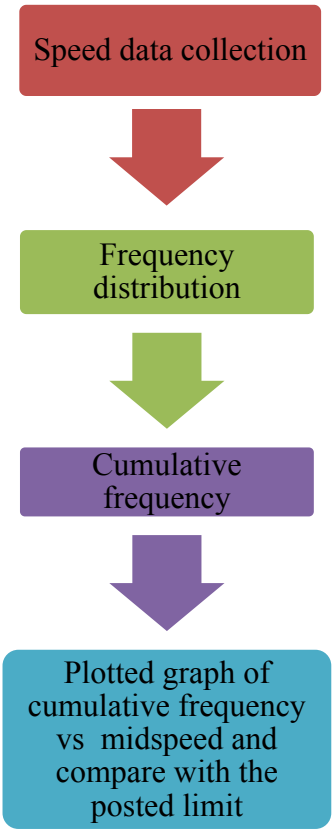

Figure 8: Procedure for speed data collection

3.2.2 Traffic volume data collection

The traffic volume data collection will give the number of vehicles that pass a point on a road during a specified time period. It is used to measure the flow quantity. The units are vehicles per day and vehicles per hour. First, determine the traffic volume during each 15 minutes from 8.00 am to 5 pm for a week. Peak hour will be obtained from the data collection. Flowchart 2 shows on how the traffic volume data is collected.

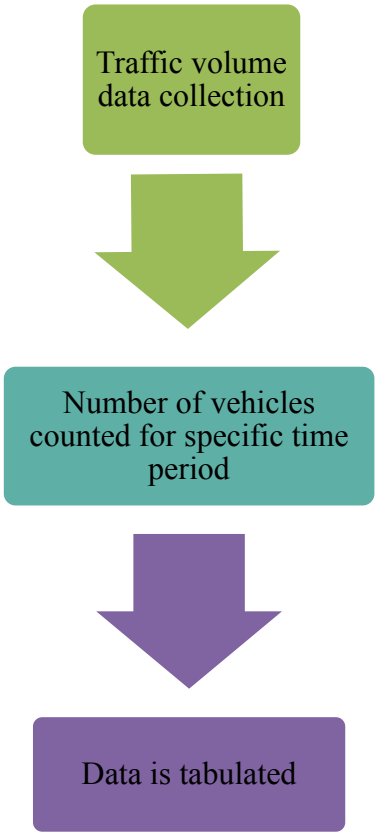

Figure 9: Procedure of traffic volume data collection

3.3 Key Milestones

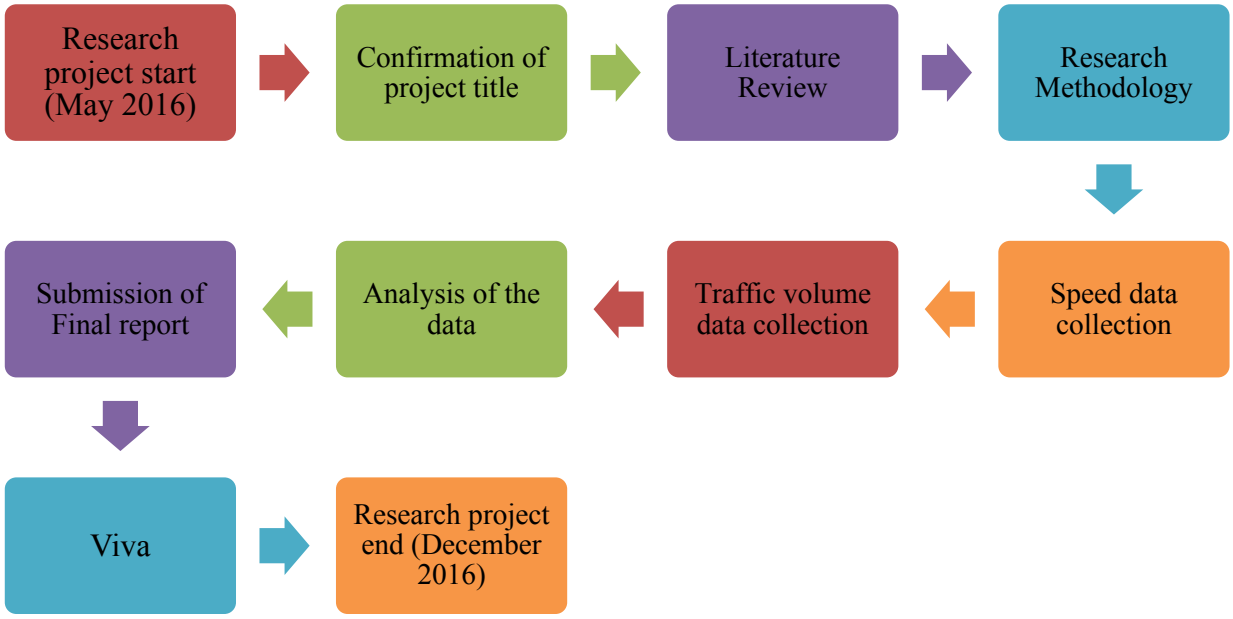

Figure 10: Key Milestones

3.4 Gant Chart

Activities	Academic Week													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Title confirmation														
Literature review														
Submission Extended proposal														
Proposal defense														
Research work continue														
Submission of Interim draft report														
Submission of Interim report														

Table 2: FYP 1 Gant chart

Activities	Academic Week													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Fieldwork/Analysis Work														
Research work continue														
Submission of Progress Report														
Pre-SEDEX														
Submission of draft Final Report														
Submission of Dissertation (soft bound)														
Submission of Technical Paper														
Viva														
Submission of Project Dissertation (hard bound)														

Table 3: FYP 2 Gant chart

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Results

4.1.1 Speed Data Collection

For the speed data surveys, there are total four locations where the survey takes place. In this chapter, the results will be show according to the location.

4.1.1.1 Location 1: Along Jalan USM Lama

Figure 11 shows the first location for the speed data collection which is along Jalan USM Lama. This road is located in front of the Multipurpose Hall (MPH). There are two direction for the lane and are called as Direction 1(incoming vehicles) and Direction 2 (outgoing vehicles).

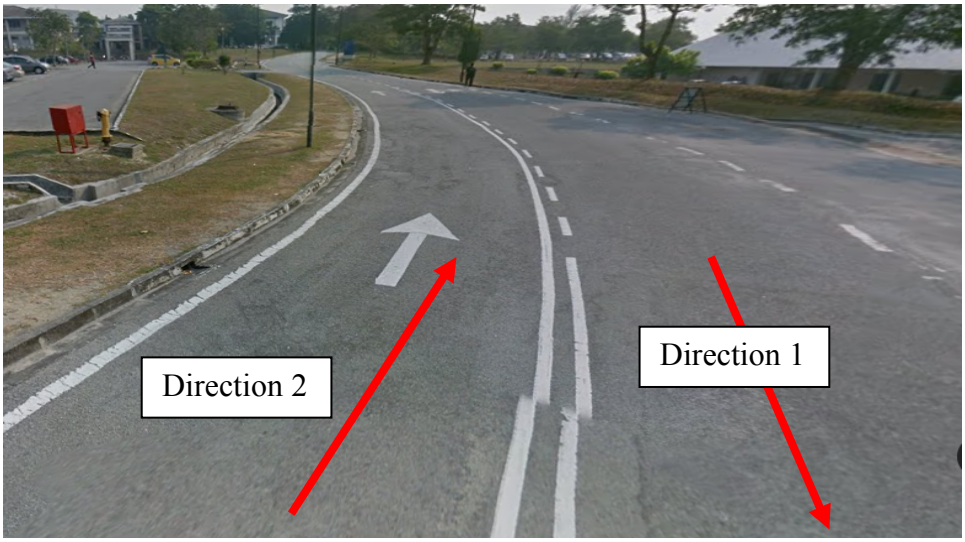

Figure 11: Jalan USM Lama

The details of the conducted survey as below:

Date: 17/10/2016 (Monday)

Time: 11.00 AM – 12.00 PM

Table 3 in Appendix A shows the cumulative frequency for car in Direction 1 which is determined from the speed data collected at the stated date and time.

Figure 12 shows the cumulative frequency against mid speed. The purple line indicates the distribution of the data and the black lines are for 85th and 50th percentile

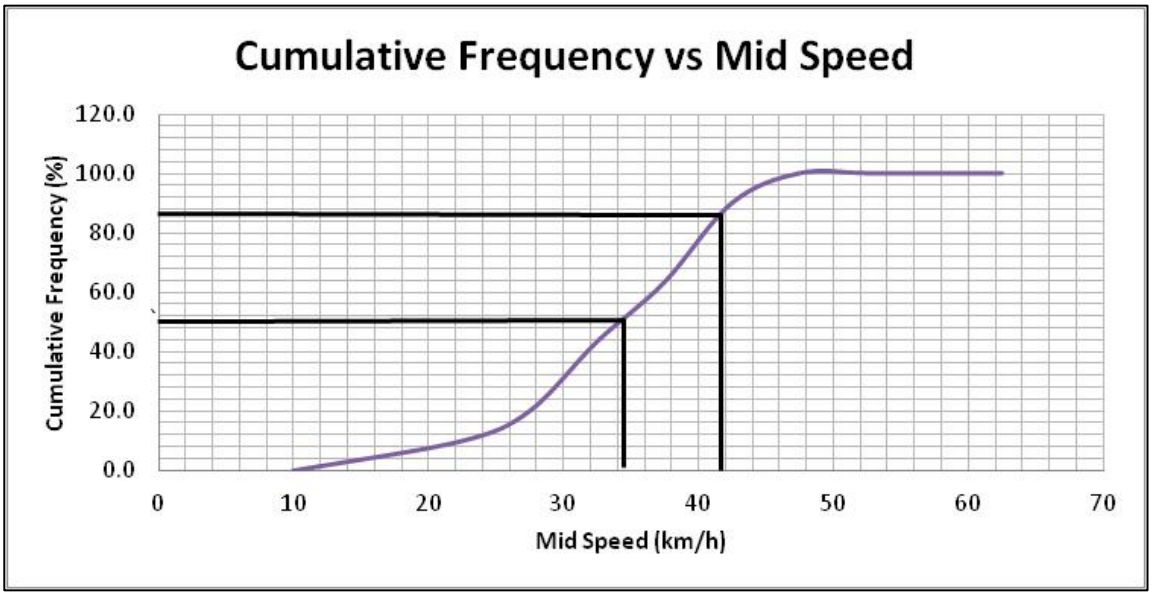

Figure 12: Cumulative frequency for Direction 1

From Figure 12, the mid speed for 85th percentile is 41.5 km/h and 50th percentile is 34 km/h. Table 4 in Appendix A and Figure 13 below show the cumulative frequency for car in Direction 2.

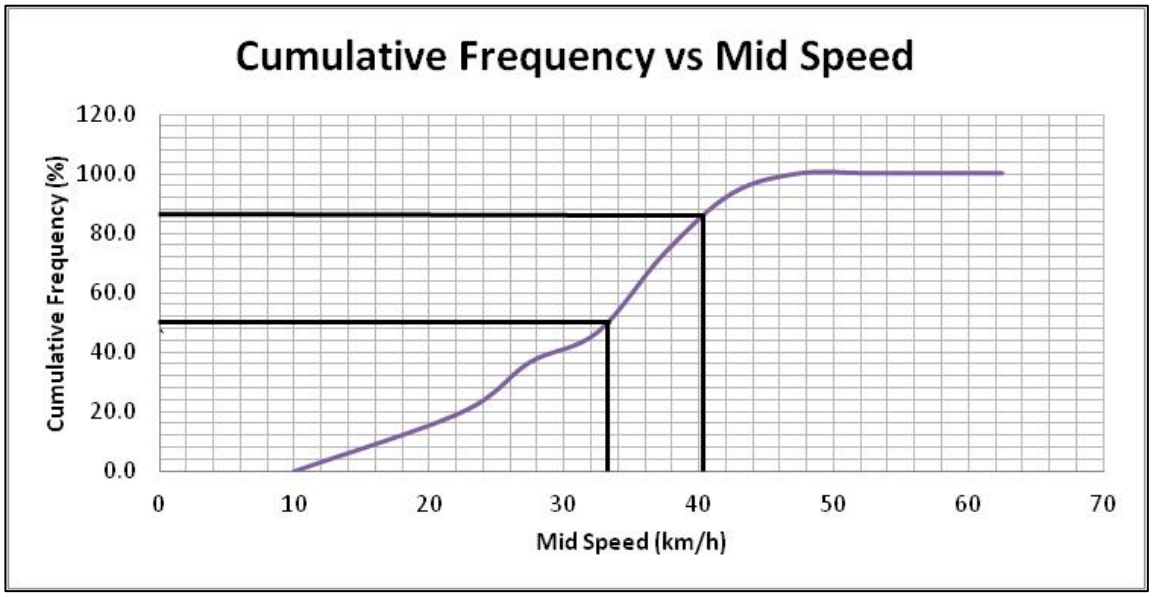

Figure 13: Cumulative frequency for Direction 2

From Figure 13, the mid speed for 85th percentile is 40 km/h and 50th percentile is 33.5 km/h.

Date: 18/10/2016 (Tuesday)

Time: 9.30 AM – 10.30 AM

Table 5 in Appendix A and Figure 14 show the cumulative frequency for car in Direction 1 which is determined from the speed data collected at the stated date and time.

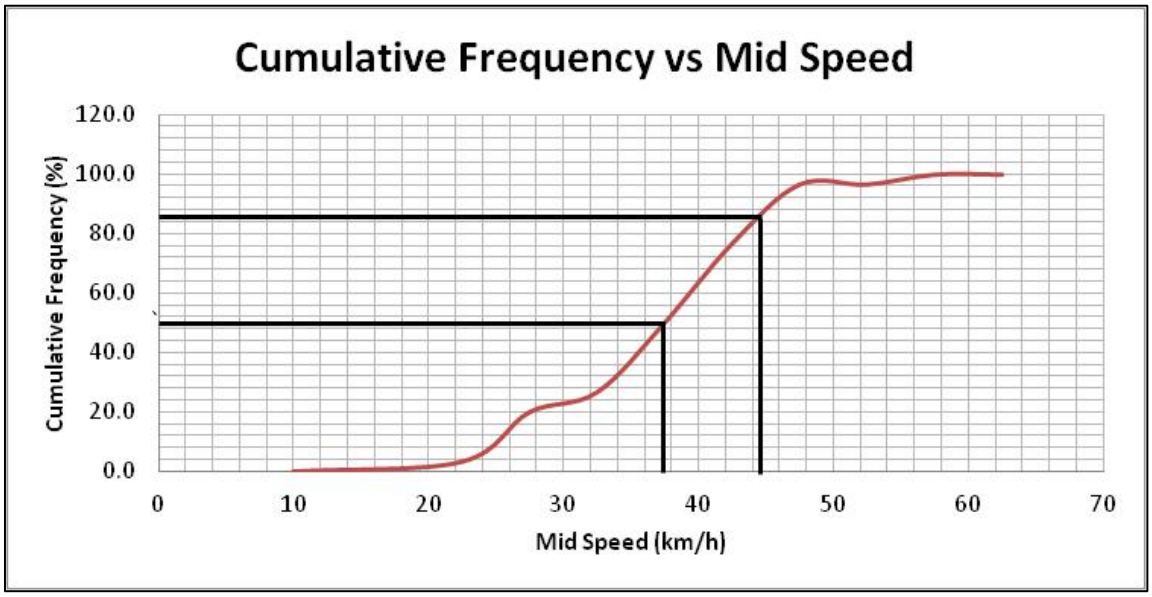

Figure 14: Cumulative frequency for Direction 1

From Figure 14, the mid speed for 85th percentile is 44.5 km/h and 50th percentile is 37.5 km/h. Table 6 in Appendix A and Figure 15 below show the cumulative frequency for car in Direction 2.

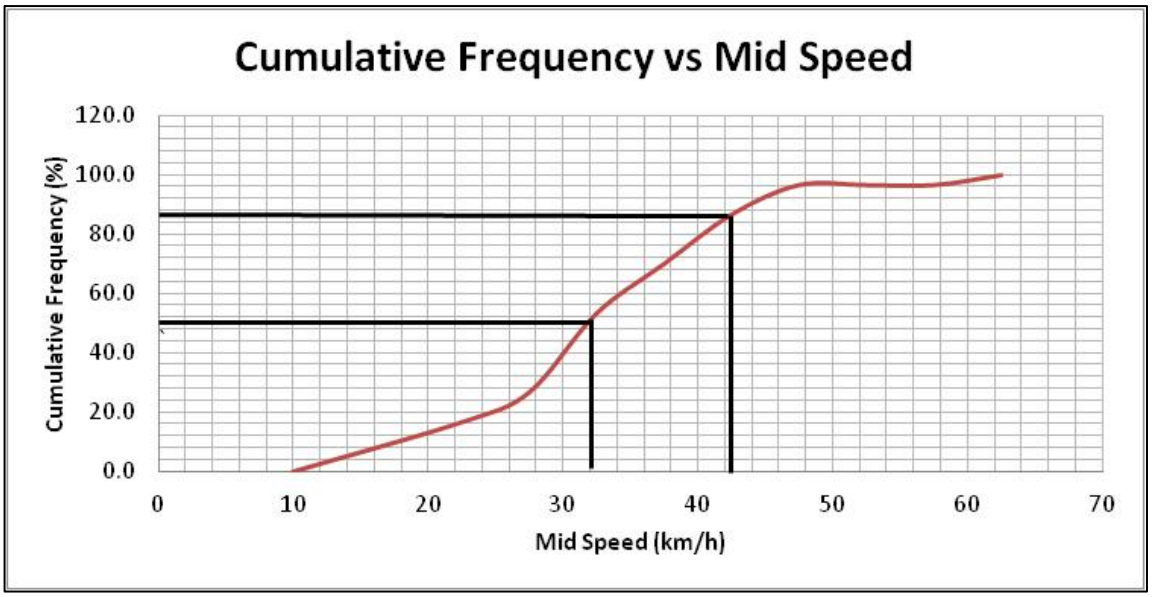

Figure 15: Cumulative frequency for Direction 2

From Figure 15, the mid speed for 85th percentile is 42.5 km/h and 50th percentile is 32 km/h.

Date: 19/10/2016 (Wednesday)

Time: 11.00 AM – 12.00 PM

Table 7 in Appendix A and Figure 16 show the cumulative frequency for car in Direction 1 which is determined from the speed data collected at the stated date and time.

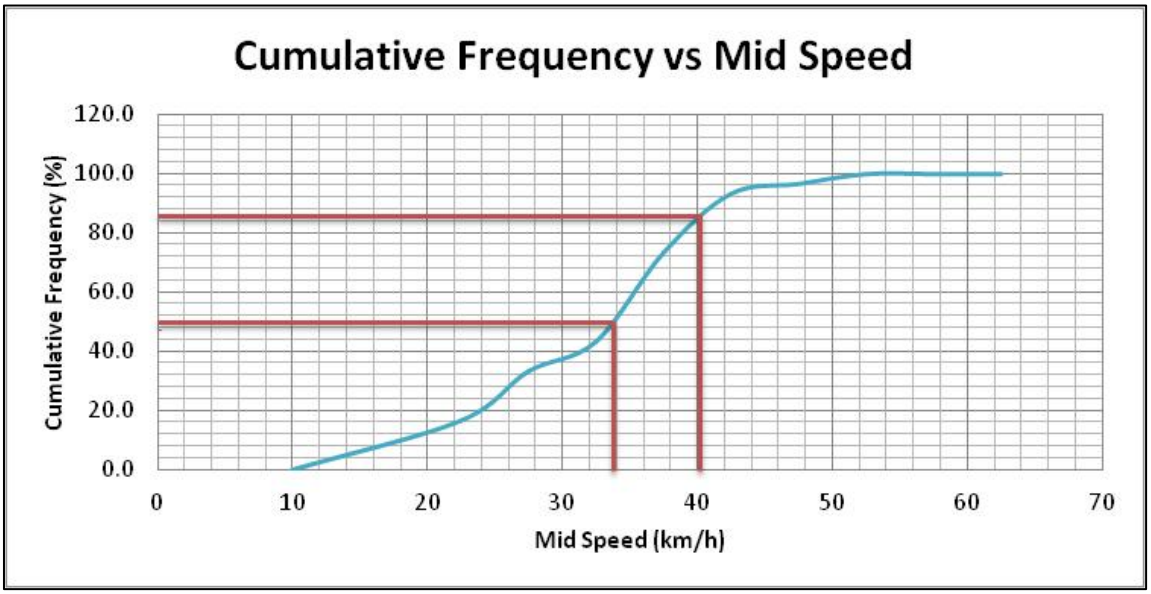

Figure 16: Cumulative frequency for Direction 1

From Figure 16, the mid speed for 85th percentile is 40 km/h and 50th percentile is 34 km/h. Table 8 in Appendix A and Figure 17 below shows the cumulative frequency for car in Direction 2.

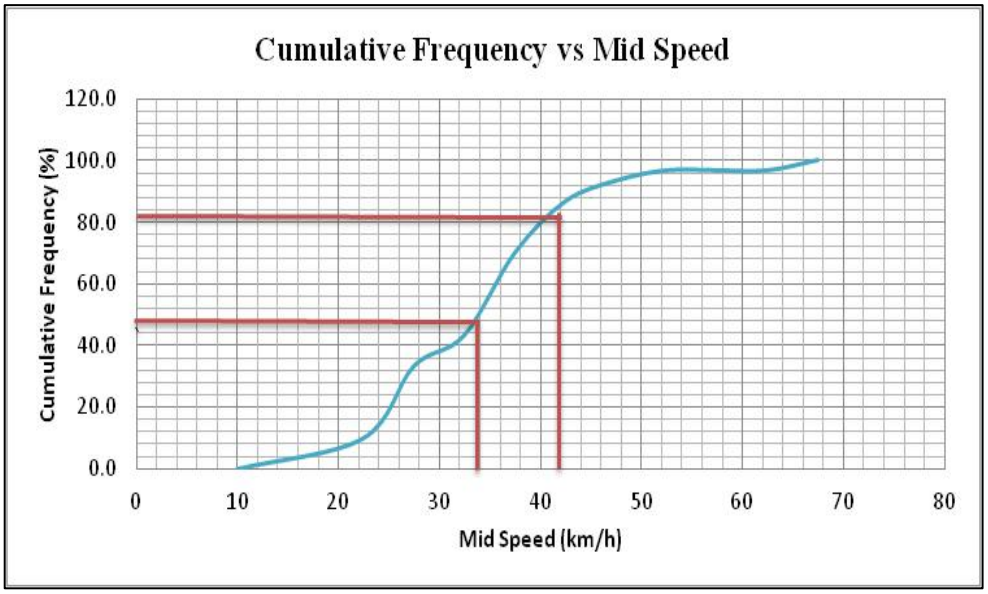

Figure 17: Cumulative frequency for Direction 2

From Figure 17, the mid speed for 85th percentile is 42 km/h and 50th percentile is 34 km/h.

4.1.1.2 Location 2: Jalan V1 dan V2

Figure 18 shows the exact location for the second location of the speed data collection. This location is located in between Village 2 (male hostel) and Village 1 (female hostel).

Figure 18: Location 2

The details of the conducted survey as below:

Date: 17/10/2016 (Monday)

Time: 1 PM – 2 PM

Table 9 in Appendix A and Figure 19 show the cumulative frequency for car in Direction 1 which is determined from the speed data collected at the stated date and time.

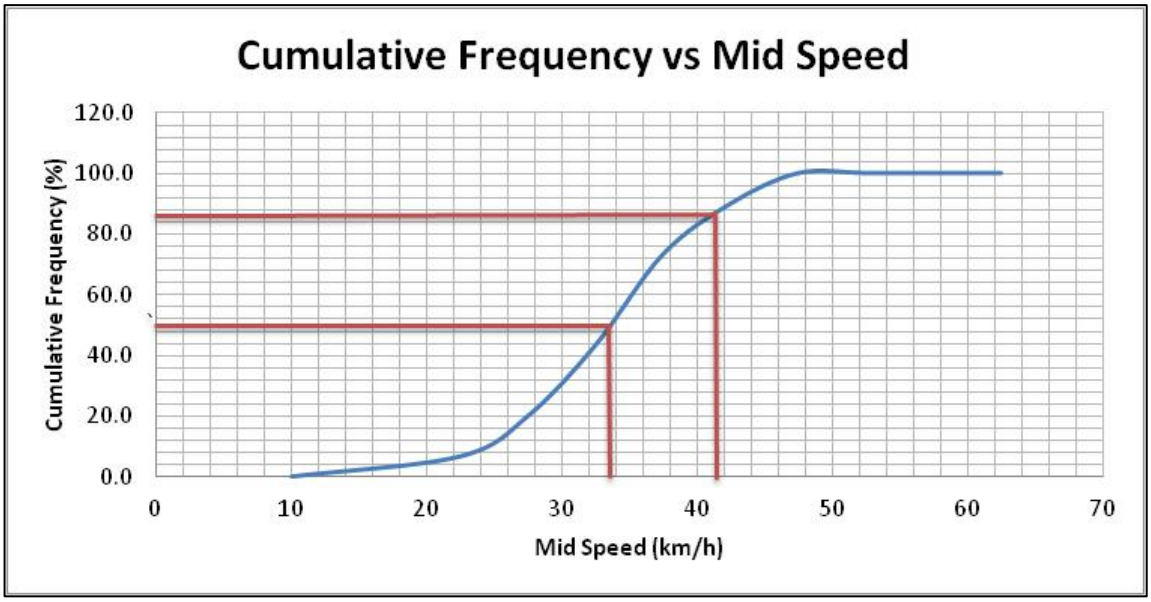

Figure 19: Cumulative frequency for Direction 1

From Figure 19, the mid speed for 85th percentile is 41.5 km/h and 50th percentile is 33.5 km/h. Table 10 in Appendix A and Figure 20 below shows the cumulative frequency for car in Direction 2.

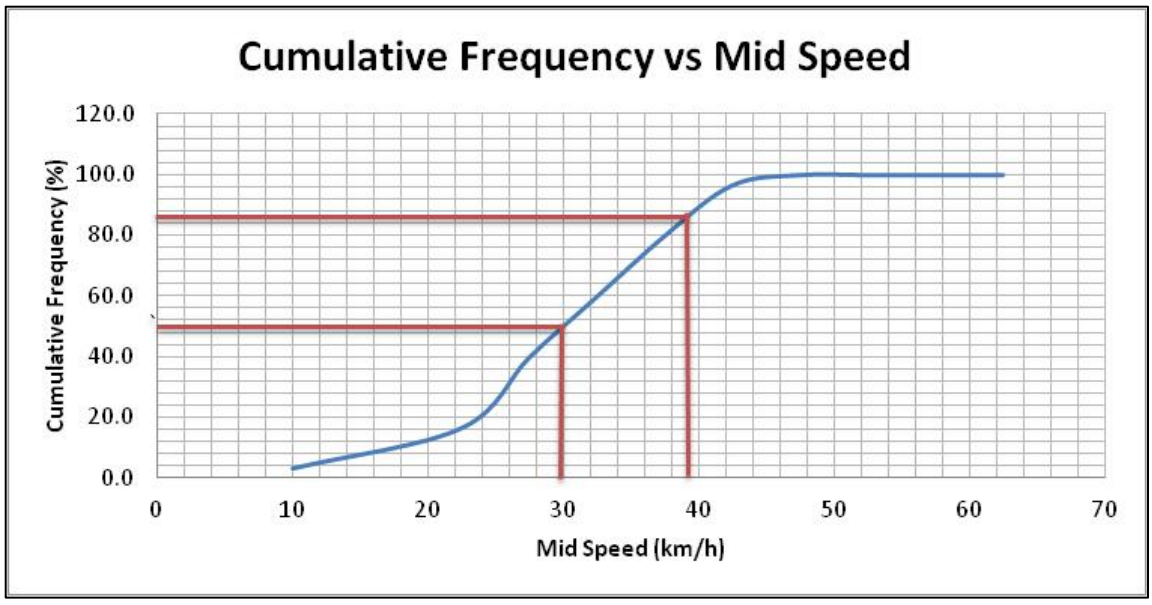

Figure 20: Cumulative frequency for Direction 2

From Figure 20, the mid speed for 85th percentile is 39 km/h and 50th percentile is 30 km/h.

Date: 18/10/2016 (Tuesday)

Time: 11 AM – 12 PM

Table 11 in Appendix A and Figure 21 show the cumulative frequency for car in Direction 1 which is determined from the speed data collected at the stated date and time.

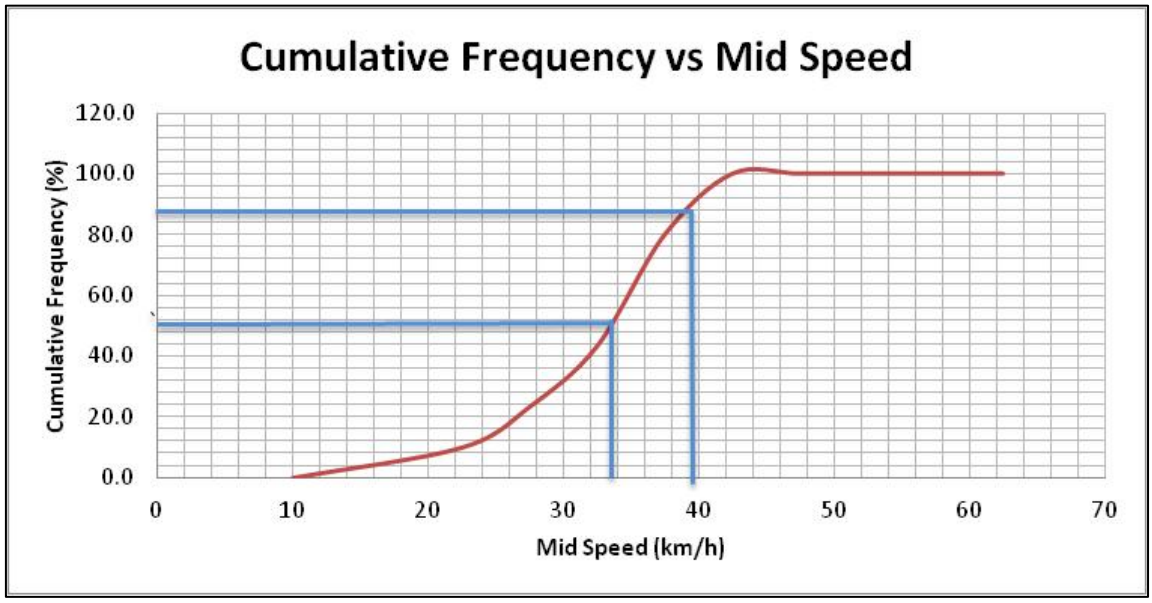

Figure 21: Cumulative frequency for Direction 1

From Figure 21, the mid speed for 85th percentile is 39.5 km/h and 50th percentile is 33.5 km/h. Table 12 in Appendix A and Figure 22 below shows the cumulative frequency for car in Direction 2.

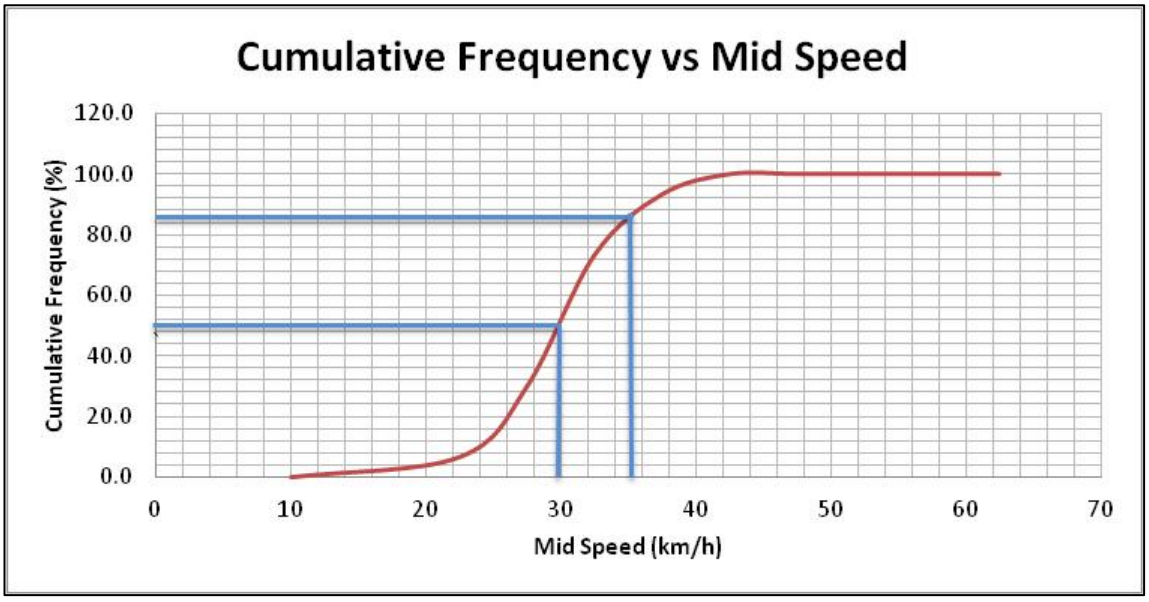

Figure 22: Cumulative frequency for Direction 2

From Figure 22, the mid speed for 85th percentile is 35.5 km/h and 50th percentile is 30 km/h.

Date: 19/10/2016 (Wednesday)

Time: 1.30 PM – 2.30 PM

Table 13 in Appendix A and Figure 23 below show the cumulative frequency for car in Direction 1(incoming vehicles).

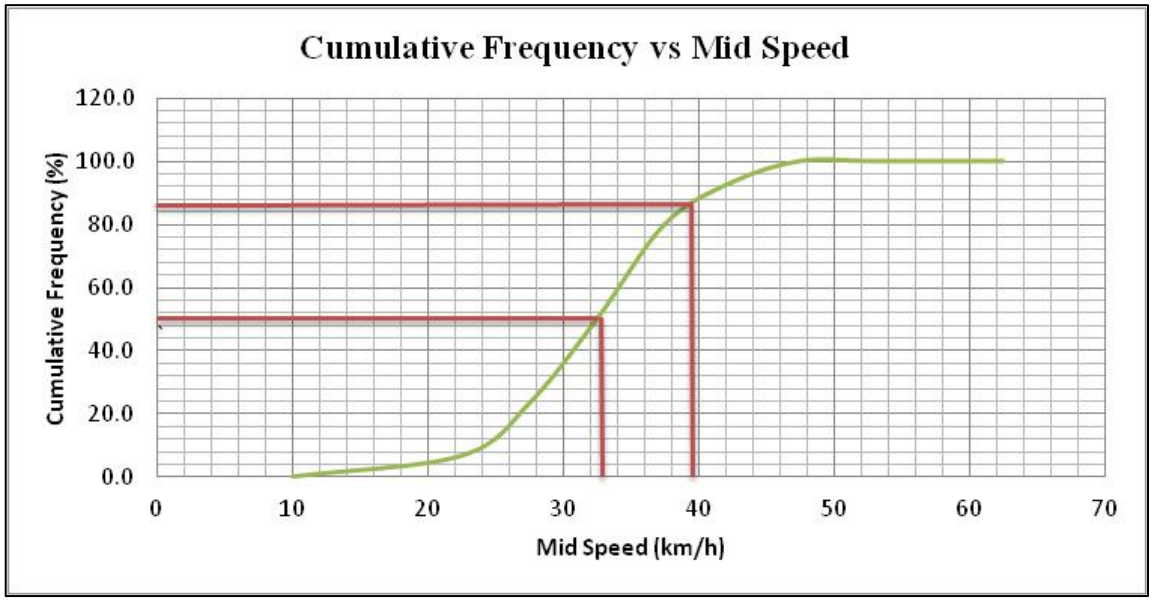

Figure 23: Cumulative frequency for Direction 1

From Figure 23, the mid speed for 85th percentile is 39 km/h and 50th percentile is 32 km/h. Table 14 in Appendix A and Figure 24 below shows the cumulative frequency for car in Direction 2 (outgoing vehicles).

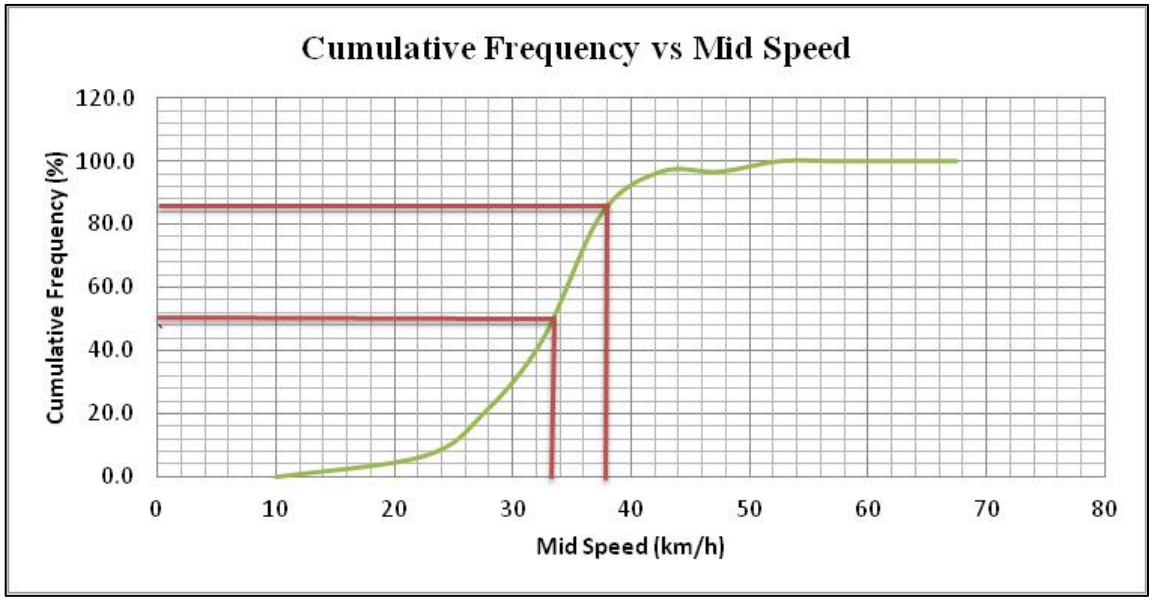

Figure 24: Cumulative frequency for Direction 2

From Figure 24, the mid speed for 85th percentile is 38 km/h and 50th percentile is 33.9 km/h.

4.1.1.3 Location 3: Jalan V1

Figure 25 shows the third location for the survey of speed data. This location is located in front of Village 1's cafe.

Figure 25: Jalan V1

The details of the conducted survey as below:

Date: 17/10/2016 (Monday)

Time: 4 PM – 5 PM

Table 15 in Appendix A and Figure 26 below show the cumulative frequency for car in Direction 1(incoming vehicles).

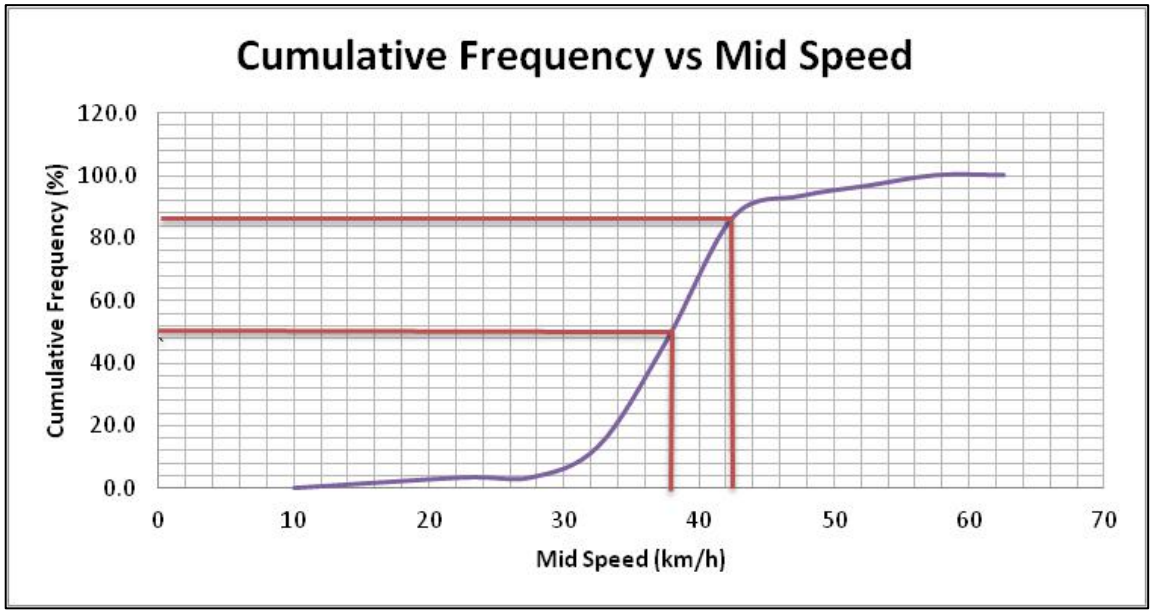

Figure 26: Cumulative frequency for Direction 1

From Figure 26, the mid speed for 85th percentile is 42.5 km/h and 50th percentile is 38 km/h. Table 16 in Appendix A and Figure 27 below shows the cumulative frequency for car in Direction 2 (outgoing vehicles).

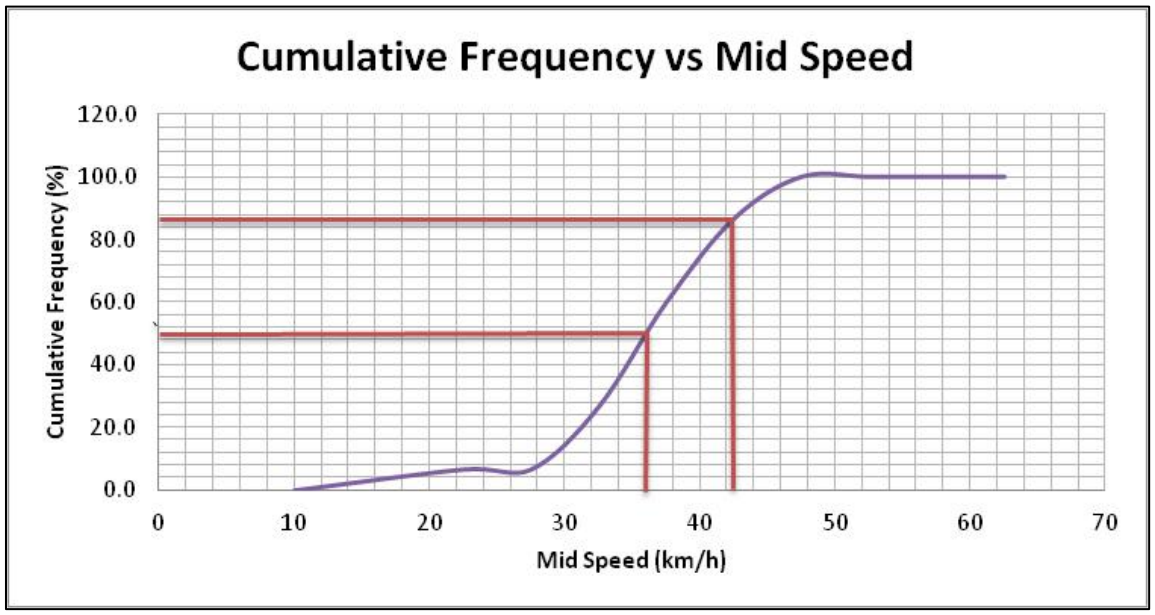

Figure 27: Cumulative frequency for Direction 2

From Figure 27, the mid speed for 85th percentile is 42.5 km/h and 50th percentile is 36 km/h.

Date: 18/10/2016 (Tuesday)

Time: 4 PM – 5 PM

Table 17 in Appendix A and Figure 28 below show the cumulative frequency for car in Direction 1(incoming vehicles).

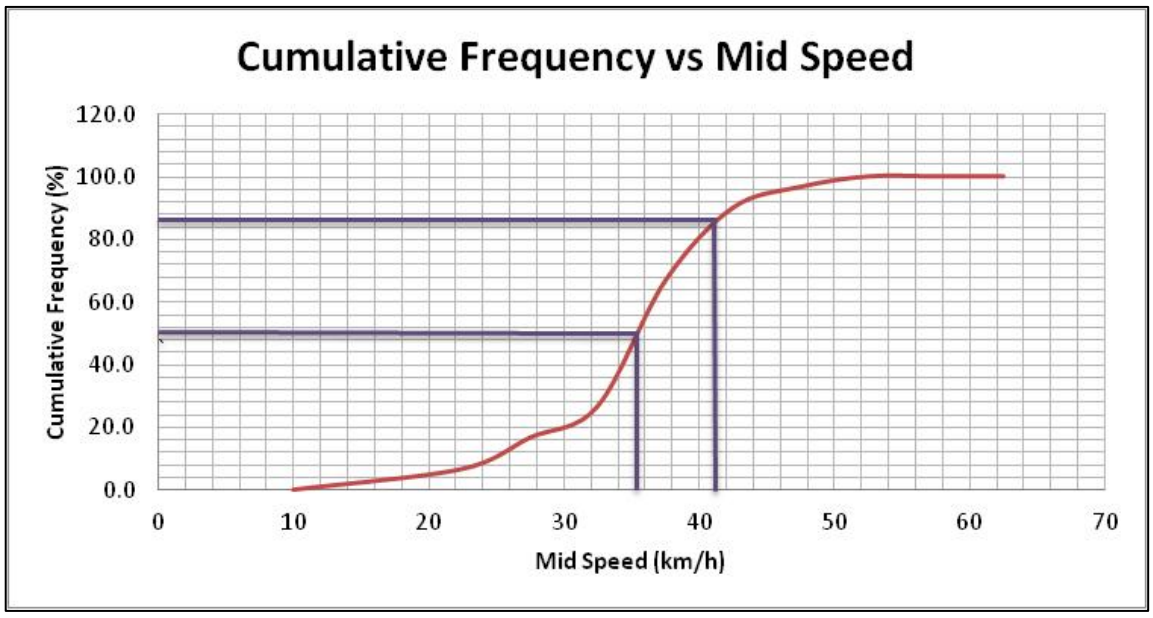

Figure 28: Cumulative frequency for Direction 1

From Figure 28, the mid speed for 85th percentile is 41 km/h and 50th percentile is 35.5 km/h. Table 18 in Appendix A and Figure 29 below shows the cumulative frequency for car in Direction 2 (outgoing vehicles).

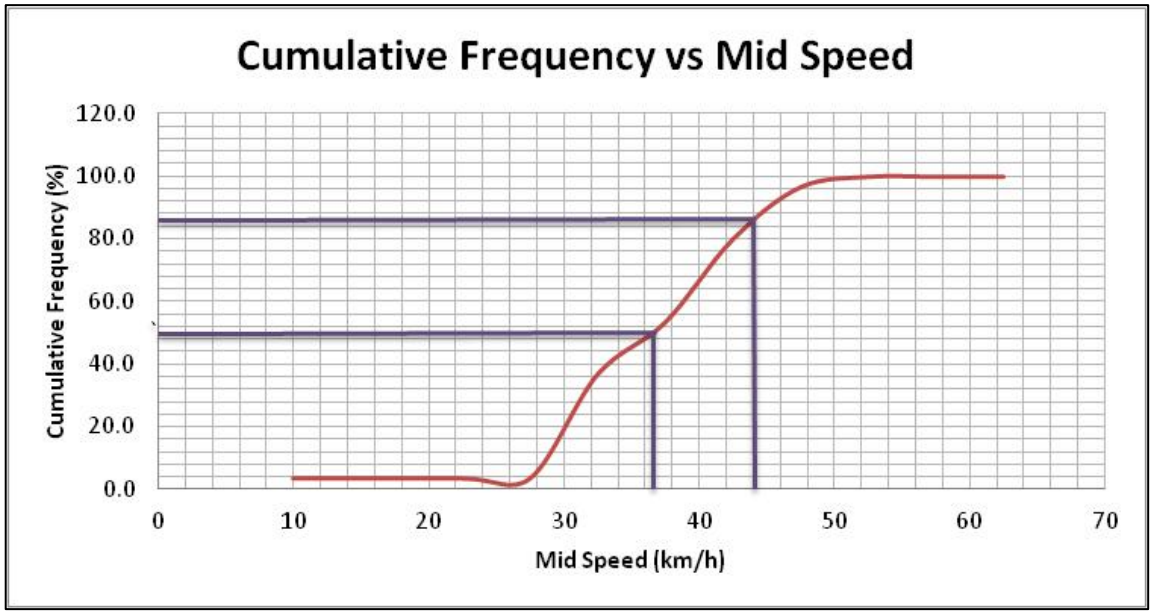

Figure 29: Cumulative frequency for Direction 2

From Figure 29, the mid speed for 85th percentile is 44 km/h and 50th percentile is 36.5 km/h.

Date: 19/10/2016 (Wednesday)

Time: 3 PM – 4 PM

Table 19 in Appendix A and Figure 30 below show the cumulative frequency for car in Direction 1(incoming vehicles)

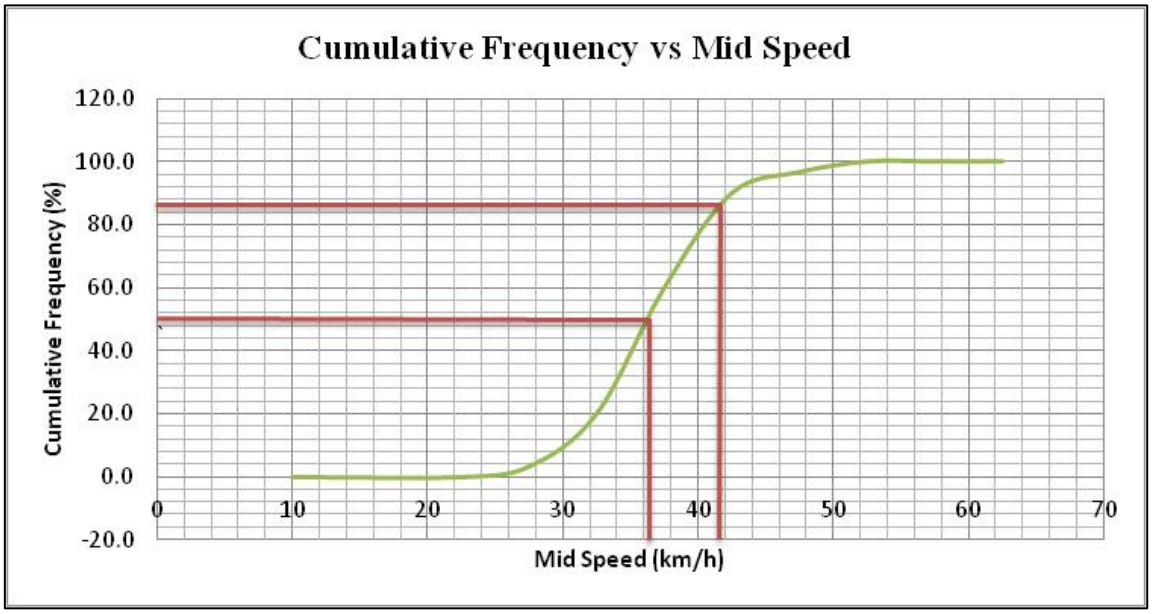

Figure 30: Cumulative frequency for Direction 1

From Figure 30, the mid speed for 85th percentile is 41 km/h and 50th percentile is 36 km/h. Table 20 in Appendix A and Figure 31 below shows the cumulative frequency for car in Direction 2 (outgoing vehicles).

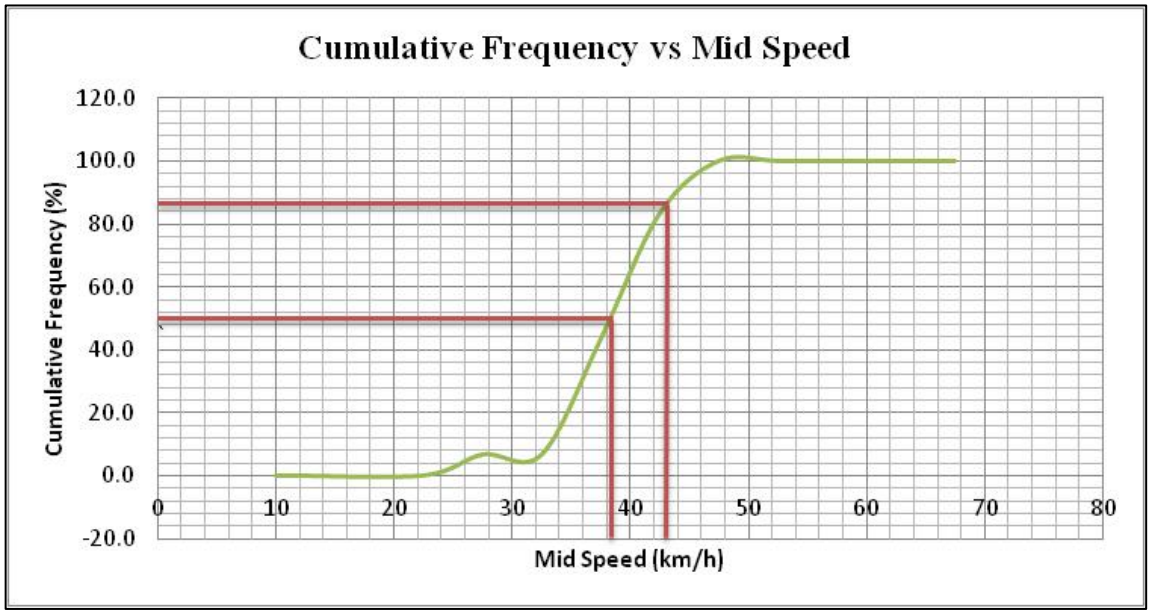

Figure 31: Cumulative frequency for Direction 2

From Figure 31, the mid speed for 85th percentile is 43 km/h and 50th percentile is 38 km/h.

4.1.1.4 Location 4: Jalan V4 dan V5

Figure 32 shows the forth location for the speed data collection. This location is located in front of Village 4 (female hostel) and Village 5 (male hostel).

Figure 32: Jalan V4 dan V5

The details of the conducted survey as below:

Date: 17/10/2016 (Monday)

Time: 6.30 PM – 7.30 PM

Table 21 in Appendix A and Figure 33 below show the cumulative frequency for car in Direction 1(incoming vehicles).

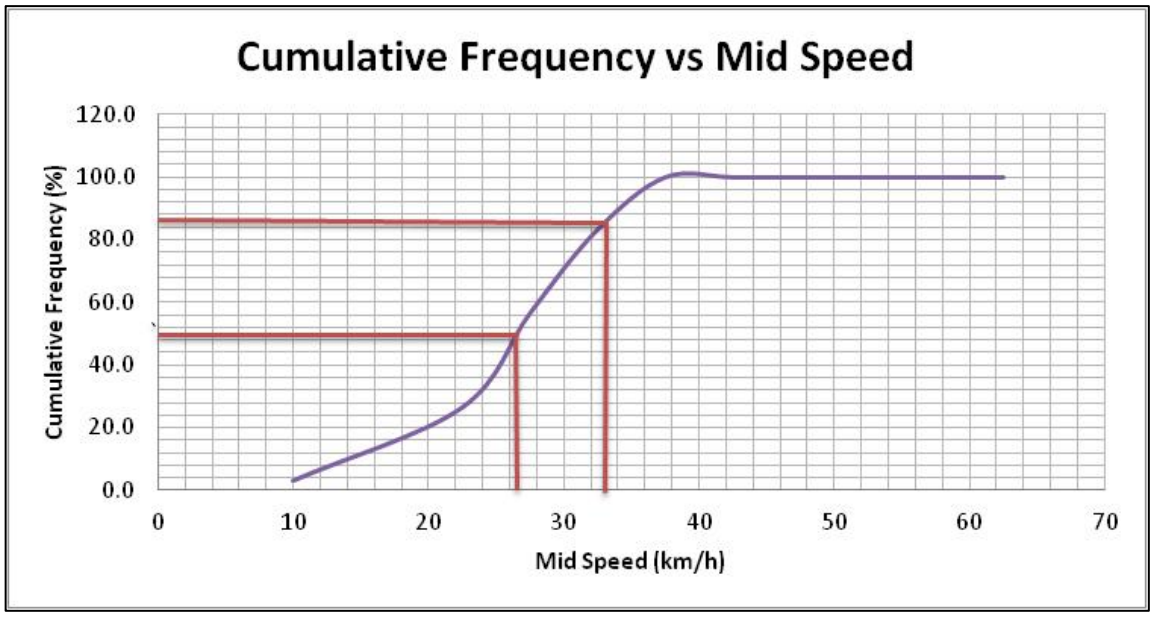

Figure 33: Cumulative frequency for Direction 1

From Figure 33, the mid speed for 85th percentile is 33 km/h and 50th percentile is 26.5 km/h. Table 22 in Appendix A and Figure 34 below shows the cumulative frequency for car in Direction 2 (outgoing vehicles).

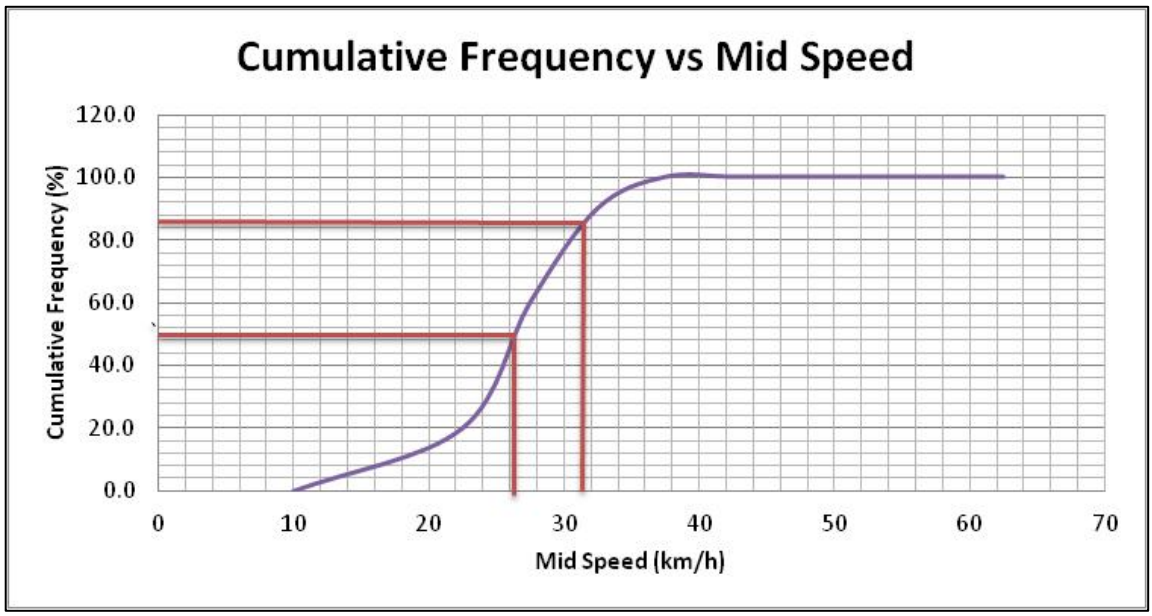

Figure 34: Cumulative frequency for Direction 2

From Figure 34, the mid speed for 85th percentile is 31.5 km/h and 50th percentile is 26 km/h.

Date: 18/10/2016 (Tuesday)

Time: 6 PM – 7 PM

Table 23 in Appendix A and Figure 35 below show the cumulative frequency for car in Direction 1(incoming vehicles).

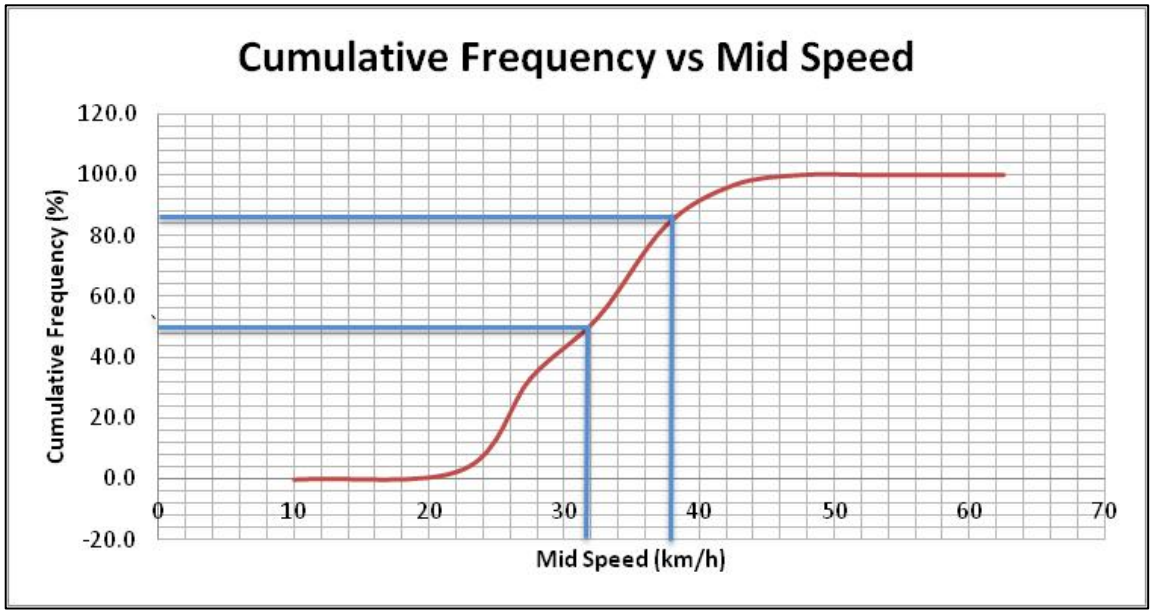

Figure 35: Cumulative frequency for Direction 1

From Figure 35, the mid speed for 85th percentile is 38 km/h and 50th percentile is 32 km/h. Table 24 in Appendix A and Figure 36 below shows the cumulative frequency for car in Direction 2 (outgoing vehicles).

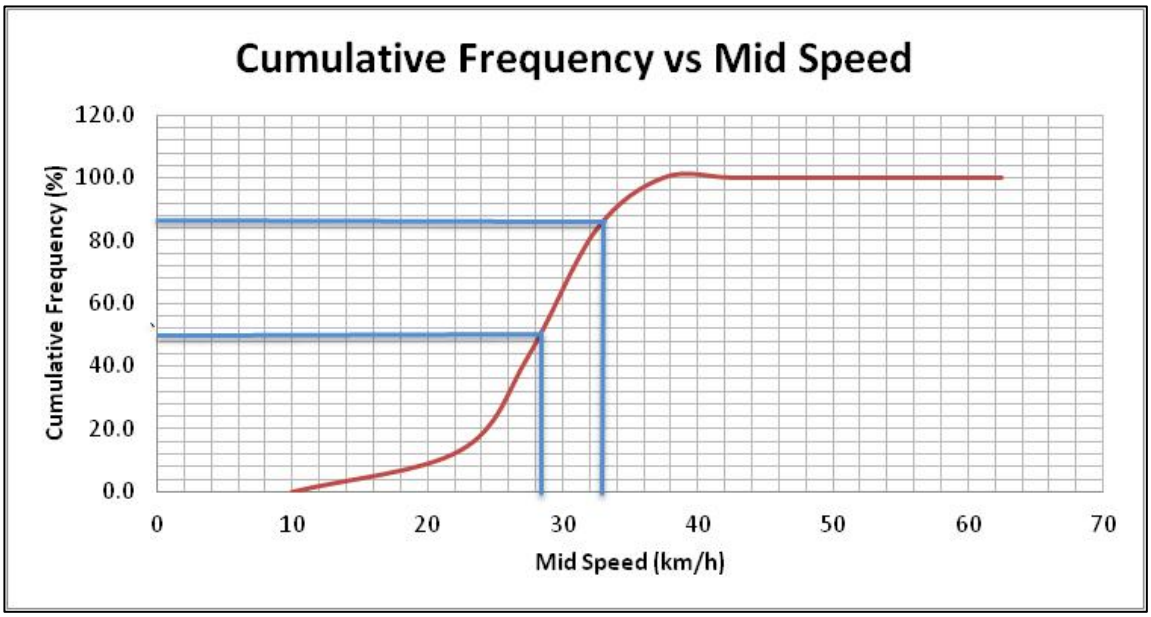

Figure 36: Cumulative frequency for Direction 2

From Figure 36, the mid speed for 85th percentile is 33 km/h and 50th percentile is 28.5 km/h.

Date: 19/10/2016 (Wednesday)

Time: 5.15 PM – 6.15 PM

Table 25 in Appendix A and Figure 37 below show the cumulative frequency for car in Direction 1(incoming vehicles).

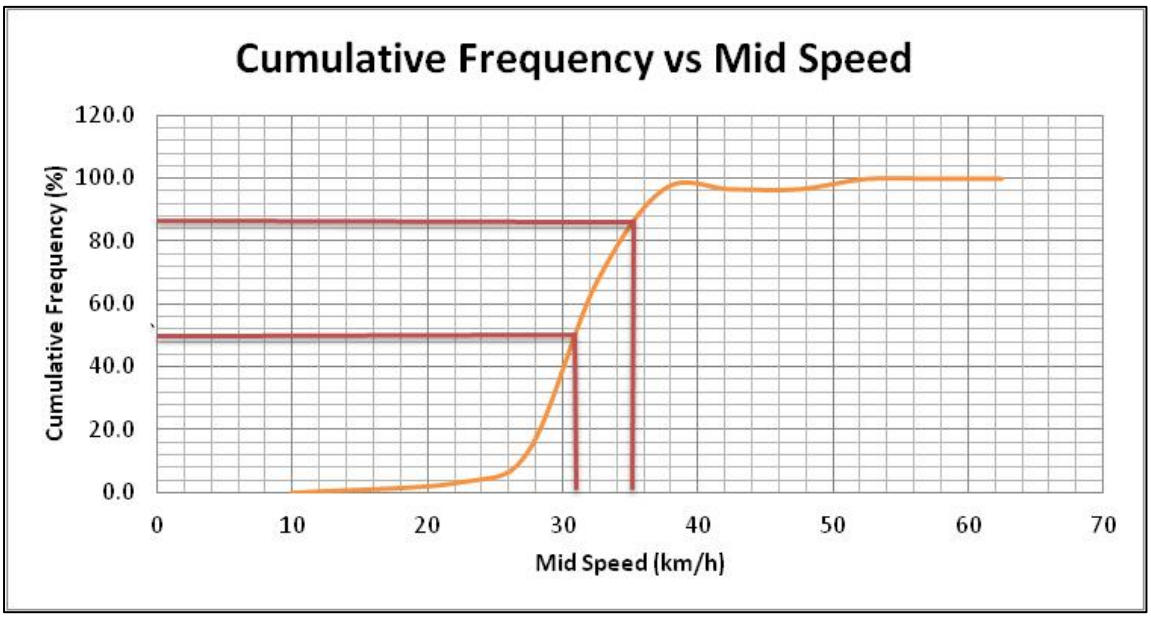

Figure 37: Cumulative frequency for Direction 1

From Figure 37, the mid speed for 85th percentile is 35 km/h and 50th percentile is 31 km/h. Table 26 in Appendix A and Figure 38 below shows the cumulative frequency for car in Direction 2 (outgoing vehicles).

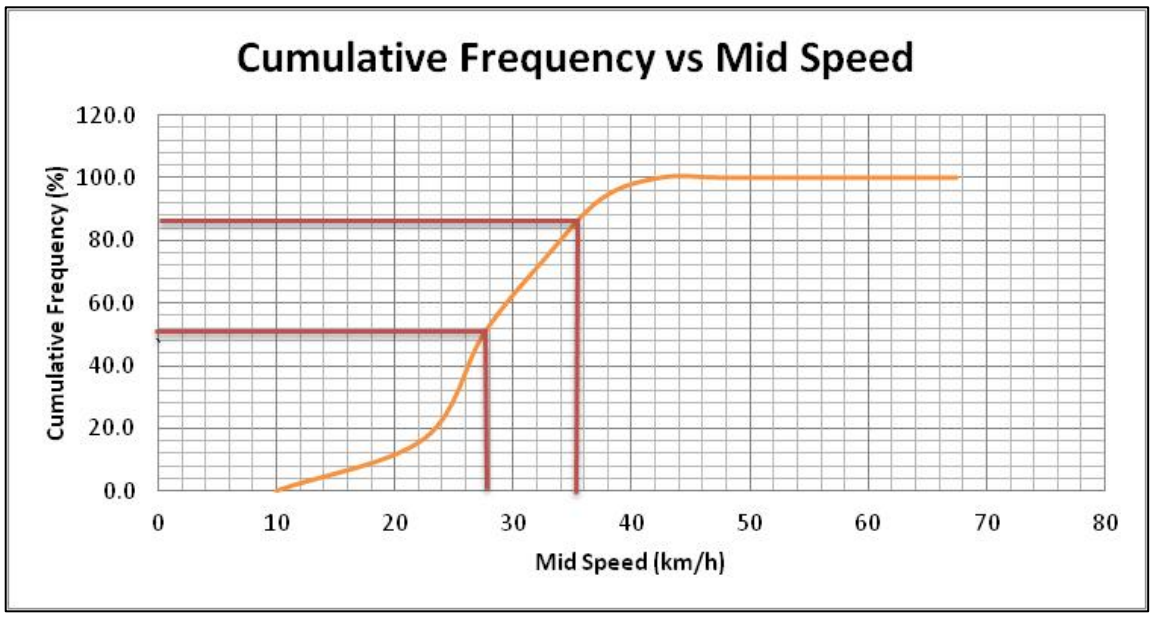

Figure 38: Cumulative frequency for Direction 2

From Figure 38, the mid speed for 85th percentile is 35 km/h and 50th percentile is 27 km/h.

Figure 39 shows the graph for all the cumulative frequency for every direction of every location.

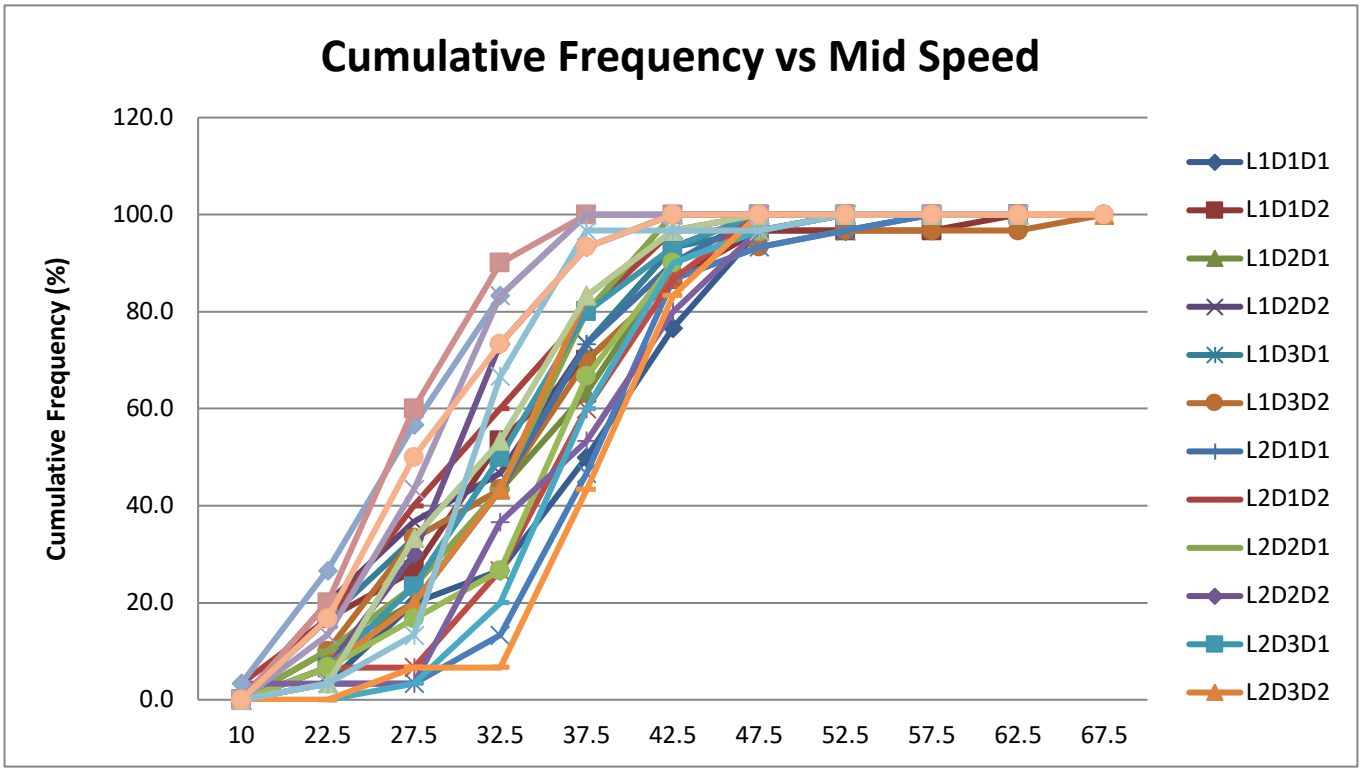

Figure 39: Graph for all cumulative frequency

4.1.2 Volume Traffic Data Collection

Volume traffic count were conducted and tabulated as in from Table 27 to Table 38. The sequences of the tables are according to the date and time and also the location. Refer Figure 9 to Figure 12 for direction 1 and 2 for every location.

4.1.2.1 Location 1: Along Jalan USM Lama

Date: 17/10/2016 (Monday)

Time: 10.30 AM – 12.30 PM

Table 28: Volume count

Type of vehicles	Direction 1	Direction 2
Car	78	97
Motorcycle	19	19
Bus	0	0
Lorry	0	10

Date: 18/10/2016 (Tuesday)

Time: 8.30 AM – 10.30 AM

Table 29: Volume count

Type of vehicles	Direction 1	Direction 2
Car	64	74
Motorcycle	14	26
Bus	0	0
Lorry	0	10

Date: 19/10/2016 (Wednesday)

Time: 10 AM – 12 PM

Table 30: Volume count

Type of vehicles	Direction 1	Direction 2
Car	52	74
Motorcycle	18	25
Bus	0	0
Lorry	3	7

4.1.2.2 Location 2: Jalan V1 dan V2

Date: 17/10/2016 (Monday)

Time: 12.40 PM – 2.40 PM

Table 31: Volume count

Type of vehicles	Direction 1	Direction 2
Car	134	149
Motorcycle	40	25
Bus	0	0
Lorry	5	1

Date: 18/10/2016 (Tuesday)

Time: 10.35 AM – 12.35 PM

Table 32: Volume count

Type of vehicles	Direction 1	Direction 2
Car	114	89
Motorcycle	51	47
Bus	0	0
Lorry	2	2

Date: 19/10/2016 (Wednesday)

Time: 12.30 PM – 2.30 PM

Table 33: Volume count

Type of vehicles	Direction 1	Direction 2
Car	130	164
Motorcycle	55	51
Bus	0	0
Lorry	1	1

4.1.2.3 Location 3: Jalan V1

Date: 17/10/2016 (Monday)

Time: 3.45 PM – 5.45 PM

Table 34: Volume count

Type of vehicles	Direction 1	Direction 2
Car	196	278
Motorcycle	71	87
Bus	0	1
Lorry	2	2

Date: 18/10/2016 (Tuesday)

Time: 3.30 PM – 5.30 PM

Table 35: Volume count

Type of vehicles	Direction 1	Direction 2
Car	216	250
Motorcycle	47	64
Bus	3	2
Lorry	1	3

Date: 19/10/2016 (Wednesday)

Time: 2.35 PM – 4.35 PM

Table 36: Volume count

Type of vehicles	Direction 1	Direction 2
Car	247	179
Motorcycle	65	53
Bus	1	0
Lorry	3	1

4.1.2.4 Location 4: Jalan V4 dan V5

Date: 17/10/2016 (Monday)

Time: 6 PM – 8 PM

Table 37: Volume count

Type of vehicles	Direction 1	Direction 2
Car	312	99
Motorcycle	62	26
Bus	1	0
Lorry	1	2

Date: 18/10/2016 (Tuesday)

Time: 5.45 PM – 7.45 PM

Table 38: Volume count

Type of vehicles	Direction 1	Direction 2
Car	305	91
Motorcycle	51	26
Bus	0	0
Lorry	0	0

Date: 19/10/2016 (Wednesday)

Time: 4.45 PM – 6.45 PM

Table 39: Volume count

Type of vehicles	Direction 1	Direction 2
Car	330	68
Motorcycle	62	30
Bus	0	1
Lorry	0	3

4.2 Discusion

In this section, the result of survey will be discussed. Based on the result analysis, Table 39 is tabulated and is shown below. The table shows the summarization of the data from the survey that has been conducted.

Table 40: Summary of the data

Day	Location	Direction	Speed (km/h)		
			Speed limit	50th percentile	85th percentile
17/10/2016	1 (Jalan USM Lama)	1	40	34	41.5
		2	40	33.5	40
	2 (Jalan V1 Dan V2)	1	40	33.5	41.5
		2	40	30	39
	3 (Jalan V1)	1	40	38	42.5
		2	40	36	42.5
	4 (Jalan V4 dan V5)	1	40	26.5	33
		2	40	26	31.5
18/10/2016	1 (Jalan USM Lama)	1	40	37.5	44.5
		2	40	32	42.5
	2 (Jalan V1 Dan V2)	1	40	33.5	39.5
		2	40	30	35.5
	3 (Jalan V1)	1	40	35.5	41
		2	40	36.5	44
	4 (Jalan V4 dan V5)	1	40	32	38
		2	40	28.5	33
19/10/2016	1 (Jalan USM Lama)	1	40	34	40
		2	40	34	42
	2 (Jalan V1 Dan V2)	1	40	32	39
		2	40	33.9	38
	3 (Jalan V1)	1	40	36	41
		2	40	38	43
	4 (Jalan V4 dan V5)	1	40	31	35
		2	40	27	35

*Direction 1: Incoming vehicles *Direction 2: Outgoing vehicles

There are total four locations for the survey. Location 1, 2 and 3 are where there are past record of accidents happened repeatedly while Location 4 is where no accident happened has been recorded.

The highlighted boxes in the Table 39 shows that the speed recorded is more than 40 km/h which is the design speed limit in Universiti Teknologi PETRONAS (UTP). For Location 1and 3, the 85th percentile of cumulative frequency recorded has been more than speed limit for the three consecutive days. For Location 2, even though the 85th percentile of cumulative frequency recorded only exceed speed limit on the first day of

survey, the other speed recorded shows that the value is around 35.5 km/h to 39 km/h which is only a few km/h to exceed the speed limit of 40 km/h. The table above also shows that the 85th percentile of cumulative frequency recorded for Location 4 is not exceeds the speed limit of 40 km/h.

From the discussion above, when the result for Location 1,2 and 3 are compare to Location 4's, it shows that the degree of speed is not the major cause of the accident happened in UTP. This is because, the differences between the speed limit and the highlighted speed is not much; only 1.5 km/h to 3 km/h. However, speed has its contribution in causing the accidents. Besides, road bump provided by the university seems very effective in reducing the speed in UTP because of the small differences of speed limit and 85th percentile speed data collected.

There are some other factors that cause the accidents in UTP such as road alignment and students demography. For road alignment; according to the students, the road alignment at Location 2 (Jalan V1 dan Jalan V2) is very narrow. Thus, some measures have to be taken for example the width of the road has to be measured and compare to the standard alignment of road to make sure the road is using the standard measurement. From the previous discussion within the UTP staff of HSE Department, it stated that the majority of the students involved in accidents are foundation and foreigner students. This factor will refer to the behavior of the driver because human error is one of the causes of accidents.

CHAPTER 5

CONCLUSION

The objective of the research study is to analyze the speed profile in University Teknologi PETRONAS. To precede the research, a few surveys or experiments has to be conducted to determine the speed by using speed data collection and traffic volume data collection. From the project research, the speed and its characteristics of all types of vehicles in the university will be obtained. For the traffic volume data collection, the data obtained will be analyzed by determine the peak hours for each type of vehicles and also the influence factors.

All the data obtained from the surveys will be calculated to get the cumulative frequency. The graph of cumulative frequency against mid speed will determine the 85^{th} percentile speed and the relationship between the speed and the accident will be determined. Basically, if the 85^{th} percentile speed is higher than the speed limit, then speed will be the cause of the accident and vice versa.

Based on the result of the survey and the analysis that has been made, every type of vehicles shows same characteristics in term of speed but in some location there are few vehicles that exceed the speed limit. Besides, the analysis shows that speed is not the major cause of accidents in UTP and the speed limit posted was often violated by major portion of drivers but it is still efficient enough to reduce the speed of vehicles.

Other than that, another minor factor that contributes to the accident is the behavior of the driver. Majority of the vehicle user in UTP are not using car signal very well as in not using at all or given late signal.

REFERENCES

Speed Concepts: Informational Guide - Safety | Federal Highway Administration. (n.d.). Retrieved June 16, 2016, from http://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa10001/

Paul, B., & John, E. (2013, March). Speed Profile Analysis of Kerala Roads. *International Journal of Engineering Research and Development, 6*(5), 107-111. Retrieved June 16, 2016, from http://www.ijerd.com/paper/vol6-issue5/R0605107111.pdf

APPENDICES

APPENDIX A

Location 1: Along Jalan USM Lama

Date: 17/10/2016 (Monday)

Time: 11.00 AM – 12.00 PM

Table 4: Cumulative frequency for Direction 1

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	3	10.0	10.0
25 - 30	27.5	3	10.0	20.0
30 - 35	32.5	7	23.3	43.3
35 - 40	37.5	6	20.0	63.3
40 - 45	42.5	8	26.7	90.0
45- 50	47.5	3	10.0	100.0
50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Table 5: Cumulative frequency for Direction 2

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	6	20.0	20.0
25 - 30	27.5	5	16.7	36.7
30 - 35	32.5	3	10.0	46.7
35 - 40	37.5	8	26.7	73.3
40 - 45	42.5	6	20.0	93.3
45- 50	47.5	2	6.7	100.0
50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Date: 18/10/2016 (Tuesday)

Time: 9.30 AM – 10.30 AM

Table 6: Cumulative frequency for Direction 1

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	1	3.3	3.3
25 - 30	27.5	5	16.7	20.0
30 - 35	32.5	2	6.7	26.7
35 - 40	37.5	7	23.3	50.0
40 - 45	42.5	8	26.7	76.7
45- 50	47.5	6	20.0	96.7
50 - 55	52.5	0	0.0	96.7
55 -60	57.5	1	3.3	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Table 7: Cumulative frequency for Direction 2

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	5	16.7	16.7
25 - 30	27.5	3	10.0	26.7
30 - 35	32.5	8	26.7	53.3
35 - 40	37.5	5	16.7	70.0
40 - 45	42.5	5	16.7	86.7
45- 50	47.5	3	10.0	96.7
50 - 55	52.5	0	0.0	96.7
55 -60	57.5	0	0.0	96.7
60 - 65	62.5	1	3.3	100.0
	Total	30		

Date: 19/10/2016 (Wednesday)

Time: 11.00 AM – 12.00 PM

Table 8: Cumulative frequency for Direction 1

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (% f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	5	16.7	16.7
25 - 30	27.5	5	16.7	33.3
30 - 35	32.5	3	10.0	43.3
35 - 40	37.5	9	30.0	73.3
40 - 45	42.5	6	20.0	93.3
45- 50	47.5	1	3.3	96.7
50 - 55	52.5	1	3.3	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Table 9: Cumulative frequency for Direction 2

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	3	10.0	10.0
25 - 30	27.5	7	23.3	33.3
30 - 35	32.5	3	10.0	43.3
35 - 40	37.5	8	26.7	70.0
40 - 45	42.5	5	16.7	86.7
45- 50	47.5	2	6.7	93.3
50 - 55	52.5	1	3.3	96.7
55 -60	57.5	0	0.0	96.7
60 - 65	62.5	0	0.0	96.7
65 - 70	67.5	1	3.3	100.0
	Total	30		

Location 2: Jalan V1 dan V2

Date: 17/10/2016 (Monday)

Time: 1 PM – 2 PM

Table 10: Cumulative frequency for Direction 1

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	2	6.7	6.7
25 - 30	27.5	4	13.3	20.0
30 - 35	32.5	7	23.3	43.3
35 - 40	37.5	9	30.0	73.3
40 - 45	42.5	5	16.7	90.0
45- 50	47.5	3	10.0	100.0
50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Table 11: Cumulative frequency for Direction 2

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	1	3.3	3.3
20 - 25	22.5	4	13.3	16.7
25 - 30	27.5	7	23.3	40.0
30 - 35	32.5	6	20.0	60.0
35 - 40	37.5	6	20.0	80.0
40 - 45	42.5	5	16.7	96.7
45- 50	47.5	1	3.3	100.0
50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Date: 18/10/2016 (Tuesday)

Time: 11 AM – 12 PM

Table 12: Cumulative frequency for Direction 1

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	3	10.0	10.0
25 - 30	27.5	4	13.3	23.3

30 - 35	32.5	6	20.0	43.3
35 - 40	37.5	11	36.7	80.0
40 - 45	42.5	6	20.0	100.0
45- 50	47.5	0	0.0	100.0
50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Table 13: Cumulative frequency for Direction 2

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	2	6.7	6.7
25 - 30	27.5	7	23.3	30.0
30 - 35	32.5	13	43.3	73.3
35 - 40	37.5	6	20.0	93.3
40 - 45	42.5	2	6.7	100.0
45- 50	47.5	0	0.0	100.0
50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Date: 19/10/2016 (Wednesday)

Time: 1.30 PM – 2.30 PM

Table 14: Cumulative frequency for Direction 1

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (% f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	2	6.7	6.7
25 - 30	27.5	5	16.7	23.3
30 - 35	32.5	8	26.7	50.0
35 - 40	37.5	9	30.0	80.0
40 - 45	42.5	4	13.3	93.3
45- 50	47.5	2	6.7	100.0

50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Table 15: Cumulative frequency for Direction 2

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	2	6.7	6.7
25 - 30	27.5	4	13.3	20.0
30 - 35	32.5	7	23.3	43.3
35 - 40	37.5	12	40.0	83.3
40 - 45	42.5	4	13.3	96.7
45- 50	47.5	0	0.0	96.7
50 - 55	52.5	1	3.3	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
65 - 70	67.5	0	0.0	100.0
	Total	30		

Location 3: Jalan V1

Date: 17/10/2016 (Monday)

Time: 4 PM – 5 PM

Table 16: Cumulative frequency for Direction 1

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	1	3.3	3.3
25 - 30	27.5	0	0.0	3.3
30 - 35	32.5	3	10.0	13.3
35 - 40	37.5	10	33.3	46.7
40 - 45	42.5	12	40.0	86.7
45- 50	47.5	2	6.7	93.3
50 - 55	52.5	1	3.3	96.7

55 -60	57.5	1	3.3	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Table 17: Cumulative frequency for Direction 2

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	2	6.7	6.7
25 - 30	27.5	0	0.0	6.7
30 - 35	32.5	6	20.0	26.7
35 - 40	37.5	10	33.3	60.0
40 - 45	42.5	8	26.7	86.7
45- 50	47.5	4	13.3	100.0
50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Date: 18/10/2016 (Tuesday)

Time: 4 PM – 5 PM

Table 18: Cumulative frequency for Direction 1

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	2	6.7	6.7
25 - 30	27.5	3	10.0	16.7
30 - 35	32.5	3	10.0	26.7
35 - 40	37.5	12	40.0	66.7
40 - 45	42.5	7	23.3	90.0
45- 50	47.5	2	6.7	96.7
50 - 55	52.5	1	3.3	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Table 19: Cumulative frequency for Direction 2

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	1	3.3	3.3
20 - 25	22.5	0	0.0	3.3
25 - 30	27.5	0	0.0	3.3
30 - 35	32.5	10	33.3	36.7
35 - 40	37.5	5	16.7	53.3
40 - 45	42.5	8	26.7	80.0
45- 50	47.5	5	16.7	96.7
50 - 55	52.5	1	3.3	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Date: 19/10/2016 (Wednesday)

Time: 3 PM – 4 PM

Table 20: Cumulative frequency for Direction 1

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (% f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	0	0.0	0.0
25 - 30	27.5	1	3.3	3.3
30 - 35	32.5	5	16.7	20.0
35 - 40	37.5	12	40.0	60.0
40 - 45	42.5	9	30.0	90.0
45- 50	47.5	2	6.7	96.7
50 - 55	52.5	1	3.3	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Table 21: Cumulative frequency for Direction 2

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (% f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	0	0.0	0.0

25 - 30	27.5	2	6.7	6.7
30 - 35	32.5	0	0.0	6.7
35 - 40	37.5	11	36.7	43.3
40 - 45	42.5	12	40.0	83.3
45- 50	47.5	5	16.7	100.0
50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
65 - 70	67.5	0	0.0	100.0
	Total	30		

Location 4: Jalan V4 dan V5

Date: 17/10/2016 (Monday)

Time: 6.30 PM – 7.30 PM

Table 22: Cumulative frequency for Direction 1

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	1	3.3	3.3
20 - 25	22.5	7	23.3	26.7
25 - 30	27.5	9	30.0	56.7
30 - 35	32.5	8	26.7	83.3
35 - 40	37.5	5	16.7	100.0
40 - 45	42.5	0	0.0	100.0
45- 50	47.5	0	0.0	100.0
50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Table 23: Cumulative frequency for Direction 2

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	6	20.0	20.0
25 - 30	27.5	12	40.0	60.0
30 - 35	32.5	9	30.0	90.0

35 - 40	37.5	3	10.0	100.0
40 - 45	42.5	0	0.0	100.0
45- 50	47.5	0	0.0	100.0
50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Date: 18/10/2016 (Tuesday)

Time: 6 PM – 7 PM

Table 24: Cumulative frequency for Direction 1

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	1	3.3	3.3
25 - 30	27.5	9	30.0	33.3
30 - 35	32.5	6	20.0	53.3
35 - 40	37.5	9	30.0	83.3
40 - 45	42.5	4	13.3	96.7
45- 50	47.5	1	3.3	100.0
50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Table 25: Cumulative frequency for Direction 2

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (%f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	4	13.3	13.3
25 - 30	27.5	9	30.0	43.3
30 - 35	32.5	12	40.0	83.3
35 - 40	37.5	5	16.7	100.0
40 - 45	42.5	0	0.0	100.0
45- 50	47.5	0	0.0	100.0
50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0

60 - 65	62.5	0	0.0	100.0
	Total	30		

Date: 19/10/2016 (Wednesday)

Time: 5.15 PM – 6.15 PM

Table 26: Cumulative frequency for Direction 1

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (% f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	1	3.3	3.3
25 - 30	27.5	3	10.0	13.3
30 - 35	32.5	16	53.3	66.7
35 - 40	37.5	9	30.0	96.7
40 - 45	42.5	0	0.0	96.7
45- 50	47.5	0	0.0	96.7
50 - 55	52.5	1	3.3	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
	Total	30		

Table 27: Cumulative frequency for Direction 2

Speed range (km/h)	Mid speed (km/h)	Frequency (f)	Percent frequency (% f)	Cumulative frequency
0 - 20	10	0	0.0	0.0
20 - 25	22.5	5	16.7	16.7
25 - 30	27.5	10	33.3	50.0
30 - 35	32.5	7	23.3	73.3
35 - 40	37.5	6	20.0	93.3
40 - 45	42.5	2	6.7	100.0
45- 50	47.5	0	0.0	100.0
50 - 55	52.5	0	0.0	100.0
55 -60	57.5	0	0.0	100.0
60 - 65	62.5	0	0.0	100.0
65 - 70	67.5	0	0.0	100.0
	Total	30		