How Activity-Travel Behaviour Influenced Individuals' Rate of Accident

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TABLE OF CONTENTS

CERTIFICATION OF ORIGINALITY

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree at Petronas University of Technology or any other educational institution, except where due acknowledgment is made in the thesis. Any contribution made to the research by colleagues, with whom I have worked at Petronas University of Technology or elsewhere, during my candidature, is fully acknowledged.

I also declare that the intellectual content of this thesis is the product of my own work, except to the extent that assistance from others in the project's design and conception or in style, presentation and linguistic expression is acknowledged.

Muhammad Hamizan b Ismail

ABSTRACT

By using five consecutive day time-used activity diary survey and household data from entire Malaysia, this study is to examine the influences between individuals' activity-travel behaviour and individuals' rate of accident. From the data, travel behaviour such as number of trips, travel time, and percentage of using certain travel mode of people with high accident rate and low accident rate will be compared to study the differences between them. Generalized Least Square (GLS) method has been chosen as a statistical model to identify what is the most significant variables that influenced individuals' rate of accident.

INTRODUCTION

1.1 BACKGROUND STUDY

Human travel every day. Travel is a derived demand that is based on the needs and desired of individuals (Susilo, Y. O., 2005). In this era, we can see the rise and rapid growth of infrastructure and mode performance, allowing the individuals to modify their activity-travel pattern such as number of trips, use of motorized modes, trip chains, travel time and departure time (Dharmowijoyo, D. B. E., Susilo, Y. O., & Karlström, A., 2016). In order to satisfy their needs, people will not have same travel pattern every day. Activities such as eating, sleeping, and commuting are repeated every day, but others activity such as shopping, personal businesses, and social recreation are random. With better infrastructure condition and mode performance, individuals are able to visit farther places or to visit more locations within closer distances. The better infrastructure condition and mode performance will provide "opportunity" to individuals to have more variability in their activity-travel behaviour (Susilo and Kitamura, 2005; Dharmowijoyo et al, 2015).

Based on Hägerstrand time and space prism (Hagerstrand, 1970), stated that variability in travel behaviours are results of an interaction among constraints, needs, and resources within time and space. Hägerstrand argued that the prism contain by 3 main constraints; capability constraint, coupling constraint, and authority constraint. By considering these constraints, it will help us to understand the way individuals compose their daily activity-travel pattern and adapt to changes time (Dharmowijoyo, D. B. E., Susilo, Y. O., & Karlström, A., 2016). It can be say that constraints control people needs. For example, people maybe want to do some recreational activities or meeting their friends at other places, but the constraints will limit their needs. Next, resources at given time and space activity also effect human daily travel-activity. The example of resources are money, type of modes, and infrastructure at place. Some people might be exposed to an area with several transportations mode to be chosen such as cars, trains, and monorails and some people maybe not. People with more money can travel further than people with less money. This shows that activity-travel behaviour will be limited to the resources that they have. Consequently, these are the factors that will results in human decision making for travelling.

Because of the activity-travel behaviour, it will lead to individuals' participation into a particular mode (Dharmowijoyo, D. B. E., Susilo, Y. O., & Karlström, A., 2016). Participation into chosen mode might influence individual's particulars' safety behaviour and resulting them to the exposure of risk, crash risk, and injury risk – accident (Schepers, P. et al, 2014). Travel behaviour literature commonly distinguishes between traffic volumes, modal split and distribution of traffic over time and space (Van Wee, 2009). Locations of activities, travel distance, and travel time are the factors that play as important roles in accident rates based on the travel behaviour.

1.2 PROBLEM STATEMENTS

The dominant theory for explaining travel behaviour is utility maximization. This holds that people will maximize their utility such as trip, time, cost, and effort to travel. Due to lots of constraints and needs that must be fulfilled, people tend to choose to travel via less safer mode – motorized mode to complete their daily task. This will cause the increasing of traffic volume and distribution of traffic over time and space and will lead to traffic congestion. With the chosen travel mode, people will be exposed to risk in traffic because there are dangers present in traffic and will lead to accident because the number of vehicles exceed the capacity of the road.

Some of factors that need to be considered that related to travel behaviour and accident rate is travel distance. People who travel longer distance may be exposed to danger in longer time than people who travel shorter distance. Besides that, physical conditions during travel play as an important role because people who travel in longer time need to be focused in order to prevent road accident. Next, time of travel also need to be considered because during certain time, there will be increasing in traffic especially after office hour and during festive season. During this time, there will be increasing in traffic volume and it will give an impact to the rate of accident. Because of the travel behaviour also, people are free to choose the path and road taken to travel. Some roads that have severe infrastructure will causes the road users to be involved in accidents.

Thus, this paper will examine what is the relationship between individuals' travel behaviour and rate of accident.

1.3 OBJECTIVES

The objectives of this research are:

- To study the relationship between travel behaviour and accident rate.
- To conduct a survey to analyse activity-travel behaviour of student at Universiti Teknologi PETRONAS

1.4 SCOPE OF STUDY

Basically, this paper will mainly focus on the relationship of activity-travel behaviour towards accident rates of the students and staff in Universiti Teknologi PETRONAS and people from Seri Iskandar. With the range amount of 100 to 200 respondents, a survey in the form of questionnaire will be distributed to a variety of gender, nationality, race, religion and age. This to ensure that the results will consists diversity and variation and can be analysed to study it's effect towards physical health condition.

2 LITERATURE REVIEW

2.1 TIME GEOGRAPHY AND SPACE-TIME PRISM

Time geography is a constraints-oriented approach to understanding human activities in space and time (Miller, 2017). This time geography and space-time prism aims to represent the spatial unit which contains the places frequented by an individual over a period of time (Susilo, 2005). Governed by the constraints, participating in an activity requires people to allocating their environment and time to meet their obligations, needs, and desire. Although, the time geographic approach highlights that space-time constraints on choice imposed by physiological, economic and cultural factors, and the nature of space itself (Fox, 1995). This means that, people ability to travel between space and time is depends on their resources available, for example, time, money, and automobile.

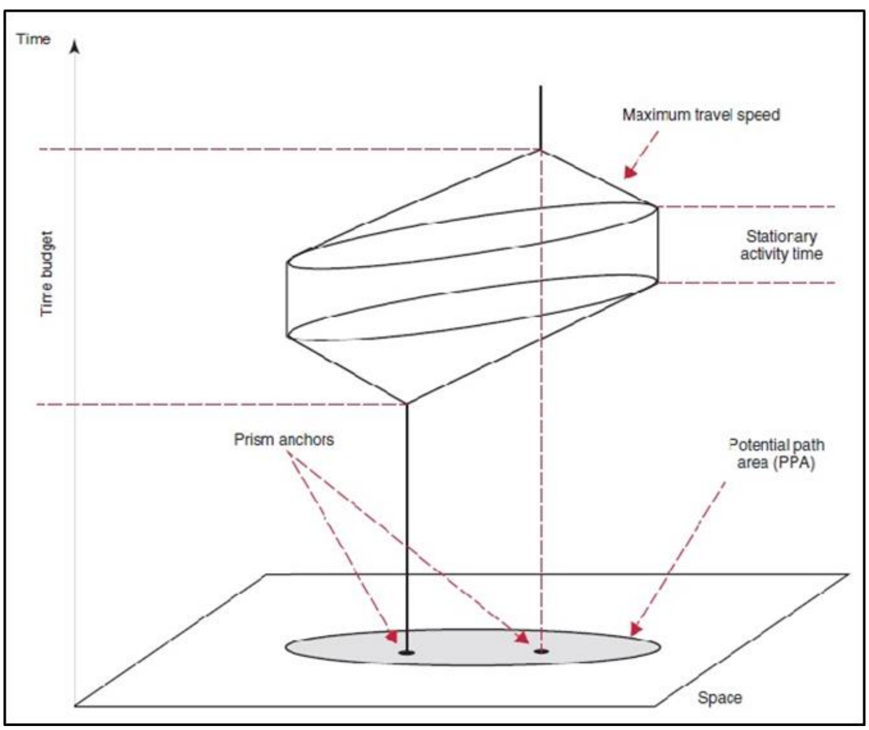

Figure 1: A planar space-time prism.

Figure 1 shows that the space time prism. The volume in space and time in which the individual's physical presence is possible is called prism (Susilo, 2005), which envelope of all possible space-time paths between known locations and times (Miller, 2017). Based on (Hagerstrand, 1970) time geographic approach, individual's space-time prism depends on three type of constraints; capability constraint, coupling constraint, and authority constraint. Capability constraints limit the activities of individuals through their own physical capabilities or available resources. People need to conduct maintenance activities such as eating and sleeping; these require time and place. Coupling constraints define where, when, and for how long an individual has to join with other individuals for shared activities such as work, meetings, and classes. Authority constraints are fiat restrictions over particular space–time domains. For example, a shopping mall or gated community can make it difficult and illegal to enter at designated times, while a public street cannot.

Time geography can help us to understand a wide range phenomena in human and linked human-environmental system (Miller, 2017). Besides that, it can help us to recognize social differences across wide range of factors (age, gender, socioeconomic status, culture) as well as geographic context. Lastly, with time geography and space-time prism, it can help us to study and design transportation system that meets people demand and desire.

2.2 LINKAGE BETWEEN TRAVEL BEHAVIOUR AND ACCIDENT RATE

Travel behaviour literature commonly distinguishes between traffic volumes, modal split, and distribution of traffic over time and space (Van Wee, 2009). Van Wee (2009) developed a model for transport that contains elements that determining travel behaviour: locations of activities, transport resistance (costs) and needs, opportunities and abilities. People travel between locations of activities to perform activities such as living, working, and shopping. Travel takes money and time and incurs non-monetary' costs such as discomfort, which together make up travel resistance. Perceived risk, which is also a type of resistance, is modelled explicitly by an arrow from risk to travel resistance. Besides locations and travel resistance, travel behaviour is also affected by needs, opportunities, and abilities; for instance the need for active travel, the possession of a driving license and car, or the physical fitness needed to walk or cycle. All three categories are influential in all directions. Travel behaviour decisions sum up to traffic volumes, modal split, and the distribution of traffic over time and space (Van Wee and Maat, 2003). Travel decisions taken by individuals before traffic participation such as mode choice and road taken have also been called 'strategic and lifestyle decisions' (Michon, 1985; Hatakka et al., 1999).These decisions result in exposure to risk during traffic participation. Behaviour during traffic participation has been described as tactical and operational behaviour (Michon, 1985).

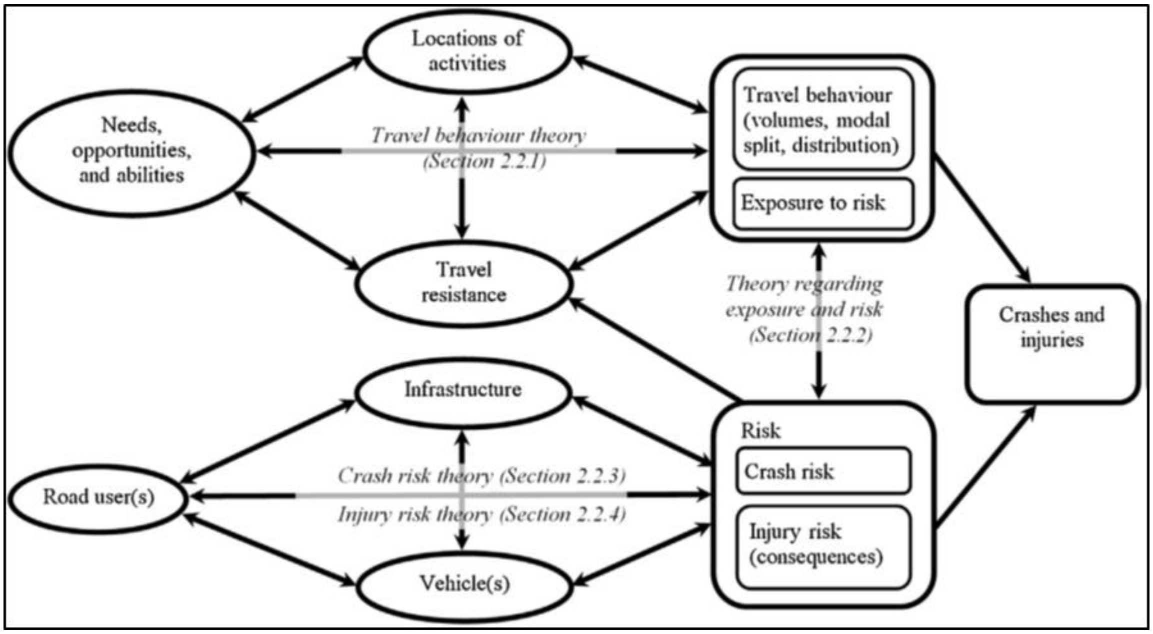

Figure 2: Conceptional framework for road safety, including exposure of risk.

Risk during travel is mainly depend on three factors; road users, infrastructure, and vehicles. Perceived risk, which is weakly correlated to actual risk, influences travel behaviour (Vlakveld et al., 2008). Type of vehicles give the perception of risk (Heinen et al., 2010), for example, travel via motorized mode is more unsafe compare to train. For infrastructure, the condition of the road and the number of previous crashes at a certain intersection may influenced the risk during travel. Because of that, it will give a higher chance of accident to the road user which is the last factor of risk during travel.

3 METHODOLOGY

3.1 PROJECT FLOWCHART

Figure 3 illustrates the project flowchart of the study which proposed the progress of the research work. The flow begins with problem statement and objective. Then it will continue with background and literature study. Next is the characterization and preparation of design survey questions. Data collection will begin after the questions are already prepared through survey. After the data collection complete, exploratory analysis of human travel behavior will be conducted. Then, documentation and reporting work will be the last step.

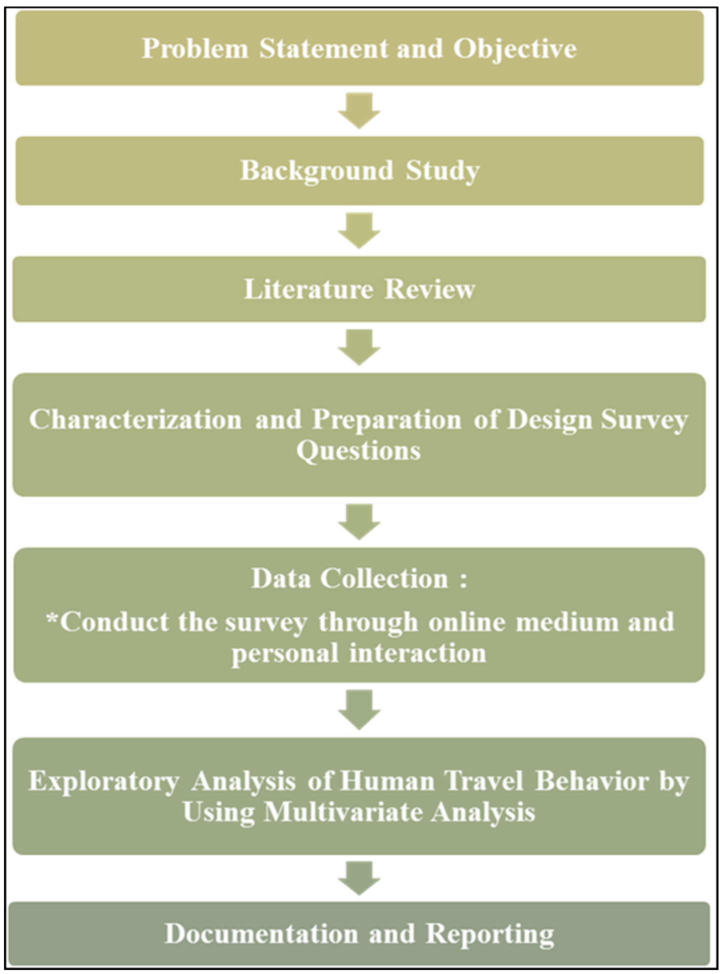

Figure 3: Project flowchart.

3.2 DETAILED RESEARCH METHODOLOGY

In order to capture people's travel behaviour, a comprehensive panel of data set was design at the household level, including detailed travel behavior variables, complete with detailed in-home and out-home activity participation, individual cognition, habits and effective behaviours, and accident related questions. This data set can be divided into three parts, which is survey design, survey implementation, and exploratory analysis.

3.2.1 SURVEY DESIGN

Sets of questionnaires will be designed to study the influence of human activity-travel behaviour on accident rates. The type of data are follows:

Type of Data	Category
Household and individual characteristics question	• Number of household members • Accommodation type • Accommodation ownership • Perceived accessibility • Residential environment quality • Internet access • Total household income • Number of dependent children and their ages • Presence of disable person • Individual with special needs within the household • Respondent's personal characteristics: ➢ Age ➢ Occupation type

	➢ Highest level of education completed ➢ Access to a motorised travel mode
Time-use and activity diary questions	• In-home mandatory activities • Out-of-home mandatory activities • Maintenance activities • Leisure activities • Multi-tasking activities
Accident-related question	• 24-months of location prior to accident event • Type of mode during accident • Time of accident • Type of road (urban, highways, etc.) • Travel distance during accident • Average speed during accident

3.2.2 SURVEY IMPLEMENTATION

This survey will be implement to Universiti Teknologi Petronas (UTP) students and staffs and people who lived in area of Seri Iskandar, also people from the entire country. (Huff and Hanson, 1986) stated that in order to ensure the success of the survey, personal relationships between the respondents and the survey team have to be built. This means that, it will be more easy for the survey team to make the survey inside the campus area because they already have connection between them. Furthermore, the survey also can be done online by sending the questionnaire through email or other mobile application. But, to make the survey outside the campus area which is people in Seri Iskandar, it will be some challenges to find the respondent. This is because the survey team need to explain briefly the purpose of the survey to the prospective respondent and not many of them will have time to do the survey. It is important to timing and planning the survey because it is vital to the data collection process.

3.2.3 DATA INPUT

After the data have been collected, the data will then transfer to the computer. The original data which is in hard copy format will be transferred into a soft copy data. This data input process is done to make the interpretation work become easier. For this study, the data will be transferred into Microsoft Excel.

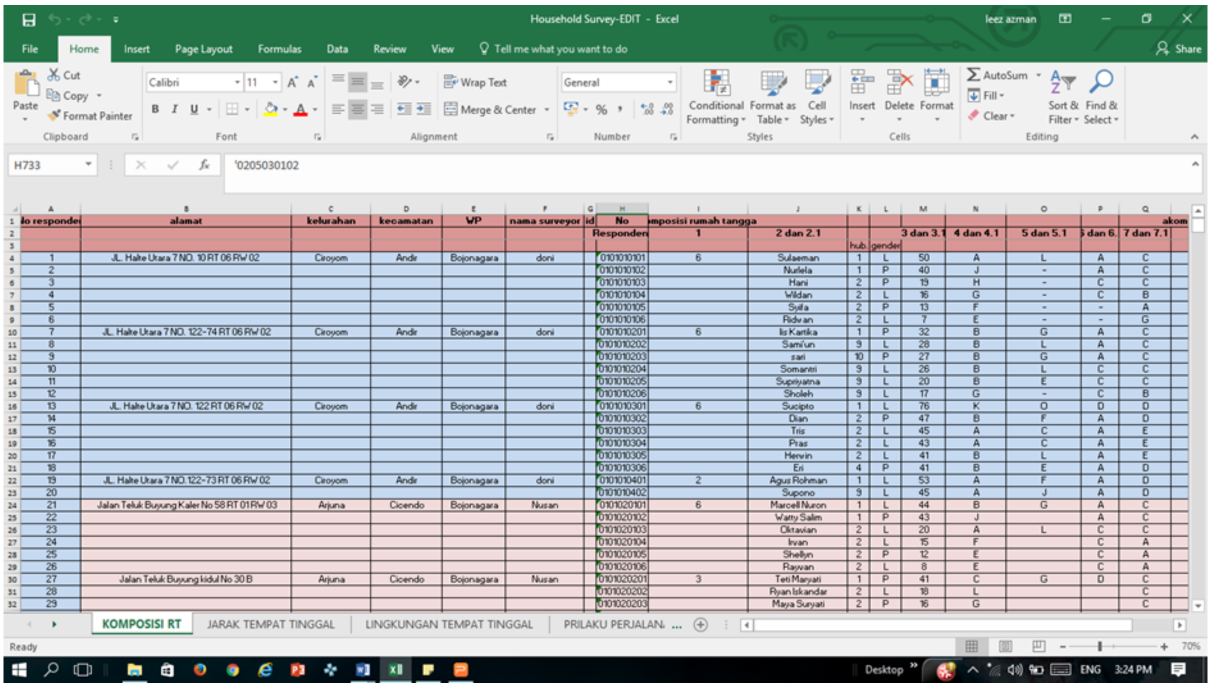

Figure 4: Data input by using Microsoft Excel.

3.2.4 INTERPRETATION OF DATA

After inputting the data into the computer, the data will be interpreted. All the data will be go through one by one to assign the meaning and to determine the significance and implications of the findings. Therefore, after the interpretation of data, it will give a broader meaning of research findings.

3.2.5 ANALYSIS OF DATA

All the data from the survey will be analyzed by using Statistical Package for the Social Scientist (SPSS) software. SPSS software is a data management and statistical analysis tool which has a very versatile data processing capability. Because of the survey offer the people multiple of answer, SPSS software can generate routine descriptive statistical data for question responses, such as frequency counts of closed questions, distribution of multiple-choice question responses etc. Furthermore, SPSS software can explore the relationship between human's travel-behaviour and accident rate and can creating graphical presentations of questionnaire data for reporting, presentations or publications. All the data will electronically store in spreadsheet-like table similar to that of Excel Spreadsheet.

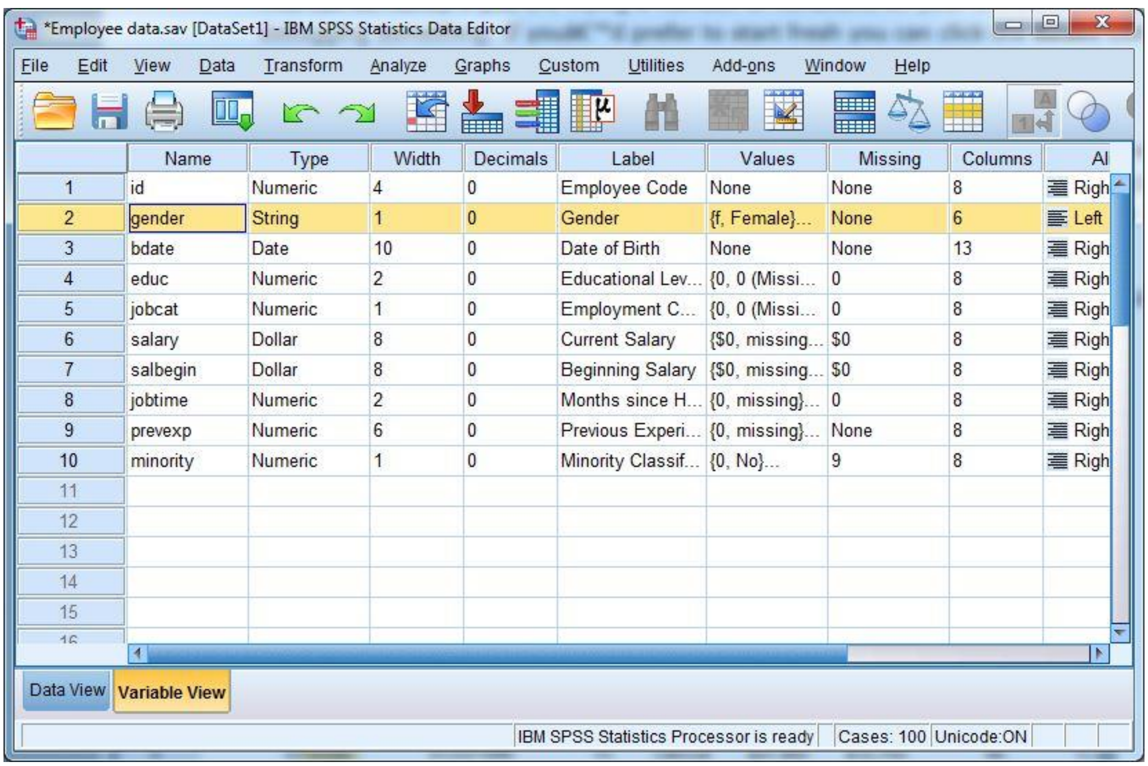

Figure 5: SPSS data input example.

3.3 GANTT CHART

No	Activity	WEEK NO.													
		May-17			Jun-17				Jul-17				Aug-17		
		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
1	Confirmation on Project Title														
2	Preliminary Research and Literature Review														
3	Extended Proposal Writing														
4	Submission of Extended Proposal						19-Jun								
5	Detailed Literature Review														
6	Proposal Defence									03-Jul					
7	Interim Report														
8	Submission of Interim Report Draft													07-Aug	
9	Submission of Final Interim Report														14-Aug

No	Activity	WEEK NO.													
		Sep-17			Oct-17				Nov-17				Dec-17		
		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
1	Preparation of Design Survey Questionaire														
2	Survey and Data Collection														
	Explotary Analysis														
3	Submission of Progress Report														
4	Pre-Sedex														
5	Final Report														
6	Submission of Final Report														
7	VIVA														

4 DATA ANALYSIS

4.1 MALAYSIAN DATASET

The Malaysian dataset includes multi-dimensional information such as household, physical activity and lifestyle, individual's subjective characteristics, time-use and activity diary, and subjective well-being data. The survey was conducted to capture individuals' behaviour in multi-dimensional perceptions and it's relation to individuals' activity with time-space constraints.

The survey contains an activity diary survey for 143 respondents for 77 households from all over Malaysia especially people who lived in Seri Iskandar, Perak area. The activity diary is for 3 consecutive weekdays, Wednesday, Thursday and Friday, and two consecutive weekend days, Saturday and Sunday. The questionnaires were applied in English language and it does not bring any problem to the respondent to understand it even though Bahasa Malaysia is the native language of people in Malaysia. The recruitment process started with direct interaction between surveyors and potential respondents. To ensure that the survey is successful, high commitment from the respondents is required, so, the respondents were asked to sign a commitment letter agreeing not to withdraw from the survey until it was completed. After signing the agreement, the surveyors began to distribute the questionnaires to the respondents. But even though the agreement has been made, they are some respondents who not complete the survey and the respondent will be consider out from this survey. The completed survey will be emailed by the respondents to the surveyors and some was taken directly from the respondents especially respondents from Universiti Teknologi Petronas.

The household data section contained of 3 main sections. First section is household composition that required respondent to give the information regarding his/her occupation, highest education, number of dependent child and number of households and household income. Next section is travel behaviour related question that captured information about the respondent's access to particular type of mode to travel, what travel mode that respondent regularly use, how often respondent experienced an accident and how far respondent’s accommodation from certain locations (e.g. office, bank, school, hospital and supermarket). The last section is health and social related question that contained daily physical activities, social and communication activities and daily lifestyle.

The time-use and activity diary survey captured twenty-one in-home and out-of-home activity classifications, travel duration and mode characteristics. In this study, time-use and activity diary into groups of mandatory and discretionary. Mandatory activities are activities that are impossible to be re-scheduled (Cullen and Godson, 1975). Next, also from Cullen and Godson in 1975 stated that discretionary activities are activities that are easy to be re-scheduled within time and space limitations.

Mandatory activities involved in-home and out-home activities. In-home mandatory activities are activities that performed within the home to meet the individual's basic needs such as sleeping, eating, and personal cares (Dharmowijoyo, D. B. E., Susilo, Y. O., & Karlström, A., 2016). For out-home mandatory activities, it was defined as activities that required people to meet other individuals out-side of their home such as working and studying (Dharmowijoyo, D. B. E., Susilo, Y. O., & Karlström, A., 2016).

Discretionary activities were divided into two groups which is maintenance and leisure. Maintenance activities are discretionary activities that performed to satisfy individual’s and household’s physical and biological condition (Dharmowijoyo, D. B. E., Susilo, Y. O., & Karlström, A., 2016). Example for in-home activities under maintenance activities are tiding up the house, activity with children and online shopping, for out-home, the example are grocery shopping and personal care. For leisure activities, it was defined as discretionary activities that depends on individual’s available time for satisfying cultural and physiological needs either out-home or in-home (Akar et al., 2011). For in-home, home entertainment such as watching television and browsing social media are considered as leisure activity. For leisure activities out-home, some of the examples are window shopping, sports activity, visiting relative, eating outside, NGO activity and vacation. For this study, visiting relative, eating outside and window shopping were put into same variable which is out-home social recreational activities.

Table 1 Profile of the samples used in the study

Variables	Percentage or mean
Socio-demographic characteristic at individual level	
Male	60.1%
Worker, student and non-worker	34.3%, 48.9%, and 16.1%
Low income	31.7%
Medium income	36.6%
High income	31.7%
Aged younger than 22 years old	6.3%
Aged 23-45 years old	86.6%
Aged 46-55 years old	4.9%
Aged older than 55 years old	2.8%
Household Characteristics	
Number of household members	3.76
Number of dependent children per house	0.82
Number of cars per household	1.19
Number of motorcycle per household	0.42
Trips engagement and travel time spent on weekdays (weekends) [a]	
Number of trips	2.1818 (2.1294)
Percentage of using motorised mode	70.86% (85.59%)
Percentage of using public transport	27.39% (0.78%)
Percentage of using non-motorised mode	1.75% (13.63%)
Total Travel Time (min)	64.335 (89.4225)
Time spent for in-home mandatory activities (min)	571.4685 (611.748)
Time spent for in-home leisure and maintenance activities (min)	126.3465 (153.2775)
Time spent for out-home social recreational activities (min)	109.755 (151.0485)
Time spent for out-home sports activity (min)	12.9375 (20.088)

[a] *The values in brackets show the percentage/mean values on weekends, otherwise is on weekdays*

4.2 DAY-TO-DAY VARIABILITY IN INDIVIDUALS' TRAVEL BEHAVIOUR AND ACCIDENT RATE

In the questionnaire, there is 1 question under Travel Behaviour section (B) that related to accident. The question required the respondent to rate how often they experienced an accident in last year and last two years. The subjective characteristic question that related to accident as shown as **Table 2** below:

Table 2 Subjective characteristic question used in the study

Question	Mean
Regarding your mode preference, how often do you involve in an accident in last a year and last two years? 1= Never , 7= Almost every month	1.15(1.17)[a]

[a] *The values in brackets show the mean values of accident rate last 2 years*

Based on the dataset, 16 of the respondents have experienced an accident in last year and last two years, and other 127 respondents have never experienced an accident at that period of time. With the mean value stated at **Table 2**, respondent who put greater value than the mean will consider as people with high rate of accident because the rate is more than average. Then, average time use for travel, number of trips and percentage of type of travel used will be analyze into two groups which is people with high accident rate and people with low accident rate.

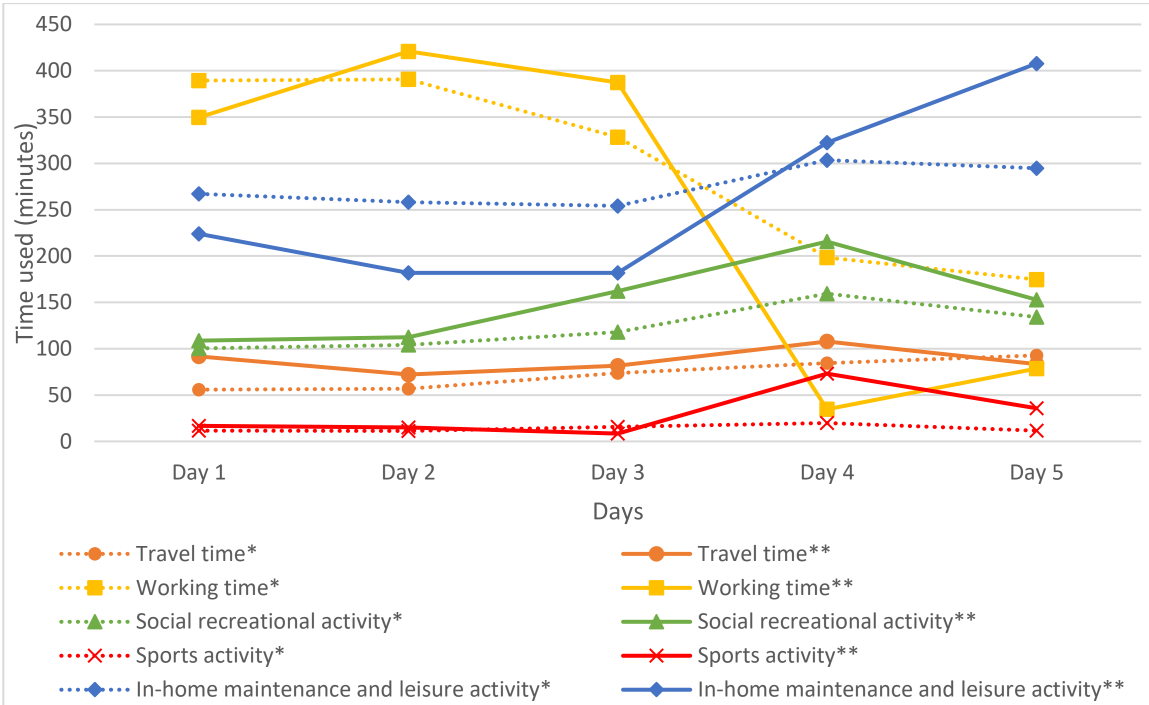

Figure 6a Time used against activity

*** indicate for people with low accident rate ** indicate for people with high accident rate***

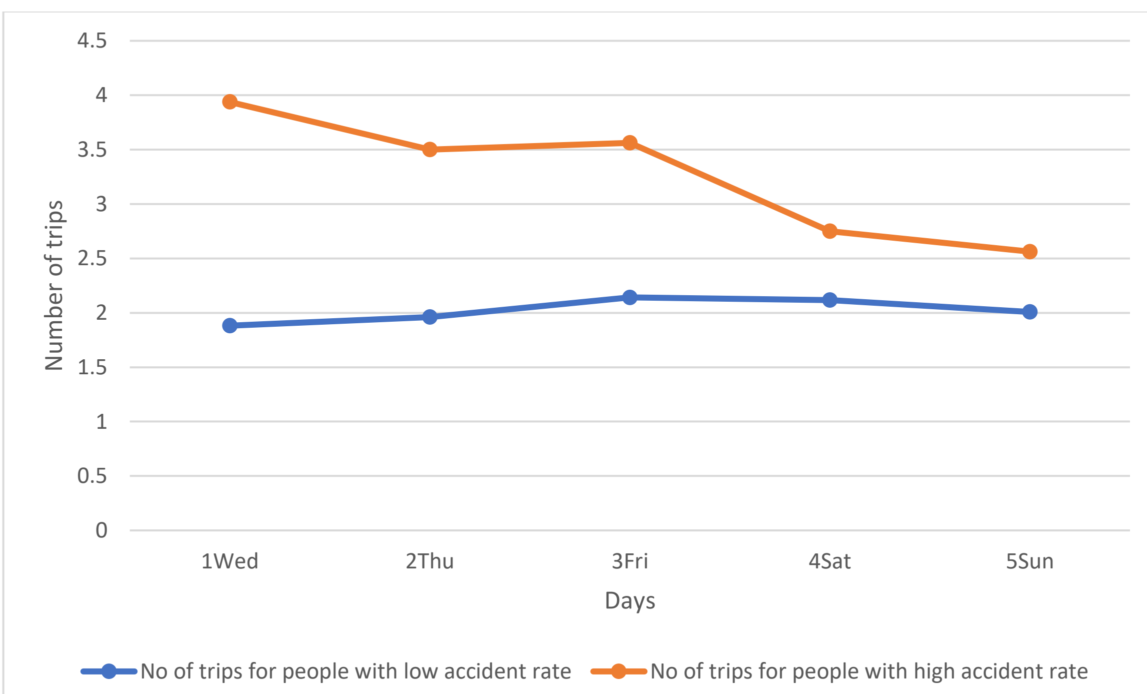

Figure 7b Number of trips for people with high and low accident rate

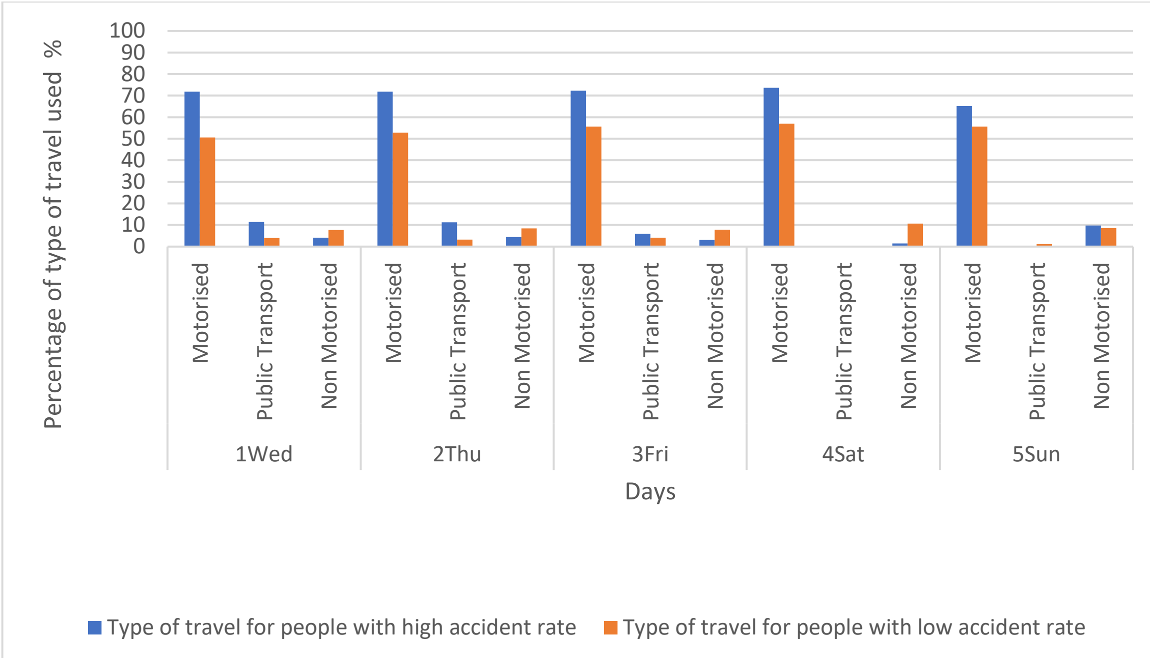

Figure 8c Percentage of type mode used

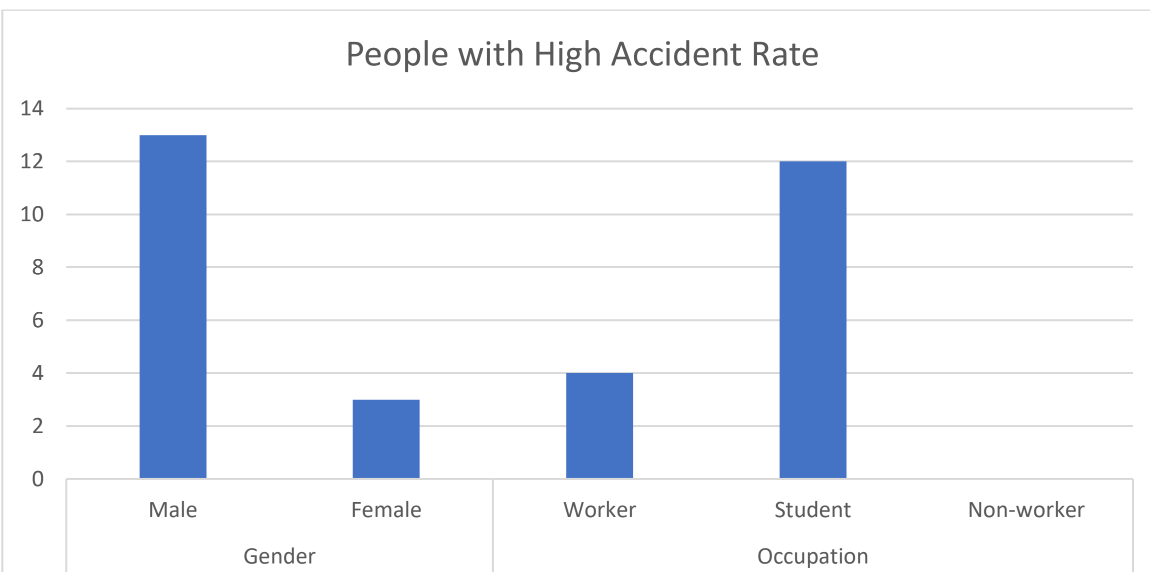

Figure 9d Gender and occupation comparison

Figure 6a shows that travel time used between people with high accident rate and low accident rate. As shown on the graph, people with high accident rate travel more longer than people with low accident rate except during Day 5 (Sunday). People with high accident rate have higher average mean of travel time which is 87.375 minutes compare to people with low accident risk which is 62.3145 minutes. The highest travel time for people with high accident rate and low accident rate are during Day 4 (Saturday) and Day 5 (Sunday). This is because during weekend, people have more free time to travel to do more out-home activity such as social recreational, grocery shopping, and NGO activity.

For working time, people with low accident rate have higher time used compare to people with high accident rate on Day 1 (Wednesday), Day 4 (Saturday) and Day 5 (Sunday). But for out-home social recreational activities and out-home sports activities, people with high accident rate spent a lot more time compare to people with low accident rate for all five consecutive days, except during Day 3 (Friday), people with low accident rate have higher time used for sports activities. For in-home maintenance and leisure activities, during weekdays, people with low accident rate spent more time to do in-home maintenance and leisure activities compare to people with high accident rate. But during weekends, people with high accident rate have higher time used. From the analysis, it can be concluded that people who have higher travel time and do more out-home activities that required them to travel have higher accident risk because they will be exposed to danger more compare to people with lower travel time.

For **Figure 6b,** it shows the average number of trips made per day between people with high accident rate and low accident rate. As we can see, people with high accident rate have higher number of trips (mean = 3.2625) for all 5 consecutive days compare to people with low accident rate (mean = 2.0220). During Day 1 (Wednesday), people with high accident rate have the highest number of trips made per day which is 3.94 trips, and for people with low accident rate is during Day 3 (Friday) which is 2.14 trips.

Figure 6c shows the percentage of type of travel used between people with high accident rate and low accident rate. Type of travel were divided into 3 groups which is via motorised mode (e.g. driving and riding motorcycle), non-motorised mode (e.g. walking and cycling) and public transport. For motorised mode, people with high accident rate have higher percentage compare to people with low accident rate for 5 consecutive days. The day with the highest percentage of motorised mode for the two groups is during Day 4 (Saturday) respectively. For non-motorised mode, people with low accident rate have higher percentage compare to people with high accident rate for all 5 consecutive days. For public transport, people with high accident rate have higher percentage during Day 1 (Wednesday), Day 2 (Thursday) and Day 3 (Friday), and people with low accident rate have higher percentage during Day 5 (Sunday). During Day 4 (Saturday), none of the respondent had taken the public transport. From this, we can conclude that people who travel via motorised mode have higher chance to experience an accident during travel. This is because travel via motorised mode is less safer compare to other modes. But due to lot of constraints for travel, people are still choosing motorised mode as their main travel mode without taking any concerned about the risk of an accident.

4.3 ESTIMATION RESULTS

The relationship between individuals' activity-travel behaviour and rate of accident has been estimated by using Generalized Least Squares (GLS) method in RStudio software. In statistics, GLS is a technique for estimating the unknown parameters in a linear regression model. GLS can be used to perform linear regression when there is a certain degree of correlation between the residuals in a regression model. In these cases, ordinary least squares and weighted least squares can be statistically inefficient, or even give misleading inferences (B.Chu, 2001). Coding that were run in RStudio model as shown in **Figure 10**:

```
data(Data_Malaysia)
library(nlme)
data(Data_Malaysia)
mydata <- read.table("c:/Data_Malaysia2.csv", header=TRUE,
                     sep=",", row.names="id")
Data_Malaysia

model1=gls(AccidentTotal~Gender + Age_Below22 + Age_23_45 + Age_46_55 + Workers
           + Students + Access_Car + Access_Motorcycle + No_Of_Trip
           + Percent_Motorised + Percent_Public_Transport + Percent_NonMotorised
           + TravelTime + Social_Family_Activities + OH_Mandatory + OH_Maintenance
           + Window_Shopping + NGO_Activity + Sports + IH_Mandatory
           + IH_Maintenance + IH_Leisure,
           data=Data_Malaysia, method="ML", na.action="na.omit")

summary(model1)
coef(model1)
```

Figure 10: Coding that were run in RStudio

As we can see in **Figure 10**, rate of accident has been assigned as independent variable. For the dependent variables, all the variables are stated in the results presented at **Table 3** below:

Table 3 Model estimation result for accident rate against variables (values only for significant variables)

Variables	Accident Rate	
	Coeff	*t-stat*
Intercept	3.0195991	6.860553
Male	0.2484695	1.817473
Aged 23-45	-	-
Aged 23-45	-	-
Aged 46-55	-	-
Low-income individual	-	-
Medium-income individual	-	-
Workers	0.4375809	1.863475
Students	-	-
Household number	-0.1201861	-2.182833
Dependent child number	-	-
Access to motorised mode	-0.4559710	-1.712158
Number of trips	-	-
Travel time	-	-
Percentage of using motorised mode	0.0049706	2.360187
Percentage of using non-motorised mode	-	-
Percentage of using public transport	-	-
Total in-home mandatory activity	-0.0131103	-2.840522
Total in-home maintenance activity	-	-
Total in-home leisure activity	-0.0323631	-3.567681
Total out-home mandatory activity	-0.0218649	-4.485515
Total out-home maintenance activity	-	-
Total out-home social family activity	0.0389607	3.621724
Total out-home window shopping activity	-	-
Total out-home NGO activity	-0.0304362	-2.304944
Total out-home sports activity	0.0552800	1.864738

The estimation results show that males, and those who are workers make an average 0.2 and 0.4 of accident rate respectively, compare to females and non-workers in this model.

There is no significant difference between classification of age and income in term of accident rate. Next, people who come from larger households number have lower accident rate than their counterparts.

People with access to motorised mode tend to have lower accident rate with an average of 0.5 less than people with no access to motorised mode. But, people who have higher percentage of motorised mode used have higher accident rate with 0.005. Shockingly, in this model, number of trips and travel time have no significant difference in term of accident rate.

People with more in-home mandatory and leisure activity have lower accident rate and People who make more out-home social family activities and sports activities have an average 0.04 and 0.06 of accident rate respectively than their counterparts. Lastly, people with more out-home mandatory activities and NGO activities have lower accident rate.

5 CONCLUSION

By using the Malaysian dataset and a multi-dimensional 5-days household time-use and activity diary, this study is to investigate the interaction of day-to-day variability of individuals' activity time duration with individuals' rate of accident. From the dataset, the respondents were categorised into two groups which is people with high accident rate and low accident rate. Then, the dataset was analysed to find what is the relation between these two groups with average time use for travel, number of trips and percentage of type of travel used.

After that, the results were further explained to clarify what is the factors that stimulate the end result. The estimation of the result showed that the initial assumptions about this study are positive. This is because people with higher accident rate tend to travel longer and have higher number and percentage of trips and motorised mode used for travel. But, in order to prove the assumption is true, a statistical model has been proposed by using Generalized Least Squares (GLS) method.

From the estimation result, shockingly, travel time and number of trips actually are not categorized into variables that have a significant value that influenced individuals' rate of accident. This is because the proposed statistical model does not split the value of people with high accident rate and low accident rate, but calculate it as general. From the estimation result also we can see that, out-home activities variables have significant differences because people who do more out-home activities will be more exposed to danger of accident when travel. Gender and occupation also play as a major role in this model. Male and workers group have a significant value that can influenced individuals' rate of accident

Further improvement that can be done is to get more number of respondents. With higher respondent, result can be analyzed and be more accurate. Respondent also can be select at an area with more transportation infrastructure so that the outcome of the results will be more variability.

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