



Willingness to Use Overhead Bridge Facilities Based on Theory of Planned Behavior

Komala Devi Sundararajan¹, Kamarudin Ambak^{1,*}, Basil David Daniel¹, Nur Sabahiah Abdul Sukor², Siti Zaharah Ishak³

¹Smart Driving Research Center,

Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor, MALAYSIA

²Faculty of Civil Engineering,

Universiti Sains Malaysia, 14300 Nibong Tebal, Pulau Pinang, MALAYSIA

³Malaysian Institute of Road Safety Research (MIROS),

Ministry of Transport, 4300 Kajang, Selangor, MALAYSIA

*Corresponding Author

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Abstract: Overhead Bridge is the most vital crossing facilities for pedestrian to cross the busy road. This bridge is most important to implement the way to prevent the incident and to create awareness for the pedestrian to take a safety crossing behavior in order to avoid the accident crashes. The objective of this study is to estimate the frequency of overhead bridge usage and the relationship between characteristics and attitude among pedestrian. In understanding this output, Theory of Planned Behavior turned into used in the study to decide whether the characteristics and attitude affect the behavior of pedestrian that concerning the accident. This study was conducted at overhead bridges which located between Ayer Hitam to Batu Pahat. The sample for this study consists of 200 respondents. Set questionnaires which contain 30 items of questions were used to collect the data. The data were analysis using descriptive analysis, correlation analysis and regression analysis. Data was analyzed using SPSS. There were 86 males and 114 females are evaluated the questionnaires. There were 157 respondents are who below 30 years and younger people. Correlation for all the factors of TPB are shows positive linear relationship. Attitude and Perceived Behavior Control show a significant to predict intention. Intention also showed strong relationship to the behavior. Lastly, Perceived Behavior Control showed strong relationship to the behavior. Attitude and Perceived Behavior Control may be having an impact on pedestrian to willing used overhead bridge and prevent pedestrians' accidents and fatalities.

Key words: Overhead bridge, facilities, pedestrian, theory of planned behavior

1. Introduction

Due to the economic growth in the countries, there was a speedy urbanization and an increase in the development of traffic in Malaysia. Transport plays an important role in the contribution to the Malaysian economy. The busy modern lifestyle has increased the value of time. From 2010, there were 1.015 billion automobiles around this world [1]. Road transport offers full freedom to road users to move vehicles from one lane to another and from one another as desired and convenient [2], [3]. Road users can classify as motorcyclists, pedestrians, cyclist, car drivers, van drivers, bus drivers, lorry drivers and other vehicle drivers. Transport and urban planners have intensified their efforts to restore the interior

of the century, however they are regulated by using the community roads law which excludes or transports constrain non-motorized mode [4]. Apart from this, in Malaysia, pedestrian are also the most important travel mode on every day in human society. Traffic accidents have become a major socioeconomic problem and a leading cause of death in Malaysia [5].

When compared to other road users, pedestrians, are defined as Vulnerable Road Users (VRU), are not related to any vehicle mode [6], [7]. They are unprotected (more exposed) during interaction with road traffic system, especially when involved in road accidents unlike other road users inside vehicles with protection “shell”, as well as motorcyclists and cyclists with compulsory/ recommended crash helmet [8]. Road user’s accidents have also been identified as the leading cause of death in Malaysia, after coronary/heart disease, stroke, influenza and pneumonia [9], [10].

There are many studies done on pedestrian crossing. A pedestrian may need to cross the road for any reasons. The decision taken by pedestrian about when, where and how to cross a busy road usually involve a trade-off between safety and convenience [11], [12]. Road crossing is a stimulating decision problem whose analysis may light shade on how humans value their time and their lives, how they perceive their environment, how their behavior changes during crossing, how they apply different tactics for crossing the road and how they interact with one another [13]. In general, pedestrian trip can be identified as a series of decisions from the strategic level to the operational level, each affecting subsequent choices [14], [15]. As the decision of choosing either crossing at the intersection or mid-block is made at tactical levels and change of behavior is obtained at final stage at operational level [16], [17]. To deal with pedestrian traffic problems, various crossing facilities are designed to assist pedestrian in crossing safely, for example, crosswalk (signalized and unsignalized), pedestrian overpass, and pedestrian underpass at intersection [18]. With pedestrian crossing facilities, pedestrians are separated from motor vehicles temporally or spatially [18].

Pedestrian safety is not limited to urban areas only and it is also being considered as a serious road safety problem throughout the country [19]. The Malaysia government strongly recommends the publics to make use of pedestrian in order to reduce the accident rate and increase safety facilities for pedestrian or public walks on the road (Malaysia Road Safety Department). From this, here at Ayer Hitam and Batu Pahat environment area have many types of pedestrian facilities for road users and their safety. Conditions for pedestrian at Ayer Hitam and Batu Pahat area have wide-ranging impacts on whether public transportation services are used, whether student walk to school, college and university. Public perceptions toward the operation of pedestrian facilities are too important to the valuation process. Pedestrian are the most accurate group to identify the process to create a safety and suitable environment for them and options that increase their chances of proper use of prescribed pedestrian preservation [11].

Therefore, this project aims to estimate the frequency of overhead bridge usage among pedestrian. For more detail, to identify the characteristics and attitude among the pedestrian and also to analyze the relationship between characteristics and attitude among pedestrian based on the Theory of Planned Behavior. The construct in TPB is used to determine the relationship between attitude toward the behavior, subjective norm, perceived behavioral control, intention and behavior toward safe crossing among pedestrian. Hence, below shows the hypothesis that test to determine the significance of this construct:

H₁: There is a significant effect on attitude of pedestrian toward intention to use overhead bridge.

H₂: There is a significant effect on subjective norm of pedestrian toward intention to use overhead bridge.

H₃: There is a significant effect on perceived behavioral control of pedestrian toward intention to use overhead bridge.

H₄: There is a significant effect on perceived behavioral control of pedestrian toward behavior to use overhead bridge.

H₅: There is a significant effect on intention of pedestrian toward behavior to use overhead bridge.

2. Literature Review

Road users are who use the streets and highways, such as drivers, passengers, pedestrians, motorists, cyclist and etc. Road users is an important for society to function. For all road users have their own different pathway or lane to use the roads. This indicates that the community development is closely associated with the advancement of transportation. Every year, Malaysia is increasing their population. At 2016, the total population of Malaysia is estimated at 31.7 million people, an increase of 0.5 million people as compared to 31.2 million persons in 2015 with 1.5 percent population growth rate for the same period.

A pedestrian is a person traveling on foot, whether walking or running. In some communities, those traveling using skateboards or roller skates are also considered to be pedestrians. In modern times, the term mostly refers to someone walking on a road or footpath, but this was not the case historically [20]. Pedestrians of all types, including both sexes with numerous aging groups, are always subjected to risk and pedestrians are characterized as the most exposed road users. Young and aged people are always at an increased threat regarding pedestrian mishaps or crashes [15]. As a group, they exhibit a wide range of needs. Pedestrians also vary greatly in age, height, reaction time, visual acuity, physical ability, and awareness of their surroundings [10]. For more information, a person's age, physical ability and cognitive capacity to influence how they behave and react when walking. Pedestrian characteristic with respect to gender also been observed in various studies. Males have a tendency to show more hazardous road crossing behavior the females due to less waiting time. The studies suggest that males walk significantly faster than females while crossing the roads [17].

Pedestrians are particularly vulnerable in the road environment because most other road users are moving significantly faster than pedestrians, and pedestrians have little or no bodily protection in the event of a collision [21]. Pedestrians are also often difficult to see and their behaviors may be unpredictable. International Traffic Safety Data and Analysis Group (IRTAD) suggest that, the majority of the counties that belong to the pedestrians have experienced 30% reduction in traffic fatalities within the same time frame because they are not protected by the safety features that were designed to safeguard vehicle occupants [22].

The pedestrian bridge is one of the road crossing facilities in the system path for pedestrians. Pedestrian bridges are used by pedestrians to cross the busy roads. In addition, the pedestrian bridges can be considered as a tool or crossing facilities the safest and most efficient for pedestrian [23]. It is a form of segregation between pedestrians and vehicles on the road [24].

Provided pedestrian bridges should be able to attract the attention to pedestrian to use when are crossing the road. This is because many pedestrians often feel unwilling to use the pedestrian bridges provided by the engineers [25]. Sometime the time taken by pedestrians is more or less the same when using the pedestrian bridge or not to use when crossing road. Sometimes, pedestrian take longer to cross without using the pedestrian bridge [26]. To ensure that pedestrian bridges are provided to give the maximum return that corresponds to the cost incurred to build, then it should be located in strategic areas and where users do not have to walk far to use it [24]. Therefore, the pedestrian bridge plays its own role in reducing the accident rate involving pedestrians crossing the road, especially at the time [27]. For more information, obstacle such as a fence built along the road leading to the pedestrian bridge is 5 intended to prevent pedestrian from crossing the road without using pedestrian bridges that have been provided [24].

TPB was developed as an extension of the Theory of Reasoned Action (TRA) model. The central premise of this theory is that people make decisions rationally by systematically using accessible information [4]. The inherently conformist nature of human society in general, humans are pressured into following certain rules and displaying certain behavior in society, which conditions the way people behave. The acceptability of behavior depends heavily upon social norms and is regulated by various means of social control. Human behavior is studied by the specialized academic disciplines of psychiatry, psychology, social work, sociology, economics, and anthropology. Concepts that referring to usual way of human behave (behavioral intention) have played vital role in predicting and explaining human behavior [15].

The theory proposes a model which might be usefully employed in this context is the Theory of Planned Behavior [28], which in turn is an adaptation of theory of propositional control [29]. The TPB outlines three main impacts on an individual's decision to engage in a particular behavior [30]. First, is the individual's attitude toward the behavior which reflects the extent to which people believes that the behavior will lead to positive or negative outcomes. Second, is the perceived social pressure to perform or not perform the behavior. Third, is the individual's perception of control over performing the behavior. Based on the studies, it has provided important insights into a number of road safety behaviors, thereby highlighting the potential utility of the TPB in this area. One of the advantages of the TPB is its relative parsimony, for example: it offers a simple model of the proximal influences on intentions and behavior [31]. According to the TPB have supported its ability to predict these behaviors. These TBP are determined by three preceding factors that is the person's attitude towards the behavior, their subjective norms and their perceived behavioral control [32].

Attitude toward the behavior is a person's overall evaluation of the behavior and reflect the degree to which performance of the behavior is positively or negatively valued by an individual. This component have two factors which work together. First, beliefs about consequences of the behavior or known as behavioral belief. The second are corresponding positive or negative judgment about each of these features of the behavior or named as outcome evaluation [33]. According to the TPB, subjective norms (SN) describes the perceived pressure from others to commit the behavior [28]. Subjective norms are individuals own estimate of social pressure to perform the target behavior. There are two components involved in subjective norms and that is normative beliefs and work in interaction. Perceived behavioral control (PBC) refers to how easy or difficult it would be to carry out the act [28]. Perceived behavioral control is the extent to which a person feels able to execute the behavior. Perceived behavioral control refers to people's perception of the ease or difficulty of performing the behavior interest [28]. Intention are assumed to capture the motivational factors that influence a behavior; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior [34]. As a general rule, the stronger the intention to connect with behavior, the more likely should be its performance. Intention and perceptions of behavioral control should interact in the prediction of behavior [35]. Behavior is determined both by the cultural predisposition such a perceptions, thoughts and feelings that are patterned [28]. Any single sample of behavior reflects not only the influence of a relevant general disposition, but also the influence of various other factors unique to the particular occasion, situation, and action being observed [28].

3. Methods

3.1 Site and Sample Size

The locations of this study are conduct at overhead bridges which located at route (Jalan Kluang) between Ayer Hitam and Batu Pahat: 1) Overhead bridges near the schools, 2) Shopping complex and 3) Parit Raja. Some other bridges

are constructing where there are not many lay people. Based on everyone is pedestrians, the respondents of this research are school students, university students, college students, parents, pedestrians and etc.

Samples are drawn from a population without replacement, in which case it is a subset of a population. Elements are selected intentionally as a representation of the study area population. This sample size is reasonably enough to analyses descriptive statistics, multivariate analysis and structural equation model [36]. The sample size was determined using table of sample size determination that introduced by Krejcie and Morgan. The overall population in Batu Pahat area is approximately 401 902 per year in year 2015. So, from the table suggests that confidence level 95% is appropriate and margin error of 5% is sufficient and the sample size (n) from table is 384.

The previous study [37] suggest that a minimum sample size of 200 is appropriate for any Structural Model. From that [38] used 200 as sample size. Hence for this study a total sample size of 200 been determined.

3.2 Measures

A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents [39]. A questionnaire was designed because not any specific questionnaire regarding of overhead bridge facilities on TPB. A questionnaire of pedestrian and TPB was developed based on a pedestrian behavior, consisting of 3 Parts; Part A: Demographics. The questions are asked some basic questions on the respondent's background information and experience or knowledge. Part B: Perceived Quality of Overhead Bridge. The respondents have been asked questions based totally on their self-assessment, their opinion at the bridge and overall quality of overhead bridge. The 5-point Likert scale (very poor, poor, moderate, good, excellent) was employed. Part C: Prediction of Pedestrian User Behavior. The components are intention, attitude toward crossing, perceived behavioral control, social norms, intention and behavior. The respondents' have been instructed to mark scales based on a 5-point Likert scale (strongly not agree, not agree, neutral, agree, strongly agree). The questionnaire was distributed to pedestrians. By conducting this method, data collection was done easily and the perception of each respondent could be determined.

3.3 Tools and Data Analysis

Descriptive statistics provide simple summaries about the sample or data collection that have been made [40]. The demographic analysis described by frequency (percentage) for categorical variable with using pie chart and bar chart. The following perceived quality of overhead bridge was rating based on mean and standard deviation. A correlation exists between two variables of Theory of planned behavior when one of them is related to the other in some way. The coefficient of Pearson correlation measures the strength and direction of a linear relationship between the two variables [41]. Regression analysis is used to ascertain the linear relationship between two or more quantitative variables of TPB [42]. Data analyses were performed using SPSS 20.

4. Results

This research is carried out among the 200 pedestrians, there were 86 (43 %) males and 114 (57%) females. 157 (78.5 %) respondents who are below 30 years, which means the youngest are mostly become pedestrian.

Table 1 - Mean and standard deviation for perceived quality of overhead bridge

Item	Mean	Std. Dev
How do you comfort when using the bridge?	3.80	0.716
Usage of overhead bridge facilities	3.77	0.576
Satisfaction with safety that provide when used overhead bridge	3.28	0.770
Lighting system	2.11	0.719
Design of overhead bridge	3.01	0.521
Cleanliness in overhead bridge	1.90	1.044
Facilities in the environment of the pedestrian bridge	2.82	0.821
Utilities in the overhead bridge	2.77	0.591
Comfort ascending ladder of overhead bridge	2.41	0.822
Overall quality	3.03	0.566

Perceived quality of overhead bridge is very important generally to investigated respondents' comfort, convenience, safety, cleanliness, and overall quality of overhead bridge. The respondent's scale the rating based on their experience when cross the road by using the overhead bridge facilities. As shown in Table 1, the highest mean 3.8 of respondents are feeling comfortable to used overhead bridge when crossing the busy road. The lowest means are 1.90 which respondents felt very poor cleanliness when used the overhead bridge.

The descriptive analysis conducted for Willingness to Use Overhead Bridge Facilities Based on Theory of Planned Behavior using SPSS 20 and the mean score and standard deviation score shown in Table 2. The highest mean value identified is 4.46, shows users agree that an overhead bridge is best facilities to cross the road. The second highest mean value is 4.33 and it is respondent's family and friend will support to use overhead in every day. More than that, the lowest mean point is 2.55, which the item is respondents use a bridge or not depend on the weather. From this can analysis that respondents not much have trouble by using the overhead bridge.

Table 2 - Mean and standard deviation for respondent perception

Item	Mean	Std. Dev
An overhead bridge is best facilities to cross the road.	4.46	.500
In daily activities, use of pedestrian bridges is better than using other crossing facilities.	4.15	.528
Most of the public in this area do not use this bridge for taking a long time to cross the bridge.	4.02	.475
Overhead bridge is a fun and reliable way to cross the road.	4.15	.671
The public does not use this bridge because it has an unsatisfactory safety.	3.37	.803
Bridge built in an inappropriate position on the road.	3.34	.953
Most of public does not use the bridge because far away from that place.	3.87	.456
Bridge builds in places that are not suitable for crossing the road.	3.52	.956
Family and friends will support me in my decision to use the bridge each day.	4.33	1.033
I'm sure in a few days I will use the bridge instead of using the middle of the highway.	3.87	.847
It may be that willing to use the bridge every time.	3.77	.862
Family and my friends have always used the bridge to safety.	4.11	.976
The authorities have arranged a campaign crosses the road.	4.19	.393
I use a bridge or not depend on the circumstances.	2.99	.885
I use a bridge or not depend on the weather.	2.55	.819
I always use the pedestrian bridge for my safety.	4.25	.606
I forced to use the pedestrian bridge to cross the road.	2.60	.833
I believe that the use of the bridge will reduce the level of accidents between pedestrians.	4.17	.640
I'm sure in the next few days, I still use the bridge.	4.18	.653

A correlation value close to indicate association between two variables of TPB. Table 3 shows the correlation between two variables dependent variable and independent variables. As a result, 3 items are target to pedestrian such as Attitude, Subjective Norm and Perceived Behavior Control toward Intention. For this relationship Attitude, Subjective Norm and Perceived Behavior Control become and independent variable and Intention factors become a dependent variable.

Firstly, relation was between Attitude and Intention, the dependent variable is intention and independent variable is Attitude. For intention factors showed a strong correlation ($r=0.271$, $p<0.01$) with attitude factor. Intention factor show a positive linear relationship between two variables. Secondly, relationship between Subjective Norm and Intention, the dependent variable is Intention and independent variable is Subjective Norm. For intention factors showed a strong correlation ($r=0.288$, $p<0.01$) with the Subjective Norm factor. In additional, Intention factor show a positive linear relationship. The last relationship in this model is relation between Perceived Behavior Control and Intention. The dependent variable is Intention and independent variable is Perceived Behavior Control show the strong correlation ($r=0.281$, $p<0.01$) with the intention factor. From this, intention factor shows a positive linear relationship.

For the next model analysis, the relationship between Intention and Behavior. For this relationship the dependent variable is Behavior and independent variable is Intention factors shows the strong correlation ($r=0.446$, $p<0.01$) with Behavior. This relationship also shows the Behavior in a positive linear relationship.

For the last of model analysis, relationship between Perceived Behavior Control and Behavior. The Behavior factor becomes the dependent variable and Perceived Behavior Control becomes the independent variable. Perceived Behavior Control shows the strong correlation ($r=0.281$, $p<0.01$) with Behavior. In additional, Behavior shows a positive linear relationship to Perceived Behavior Control.

Table 3 - Correlation analysis for TPB components

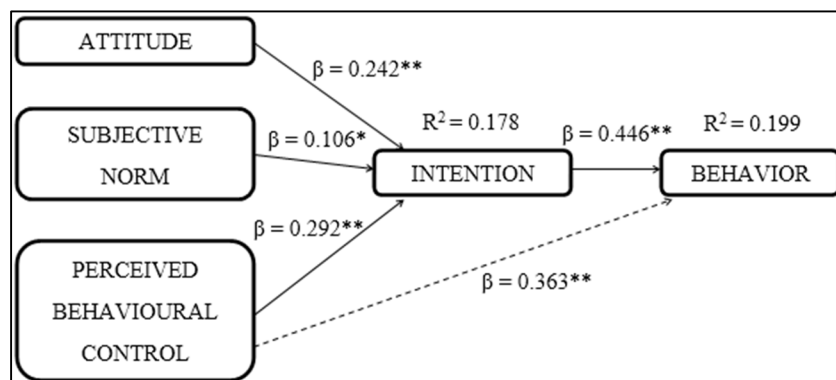
	ATT	SN	PBC	INT	BEH
ATT	1				
SN	.574**	1			
PBC	-.110	.148*	1		
INT	.271**	.288**	.281**	1	
BEH	.284**	.334**	.363**	.446**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

In this study, there are two types regression analysis conducted from TPB model. The first case is multiple regressions, where component Attitude, Subjective Norms and Perceived Behavioral Control (PBC) are independent variable. The dependent variable is Intention. The second type is linear regression with Intention component as independent variable and Behavior as dependent variable. There is also another regression data interprets with Perceived Behavioral Control as independent variable and also Behavior as dependent variable. The Beta values were shown in Model (Fig. 1).

For Attitude ($\beta_1=0.242$), Subjective Norm ($\beta_2=0.106$) and Perceived Behavior Control ($\beta_3=0.292$) show strong relationship to the Intention due to significant value is 0.003 and 0.000 ($p<0.005$). Attitude, Subjective Norm and Perceived Behavior Control show a significant to predict intention. Independent variables related to Intention ($\beta_1=0.446$) showed strong relationship to the behavior due to significant value is 0.000 ($p<0.005$). Simple Linear Regression the independent variables related to Perceived Behavioral Control ($\beta_1=0.363$) showed strong relationship ($p<0.005$) against dependent variable.



** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Fig. 1 - Structural model of willingness to use overhead bridge facilities

5. Discussion

This study aimed about willingness to use overhead bridge facilities based on Theory of Planned Behavior. From the questions given to the respondents through a questionnaire, responses were analyzed and the results obtained based on the objectives acceptable whether it plays a strong relationship or not. From the questionnaire, this section is discussing about demographic of respondent, perceived quality of overhead bridge and discussed about components in TPB that are relationship between variable Attitude, Subjective Norms, Perceived Behavioral Control, Intention and Behavior. Descriptive, correlation, and regression analysis were used to analysis these relationships.

Descriptive statistics analysis was used for respondent’s demographic background, mean score and standard deviation data used to determine perceived quality of overhead bridge. Correlation and regression analysis used to analysis TPB components.

Based on the demographic analysis, most of the female respondents are used the overhead bridge than the male respondents. Based on the respondent’s age, marriage status, education level and occupation students are mostly used the overhead bridge. While, Batu Pahat areas are strategic location with many of primary schools, secondary school and education institute established here such as Universiti Tun Hussein Onn Malaysia (UTHM), Kolej Kemahiran Tinggi Mara (KKTM) and Institute Perguruan Tun Hussein Onn (IPTHO). This show overhead bridge users in Batu Pahat area mostly are students with age with no exceed 30 years. The study also shows education is main purpose of using public bus and frequency using overhead bridge within a week is mostly 5 days.

Several studies have demonstrated the casual relationship between perceived quality of bus service and pedestrian satisfaction. The mean score shows high score in aspect how comfort when using the bridge and the usage of overhead bridge facilities. This is because here Batu Pahat and Ayer Hitam area is strategic location with education institute. Many education people or students are using the overhead bridge when cross the road. Meanwhile, the lowest mean score is cleanliness in overhead bridge. This is showing the in-charge department not very well maintenance to clean the bridges at these areas. Furthermore, some pedestrian does criticism based on the design of the bridge structure. Some old people troubled in ride the stairs and to cross the road using the overhead bridge. Other factors and aspect all are just satisfactory for users.

The objective is to identify and analyses the relationship between characteristics and attitude among pedestrian based on Theory of Planned Behavior. The Theory of Planned Behavior has been applied successfully to predict and explain diverse behaviors such as voting choices, smoking and weight loss [43]. Attitude, subjective norm and perceived behavioral control alone accounted for second highest variance in intention to use overhead bridge. Next, the least variance accounted was between Behavior and Perceived Behavioral Control. As contrast, Intention is the maximum variance accounted in behavior to use overhead bridge. It is evident from the analysis that intention more closely associated with behavior.

The correlation coefficient of each component was all correlated to behavioral intention and also reached the significance level. The correlation analysis shows that variables intention and behavior strongly correlated and there is strong relationship between these two variables. Similar to past study [44] intention is strongly associated with behavior compared with attitude linked with intention. The regression analysis shows that intention was found to contribute uniquely to the prediction of behavior. [45] report a corresponding intention and behavior relationship is high in previous study. The next high regression value is Perceived Behavioral Control that contributes to prediction of Behavior.

The strongest variable to predict the behavioral in this research study was attitude. Studies emphasizing eating behavior show a relatively strong relationship between attitudes and behavioral intentions. The intention and behavior relationship is most significant. Several studies have shown that self-identity explains additional proportions of the variance in intentions over and above TPB variables. The motivational factor intention the influence a behavior: they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior [43]. As could be expected, this finding means that overhead bridge from Ayer Hitam and Batu Pahat who had the most positive behavioral belief and attitude towards behavior were the ones who intend to use overhead bridge.

6. Conclusion

The aim of this study was to identify the characteristics and attitude among pedestrian and to analyses the relationship between characteristics and attitude among pedestrian. In conclusion, the youngsters are used this overhead bridge for their daily life to cross the road and went to school or other places. Theory of Planned Behavior was used to specify the nature of relationships between beliefs and attitudes. According to these models, people's evaluations of, or attitudes toward behavior are determined by their accessible beliefs about the behavior, where a belief is defined as the subjective probability that the behavior will produce a certain outcome. Specifically, the evaluation of each outcome contributes to the attitude in direct proportion to the person's subjective possibility that the behavior produces the outcome in question. Moreover, pedestrian behavior which have become habits ought to be cause them willing to used overhead bridge and lead to the factors that influence them to take better preference to crossing road.

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