Trip Generation Equation for Primary School

by

Mohd Raizullan bin Ramli

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the requirements for the
Bachelor of Engineering (Hons)
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Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Civil Engineering Programme
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in partial fulfilment of the requirement for the
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Approved by,

(Assoc. Prof. Dr. Madzlan bin Napiah)

UNIVERSITI TEKNOLOGI PETRONAS

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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 acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

MOHD RAIZULLAN BIN RAMLI

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ABSTRACT

In Malaysia, the car ownership is growing rapidly in recent years. The same situation even occurs in the school area. This trend seems to be continuing in the future if the environment also remains growing in trend as before. The main objective of this project is to produce regression equations for trip generation in primary schools during morning peak hour and evening peak hour based on selected variables and compare these equations with the general trip generation equation for primary school produced by HPU (Highway Planning Unit). Trip generation forecast during planning stage is very important in order to ensure that the transportation problem in the school area, such as traffic congestion and parking problems, will not occur in the future. This project also will determined whether the general trip generation equation for primary school produced by HPU, which is only based on certain area in Malaysia, can be use to all primary school or not. For this project, Sekolah Kebangsaan Tronoh, Sekolah Kebangsaan Pusing and Sekolah Kebangsaan Siputeh have been chosen as the study areas. The scope of study for the project include literature review, trip generation survey and data analysis. In this project, the methodology has been divided into several stages which are selection of study area, data collection for trip generation survey, data collection for independent variables, data analysis and finally the comparison of results with the HPU. Hopefully, this project will improve the Malaysian Trip Generation Manual.

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CHAPTER 1
INTRODUCTION

1.1 Background of Study

Trip generation is the first step in the conventional four-step transportation forecasting process (followed by trip distribution, mode choice, and route assignment), widely used for forecasting travel demands. It predicts the number of trips originating in or destined for a particular traffic analysis zone. In the main trip generation analysis is focused on residences, and that trip generation is thought of as a function of the social and economic attributes of households. At the level of the traffic analysis zone, the language is that of land uses "producing" or generating trips. Zones are also destinations of trips, trip attractors. The analysis of attractors focuses on nonresidential land uses.

Trip generation is the process of determining the number of trips that will begin or end in each traffic zone within the study area. Since the trips are determined without regard to destination, they are referred to as trip ends. Each trip has two ends, and these are described in terms of trip purpose, or whether the trips are either produced by a traffic zone or attracted to a traffic zone. For example, a home-to-school trip would be considered to have a trip end produced in the home zone and attracted to the school zone.

This project is focused on producing regression equations for trip generation in primary schools and compares it with the general trip generation equation for primary school produced by HPU. For this project, Sekolah Kebangsaan Tronoh, Sekolah Kebangsaan Pusing and Sekolah Kebangsaan Siputeh have been chosen as the study areas.

1.2 Problem Statement

HPU already produce general trip generation equation for the primary school, but it is only based on certain area in Malaysia. To prove whether this HPU trip generation equation can be use for all primary school or not, traffic survey have been done for the primary schools around the UTP campus. Regression equation will be produced from the traffic survey. Both equation will be compare to prove whether the HPU trip generation equation can be use to all primary school in Malaysia or not.

1.3 Objective and Scope of Study

The main objectives of this research are:

i. Produce regression equations for trip generation in primary schools during morning peak hour and evening peak hour based on selected independent variables.
ii. Compare these equations with the general trip generation equation for primary school produced by HPU.

The scope of study for the project is including the literature review, trip generation survey to collect the traffic data and data analysis. The trip generation equation for primary school will be deriving from the trip generation survey data. This equation will be compare with the general HPU trip generation equation for primary school.

CHAPTER 2
LITERATURE REVIEW

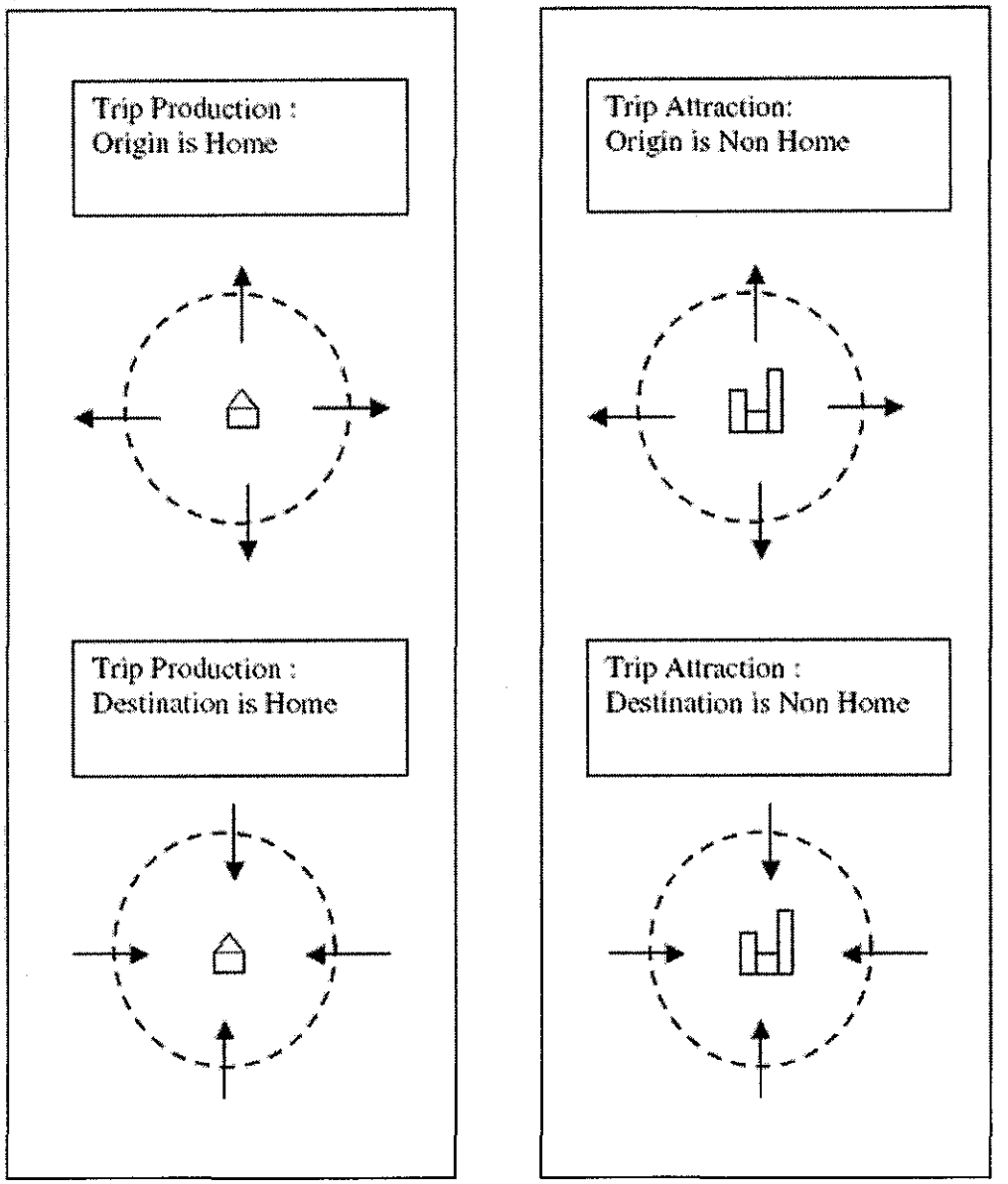
2.1 Traditional Trip Generation Model

Several transportation planning textbooks discuss two common approaches for trip generation: Regression model and categorical analysis (Meyer and Miller, 2001, Hutchinson, 1974, and Oi and Shuldiner, 1962). Historically, both techniques relate trip making to the number of vehicles in a household. Oi and Shuldiner clearly summarized the other factors that influence vehicle trip making. They enumerate the six important factors: household size, distance, residential density, income, occupation of the household head, and social area indexes. These factors have been commonly used as the independent variables to explain vehicle trip making.

In the categorical analysis, trip observations are aggregated in terms of the common socioeconomic characteristics rather than spatially grouping household or person. As the regression modeling, the vehicle ownership is the critical variable. The other factors, which are used in the regression model, can be also applied to the categorical analysis.

The traditional concept of the origin and destination is, in general, borrowed for the pedestrian demand models. Typically, trip generation, the first stage in a four steps travel demand model, is to evaluate the number of trip ends that occurred in each sub-area. According to 'Principles of Urban Transport Systems Planning' (Hutchinson, 1974), "Two types of trip generation analysis are carried out, referred to the terms, trip production and trip attraction. For the trip production, trip ends that are based at a residence are called home-based trips. For the trip attraction, trip ends are based on non-home end such as employment, retail services, recreation places, and so on." Figure 2.1 shows the relationship between origin and destination and production and attraction model. Since trip production is associated with the home, if the home is either origin or destination, the trips should be considered in trip production model. From this separate

process, the traditional trip-generation phase is assumed that trip production equivalently occurs with trip attraction.



(a) Trip production (b) Trip attraction

Figure 2.1 The relationship between origin and destination and production and attraction (After Hutchinson, 1974)

2.2 Type of Trip Generation

There are two kinds of trip generation models: production models and attraction models. Trip production models estimate the number of home-based trips to and from zones where trip makers reside. Trip attraction models estimate the number of home-based trips to and from each zone at the non-home end of the trip. Different production and attraction models are used for each trip purpose. Special generation models are used to estimate non-home based, truck, taxi, and external trips.

2.2.1 Cross-Classification

Over time the profession has come to understand that considerable predictive power and accuracy can be gained by disaggregate analysis of influential variables. This means that the models use factors describing individual sample units (e.g., persons, households or workplaces) rather than an average value of each factor for each analysis zone. The result is trip generation models with trip rates for sample units having specific characteristics, such as households of one, two, or more family members, owning one, two, or more vehicles. These models are based on the trip rates for individual sample households having those particular discrete characteristics. Most trip production models are two- or three-way cross-classification tables with the dependent variable being trips per household or trips per person. The independent variables are most often income, auto ownership, and household size. Virtually all of the trip attraction models use employment and an identifier of location as independent variables.

2.2.2 Multiple Regression

Early trip generation models were commonly developed by regression analysis because of its power and simplicity. The independent variables in such models were usually zonal averages of the various factors of influence. Trip generation equations developed by regression are still used by some planning agencies, more commonly for attraction models than for production models. This is because only zonal averages of trip attracting characteristics are usually available since most travel surveys do not survey at trip destinations. Obtaining

more detailed data for individual attraction zones requires a survey of trip attractors, such as a workplace survey.

2.2.3 Experience Based

Early travel forecasting used extrapolation of past trends to estimate future travel. Such an approach is still used occasionally for estimating future traffic on a single facility, in a relatively isolated area, where only moderate and uniform growth or change in development pattern is anticipated. One level of sophistication that can be added to trend analysis to respond to anticipated growth is comparing the past traffic trend to the trend of development during the same period. This provides understanding of how traffic on the subject facility will respond to expected development changes. That relationship between the two trends is incorporated subjectively in the trend forecast.

2.3 Trip Generation Equation

Trip generation provides the linkage between land use and travel. Trip generation may be separated into two phases. In the first, an understanding and quantification of the travel-land use linkage is developed. In the second phase, the results of the quantification are applied to forecasted land use characteristics to develop future travel estimates. The purpose of trip generation analysis is to provide the means for relating the number of trips to and from activities in an area to the land use and socioeconomic characteristics of the activities measured in terms of land use intensity, character of the activities and location within the urban environment. The study of trip generation attempts to identify and quantify the trip ends related to various urban activities without describing other trip characteristics such as direction, length or duration. Usually, the interest is in trips per average weekday, but may be for weekend or special purpose travel.

Almost all currently applied trip generation analysis can be categorized as described below :

i. Relating trip ends to land use and socioeconomic characteristics through regression analysis.
ii. Relating trip ends to land area, floor area or other use measures such as employment through trip rates.
iii. Classifying trip ends by characteristics of the analysis unit generally referred to as cross-classification analysis.

CHAPTER 3
METHODOLOGY

3.1 Project Identification

The main part in this project is to do the traffic survey for the primary schools around the UTP campus. The purpose of this survey is to collect the traffic data in order to know the total number of trip generated by each school. Initially, 5 potential primary schools are identified for this project. The schools are as follow :

Sekolah Kebangsaan Tronoh, Jalan Bota Lama, 31750 Tronoh, Perak.

Sekolah Kebangsaan Pusing, Jalan Lahat, 31550 Pusing, Perak.

Sekolah Kebangsaan Siputeh, 31560 Siputeh, Perak.

Sekolah Kebangsaan St. Bernadette's Convent, Jalan Pusing, 31000 Batu Gajah, Perak.

Sekolah Kebangsaan Sultan Yussuf, Batu Gajah, Perak.

For this project, minimum 3 schools are required. The 3 chosen schools are the first 3 schools as shown in the list (Sekolah Kebangsaan Tronoh, Sekolah Kebangsaan Pusing and Sekolah Kebangsaan Siputeh). The pictures of these primary schools have been attached in **Appendix A**.

This survey will be done during the peak hour, which is in the morning and evening. The data will be collected during the weekdays for one week for each school. The trip generation for each school will be counted for every 15 minutes interval and the total trip that enter and exit the school will be recorded in the form as attached in **Appendix B**. The trip are collected according to the vehicles type as shown below :

Type 1 - Motorcars, taxis and small vans
Type 2 – Lorries, buses and large vans
Type 3 – Motorcycles and scooters

The peak hour and total number of trip generated during the peak hour will be identified. Three independent variables have been chosen which are total number of staffs, total number of students and size of school area. These data are also needed for this project. Once all the data are collected, the following graph have been plotted :

i. Graph trips per hour versus number of students during morning peak hour
ii. Graph trips per hour versus number of students during evening peak hour
iii. Graph trips per hour versus number of staff during morning peak hour
iv. Graph trips per hour versus number of staff during evening peak hour
v. Graph trips per hour versus school area during morning peak hour
vi. Graph trips per hour versus school area during evening peak hour

The best fit line will be draw for each graph in order to get the linear equations. These linear equations will be use as the trip generation equation for the primary school and will be comparing with the general trip generation equation for primary school produced by Highway Planning Unit (HPU) to prove whether the Highway Planning Unit (HPU) trip generation equation can be use to all primary school in Malaysia or not.

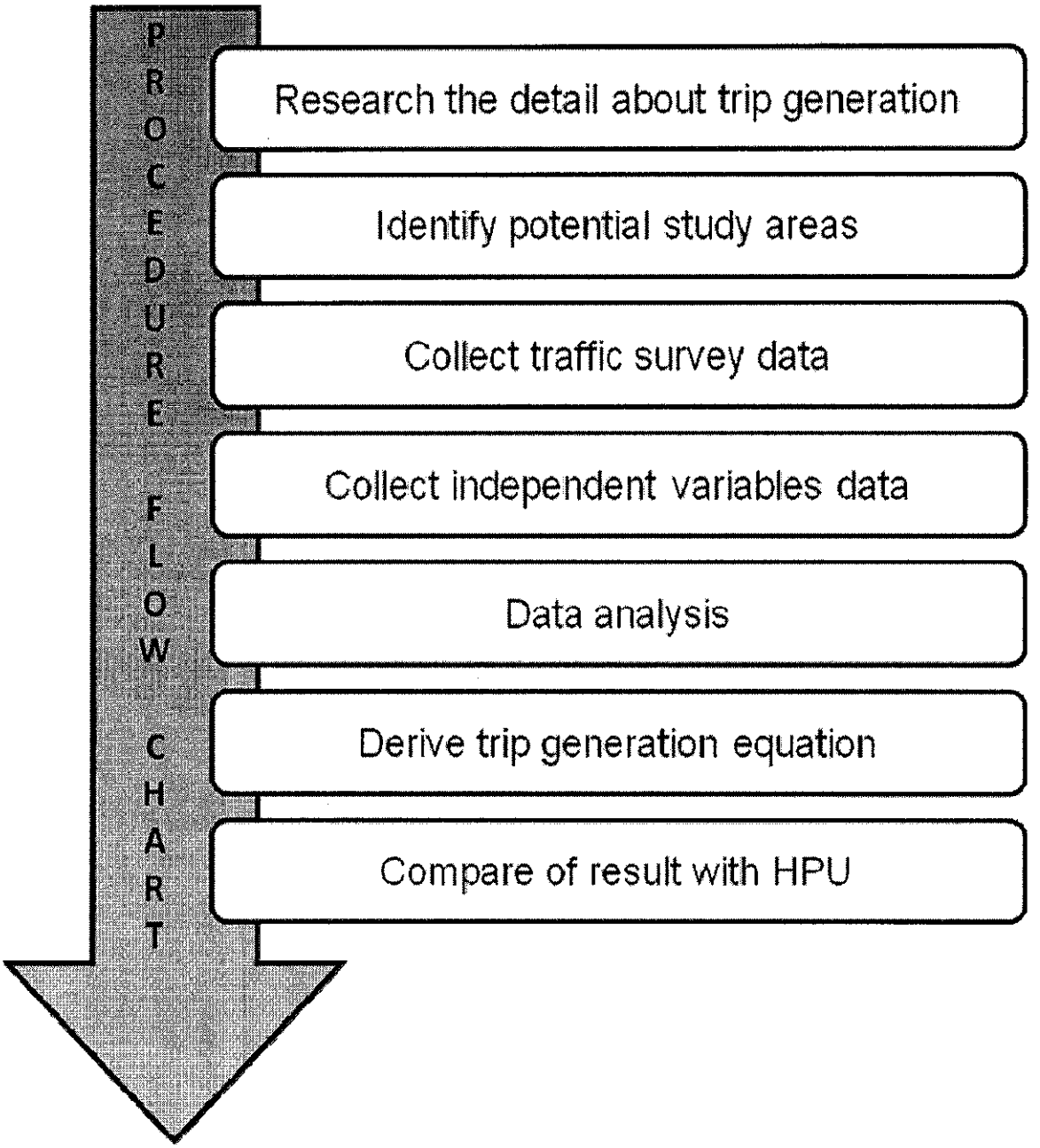


Figure 3.1: Procedure flow chart

3.2 Hazard Analysis

Safety is the important aspect for the surveyor when conducting the traffic survey. When safety is taken into consideration, the accidents can be prevented. Accidents do not happen without cause. The identification, isolation, and control of these causes are underlying principles of all accident prevention techniques. Here are some safety rules that will be beneficial when conducting the traffic survey :

1. Wear high-visibility safety vests of approved color and high-top leather work boots to provide the most protection whenever working within the right-of-way, at any time when exposed to traffic.
2. Always face traffic when working on the shoulders of roads. If this situation can't be done alone, have a co-worker act as a lookout. When working in a zone between two-way traffic stand parallel to the traveled way and again use a lookout.
3. Do not make sudden movements that might confuse a motorist and cause him/her to take evasive action that could result in injury to the motorist as well as to surveyors.
4. Avoid interrupting traffic as much as possible. There are several ways to do this. One of the best ways is to use offset lines as much as possible. This procedure will keep the surveyors from oncoming traffic. Minimize the crossing of traffic lanes on heavily traveled roads. Do not try to walk or run across traffic lanes.
5. Use an approved barrier such as oranges cones to shield the surveyors from traffic.
6. Avoid working on wet pavement in an active traffic area. This will put the surveyors in a danger situation.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Results of Trip Generation Survey

The trip generation survey has been conducted in three study areas (primary school) which were Sekolah Kebangsaan Tronoh, Sekolah Kebangsaan Pusing and Sekolah Kebangsaan Siputeh. Three types of vehicles have been considered during the survey which was vehicle Type 1 (motorcars, taxis and small vans), Type 2 (lorries, buses and large vans) and Type 3 (motorcycles and scooters). The results of the survey were based on morning and evening peak hour. The results of the survey are based on samples taken in five days for each study area which were from Monday to Friday. The full results of the survey have been attached in **Appendix C**. **Table 4.1, 4.2, 4.3, 4.4, 4.5** and **4.6** shows the overall results of the survey.

Table 4.1 Trip generation for Sekolah Kebangsaan Tronoh during morning peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans)		**Type 2** (lorries, buses and large vans)		**Type 3** (motorcycles and scooters)	
	In	**Out**	**In**	**Out**	**In**	**Out**
Monday	61	46	0	0	37	34
Tuesday	67	54	0	0	39	37
Wednesday	62	52	0	0	41	39
Thursday	65	53	0	0	40	39
Friday	63	53	0	0	40	38

Table 4.2 Trip generation for Sekolah Kebangsaan Tronoh during evening peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans)		**Type 2** (lorries, buses and large vans)		**Type 3** (motorcycles and scooters)	
	In	**Out**	**In**	**Out**	**In**	**Out**
Monday	35	42	0	0	30	31
Tuesday	36	42	0	0	29	31
Wednesday	37	47	0	0	25	26
Thursday	34	44	0	0	30	31
Friday	38	47	0	0	31	32

Table 4.3 Trip generation for Sekolah Kebangsaan Pusing during morning peak hour

Sample Day	Type 1 (motorcars, taxis and small vans)		Type 2 (lorries, buses and large vans)		Type 3 (motorcycles and scooters)	
	In	Out	In	Out	In	Out
Monday	78	60	3	3	52	48
Tuesday	80	61	3	3	53	51
Wednesday	74	57	3	3	53	51
Thursday	79	63	3	3	56	55
Friday	79	63	3	3	53	51

Table 4.4 Trip generation for Sekolah Kebangsaan Pusing during evening peak hour

Sample Day	Type 1 (motorcars, taxis and small vans)		Type 2 (lorries, buses and large vans)		Type 3 (motorcycles and scooters)	
	In	Out	In	Out	In	Out
Monday	30	43	5	3	26	30
Tuesday	30	49	3	3	12	20
Wednesday	19	24	6	5	26	26
Thursday	33	31	4	4	36	29
Friday	44	54	4	4	35	36

Table 4.5 Trip generation for Sekolah Kebangsaan Siputeh during morning peak hour

Sample Day	Type 1 (motorcars, taxis and small vans)		Type 2 (lorries, buses and large vans)		Type 3 (motorcycles and scooters)	
	In	Out	In	Out	In	Out
Monday	114	94	6	6	94	93
Tuesday	115	95	6	6	93	91
Wednesday	120	98	6	6	97	94
Thursday	112	91	6	6	99	98
Friday	109	87	6	6	94	92

Table 4.6 Trip generation for Sekolah Kebangsaan Siputeh during evening peak hour

Sample Day	Type 1 (motorcars, taxis and small vans)		Type 2 (lorries, buses and large vans)		Type 3 (motorcycles and scooters)	
	In	Out	In	Out	In	Out
Monday	65	79	5	5	50	52
Tuesday	67	81	5	5	52	55
Wednesday	55	74	5	5	45	47
Thursday	71	86	5	5	62	65
Friday	58	80	4	4	48	50

The percentage of the vehicles entering and exiting the survey location has been determined from the results of the survey as shown in **Table 4.7**.

Table 4.7 Percentage of the vehicles entering and exiting the survey locations

Morning Peak Hour				Evening Peak Hour			
Total In	**Total Out**	**% In**	**% Out**	**Total In**	**Total Out**	**% In**	**% Out**
2264	1983	53.3	46.7	1235	1427	46.4	53.6
TOTAL = 4247		**TOTAL = 100.0**		**TOTAL = 2662**		**TOTAL = 100.0**	

Besides, the total trip generation during morning and evening peak hour in unit of trip per hour (trip/hour) based on types of vehicles can be determined from the results as shown in **Table 4.8, 4.9, 4.10, 4.11, 4.12, 4.13** and **4.14**.

Table 4.8 Total trip generation (trip/hour) based on types of vehicle for Sekolah Kebangsaan Tronoh during morning peak hour

Sample Day	Type 1 (motorcars, taxis and small vans) **(trip/hour)**	Type 2 (lorries, buses and large vans) **(trip/hour)**	Type 3 (motorcycles and scooters) **(trip/hour)**
Monday	107	0	71
Tuesday	121	0	76
Wednesday	114	0	80
Thursday	118	0	79
Friday	116	0	78

Table 4.9 Total trip generation (trip/hour) based on types of vehicle for Sekolah Kebangsaan Tronoh during evening peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans) **(trip/hour)**	**Type 2** (lorries, buses and large vans) **(trip/hour)**	**Type 3** (motorcycles and scooters) **(trip/hour)**
Monday	77	0	61
Tuesday	78	0	60
Wednesday	84	0	51
Thursday	78	0	61
Friday	85	0	63

Table 4.10 Total trip generation (trip/hour) based on types of vehicle for Sekolah Kebangsaan Pusing during morning peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans) **(trip/hour)**	**Type 2** (lorries, buses and large vans) **(trip/hour)**	**Type 3** (motorcycles and scooters) **(trip/hour)**
Monday	138	6	100
Tuesday	141	6	104
Wednesday	131	6	104
Thursday	142	6	111
Friday	142	6	104

Table 4.11 Total trip generation (trip/hour) based on types of vehicle for Sekolah Kebangsaan Pusing during evening peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans) **(trip/hour)**	**Type 2** (lorries, buses and large vans) **(trip/hour)**	**Type 3** (motorcycles and scooters) **(trip/hour)**
Monday	73	8	56
Tuesday	79	6	32
Wednesday	43	11	52
Thursday	64	8	65
Friday	98	8	71

Table 4.12 Total trip generation (trip/hour) based on types of vehicle for Sekolah Kebangsaan Siputeh during morning peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans) **(trip/hour)**	**Type 2** (lorries, buses and large vans) **(trip/hour)**	**Type 3** (motorcycles and scooters) **(trip/hour)**
Monday	208	12	187
Tuesday	210	12	184
Wednesday	218	12	191
Thursday	203	12	197
Friday	196	12	186

Table 4.13 Total trip generation (trip/hour) based on types of vehicle for Sekolah Kebangsaan Siputeh during evening peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans) **(trip/hour)**	**Type 2** (lorries, buses and large vans) **(trip/hour)**	**Type 3** (motorcycles and scooters) **(trip/hour)**
Monday	144	10	102
Tuesday	148	10	107
Wednesday	129	10	92
Thursday	157	10	127
Friday	138	8	98

Table 4.14 Total trips generated (trip/hour) based on types of vehicle during morning and evening peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans) **(trip/hour)**		**Type 2** (lorries, buses and large vans) **(trip/hour)**		**Type 3** (motorcycles and scooters) **(trip/hour)**	
	Morning Peak Hour	**Evening Peak Hour**	**Morning Peak Hour**	**Evening Peak Hour**	**Morning Peak Hour**	**Evening Peak Hour**
Monday	453	294	18	18	358	219
Tuesday	472	305	18	16	364	199
Wednesday	463	256	18	21	375	195
Thursday	463	299	18	18	387	253
Friday	454	321	18	16	368	232
TOTAL	**2305**	**1475**	**90**	**89**	**1852**	**1098**

The vehicle composition which generates the trips for both study areas has been analyzed in **Table 4.15** and **4.16**.

Table 4.15 Vehicle composition that entering and exiting the survey locations during morning peak hour

Vehicle Type	Vehicle Composition (%)
Type 1 (motorcars, taxis and small vans)	54.3
Type 2 (lorries, buses and large vans)	2.1
Type 3 (motorcycles and scooters)	43.6
TOTAL	**100.0**

Table 4.16 Vehicle composition that entering and exiting the survey locations during evening peak hour

Vehicle Type	Vehicle Composition (%)
Type 1 (motorcars, taxis and small vans)	55.4
Type 2 (lorries, buses and large vans)	3.3
Type 3 (motorcycles and scooters)	41.3
TOTAL	**100.0**

The total trip generation during morning and evening peak hour in unit of passenger car unit per hour (pcu/hour) can be determined by multiplying vehicle Type 1 (motorcars, taxis and small vans) with 1.0, Type 2 (lorries, buses and large vans) with 2.0 and Type 3 (motorcycles and scooters) with 0.33. The results were shown in **Table 4.17, 4.18, 4.19, 4.20, 4.21, 4.22** and **4.23**.

Table 4.17 Total trip generation (pcu/hour) for Sekolah Kebangsaan Tronoh during morning peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans) **(pcu/hour)**	**Type 2** (lorries, buses and large vans) **(pcu/hour)**	**Type 3** (motorcycles and scooters) **(pcu/hour)**
Monday	107	0	24
Tuesday	121	0	25
Wednesday	114	0	27
Thursday	118	0	26
Friday	116	0	26

Table 4.18 Total trip generation (pcu/hour) for Sekolah Kebangsaan Tronoh during evening peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans) **(pcu/hour)**	**Type 2** (lorries, buses and large vans) **(pcu/hour)**	**Type 3** (motorcycles and scooters) **(pcu/hour)**
Monday	77	0	20
Tuesday	78	0	20
Wednesday	84	0	17
Thursday	78	0	20
Friday	85	0	21

Table 4.19 Total trip generation (pcu/hour) for Sekolah Kebangsaan Pusing during morning peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans) **(pcu/hour)**	**Type 2** (lorries, buses and large vans) **(pcu/hour)**	**Type 3** (motorcycles and scooters) **(pcu/hour)**
Monday	138	12	33
Tuesday	141	12	35
Wednesday	131	12	35
Thursday	142	12	37
Friday	142	12	35

Table 4.20 Total trip generation (pcu/hour) for Sekolah Kebangsaan Pusing during evening peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans) **(pcu/hour)**	**Type 2** (lorries, buses and large vans) **(pcu/hour)**	**Type 3** (motorcycles and scooters) **(pcu/hour)**
Monday	73	16	19
Tuesday	79	12	11
Wednesday	43	22	17
Thursday	64	16	22
Friday	98	16	24

Table 4.21 Total trip generation (pcu/hour) for Sekolah Kebangsaan Siputeh during morning peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans) **(pcu/hour)**	**Type 2** (lorries, buses and large vans) **(pcu/hour)**	**Type 3** (motorcycles and scooters) **(pcu/hour)**
Monday	208	24	62
Tuesday	210	24	61
Wednesday	218	24	64
Thursday	203	24	66
Friday	196	24	62

Table 4.22 Total trip generation (pcu/hour) for Sekolah Kebangsaan Siputeh during evening peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans) **(pcu/hour)**	**Type 2** (lorries, buses and large vans) **(pcu/hour)**	**Type 3** (motorcycles and scooters) **(pcu/hour)**
Monday	144	20	34
Tuesday	148	20	36
Wednesday	129	20	31
Thursday	157	20	42
Friday	138	16	33

Table 4.23 Total trips generated (pcu/hour) during morning and evening peak hour

Sample Day	**Type 1** (motorcars, taxis and small vans) **(pcu/hour)**		**Type 2** (lorries, buses and large vans) **(pcu/hour)**		**Type 3** (motorcycles and scooters) **(pcu/hour)**	
	Morning Peak Hour	**Evening Peak Hour**	**Morning Peak Hour**	**Evening Peak Hour**	**Morning Peak Hour**	**Evening Peak Hour**
Monday	453	294	36	36	119	73
Tuesday	472	305	36	32	121	66
Wednesday	463	256	36	42	125	65
Thursday	463	299	36	36	129	84
Friday	454	321	36	32	123	77
TOTAL	**2305**	**1475**	**180**	**178**	**617**	**365**

The total of trip generation (trip/hour) during morning and evening peak hour for study areas has been summarized in **Table 4.24, 4.25** and **4.26**.

Table 4.24 Total trip generation (trip/hour) for Sekolah Kebangsaan Tronoh during morning and evening peak hour

Sample Day	Morning Peak Hour (trip/hour)	Evening Peak Hour (trip/hour)
Monday	178	138
Tuesday	197	138
Wednesday	194	135
Thursday	197	139
Friday	194	148

Table 4.25 Total trip generation (trip/hour) for Sekolah Kebangsaan Pusing during morning and evening peak hour

Sample Day	Morning Peak Hour (trip/hour)	Evening Peak Hour (trip/hour)
Monday	244	137
Tuesday	251	117
Wednesday	241	106
Thursday	259	137
Friday	252	177

Table 4.26 Total trip generation (trip/hour) for Sekolah Kebangsaan Siputeh during morning and evening peak hour

Sample Day	Morning Peak Hour (trip/hour)	Evening Peak Hour (trip/hour)
Monday	407	256
Tuesday	406	265
Wednesday	421	231
Thursday	412	294
Friday	394	244

The total of trip generation (pcu/hour) during morning and evening peak hour for study areas has been summarized in **Table 4.27, 4.28** and **4.29**.

Table 4.27 Total trip generation (pcu/hour) for Sekolah Kebangsaan Tronoh during morning and evening peak hour

Sample Day	Morning Peak Hour (pcu/hour)	Evening Peak Hour (pcu/hour)
Monday	131	97
Tuesday	146	98
Wednesday	141	101
Thursday	144	98
Friday	142	106

Table 4.28 Total trip generation (pcu/hour) for Sekolah Kebangsaan Pusing during morning and evening peak hour

Sample Day	Morning Peak Hour (pcu/hour)	Evening Peak Hour (pcu/hour)
Monday	183	108
Tuesday	188	102
Wednesday	178	82
Thursday	191	102
Friday	189	138

Table 4.29 Total trip generation (pcu/hour) for Sekolah Kebangsaan Siputeh during morning and evening peak hour

Sample Day	Morning Peak Hour (pcu/hour)	Evening Peak Hour (pcu/hour)
Monday	294	198
Tuesday	295	204
Wednesday	306	180
Thursday	293	219
Friday	282	187

Three independent variables have been selected for this particular land use which is primary schools. The independent variables include :

i. Total number of students
ii. Total number of staff
iii. School area (acres)

The information on the independent variables for study areas are as in **Table 4.30.**

Table 4.30 Independent variables

Study Area	Number of Students	Number of Staff	School Area (10^3 ft^2)
Sekolah Kebangsaan Tronoh	247	29	152
Sekolah Kebangsaan Pusing	341	35	222
Sekolah Kebangsaan Siputeh	576	49	209

The relationship between the selected independent variables and the trips generated has been found. **Figure 4.1, 4.2, 4.3, 4.4, 4.5** and **4.6** shows the trip generation relationships during morning and evening peak hour. The trip generation equations have been produced from the plotted linear graphs.

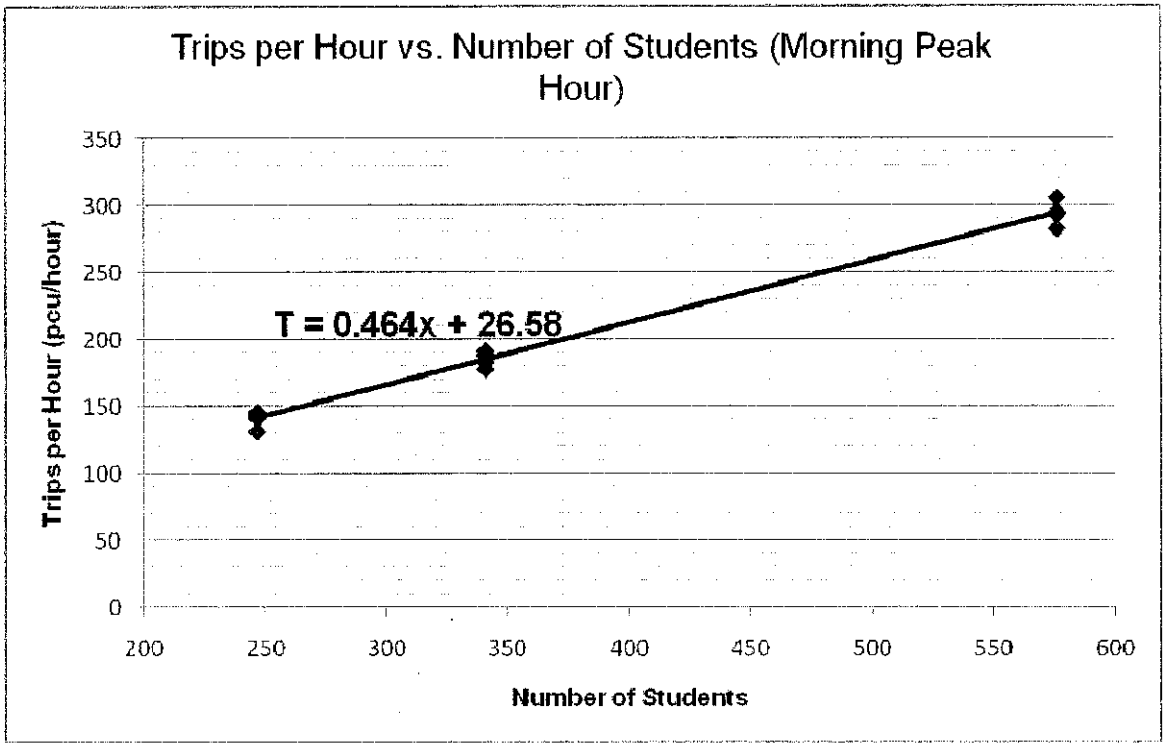


Figure 4.1 Graph trips per hour versus number of students during morning peak hour

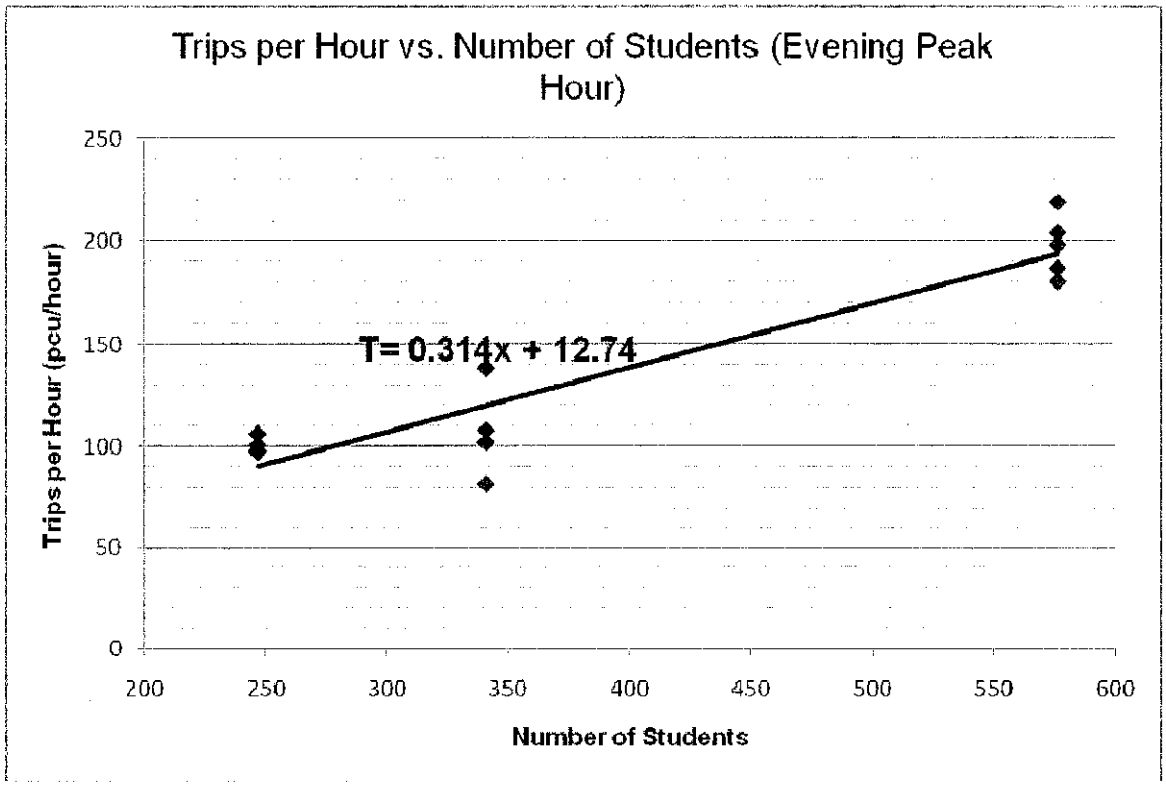


Figure 4.2 Graph trips per hour versus number of students during evening peak hour

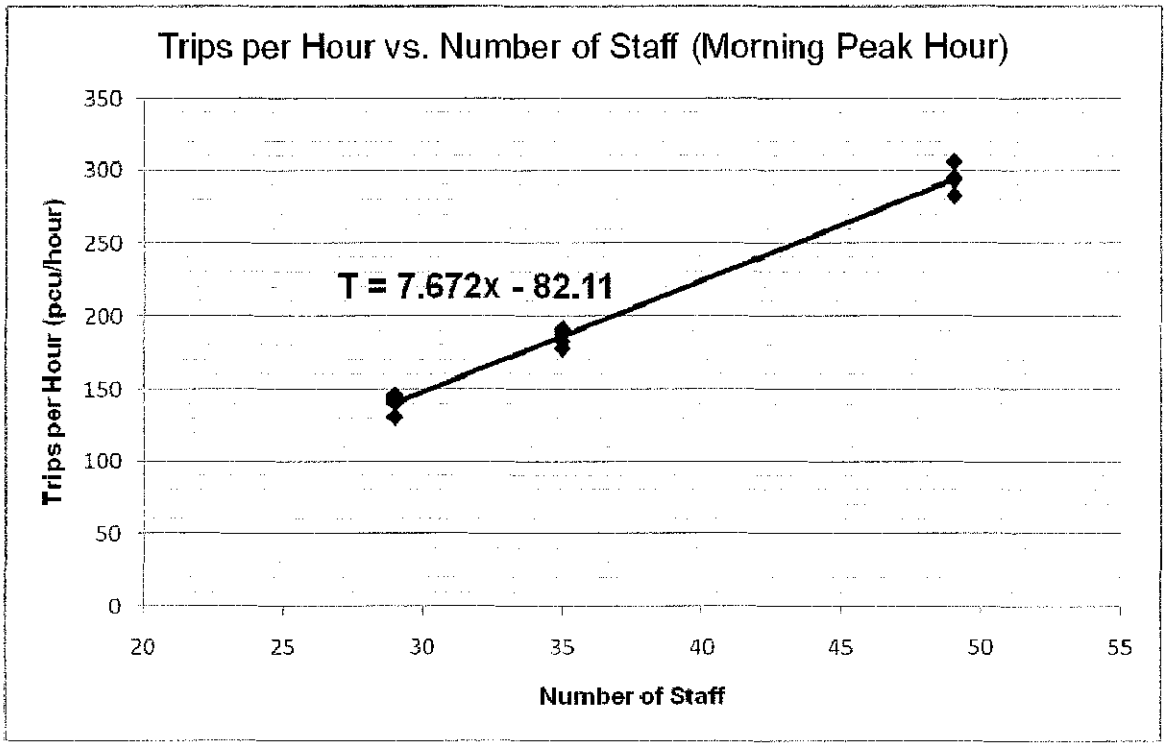


Figure 4.3 Graph trips per hour versus number of staff during morning peak hour

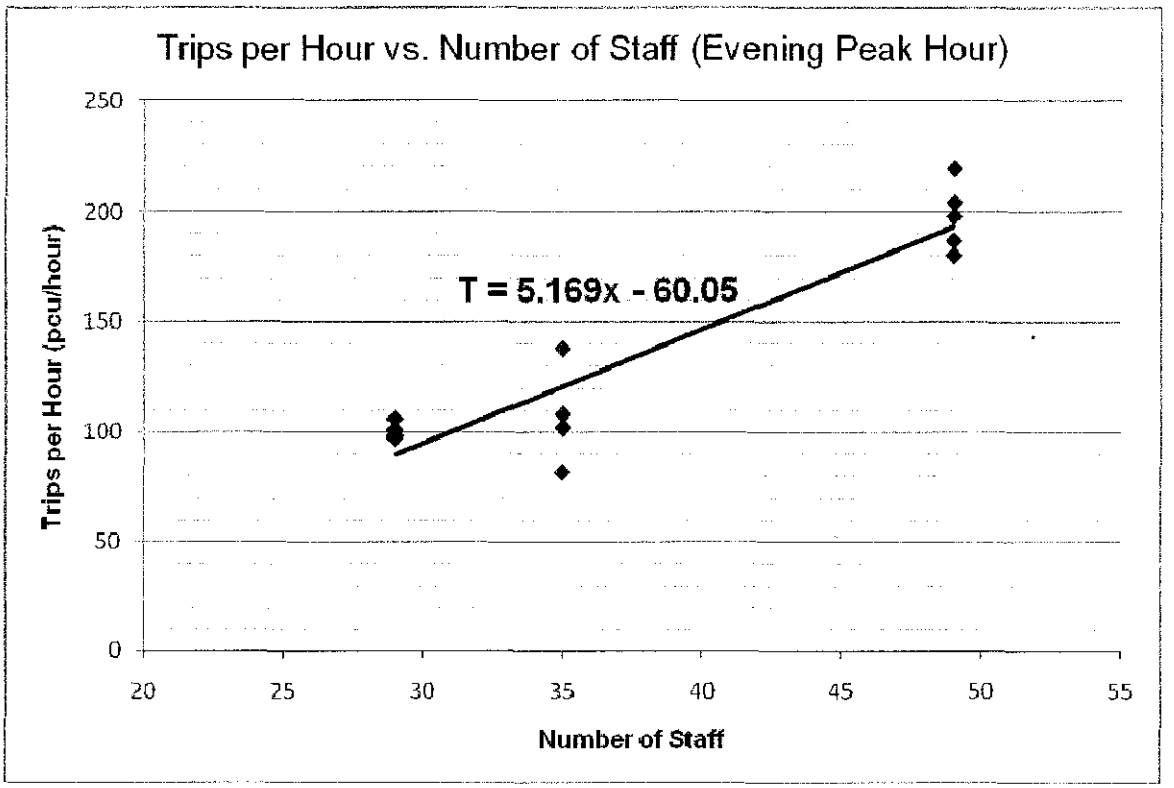


Figure 4.4 Graph trips per hour versus number of staff during evening peak hour

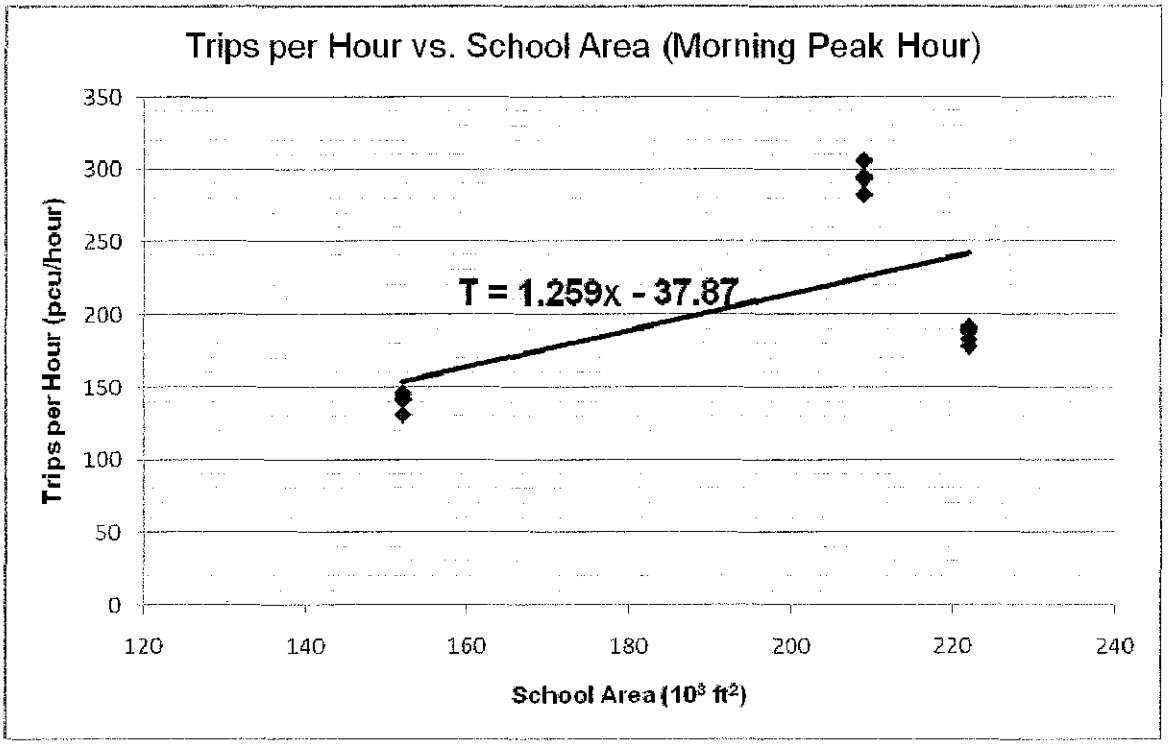


Figure 4.5 Graph trips per hour versus school area during morning peak hour

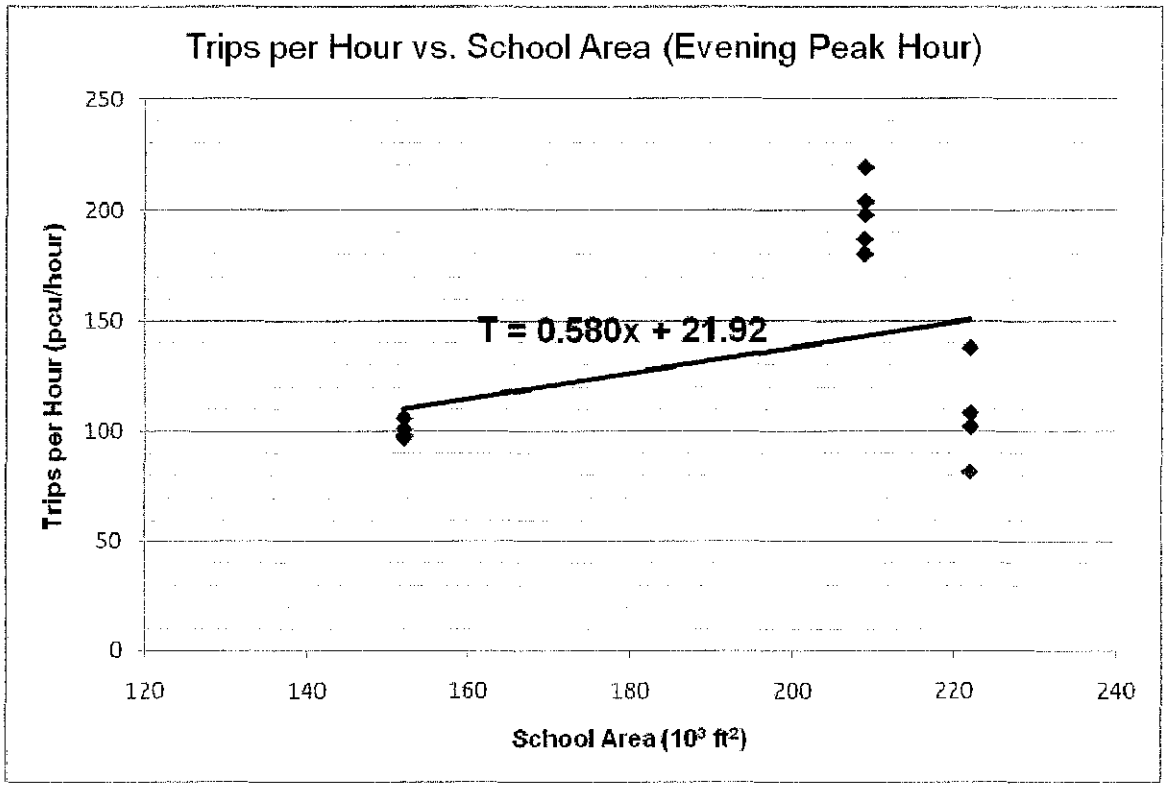


Figure 4.6 Graph trips per hour versus school area during evening peak hour

The best fit line has been drawn for each graph in order to get linear equation. The trip generation equations for primary school during morning and evening peak hour have been summarized in **Table 4.31**.

Table 4.31 Trip generation equations for primary schools based on selected independent variables

Independent Variables	Trip Generation Equations	
	Morning Peak Hour	**Evening Peak Hour**
Number of Students	T = 0.464x + 26.58	T= 0.314x + 12.74
Number of Staff	T = 7.672x - 82.11	T = 5.169x - 60.05
School Area (10^3 ft^2)	T = 1.259x - 37.87	T = 0.580x + 21.92

From the Malaysian Trip Generation Manual, the following data are given :

Table 4.32 Average, minimum and maximum rate of trips based on number of students and school area given in Malaysian Trip Generation Manual

Independent Variables	Morning Peak Hour	Evening Peak Hour
Number of Students	**Average rate** 0.43 trips/student **Minimum rate** 0.23 trips/student **Maximum rate** 0.78 trips/student	**Average rate** 0.37 trips/student **Minimum rate** 0.19 trips/student **Maximum rate** 0.66 trips/student
School Area (ft^3)	**Average rate** 7.9 trips/ft^2 **Minimum rate** 0.11 trips/ft^2 **Maximum rate** 20.14 trips/ft^2	**Average rate** 3.3 trips/ft^2 **Minimum rate** 0.06 trips/ft^2 **Maximum rate** 13.1 trips/ft^2

The minimum and maximum rate of trips are plotted on the graph (dash line) to compare between the trip rates given by the Malaysian Trip Generation Manual produced by Highway Planning Unit with the trip generation equation derive from data collected during the traffic survey. **Figure 4.7, 4.8, 4.9** and **4.10** shows the comparison graph.

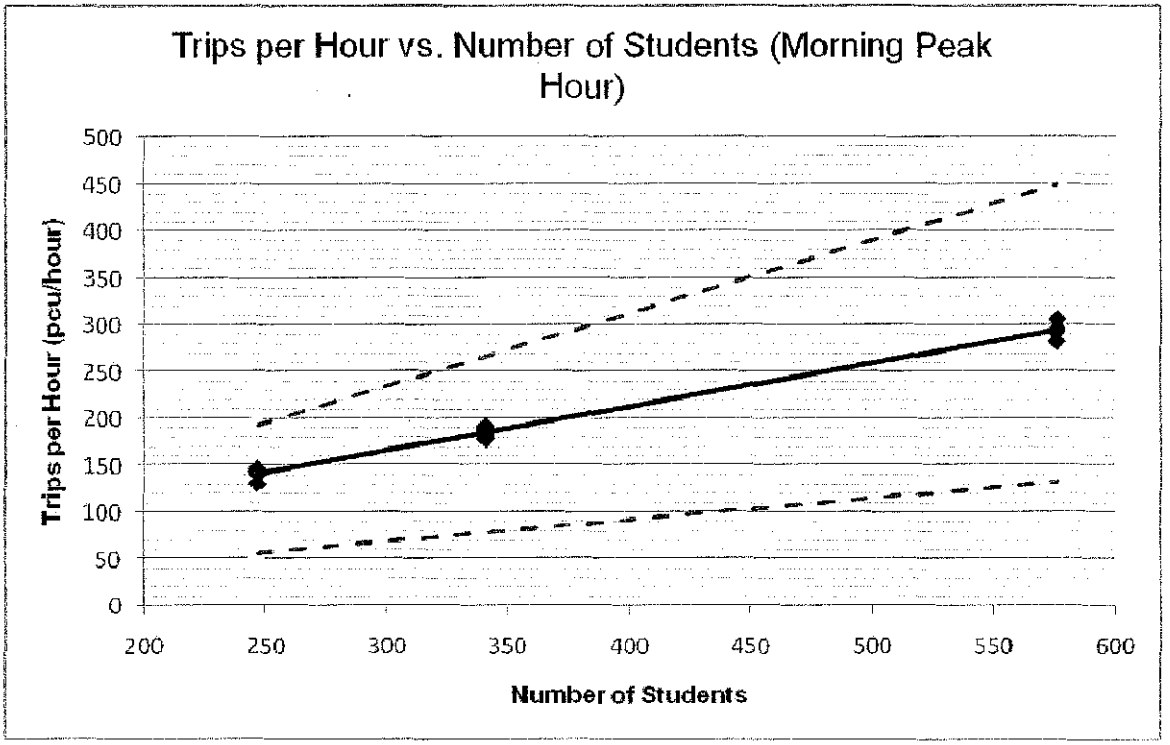


Figure 4.7 Graph trips per hour versus number of students during morning peak hour (comparison with data given in Malaysian Trip Generation Manual)

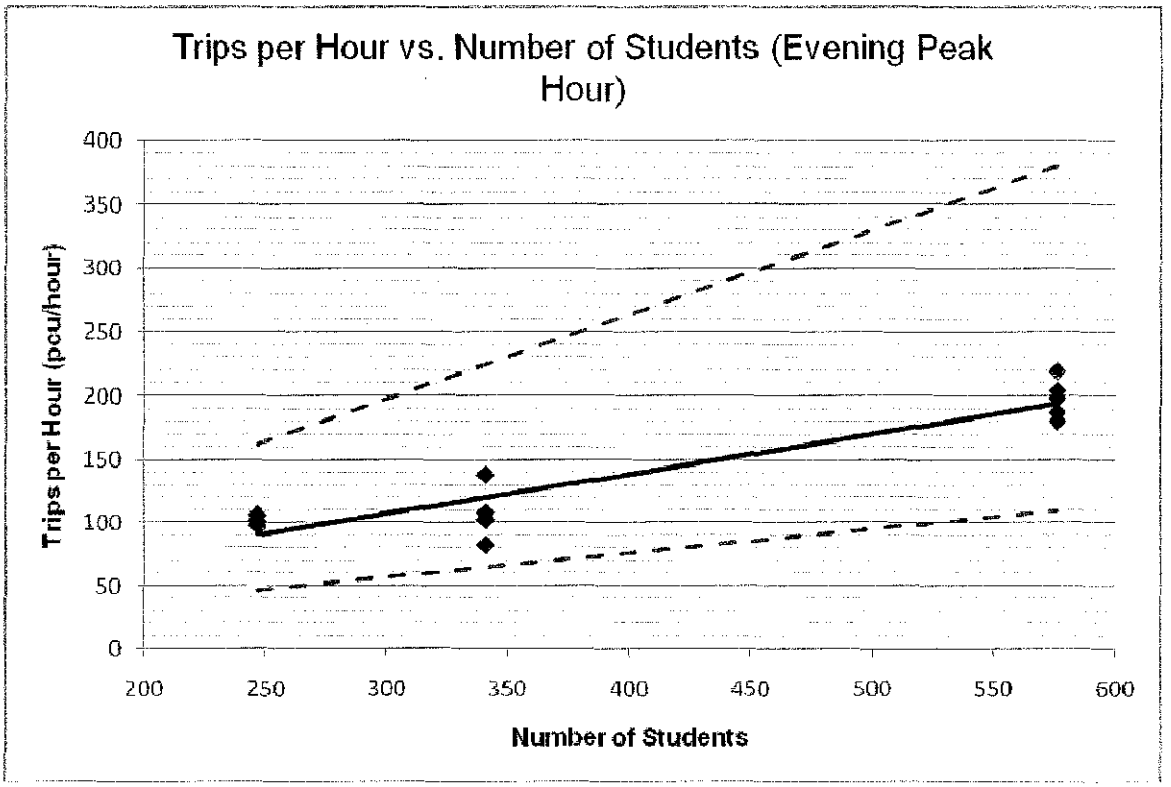


Figure 4.8 Graph trips per hour versus number of students during evening peak hour (comparison with data given in Malaysian Trip Generation Manual)

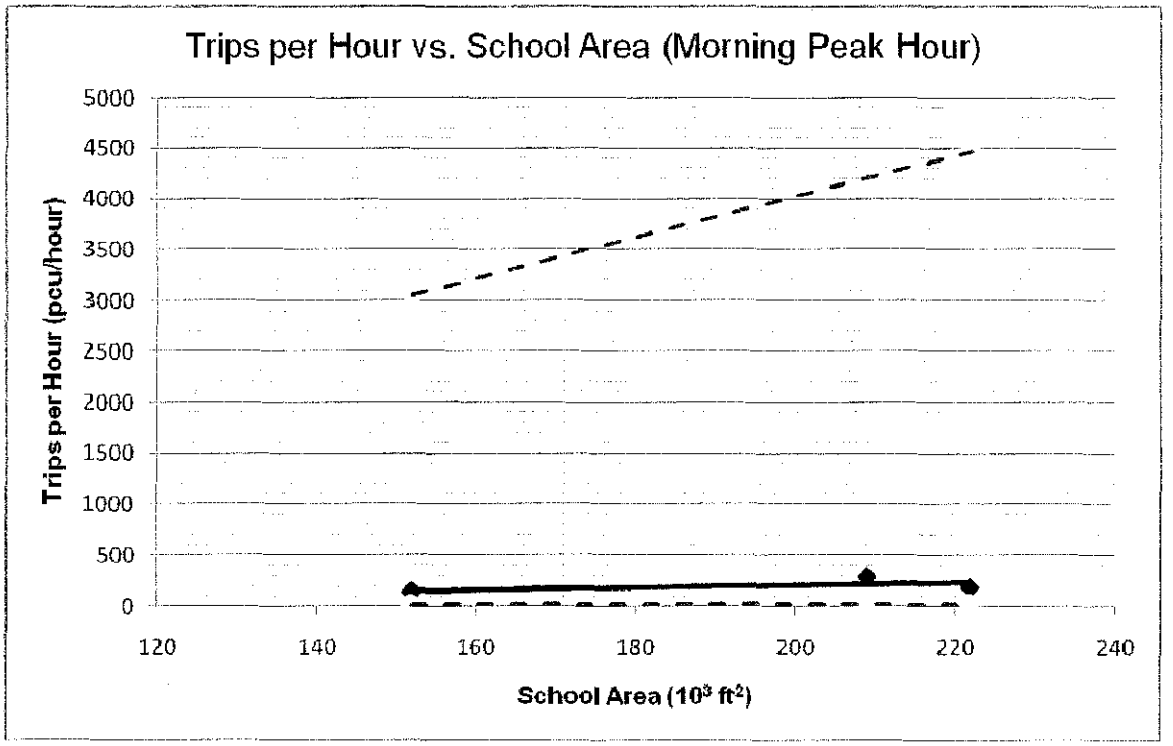


Figure 4.9 Graph trips per hour versus school area during morning peak hour (comparison with data given in Malaysian Trip Generation Manual)

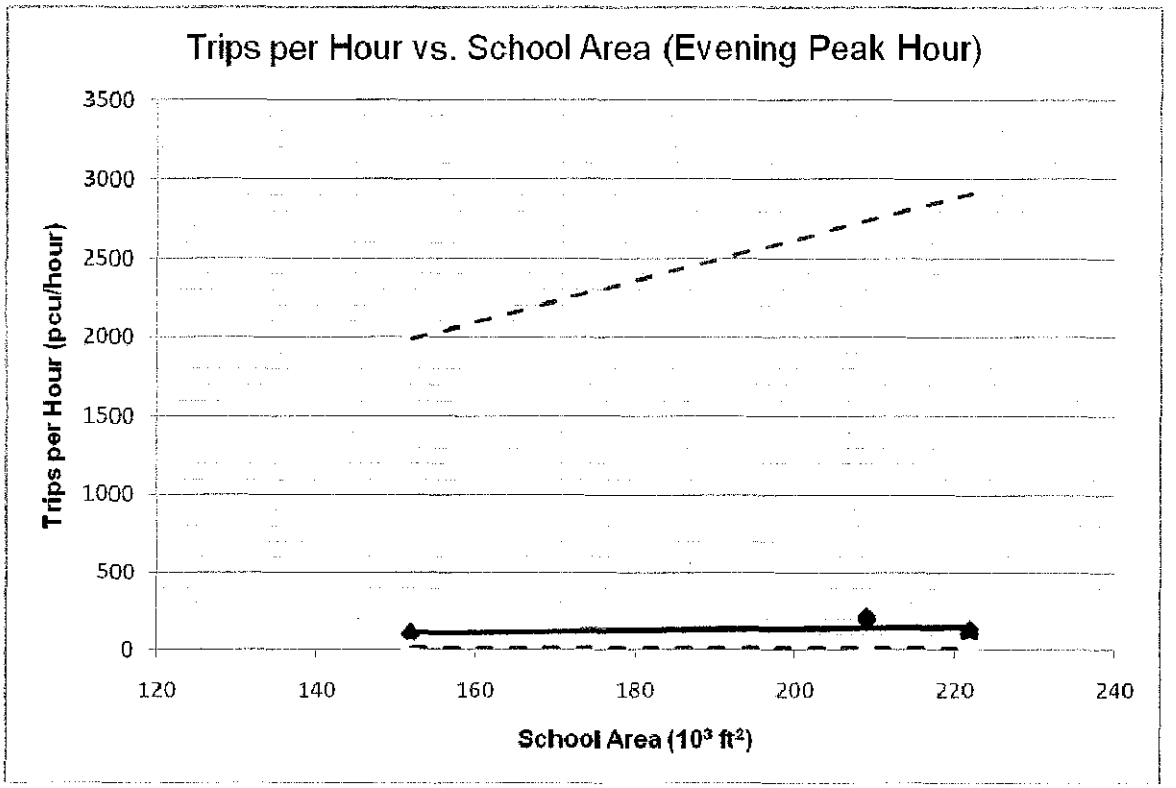


Figure 4.10 Graph trips per hour versus school area during evening peak hour (comparison with data given in Malaysian Trip Generation Manual)

4.2 Discussion

4.2.1 Comparison

From the graph in **Figure 4.7, 4.8, 4.9** and **4.10**, we can compare between the trip rates given by the Malaysian Trip Generation Manual produced by Highway Planning Unit with the trip generation equation derive from data collected during the traffic survey. Comparison can be done based on number of students and school area only, since there is no rate of trips based on number of staff are given in Malaysian Trip Generation Manual. From this comparison graph, it can be proved whether the trip generation equation for primary school produced by Highway Planning Unit, which is based on a certain area in Malaysia can be use to all primary school or not. If the data collected from traffic survey locate within the minimum and maximum trip rates given in Malaysian Trip Generation Manual, it is proved that the trip generation equation for primary school produced by Highway Planning Unit can be use to all primary school in Malaysia. If not, it is shows that its only can be use in a certain area and cannot represent the whole primary school in Malaysia.

4.2.2 Independent Variables

In this project, three independent variables have been chosen which are total number of students, total number of staff and school area. These variables actually give significant impact on the trip generation equation of the study areas. Based on the theory, as the total number of students, total number of staff and size of school area increase, the trips generated will also increase. After data analysis has been done, the relationship between total number of students and total number of staff with the trip generated is according to the theory. However, the relationship between the school area with the trips generated is not according to the theory. It is because some of this primary school has larger area, but the area has not been developed. Therefore, it will reduce the number of students and staff, and also reduced the total trips generated.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In conclusion, the regression equations for trip generation in primary schools around the UTP Campus during morning and evening peak hour based on total number of students, total number of staff and school area have been produced, as shown in **Table 5.1**.

Table 5.1 Trip generation equations for primary schools based on selected independent variables

Independent Variables	**Trip Generation Equations**	
	Morning Peak Hour	**Evening Peak Hour**
Number of Students	T = 0.464x + 26.58	T= 0.314x + 12.74
Number of Staff	T = 7.672x - 82.11	T = 5.169x - 60.05
School Area (10^3 ft^2)	T = 1.259x - 37.87	T = 0.580x + 21.92

Comparison between the trip rates given by the Malaysian Trip Generation Manual produced by Highway Planning Unit with the trip generation equation derive from data collected during the traffic survey clearly shows that all the data collected locate within the minimum and maximum trip rates given in Malaysian Trip Generation Manual. Therefore, it is proved that the trip generation equation for primary school produced by Highway Planning Unit can be use to all primary school in Malaysia, although it is done based on a certain area in Malaysia only.

5.2 Recommendation

5.2.1 Data Collection

It is recommended to gather more data in order to get more accurate results. In this project, the samples were taken at only three places due to time constraint. ITE (Institution of Transportation Engineer) recommended five sites to be use when it becomes necessary to establish a local trip generation.

5.2.2 Types of Vehicles

Types of vehicles which have been considered in this project were only vehicle Type 1 (motorcars, taxis and small vans), Type 2 (lorries, buses and large vans) and Type 3 (motorcycles and scooters). Therefore, it is recommended to also consider other types of vehicle such as bicycles in order to improve the results of the trip generation survey. There are a lot of students that use bicycles as their transportation mode.

5.2.3 Independent Variables

Rate of trips for primary school based on number of staff are not given in Malaysian Trip Generation Manual. In order to improve this manual, the trip generation equation for primary school based on number of staff should be included. Number of staff can give a big impact on the trip generation equation because most of teachers and staff come to school with their own transport. Based on the theory, as the total number of staff increase, the trips generated will also increase.

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APPENDIX A

PICTURES OF SURVEY LOCATION
(PRIMARY SCHOOL)

Sekolah Kebangsaan Tronoh

Sekolah Kebangsaan Pusing

Sekolah Kebangsaan Siputeh

FINAL YEAR PROJECT (FYP)

TRIP GENERATION EQUATION FOR PRIMARY SCHOOL

TRAFFIC SURVEY FORM

SCHOOL : _____

DAY : _____ DATE : _____

15 MINUTES INTERVAL TIME																							
TYPE 1 Motorcars, taxis and small vans								*TYPE 2* Lorries, buses and large vans						*TYPE 3* Motorcycles and scooters									
IN				OUT				IN			OUT			IN				OUT					
1	2	3	4	1	2	3	4	1	2	3	1	2	3	1	2	3	4	1	2	3	4		
5	6	7	8	5	6	7	8	4	5	6	4	5	6	5	6	7	8	5	6	7	8		
9	10	11	12	9	10	11	12	7	8	9	7	8	9	9	10	11	12	9	10	11	12		
13	14	15	16	13	14	15	16	10	11	12	10	11	12	13	14	15	16	13	14	15	16		
17	18	19	20	17	18	19	20	13	14	15	13	14	15	17	18	19	20	17	18	19	20		
21	22	23	24	21	22	23	24	16	17	18	16	17	18	21	22	23	24	21	22	23	24		
25	26	27	28	25	26	27	28	19	20	21	19	20	21	25	26	27	28	25	26	27	28		
29	30	31	32	29	30	31	32	22	23	24	22	23	24	29	30	31	32	29	30	31	32		
33	34	35	36	33	34	35	36	25	26	27	25	26	27	33	34	35	36	33	34	35	36		
37	38	39	40	37	38	39	40	28	29	30	28	29	30	37	38	39	40	37	38	39	40		
41	42	43	44	41	42	43	44	31	32	33	31	32	33	41	42	43	44	41	42	43	44		
45	46	47	48	45	46	47	48	34	35	36	34	35	36	45	46	47	48	45	46	47	48		
49	50	51	52	49	50	51	52	37	38	39	37	38	39	49	50	51	52	49	50	51	52		
53	54	55	56	53	54	55	56	40	41	42	40	41	42	53	54	55	56	53	54	55	56		
57	58	59	60	57	58	59	60	43	44	45	43	44	45	57	58	59	60	57	58	59	60		

APPENDIX C

FULL RESULTS OF TRIP GENERATION SURVEY

1. SEKOLAH KEBANGSAAN TRONOH

MONDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	0	0	0	0	2	2	4	
6.45 AM	7.00 AM	***1***	***1***	***0***	***0***	***2***	***2***	6	
7.00 AM	7.15 AM	***17***	***17***	***0***	***0***	***17***	***17***	68	
7.15 AM	7.30 AM	***29***	***20***	***0***	***0***	***13***	***10***	72	150
7.30 AM	7.45 AM	***14***	***8***	***0***	***0***	***5***	***5***	32	178
7.45 AM	8.00 AM	2	1	0	0	0	0	3	175

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 178 trips (98 in, 80 out)

MONDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
1.00 PM	1.15 PM	***14***	***12***	***0***	***0***	***14***	***14***	54	
1.15 PM	1.30 PM	***8***	***11***	***0***	***0***	*7*	*7*	33	
1.30 PM	1.45 PM	***10***	***14***	***0***	***0***	***6***	***6***	36	
1.45 PM	2.00 PM	***3***	***5***	***0***	***0***	***3***	***4***	15	138
2.00 PM	2.15 PM	1	2	0	0	2	3	8	92

Peak hour time : 1.00 PM – 2.00 PM

Peak hour trip : 138 trips (65 in, 73 out)

TUESDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	2	2	0	0	0	0	4	
6.45 AM	7.00 AM	***4***	***4***	***0***	***0***	***3***	***3***	14	
7.00 AM	7.15 AM	***20***	***19***	***0***	***0***	***17***	***17***	73	
7.15 AM	7.30 AM	***28***	***22***	***0***	***0***	***13***	***13***	76	167
7.30 AM	7.45 AM	***15***	***9***	***0***	***0***	***6***	***4***	34	197
7.45 AM	8.00 AM	2	2	0	0	1	1	6	189

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 197 trips (106 in, 91 out)

TUESDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
1.00 PM	1.15 PM	***13***	***10***	***0***	***0***	***12***	***12***	47	
1.15 PM	1.30 PM	***9***	***12***	***0***	***0***	***7***	***7***	35	
1.30 PM	1.45 PM	***9***	***11***	***0***	***0***	***7***	***8***	35	
1.45 PM	2.00 PM	***5***	***9***	***0***	***0***	***3***	***4***	21	138
2.00 PM	2.15 PM	4	8	0	0	2	2	16	107
2.15 PM	2.30 PM	4	5	0	0	3	3	15	87

Peak hour time : 1.00 PM – 2.00 PM

Peak hour trip : 138 trips (65 in, 73 out)

WEDNESDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	0	0	0	0	1	1	2	
6.45 AM	7.00 AM	***3***	***3***	***0***	***0***	***2***	***2***	10	
7.00 AM	7.15 AM	***19***	***17***	***0***	***0***	***18***	***18***	72	
7.15 AM	7.30 AM	***28***	***23***	***0***	***0***	***14***	***13***	78	162
7.30 AM	7.45 AM	***12***	***9***	***0***	***0***	*7*	***6***	34	194
7.45 AM	8.00 AM	3	2	0	0	1	1	7	191

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 194 trips (103 in, 91 out)

WEDNESDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
1.00 PM	1.15 PM	***17***	***13***	***0***	***0***	***15***	***12***	57	
1.15 PM	1.30 PM	***10***	***13***	***0***	***0***	*5*	*5*	33	
1.30 PM	1.45 PM	*7*	***15***	***0***	***0***	*3*	***6***	31	
1.45 PM	2.00 PM	*3*	***6***	***0***	***0***	*2*	*3*	14	135
2.00 PM	2.15 PM	1	2	0	0	2	2	7	85

Peak hour time : 1.00 PM – 2.00 PM

Peak hour trip : 135 trips (62 in, 73 out)

THURSDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	1	1	0	0	1	1	4	
6.45 AM	7.00 AM	*7*	*7*	*0*	*0*	*3*	*3*	20	
7.00 AM	7.15 AM	*19*	*17*	*0*	*0*	*20*	*20*	76	
7.15 AM	7.30 AM	*25*	*18*	*0*	*0*	*7*	*6*	56	156
7.30 AM	7.45 AM	*14*	*11*	*0*	*0*	*10*	*10*	45	197
7.45 AM	8.00 AM	2	2	0	0	1	1	6	183

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 197 trips (105 in, 92 out)

THURSDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
1.00 PM	1.15 PM	*11*	*11*	*0*	*0*	*16*	*12*	50	
1.15 PM	1.30 PM	*8*	*9*	*0*	*0*	*7*	*12*	36	
1.30 PM	1.45 PM	*12*	*18*	*0*	*0*	*6*	*5*	41	
1.45 PM	2.00 PM	*3*	*6*	*0*	*0*	*1*	*2*	12	139
2.00 PM	2.15 PM	2	3	0	0	2	3	10	99

Peak hour time : 1.00 PM – 2.00 PM

Peak hour trip : 139 trips (64 in, 75 out)

FRIDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**							**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**		**TOTAL**	
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	0	0	0	0	2	2	4	
6.45 AM	7.00 AM	*4*	*4*	*0*	*0*	*2*	*2*	12	
7.00 AM	7.15 AM	*24*	*22*	*0*	*0*	*16*	*16*	78	
7.15 AM	7.30 AM	*22*	*15*	*0*	*0*	*14*	*12*	63	157
7.30 AM	7.45 AM	*13*	*12*	*0*	*0*	*8*	*8*	41	194
7.45 AM	8.00 AM	1	1	0	0	2	2	6	188

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 194 trips (103 in, 91 out)

FRIDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**							**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**		**TOTAL**	
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
11.45 AM	12.00 PM	*5*	*4*	*0*	*0*	*5*	*3*	17	
12.00 PM	12.15 PM	*12*	*14*	*0*	*0*	*13*	*15*	54	
12.15 PM	12.30 PM	*17*	*20*	*0*	*0*	*11*	*10*	58	
12.30 PM	12.45 PM	*4*	*9*	*0*	*0*	*2*	*4*	19	148
12.45 PM	1.00 PM	1	4	0	0	1	2	8	139

Peak hour time : 11.45 AM – 12.45 PM

Peak hour trip : 148 trips (69 in, 79 out)

2. SEKOLAH KEBANGSAAN PUSING

MONDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	1	1	0	0	2	2	6	
6.45 AM	7.00 AM	*7*	*7*	***0***	***0***	*7*	*7*	28	
7.00 AM	7.15 AM	***25***	***19***	***1***	***1***	***22***	***20***	88	
7.15 AM	7.30 AM	***38***	***27***	***2***	***2***	***18***	***17***	104	226
7.30 AM	7.45 AM	***8***	*7*	***0***	***0***	***5***	***4***	24	244
7.45 AM	8.00 AM	2	2	0	0	2	2	8	224

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 244 trips (133 in, 111 out)

MONDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
1.00 PM	1.15 PM	13	9	2	2	11	10	47	
1.15 PM	1.30 PM	***6***	***5***	***2***	***2***	***13***	***8***	36	
1.30 PM	1.45 PM	***2***	***4***	***0***	***0***	***1***	***4***	11	
1.45 PM	2.00 PM	***1***	***4***	***0***	***0***	***0***	***2***	7	101
2.00 PM	2.15 PM	***21***	***30***	***3***	***1***	***12***	***16***	83	137
2.15 PM	2.30 PM	3	11	0	2	1	1	18	119

Peak hour time : 1.15 PM – 2.15 PM

Peak hour trip : 137 trips (61 in, 76 out)

TUESDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	0	0	0	0	2	2	4	
6.45 AM	7.00 AM	*7*	*7*	***0***	***0***	***6***	***6***	26	
7.00 AM	7.15 AM	***18***	***15***	***1***	***1***	***16***	***16***	67	
7.15 AM	7.30 AM	***42***	***31***	***2***	***2***	***25***	***23***	125	222
7.30 AM	7.45 AM	***13***	***8***	***0***	***0***	***6***	***6***	33	251
7.45 AM	8.00 AM	2	2	0	0	1	1	6	231

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 251 trips (136 in, 115 out)

TUESDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
1.00 PM	1.15 PM	8	8	3	3	17	13	52	
1.15 PM	1.30 PM	8	5	1	1	5	2	22	
1.30 PM	1.45 PM	***4***	***6***	***0***	***0***	***3***	***2***	15	
1.45 PM	2.00 PM	***1***	***4***	***1***	***0***	***2***	***2***	10	99
2.00 PM	2.15 PM	***17***	***25***	***1***	***1***	***6***	***15***	65	112
2.15 PM	2.30 PM	***8***	***14***	***1***	***2***	***1***	***1***	27	117

Peak hour time : 1.30 PM – 2.30 PM

Peak hour trip : 117 trips (45 in, 72 out)

WEDNESDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	1	1	0	0	2	2	6	
6.45 AM	7.00 AM	***8***	***8***	***0***	***0***	*7*	*7*	30	
7.00 AM	7.15 AM	***17***	***12***	***1***	***1***	***18***	***18***	67	
7.15 AM	7.30 AM	***32***	***26***	***2***	***2***	***22***	***21***	105	208
7.30 AM	7.45 AM	***17***	***11***	***0***	***0***	***6***	***5***	39	241
7.45 AM	8.00 AM	1	1	0	0	1	1	4	215

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 241 trips (130 in, 111 out)

WEDNESDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
1.00 PM	1.15 PM	***11***	***10***	***2***	***2***	***15***	***14***	54	
1.15 PM	1.30 PM	***2***	***4***	***0***	***0***	***11***	***9***	26	
1.30 PM	1.45 PM	***5***	*7*	***2***	***2***	***0***	***2***	18	
1.45 PM	2.00 PM	***1***	***3***	***2***	***1***	***0***	***1***	8	106
2.00 PM	2.15 PM	9	17	1	2	6	8	43	95
2.15 PM	2.30 PM	5	9	0	0	0	1	15	84

Peak hour time : 1.00 PM – 2.00 PM

Peak hour trip : 106 (51 in, 55 out)

THURSDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	2	2	0	0	2	2	8	
6.45 AM	7.00 AM	***10***	***9***	***0***	***0***	*7*	*7*	33	
7.00 AM	7.15 AM	***21***	***15***	***1***	***1***	***20***	***20***	78	
7.15 AM	7.30 AM	***29***	***21***	***2***	***2***	***22***	***21***	97	216
7.30 AM	7.45 AM	***19***	***18***	***0***	***0***	*7*	*7*	51	259
7.45 AM	8.00 AM	1	1	0	0	3	2	7	233

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 259 trips (138 in, 121 out)

THURSDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
12.45 PM	1.00 PM	***10***	***6***	***0***	***0***	***12***	***6***	34	
1.00 PM	1.15 PM	***19***	***14***	***2***	***2***	***14***	***10***	61	
1.15 PM	1.30 PM	***2***	***4***	***0***	***0***	*7*	***9***	22	
1.30 PM	1.45 PM	***2***	*7*	***2***	***2***	***3***	***4***	20	137
1.45 PM	2.00 PM	0	5	2	1	2	2	12	115
2.00 PM	2.15 PM	10	21	1	2	2	9	45	99
2.15 PM	2.30 PM	5	8	0	0	1	3	17	94

Peak hour time : 12.45 PM – 1.45 PM

Peak hour trip : 137 trips (73 in, 64 out)

FRIDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	1	1	0	0	2	2	6	
6.45 AM	7.00 AM	***8***	***7***	***0***	***0***	***8***	***8***	31	
7.00 AM	7.15 AM	***18***	***14***	***1***	***1***	***18***	***18***	70	
7.15 AM	7.30 AM	***40***	***31***	***2***	***2***	***24***	***22***	121	228
7.30 AM	7.45 AM	***13***	***11***	***0***	***0***	***3***	***3***	30	252
7.45 AM	8.00 AM	3	2	0	0	3	2	10	231

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 252 trips (135 in, 117 out)

FRIDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
11.45 AM	12.00 PM	***9***	***5***	***0***	***0***	***7***	***3***	24	
12.00 PM	12.15 PM	***15***	***16***	***2***	***2***	***22***	***20***	77	
12.15 PM	12.30 PM	***16***	***25***	***2***	***1***	***5***	***10***	59	
12.30 PM	12.45 PM	***4***	***8***	***0***	***1***	***1***	***3***	17	177
12.45 PM	1.00 PM	1	4	0	0	0	1	6	159

Peak hour time : 11.45 AM – 12.45 PM

Peak hour trip : 177 trips (83 in, 94 out)

3. SEKOLAH KEBANGSAAN SIPUTEH

MONDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	1	1	0	0	0	0	2	
6.45 AM	7.00 AM	***10***	***9***	***1***	***1***	***14***	***14***	49	
7.00 AM	7.15 AM	***38***	***33***	***1***	***1***	***25***	***25***	123	
7.15 AM	7.30 AM	***46***	***35***	***4***	***4***	***44***	***44***	177	351
7.30 AM	7.45 AM	***20***	***17***	***0***	***0***	***11***	***10***	58	407
7.45 AM	8.00 AM	0	0	0	0	2	1	3	361

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 407 trips (214 in, 193 out)

MONDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
1.00 PM	1.15 PM	***37***	***34***	***3***	***3***	***38***	***31***	146	
1.15 PM	1.30 PM	***22***	***29***	***1***	***1***	***9***	***14***	76	
1.30 PM	1.45 PM	***6***	***15***	***1***	***1***	***3***	***5***	31	
1.45 PM	2.00 PM	***0***	***1***	***0***	***0***	***0***	***2***	3	256

Peak hour time : 1.00 PM – 2.00 PM

Peak hour trip : 256 trips (120 in, 136 out)

TUESDAY (MORNING)

START TIME	END TIME	15 MINUTES INTERVAL TRIPS						TOTAL	HOURLY TRIPS
		TYPE 1		TYPE 2		TYPE 3			
		IN	OUT	IN	OUT	IN	OUT		
6.30 AM	6.45 AM	1	1	0	0	2	2	6	
6.45 AM	7.00 AM	*12*	*10*	*1*	*1*	*13*	*13*	50	
7.00 AM	7.15 AM	*35*	*31*	*2*	*2*	*22*	*21*	113	
7.15 AM	7.30 AM	*46*	*36*	*3*	*3*	*49*	*48*	185	354
7.30 AM	7.45 AM	*22*	*18*	*0*	*0*	*9*	*9*	58	406
7.45 AM	8.00 AM	1	0	0	0	3	2	6	362

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 406 (214 in, 192 out)

TUESDAY (EVENING)

START TIME	END TIME	15 MINUTES INTERVAL TRIPS						TOTAL	HOURLY TRIPS
		TYPE 1		TYPE 2		TYPE 3			
		IN	OUT	IN	OUT	IN	OUT		
1.00 PM	1.15 PM	*41*	*38*	*3*	*3*	*28*	*25*	138	
1.15 PM	1.30 PM	*23*	*32*	*1*	*1*	*18*	*21*	96	
1.30 PM	1.45 PM	*3*	*8*	*1*	*1*	*6*	*8*	27	
1.45 PM	2.00 PM	*0*	*3*	*0*	*0*	*0*	*1*	4	265

Peak hour time : 1.00 PM – 2.00 PM

Peak hour trip : 265 trips (124 in, 141 out)

WEDNESDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	2	2	0	0	2	2	8	
6.45 AM	7.00 AM	***12***	***11***	***1***	***1***	***17***	***17***	59	
7.00 AM	7.15 AM	***40***	***34***	***2***	***2***	***23***	***23***	124	
7.15 AM	7.30 AM	***43***	***36***	***3***	***3***	***42***	***39***	166	357
7.30 AM	7.45 AM	***25***	***17***	***0***	***0***	***15***	***15***	72	421
7.45 AM	8.00 AM	0	0	0	0	0	0	0	362

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 421 trips (223 in, 198 out)

WEDNESDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
1.00 PM	1.15 PM	***33***	***30***	***4***	***4***	***35***	***35***	141	
1.15 PM	1.30 PM	***9***	***16***	***1***	***0***	***8***	***4***	38	
1.30 PM	1.45 PM	***3***	***9***	***0***	***1***	***0***	***1***	14	
1.45 PM	2.00 PM	***10***	***19***	***0***	***0***	***2***	*7*	38	231

Peak hour time : 1.00 PM – 2.00 PM

Peak hour trip : 231 trips (105 in, 126 out)

THURSDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	0	0	0	0	0	0	0	
6.45 AM	7.00 AM	*12*	*12*	*1*	*1*	*16*	*16*	58	
7.00 AM	7.15 AM	*39*	*32*	*2*	*1*	*29*	*28*	131	
7.15 AM	7.30 AM	*40*	*33*	*3*	*4*	*39*	*39*	158	347
7.30 AM	7.45 AM	*21*	*14*	*0*	*0*	*15*	*15*	65	412
7.45 AM	8.00 AM	0	0	0	0	1	0	1	355

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 412 trips (217 in, 195 out)

THURSDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
12.45 PM	1.00 PM	*4*	*2*	*1*	*1*	*10*	*4*	22	
1.00 PM	1.15 PM	*44*	*47*	*3*	*3*	*46*	*48*	191	
1.15 PM	1.30 PM	*21*	*28*	*1*	*1*	*5*	*10*	66	
1.30 PM	1.45 PM	*2*	*9*	*0*	*0*	*1*	*3*	15	294
1.45 PM	2.00 PM	0	2	0	0	0	0	2	274

Peak hour time : 12.45 PM – 1.45 PM

Peak hour trip : 294 trips (138 in, 156 out)

FRIDAY (MORNING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
6.30 AM	6.45 AM	1	1	0	0	1	1	4	
6.45 AM	7.00 AM	***8***	***7***	***1***	***1***	***17***	***17***	51	
7.00 AM	7.15 AM	***43***	***38***	***2***	***2***	***24***	***23***	132	
7.15 AM	7.30 AM	***48***	***37***	***3***	***3***	***45***	***45***	181	368
7.30 AM	7.45 AM	***10***	***5***	***0***	***0***	***8***	*7*	30	394
7.45 AM	8.00 AM	1	0	0	0	1	1	3	346

Peak hour time : 6.45 AM – 7.45 AM

Peak hour trips : 394 trips (209 in, 185 out)

FRIDAY (EVENING)									
START TIME	**END TIME**	**15 MINUTES INTERVAL TRIPS**						**TOTAL**	**HOURLY TRIPS**
		TYPE 1		**TYPE 2**		**TYPE 3**			
		IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**		
11.45 AM	12.00 PM	*7*	***3***	***0***	***0***	***9***	***1***	20	
12.00 PM	12.15 PM	***31***	***36***	***4***	***3***	***19***	***27***	120	
12.15 PM	12.30 PM	***18***	***33***	***0***	***1***	***16***	***17***	85	
12.30 PM	12.45 PM	***2***	***8***	***0***	***0***	***4***	***5***	19	244
12.45 PM	1.00 PM	0	0	0	0	0	2	2	225

Peak hour time : 11.45 AM – 12.45 PM

Peak hour trip : 244 trips (110 in, 134 out)