

PRESERVING AND EXPANDING THE ROLE OF NON-MOTORIZED  
TRANSPORT IN UNIVERSITI TEKNOLOGI MALAYSIA (UTM) SKUDAI  
CAMPUS

OLORUNTOBI OLAKUNLE OLUWATOSIN

A thesis submitted in fulfilment of the requirements for the award of the degree of  
Master of Science (Transport Planning)

Faculty of Built Environment  
Universiti Teknologi Malaysia

JULY 2012

I would like to dedicate this thesis to my parent, my father and my mother, Dr. and Mrs J.O. Olorunubi. Without their great support and counsel, this thesis could not have been completed.

I would like to acknowledge the inspirational instruction and guidance of Dr. Muhammad Zaly Shah Bin Muhammad Hussein, and for his supervision from the outset of this thesis to the completion stage.

Finally, I would like to thank Andrew C. Ologbo, Faculty of Human Resources Management and Ikwesan A. Richard, Faculty of Computer Science for their great support and help during the data collection. I could not have completed my data collection without their assistance.

## ACKNOWLEDGEMENT

My profound gratitude goes to Dr. Muhammad Zaly Shah Bin Muhammad Hussein for his supervision and support that greatly help me in each phase of this research. The whole research projects will have amounted to nothing without his support and supervision. I want to acknowledge efforts, suggestions and encouragement from colleagues from Dept. of Transportation Planning, especially Talip Abdul Raman and Mahdi Aghaabbasi.

I want to show my gratitude for the efforts and assistance from Andrew C. Ologbo, Faculty of Human Resources Management and Ikwesan A. Richard, Faculty of Computer Science during the data collection process.

My appreciation goes to Dept. of Transportation Planning for its contribution to this work and special thanks to Dr. Muhammad Zaly Shah Bin Muhammad Hussein – Senior Lecturer in the Dept. of Urban and Regional Planning, Faculty of Built Environment, Universiti Teknologi Malaysia and Academic Leader, Logistics and Transportation, Iskandar Malaysia Research Center (IMREC), for his support and help in completing this program successfully.

OLORUNTOBI OLAKUNLE, MB101008

## **ABSTRACT**

Increase in the number of students and staffs often cause expansion of the university campus and make it obligatory to expand the role of transportation in the entire campus. However, increase in population also increases the automobile use and ownership among staffs and students and heavy traffic movement is gradually becoming incontrollable and shortages of parking spaces in the academic and administrative area is gradually increasing.

The objective of this study is to investigate walking and cycling aspect of non-motorized transport in Universiti Teknologi Malaysia (UTM) Skudai campus including policy making and planning for the best ways to make university campus a better place for non-motorized transport usage. It will also investigates various planning and design concepts, and offers contributions to help to implement them and also look into problems confronting non-motorized transport in UTM Skudai campus and as well investigate the state of non-motorized transport facilities such as walkways, crosswalk, sidewalks, bike lanes etc. and recommend facilities improvements to ensure safety, access and providing features to accommodate people with disabilities too. Non-motorized transport traffic law enforcement, education and encouragement programs will be introduced and developed alongside with provision of modern facilities for non-motorized transport usage to improve walking and cycling conditions in the entire campus.

## ABSTRAK

Peningkatan dalam bilangan pelajar dan kakitangan sering menyebabkan pengembangan kampus universiti dan menjadikan wajib untuk meluaskan peranan pengangkutan di seluruh kampus. Walau bagaimanapun, peningkatan penduduk juga meningkatkan penggunaan kereta dan pemilikan di kalangan kakitangan dan pelajar dan pergerakan lalu lintas berat secara beransur-ansur menjadi tidak terkawal dan kekurangan tempat letak kereta di kawasan akademik dan pentadbiran yang semakin bertambah.

Objektif kajian ini adalah untuk menyiasat berjalan kaki dan berbasikal aspek pengangkutan tidak bermotor di Universiti Teknologi Malaysia (UTM) Skudai kampus termasuk dasar dan merancang cara terbaik untuk membuat kampus universiti tempat yang lebih baik untuk penggunaan pengangkutan tidak bermotor. Ia juga akan menyiasat pelbagai perancangan dan konsep reka bentuk, dan menawarkan sumbangan untuk membantu untuk melaksanakan mereka dan juga melihat ke dalam masalah yang dihadapi bukan bermotor pengangkutan di UTM Skudai kampus dan juga menyiasat keadaan kemudahan pengangkutan yang tidak-bermotor seperti laluan pejalan kaki, crosswalk, kaki lima, lorong basikal dan sebagainya dan mencadangkan peningkatan kemudahan untuk memastikan ciri-ciri keselamatan, akses dan menyediakan untuk menampung orang kurang upaya juga. Program penguatkuasaan undang-undang lalu lintas bukan bermotor pengangkutan, pendidikan dan galakan akan diperkenalkan dan dibangunkan bersama-sama dengan penyediaan kemudahan moden untuk penggunaan pengangkutan tidak bermotor untuk memperbaiki syarat-syarat yang berjalan kaki dan berbasikal di seluruh kampus.

## TABLE OF CONTENTS

	<b>ACKNOWLEDGEMENT</b>	<b>iv</b>
	<b>ABSTRACT</b>	<b>v</b>
	<b>ABSTRAK</b>	<b>vi</b>
	<b>TABLE OF CONTENTS</b>	<b>vii</b>
	<b>LIST OF TABLES</b>	<b>xi</b>
	<b>LIST OF FIGURES</b>	<b>xii</b>
	<b>LIST OF SYMBOLS</b>	<b>xiv</b>
	<b>GLOSSARY OF TERMS</b>	<b>xv</b>
<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
	1.1 Background of Problem	2
	1.2 Problem Statement	6
	1.3 Research Questions	9
	1.4 Research Objectives	10
	1.5 Theoretical Framework	11
	1.6 Scope of Research	13
	1.7 Limitations of Research	13
	1.8 Expected Contributions	15
	1.9 Significance of Research	15
	1.10 Thesis Outlines	16
	1.11 Chapter Summary	18
<b>2</b>	<b>LITERATURE REVIEW</b>	<b>19</b>
	2.1 UTM Skudai Campus	20
	2.2 Theoretical Frameworks	22
	2.3 Transportation and Behavioural Model	23

2.3.1	Non-Motorized Transport Distance	25
2.3.2	Non-Motorized Transports Travel Characteristics	26
2.3.3	Non-Motorized Transportation Pathways	27
2.4	Non-Motorized Transport Issues	28
2.5	Bicycle Cycling	29
2.6	Pedestrian Mobility	31
2.7	Role of Non-Motorized Transport in Campus Community	33
2.8	Flexibility and Affordability	33
2.9	Chapter Summary	34
<b>3</b>	<b>RESEARCH METHODOLOGY</b>	<b>35</b>
3.1	Background to Methodology	36
3.2	Research Design	36
3.3	Study Variables	37
3.4	Hypothesis	38
3.4.1	Hypothesis 1	39
3.4.2	Hypothesis 2	39
3.4.3	Hypothesis 3	40
3.5	Data Sources	42
3.5.1	Primary Data	42
3.5.2	Secondary Data	43
3.6	Measurement items	44
3.7	Sampling Design	44
3.7.1	Sampling Method	45
3.7.2	Target Population	45
3.7.3	Sampling Frame	47
3.7.4	Questionnaire Design	47
3.7.5	Sample Size Computation	48

3.8	Reliability and Validity	49
3.8.1	Reliability	50
3.8.2	Validity	51
3.9	Analytical Techniques	51
3.10	Chapter Summary	52
<b>4</b>	<b>DATA COLLECTION AND ANALYSIS</b>	<b>53</b>
4.1	Sampling Plan	54
4.2	Selecting Data Collection Method	55
4.2.1	Field Observation Method	56
4.2.2	Interview and Questionnaire Method	65
4.2.3	Existing Data Method	68
4.3	Performance Indicator	68
4.4	Regression Analysis	69
4.5	Descriptive Analysis	70
4.6	Data Collection Locations	71
4.7	Level of Service Ratings	72
4.7.1	Shared-Use Path Level-Of-Service Ratings	73
4.8	Walking Percentages	75
4.9	Chapter Summary	76
<b>5</b>	<b>RESULTS AND FINDINGS</b>	<b>77</b>
5.1	Respondents Demographic Profile	77
5.2	Analysis of Measures	78
5.3	Facility Design	81
5.3.1	Complete design	82
5.3.2	Universal Design	82
5.4	Quality of Service	83
5.5	Safety	85
5.6	Chapter Summary	85



<b>6</b>	<b>CONCLUSIONS AND SUGGESTIONS</b>	<b>87</b>
	6.1 Conclusion	87
	6.2 Suggestions	89
	6.3 Chapter Summary	92
	<b>REFERENCES</b>	<b>93</b>

## LIST OF TABLES

<b>TABLE NO.</b>	<b>TITLE</b>	<b>PAGE</b>
Table 1-1	Campus Transportation Usage (Arash & Othman, 2009)	8
Table 2-1	Showing UTM, Skudai Campus Population	22
Table 3-1	Mapping of Hypothesis to Study Variables	41
Table 4-1	Field observation of NMT users on 20 February, 2012	57
Table 4-2	Field observation of NMT users on 21 February, 2012	59
Table 4-3	Field observation of NMT users on 23 February, 2012	61
Table 4-4	Field observation of NMT users on 24th February, 2012	63
Table 4-5	Distribution of survey according to Gender (Questionnaire)	69
Table 4-6	Basic Data and Performance Indicators	69
Table 4-7	Pedestrian level of Service	74
Table 4-8	Bicyclist level of Service	75
Table 5-1	Descriptive Analysis from Questionnaire Survey	78
Table 5-2	Campus walking trip Data (Descriptive Statistics from SPSS)	79
Table 5-3	Quality of Service rating in UTM Skudai campus	84

## LIST OF FIGURES

<b>FIGURE NO.</b>	<b>TITLE</b>	<b>PAGE</b>
Figure 1-1	NMT facility at Jalan Hikma with signposts in its middle	3
Figure 1-2	Well shaded NMT facility near FAB but poorly maintained	4
Figure 1-3	Dilapidated NMT facility opposite Block B11	5
Figure 1-4	Campus Bicyclist sharing facility with automobiles	6
Figure 1-5	The Transportation Usage in the campus	8
Figure 1-6	Represent campus transport usage in pie chart	9
Figure 1-7	Thoretical Frame work Diagram	12
Figure 1-8	Map of UTM Skudai Campus	14
Figure 2-1	Pedestrian sidewalk near Meranti bussines area	24
Figure 2-2	Pedestrian using walkway that connect Block (B) with Central Point	25
Figure 2-3	Walkway Connecting Faculty of Computer Science to Faculty of Civil Engineering	26
Figure 2-4	NMT Facility Connecting Faculty of Management and Faculty of Computer Science	27
Figure 2-5	Campus bicyclist resting having some rest after the active exercise	30
Figure 2-6	Bicyclist cycling towards the  Faculty of Computer Science	30
Figure 2-7	Campus bicyclist along the faculty of Computer Science	31
Figure 2-8	Pedestrians walking and running on the pedestrian sidewalk	32
Figure 4-1	Sample Size Required	55
Figure 4-2	Field observation of NMT Users on the 20th of February, 2012	58
Figure 4-3	Field observation of NMT Users on the 21st of February, 2012	60
Figure 4-4	Field observation of NMT Users on the 23rd of February, 2012	62
Figure 4-5	Field observation of NMT Users on the 24th of February, 2012	64
Figure 4-6	Showing the Interview and Informal conversation recorded	67

Figure 4-7 Eagle view of the data collection location (UTM, Skudai Campus)	71
Figure 5-1 Walking Trip Percentage	80
Figure 5-2 Walking Mean Duration	81

**LIST OF SYMBOLS**

$\mu$	-	The mean of the study population
$\bar{x}$	-	Sample mean
$\alpha$	-	Probability of Type I error
$\nu$	-	Degrees of Freedom

## GLOSSARY OF TERMS

CO2	-	Carbon Dioxide
LOS	-	Level of Service
MUTRFC	-	Malaysian Universities Transportation Research Forum and Forum and Conference
NMT	-	Non-Motorized Transport
QOS	-	Quality of Service
SPSS	-	Statistics Package for Social Science
UTM	-	Universiti Teknologi Malaysia

## **CHAPTER 1**

### **INTRODUCTION**

Human have devised various methods of transportation since time past such as walking, horseback riding, horse and cart, cycling or relaxing in a luxury car. Transportation is a very important activity in human life and people always wanted personal, short or long distance mobility in all cases. However, increase in number of automobile has made non-motorized mode of transport non-attractive to most user of transportation (Barter, 2000). Today's automobiles go much faster and further than the carts of ancient times and they can also create environmental damages unlike human-powered vehicles because automobile uses readily available fossil fuel, which reduces the need for efficiency and causes much hazards to our environment such as air pollution, noise and dust that were released to the atmosphere as well as other problems they caused, which have a greater impact on our living environment (Balsas, 2003).

Recently, several strategies were debated and developed to minimize the impact of motor vehicles in our environment, of which, promoting non-motorized modes of transport that is self-propelled, environmentally sound, socially acceptable and affordable. Non-motorized transports conserve energy and promote healthy activities as well as enable mobility and creating pollution free environment (Toor and Havlick, 2004). In the time past, walking was the primary mode of transport until the introduction of automobiles that gives much more convenience and taken over the formal mode of transportation. Perhaps, improving non-motorized transport conditions will be of great benefit to our environment (Balsas, 2003).

University environment, like any other environment is a unique place where people from different backgrounds, incomes, and attitudes gather for studying, working and relaxing purposes (Balsas, 2003). University of Technology Malaysia (UTM) Skudai campus is the study environment for this research on the role of non-motorized transport since transportation is an important activity in the campus. Therefore, increase in motorized transport usage rather than non-motorized mode of transport in the campus environment is adversely affecting campus environment and health qualities with reference to Toor and Havlick. Expanding the role of non-motorized transport in the campus will be important activities that will broaden campus mobility option.

### **1.1 Background of Problem**

Universiti Teknologi Malaysia (UTM) staffs, students and visitors to the university campus drive personal cars and other form of automobiles to and from academic, administrative and business area of the campus located in Skudai city, rather than walking or cycling short distance trips for convenience. The reason appeared be too long distance to travel or harshness of the weather conditions as well as outright reluctance to use non-motorized transport for such trips (Toor and Havlick, 2004). UTM Skudai staffs and students choice to adopt motorized mode of transport for short distance trips within the academic, administrative and business area of campus is in-explainable but a common notion could be the various level of comfort they enjoying from automobile in compare to non-motorized mode of transport.

Another background problem is the poorly maintained non-motorized transports facilities in the campus in recent years, the widths of walkways, sidewalks and bike lanes provided are not suitable and fitted to accommodate non-motorized transport traffic and volumes (Roshandeh and Othman, 2009). Most sidewalks and walkways are found to be very narrow and do not end safely especially for bicycle users. There are few breaks and missing section in the sidewalks and walkways (Roshandeh and Othman, 2009), and several other non-motorized transport facilities



defects that are visibly noticed in few places of activity in the campus. Although a few perfect and completed non-motorized transport facilities are provided in a few places in the campus with breath-taken architecture but with low usage or patronage level.

Non-motorized transport facilities such as sidewalks, bicycle lanes etc. have problems connecting with each other as well as insufficient shading from the Sun and other weather conditions. Non-motorized transports facilities have some design defects such as road sign boards built in the middle of pedestrian pathways among others (Roshandeh and Othman, 2009) that affect mobility and short distance travel. All of the above mentioned problems constitute the physical problems of non-motorized transport activities in among (UTM) staffs and students in Skudai campus.



**Figure 1-1 NMT facility at Jalan Hikma with signposts in its middle**

Pedestrian sidewalk with adequate width but with non-attractive walking surface and has signposts in the middle (Figure 1-1).



**Figure 1-2 Well shaded NMT facility near FAB but poorly maintained**

Figure 1-2 showed a picture of pedestrian walkway with adequate protection from extreme weather conditions. This non-motorized transport facility is properly shaded and poorly maintained which could poses threats to the campus non-motorized transport users in the campus.



**Figure 1-3 Dilapidated NMT facility opposite Block B11**

Pedestrian sidewalk with low level of safety and not maintained, this non-motorized transport facility had a rough top surface that could discourage walking or wheelchair travel and can also poses threats to the non-motorized transport users among the staffs and students in UTM Skudai campus as shown in (Figure 1-3).



**Figure 1-4 Campus Bicyclist sharing facility with automobiles**

Figure 1-4 above showed campus bicyclist sharing the same facilities with automobiles in the absence of suitable bicycle lanes and without a guaranteed protection from other mode of transport. The absence of non-motorized transport facilities along Meranti business area to central point area, as well as other activity areas of the campus will directly discourage the bicycle cycling in the campus.

## **1.2 Problem Statement**

There are several issues and problems affecting non-motorized transportation in UTM Skudai campus that appear to be more critical and seem to have no solution. Among the major problems the campus non-motorized transport faces are poor accessibility of non-motorized transport facilities, poorly maintained non-motorized transport facilities in few areas of the campus, non-motorized transport security and

safety, reluctance to walk or cycle due to personal reasons etc. (Roshandeh and Othman, 2009).

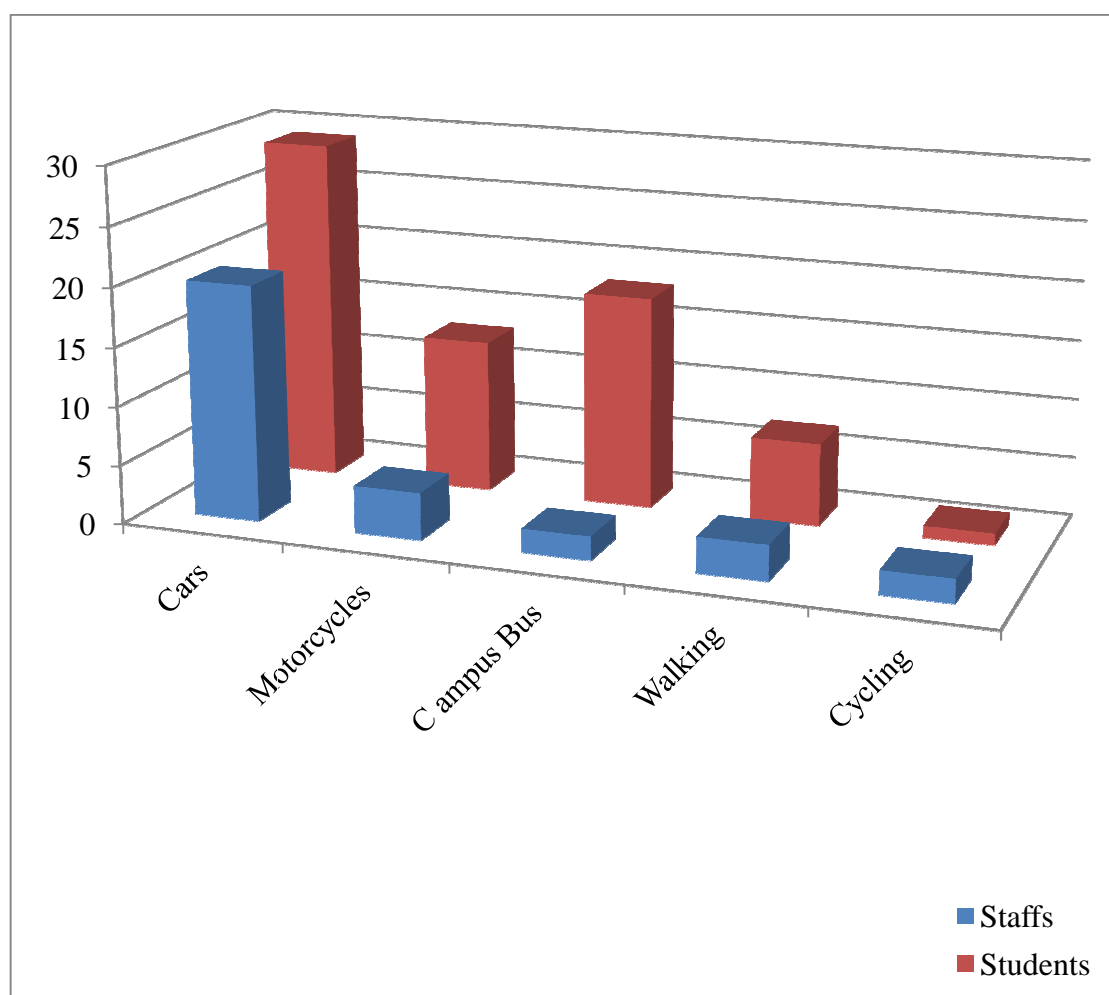
These problems creates a wider gap between non-motorized transport users and active non-motorized travel, by making it difficult for non-motorists to travel through their destination with comfort and convenience they needed especially when cycling or walking, using the existing non-motorized facilities such as sidewalks, walkways or bicycle lanes (Roshandeh and Othman, 2009). The role of non-motorized transports is declining especially in the routine areas of the campus and the above mentioned problems, among other factors contributed to the reason behind UTM Skudai campus staffs and students adherence to the use private vehicles rather than non-motorized transport mode for their short distance travel, because of the convenience and comforts they derived from automobiles as well as easy accessibility to their various short distance destinations. The above mentioned problems are highly frustrating the role of non-motorized transport in the campus and equally promoting the need of motorized vehicles and contributes to the increasing number of vehicles on campus roads. Apart from gradual congestion this situation is causing the campus gradually, such as environmental effect which is the major resulting issues from the increasing private vehicles usage. Pollutions like smoke, dust and noises from automobiles contribute to environment pollution and accelerate the process of global warming. It was found that automobile transport mode alone produces 24.1% of CO<sub>2</sub> emissions worldwide which is a high number (Kassens, 2009). Frequent automobiles usage did not just become a challenge to campus planners with better roadways, more disposable income and easy car ownership. Therefore, staffs and students cars ownership in the campus is continually growing in numbers, and equally affecting the campus air quality. Resultantly, many larger universities are trying to solve car dependency problem using variety of ways such as, managing the traffic demand with a variety of physical, educational and financial strategies (Havlick, 2007). Campus planners could sustain or create a permanent campus green space, aesthetically more pleasing and more efficient in terms of both economics and mobility.

Table 1-1 below shows the transportation Usage in Universiti Teknologi Malaysia (UTM) Skudai Campus.

**Table 1-1 Campus Transportation Usage (Arash & Othman, 2009)**

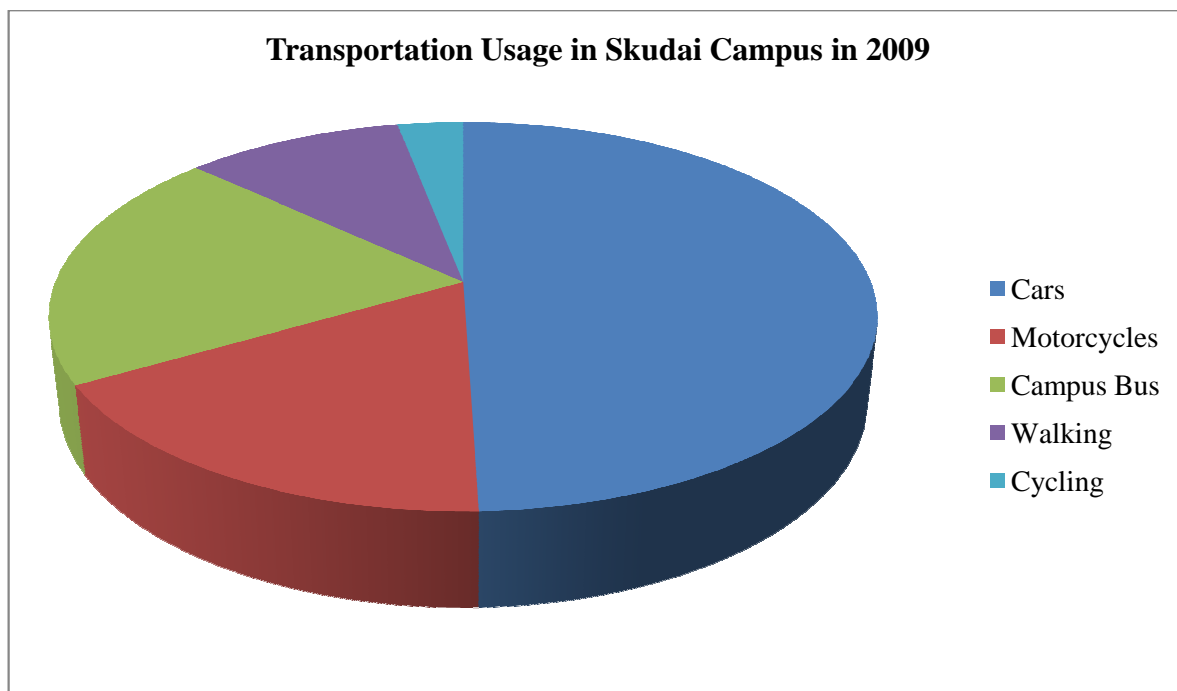
Transport Modes	Staffs (%)	Students (%)	Total (%)
Cars	20%	29%	49%
Motorcycle	4%	13%	17%
Campus Bus	2%	18%	20%
Walking	3%	7%	10%
Cycling	2%	1%	3%

Figure 1-5 below graphically interpreted the transportation Usage in Universiti Teknologi Malaysia (UTM) Skudai Campus.

**Figure 1-5 The Transportation Usage in the campus**

The transportation usage in UTM with respect to the previous campus transportation statistics by (Roshandeh and Othman, 2009) showed that automobile

usage among the staffs and students is the popular mode of transportation. The use of motor cars alone constitutes (49%), followed by Motorcycle (17%), then campus bus (20%) while walking and Cycling make up of (13%) of the total transportation usage.



**Figure 1-6 Represent campus transport usage in pie chart**

The figure above analysed the transportation usage in UTM Skudai campus from the campus transportation survey in 2009.

### **1.3 Research Questions**

This research was conducted to look into issues that are confronting campus non-motorized transport as well as investigating why most staffs and students are not keen to adopt non-motorized transport mode for their short distance travel within the academic, administrative and business area of the campus. This study is intended to look into several meaningful ways of preserving and expanding the role of non-motorized transport in UTM Skudai campus and making the entire campus a

pedestrian friendly environment and a safe environment for bicycle cycling as well as future wheel chair users.

This research asks the following questions as the first methodological step:

1. How can the role of non-motorized transport be preserved UTM Skudai campus as the primary mode of transportation and for short distance travel?
2. In what way can non-motorized transport be improved to encourage UTM Skudai staffs and students walk or cycle as transportation option for short distance trips?
3. How can the available non-motorized transport facilities expand the role of non-motorized transport and encourage non-motorized travel in UTM Skudai campus?
4. What are the natural, physical and environmental factors that will enhance non-motorized transport usage among UTM Skudai campus staffs and students in academic, administrative and business areas of the campus?

#### **1.4 Research Objectives**

The objectives of this study are therefore listed below:

1. To develop a culture that promotes effective use of non-motorized transport facilities in the campus.
2. Improving non-motorized transport condition to encourages UTM staffs and students to walk more in Skudai campus.
3. To expand the role of non-motorized transport in academic and administrative area of the campus and to encourage walking and bicycle cycling as a part of academic and health improvement.



4. To make non-motorized transport convenient for staffs and students and others who show great interest in walking, cycling and wheel chair travel.
5. Improving non-motorized transport facilities, infrastructures and other physical factors that will improve walking and bicycling as part of transportation activity in UTM Skudai campus.

## **1.5 Theoretical Framework**

The theoretical framework is structures that hold or support a theory of a research work. Theoretical framework presents the theory which explains why the problem under study exists. It serves as a basis for conducting research.

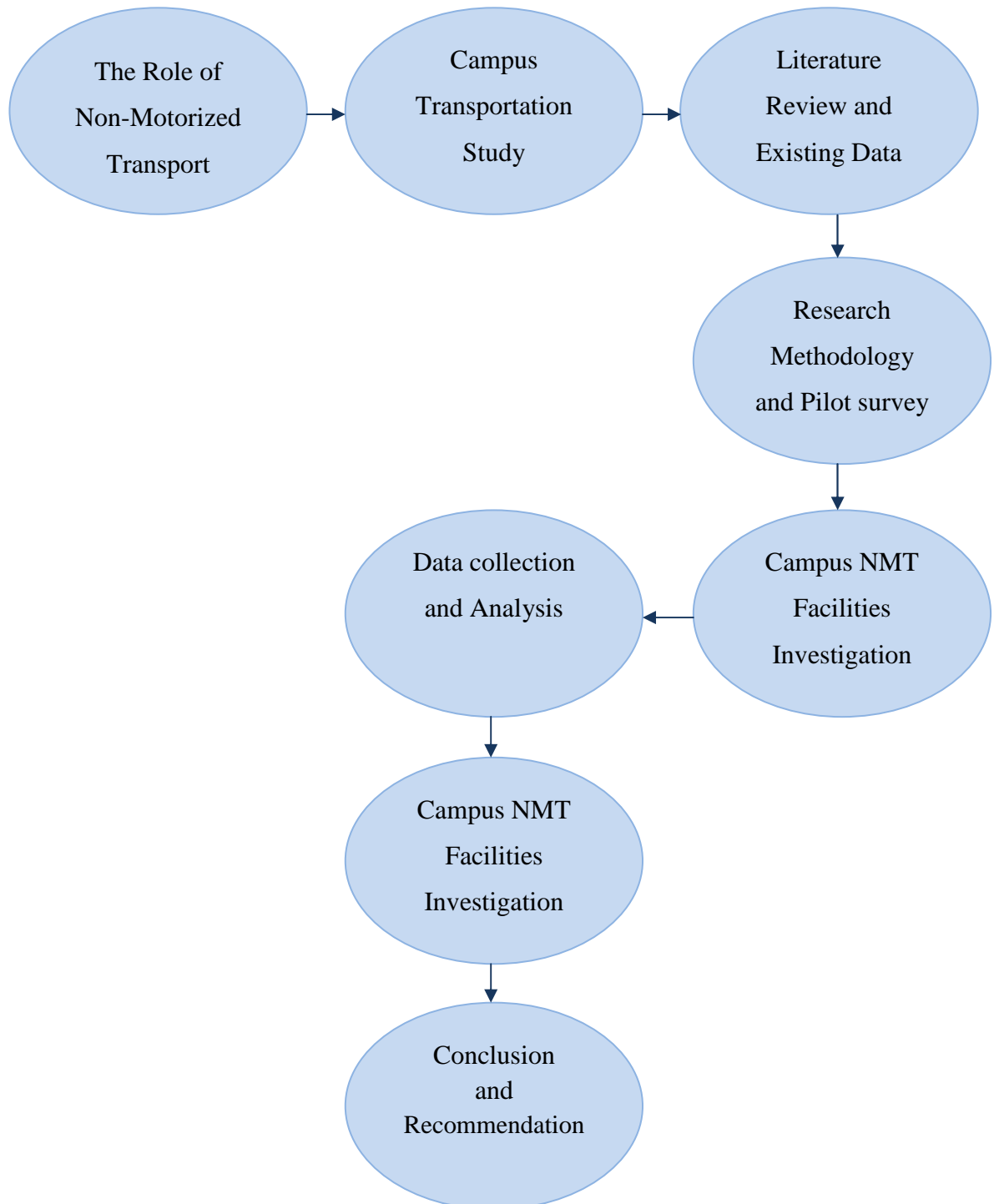
The Purpose of theoretical framework is:

1. To help the study variables to be clearly seen.
2. To provide a general framework for data analysis.
3. It is essential in preparing a research proposal using descriptive and experimental methods.

Therefore, theoretical framework of this study is therefore formulated as follows.

1. To study the UTM Skudai campus non-motorized transport as the basis for the study.
2. Investigate non-motorized transports and how to propose the theory that will meaningfully improve the non-motorized transport in UTM Skudai campus.
3. Investigates non-motorized transport facilities defects that could affect non-motorized transport mobility in the campus.
4. Pilot study, survey and data collection to identify the non-motorized transports users' attitude as emphasized in transportation theory.

5. Recommendations and ideas from other experts to expand the role of non-motorized transport in campus for short distance travel.



**Figure 1-7 Thoretical Frame work Diagram**

## **1.6 Scope of Research**

The scope of this study is to analyse the factors causing declination of non-motorized transport mobility in UTM Skudai campus and strictly reliance on automobile or motorized transport mode for short distance travel. The scope will also evaluate the benefits of non-motorized transport mobility in the campus and UTM staffs and students in Skudai campus can embrace non-motorized transport travel in the activity areas of the campus. This study make use of non-motorized transport data collected between the month of February 2012 and May 2012 and the respondents (or target population) comprise Universiti Teknologi Malaysia (UTM) staffs and students between the age of 18 and 55. These respondents are considered matured respondents and have the ability to make decisions on their choice of travel mode.

The study was conducted in the Universiti Teknologi Malaysia (UTM) Skudai campus, Johor. Data collections were the active data of the UTM Skudai campus, staffs and students as non-motorized transport users available on campus during the data collection process. Interview, survey and data collection process from respondents were be processed and analysed.

## **1.7 Limitations of Research**

This study was conducted in the Universiti Teknologi Malaysia (UTM), Skudai Campus, which is located in Johor state of Malaysia. This campus was chosen for this study due to the size of the campus and the limited time available to perform this study. Universiti Teknologi Malaysia as an Institution of higher learning is officially open for nine hours daily and for five days in a week.

The limitations of this study include the reluctance of target population to respond during questionnaire sampling and interviews, culture and communication differences, time constraints, sampling repetition and weather conditions. Non close relationships with respondents during data collection indirectly limit what is revealed

during data collection. There are other limitations beyond control especially in the field observations such as weather conditions.

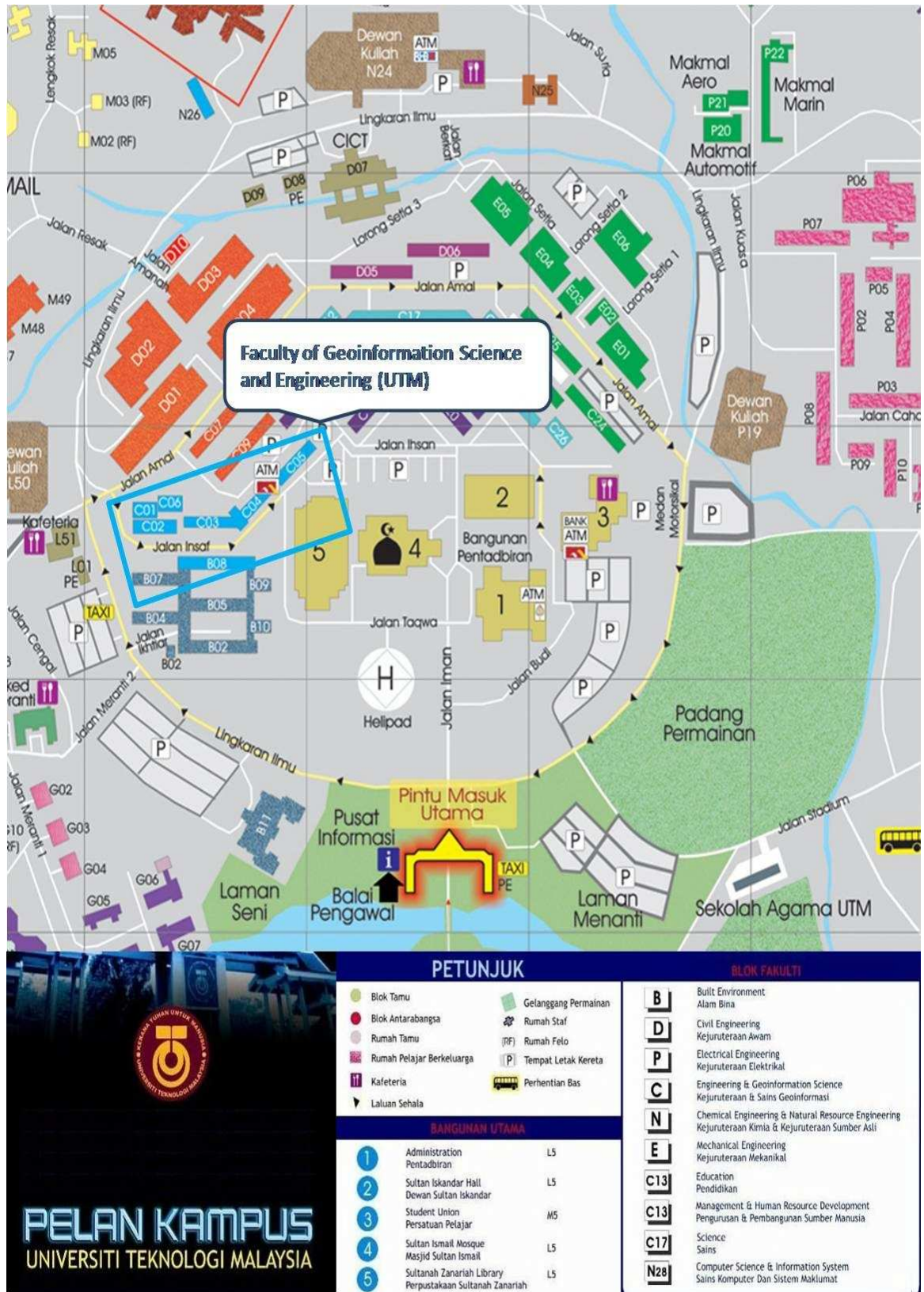


Figure 1-8 Map of UTM Skudai Campus

## **1.8 Expected Contributions**

The outcome of this study is expected to encourage, promote and expand the role of non-motorized transport in UTM Skudai campus, as well as encouraging UTM Skudai campus staffs and students to adopt non-motorized transport for short distance travel within the campus and to minimise private cars dependency in the academic, administrative and business area of the campus. This study will also investigate the safety of non-motorized transport users, and suggest improvement of existing facilities such as walkways, sidewalks, and bicycle lanes, and also safeguarding non-motorized transport facilities from abuse from automobiles to guaranty safety of non-motorized users.

This study is expected to improve the health and protects the academic, administrative and business environment from pollution causes by automobiles, i.e. CO<sub>2</sub> emissions from automobiles which account for almost two-thirds global emission (U.S Environment Protection Agency 2011). Emissions from automobile depend on the number of trips or miles traveled by each type of vehicle each day, which in turn pollute our environment. Therefore, preserving and expanding the role of non-motorized transports will also minimized CO<sub>2</sub> emission in UTM Skudai campus.

Lastly, the outcome of this research is also expected to give an insight into future modification of non-motorized transport facilities and guidelines that will govern non-motorized travelling UTM Skudai campus. It will also help in re-designing future facilities for non-motorized transport usage to promote pedestrian circulation, increase walk ability and enhance campus liveability.

## **1.9 Significance of Research**

The significance of this study is to preserve and expand the role of non-motorized transport in UTM Skudai campus and to encourage most staffs and students to switch to this transportation mode for short distance travels in the

campus. Also, to provide safety and increase the level of comfort that will encourage non-motorized transport (walking and bicycle cycling) mobility in the campus.

Furthermore, to reduce campus automobile congestion and help to make a healthy environment for learning, working and recreation purposes. Since congestion is a problem usually caused by continuous increase in the number of car ownership per head in the campus, and if it is not controlled, it will continue to be a problem and also result to shortage of car parking space in the academic, administrative and business area of the campus (Roshandeh and Othman, 2009). Expanding the role of non-motorized transport will as well minimize level of pollution from automobile and significantly promote healthy living and improve mobility in the entire campus. Walking for health and constant cycling to improve breathing and hearts (Vernez, 2003).

## **1.10 Thesis Outlines**

Chapter 1 presented a brief introduction to the concepts of non-motorized transports, and the importance of non-motorized transport in the context of campus transportation models. It also discussed the problems confronting non-motorized transports in UTM Skudai campus, the problem statement, research questions, research objectives, significance of the study, and the limitations to the research process. Additionally, Chapter 1 summarizes the objectives and presents a brief overview of this thesis.

Chapter 2 presents the relevant background information about Skudai campus, classification of campus non-motorized transport, literature review, common issues of non-motorized transports and approaches. Review of the related literature on non-motorized transport especially walking and bicycle cycling as well as research findings done by other researchers.

Additionally, Chapter 2 presents several merits and limitations of non-motorized transport in general and related to campus transportation model, and an argument is made for alternative methods that can be used to expand the role of non-

motorized transport in UTM Skudai campus. This argument emerges from the perspective of the cost reduction, and from the perspective of obtaining sensitive information.

Chapter 3 presents the methodology used in this study and as well clear preview of data collection process. It explains in details how data were collected from various sources and the approaches used in the data collection. Chapter 3 presents the research design and procedures as well as the selection of the respondents, sample types and size, the development of the questionnaire and data collection procedure. Chapter 3 also summarises description of the strategies and procedures used to analyse data collection as well as validity and reliability.

Chapter 4 present data collection and data analysis, it further described in details the sampling plan used prior to data collection and all the data collection methods used to collect all the useful data that are relevant to the objective of the study. It also summarises interview and questionnaire survey process and performance indicators used to test validity and reliability of the data collection and analysis.

Chapter 5 presents results and findings from data collection and analysis. These findings were used to answer the research objectives and questions. Chapter 5 will present the measurement strategy that will be used in the making of the non-motorized transport planning and decisions making, facilities designs and improvement, quality of service that will improve the non-motorized travel in the campus and safety measures for campus non-motorized transport users among the staffs and students.

Chapter 6 presents the conclusion and discussion as well as suggestions for preserving and expanding the role of non-motorized transport in UTM, Skudai campus.

## **1.11 Chapter Summary**

This chapter gives the introduction and discussed briefly the role of non-motorized transport in UTM Skudai campus as well as the significance and the benefits of non-motorized transports to the campus. This chapter equally gave the background of the problems and the problem statement as well as the formulated research questions and research objectives, including the scope and the limitations of the research.

This chapter also highlighted the expected contributions and possible outcome of this study. However, the next chapter will give clear insights on non-motorized transport in generally with the help of relevant literatures on transportation planning and improvement by different authors.



## REFERENCES

Alkaabi, A. (1999). Evaluation of Large Research Initiatives.

American Association of State Highway and Transportation Officials. (2004). AASHTO Green Book: A Policy on Geometric Design of Highways and Streets (5th Edition). USA.

Alliance for Biking and Walking (ABW). (2010). Bicycling and Walking in the U.S.: 2010 Benchmarking Report, Alliance for Biking & Walking.

American Association of State and Highway Transportation Officials (AASHTO). (2004). Guide for the Planning Design and Operation of Pedestrian Facilities.

American Association of State Highway and Transportation Department. (2010). Public Policies for Pedestrian and Bicyclist Safety and Mobility. 2010.

Ampem, K.D. (2004). Analysis of results.

Anthony, J.R., Elizabeth, S.A. and Arnim, H.M. (1995). Survey Methods for Transport Planning.

Bahari, N.B. and Ismail, B.S. (2009). A Greenway Network for University Campus: Faculty of Built Environment. Universiti Teknologi Malaysia.

Balsas, C.J.L. (2003). Sustainable Transportation Planning on College Campus. Journal of Transport policy 10 (2003): 35-49.

Barter, P.A. (2000). Urban Transport in Asia: Problems and Prospects for High-Density Cities.

Business Reference Library. (2004). Research using Secondary Data Sources.

David, V.H. (2004). *The History of Bicycle*.

Edward, L.F., Gabe, K.R., Shawn, M.T., Ernest, J.B., Cindy, L.E., David, R.H., Jonathan, A.K., Vivian, M.K., James, D.M., Priscilla, A.T., Diane, E. W. and Charlie, V. Z. (2010). *Pedestrian and Bicyclist Safety and Mobility in Europe*.

Florida Department of Transportation Safety Office, Coordinator: Pieratte, P. (2005). *Statewide Survey on Bicycle and Pedestrian Facilities*.

Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., and Tatham, R.L. (2006). *Multivariate Data Analysis*. 6th Edition. Pearson Prentice Hall. New Jersey.

Havlick, S.W. (2007). *The Pedestrian Friendly Campus*. Paper presented at the TDM Tool Kit Conference.

Joseph, J.C. (2009). *Population Sampling Techniques*.

Kassens, E. (2009). *Planning for Sustainable transportation: An International Perspective*.

Lewis, B. and Michael, S. (1995). *Data Analysis: An Introduction*. Sage Publications Inc. ISBN: 0-8039-5772-6.

Macmillan, A.C. (1999). *Sorting Data: Collection and Analysis*. ISBN: 0-8039-7237-7.

Mann, P.S. (1995). *Introductory Statistics, Second Edition*. ISBN: 0-471-31009-3.

Martyn, S. (2008). *Validity and Reliability from Experiment Resources*.

Mehrens, W.A. and Lehmann, I.J. (1987). *Using Standardized Tests in Education*. New York: Longman.

Michigan Department of Transportation. (2009-2012). *Michigan Pedestrian and Bicycle Safety Action Plan*.

Panitat, R. (2007). *The Appropriate Walkway Towards Sustainable Transportation in the University Community*.

Pucher, J and Ralph, B. (2008). *Transport Reviews*. Vol. 28, P.4, P. 495-528.

Richardson, A.J., Elizabeth, S.A. and Meyburg, A.H. (1995) *Survey Methods for Transport Planning*. Eucalyptus Press: Melbourne.

Roshandeh, A.M. and Othman C.P. (2009). *Evaluation of University Technology Malaysia on Campus Transport Access Management*.

Saaty, T.L. (1990). *Analytic Hierarchy Process (AHP)*.

Saunders, M.N.K., Lewis, P. and Thornhill, A. (2003). *Research Methods for Business Students (3rd Ed)*. Harlow: FT Prentice Hall.

Toor, W. and Havlick, S.W. (2004). *Transportation and Sustainable Campus Communities*.

Transportation Research Board. (TRB). Washington D.C., Chairman: Hershfang, A. (2000). *Transportation in the New Millenium. A3B04: Committee on Pedestrians*.

Transportation Research Board. (TRB). Washington D.C., Chairman: Clarke, A. (2000). *Transportation in the New Millenium. A3B07: Committee on Bicycling*.

Travers, J. (2011). *The World Health Organisation Health Benefits of Cycling*.

Trochim, W.M.K. (2002). *Types of Data*. Research Methods Knowledge Base.

Trochim, W.M.K. (2007). *Evaluation of Large Research Initiatives: Outcomes, Challenges, and Methodological Considerations*.

Turner, A.G. (2003). *Handbook on Designing of Household Sample Surveys*.

Universiti Tenaga Nasional Malaysian. (2010). *Universities Transportation Research Forum and Conferences (MUTRFC 2010)*. 21. ISBN: 978-967-5770-08-1.

U.S. Department of Transportation Federal Highway Administration (FHWA). (2001). Pedestrian Facilities Users Guide: Providing Safety and Mobility.

Vernez, A.M and Chanam, L. (2003). Walking and Bicycling. An Evaluation of Environmental Audit Instruments.

Victoria Transport Policy Institute. (2011). Evaluating Non-Motorized Transport: Techniques for Measuring Walking and Cycling Activity and Conditions.

Worthen, B.R., Borg, W.R., and White, K.R. (1993). Measurement and Evaluation in the School. NY: Longman.

Yamane, T. (1973). Statistics: An Introductory Analysis.

Yamane, T. (1997). Program Evaluation: How to Determine a Sample Size.

Y.Bhg. Prof. Dr. Mohd Zulkifli, M.G. (2009). Universiti Teknologi Malaysia History.

## **WORLD-WIDE WEB PAGES**

([www.timeshighereducation.co.uk/world-university-rankings/2011-2012/asia.html](http://www.timeshighereducation.co.uk/world-university-rankings/2011-2012/asia.html))

([www.4icu.org/reveiws/3228.htm](http://www.4icu.org/reveiws/3228.htm))

([www.awards.utm.my/blog/webometrics-ranking-jan-2011-achievement/](http://www.awards.utm.my/blog/webometrics-ranking-jan-2011-achievement/))

<http://www.experiment-resources.com/research-population.html>

<http://www.raosoft.com/samplesize.html>

[http://en.wikipedia.org/wiki/Secondary\\_data](http://en.wikipedia.org/wiki/Secondary_data)

[http://www.steppingstones.ca/artman/publish/article\\_60.shtml](http://www.steppingstones.ca/artman/publish/article_60.shtml)