

A Study Towards Pedestrians' Usage and Behavior on Footbridge

Muhammad Adam Haiqal Syahrannizam¹, Muhammad Hafiz Mohd Shahrol¹, Nur Haziqah Muhamad¹, Nor Baizura Hamid^{*1}

¹Department of Civil Engineering, Centre for Diploma Studies,
Universiti Tun Hussein Onn Malaysia, Pagoh Education Hub, 84600 Pagoh, Johor,
MALAYSIA

*Corresponding Author Designation

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Abstract: According to the statistics published by MIROS in 2019, road accidents related to the pedestrian are ranked third after car and motorcycles. Pedestrians' injury whenever they get involved in an accident, will have a greater impact compared to motorcycles and cars because they are most exposed to higher risk as they do not have safety protection equipment when using the road. This study aims to investigate the main factors that influenced pedestrian behavior during crossing roads. Besides that, this study also wants to analyze primary data that have been collected and providing beneficial solutions by giving control measures for pedestrian safety. In this study, two locations of footbridges were selected which are the Astaka Shopping Center and Bentayan Bus Station. Both locations are situated in an urban area with considerably high pedestrian volume. Data were obtained through questionnaires given to 75 respondents at both locations. Next, other primary data were obtained through observation, questionnaires, and interviews. Data were analysed using descriptive analysis. Based on the survey and observation, the main factors that influence pedestrian behavior at study locations are the condition of the footbridge, the ease to have an access to the footbridge and the law enforcement is encouraging pedestrians for using the footbridge. The results of the pedestrian safety study among the pedestrians showed that all four variables of pedestrian behavior, road user behavior, authorities' action and also the condition of footbridges were at unsatisfactory levels. 60.7% of the respondents neglect using a footbridge to save time and 94.7% of the respondents said that they had never been fined by authorities for not using a footbridge to cross the roads. Several recommendations were put forward to improve safety among pedestrians. Cooperation between the government and community are important in providing a safe path for pedestrians to cross roads to their destination.

Keywords: Footbridge, Pedestrian, Pedestrians' Safety

1. Introduction

According to the statistics of road accidents in Malaysia, pedestrian fatalities ranked third highest after car and motorcycles fatalities for the year 2009 until 2018 [1]. This has shown a significant number of fatalities among pedestrians and a comprehensive study needs to be done so that the cumulative number of pedestrians' fatalities can be decreased. One of many ways to ensure that is by making segregation between pedestrians and other road users that has been recommended by WHO to reduce the pedestrians' exposure to the road as pedestrians are very risky when they are on the road, especially children. [2]. Based on this study, it can find out the problem that usually occurs among pedestrians as they cross the road. Refer to Landa-Blanco [3], pedestrians tend to choose the quickest way to reach the destination and this has been the study's main objective, which is to investigate the main factors that influenced the pedestrians' behavior during crossing the road.

After the data has been collected, it will be examined thoroughly at it will describe the factors that influenced pedestrians' behavior and perception during crossing roads. This finding hopefully will reveal solutions that can decrease the number of road accidents related to pedestrian casualties due to the failure of using public facilities provided such as footbridges as a way to reduce pedestrians' exposure to vehicular traffic [2]. Before any field survey was conducted, there are several journals and articles has been collected and examined thoroughly so that better understandings and comprehension regarding the current situation that relates to the pedestrians, footbridge and also road safety in Malaysia.

Figure 1 shows the summary statistics of fatalities among different types of road users across Malaysia within 10 years back, from 2009 until 2018.

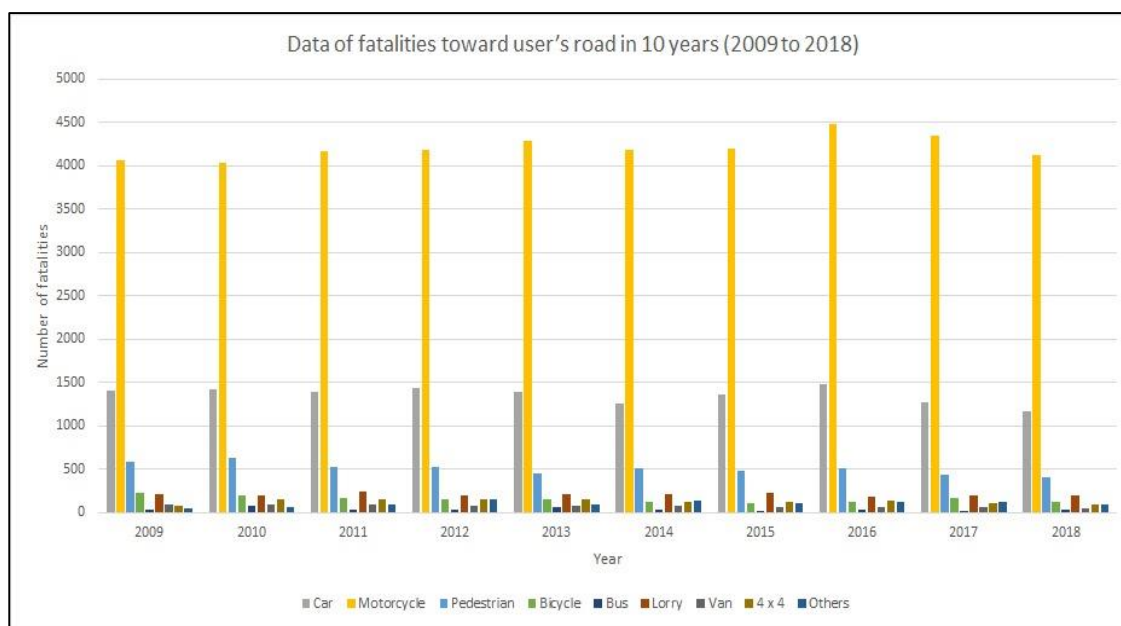


Figure 1: Data of Fatalities towards Road User in 10 years

Referring to **Figure 1**, almost every year, various types of the accident had occurred includes accident that related to pedestrians within 10 years back, from 2009 until 2018. From the figure, it illustrates that over the years, there will be road accidents happened and it includes all types of road users including pedestrians. Over the past 10 years, there are inconsistencies in accident rates among pedestrians as in 2009, the number of fatalities is 589 people and the following year is 626 fatalities. After 5 years, the fatality rate decreases to 482 people but as in 2015, the fatality rate increases to 511 people in 2016. In summary, these results indicate that several factors led to the fatalities among pedestrians and comprehensive solutions must be provided to overcome that problem and also flatten the fatality graph.

1.1 Pedestrian

In a study by Landa-Blanco [3], several criteria need to be considered to determine the factors affecting the pedestrians' usage and perception of the footbridge. One of many factors related to it is the vehicle condition. The speed and density of vehicles of a certain area play an important role in the usage of footbridges in that particular area. The number of vehicles that are using the road is inversely proportional to the number of footbridge usage as when the number of vehicles increases, the number of footbridge usage decreases and vice versa. Another factor related is the perception among pedestrians towards the footbridge itself needs to be considered as pedestrians want to reach their destination immediately and by using footbridge as their passageway, it will make their travel time longer than usual, so they end up not using the footbridge [4]. Another example of pedestrians' perception is the safety issues regarding the footbridge as the footbridge was built passing through road at a higher altitude has made the pedestrians that are scared of heights did not use the footbridge.

1.2 Footbridge

The word 'footbridge' is one of the keywords that need to be high-lightened as it plays an important role in this study. The purpose of building a footbridge varies based on its location, but its core purpose still stays the same, which is to connect pedestrians to a certain destination from a public transport [4] and also to prevent a pedestrian from walking near the traffic that leads to secure the safety of pedestrians that are crossing the roads [2]. In building a footbridge, that are several criteria that need to be considered to meet the needs and the main purpose of the building. The angle of the footbridge's stairs and the height of the handrails are examples of the criteria to be considered as they will influence the usage of the footbridge [4]. Next, a good footbridge needs to be built in a strategic location which is located is essential in building a footbridge.

1.3 Road Safety Situation

From time to time, the population growth among Malaysian is growing rapidly which leads to the increase of vehicles and congestions of road users. Since the number of road users increasing, it also means the rise of accidents' percentage in Malaysia. According to a research, the largest number of pedestrian deaths is among 6 to 10 years old most of the accident occurs during the night [5].

2. Methodology

The study was conducted according to the flow chart as shown in **Figure 2**. The figure shows the procedures that were taken throughout this research was conducted.

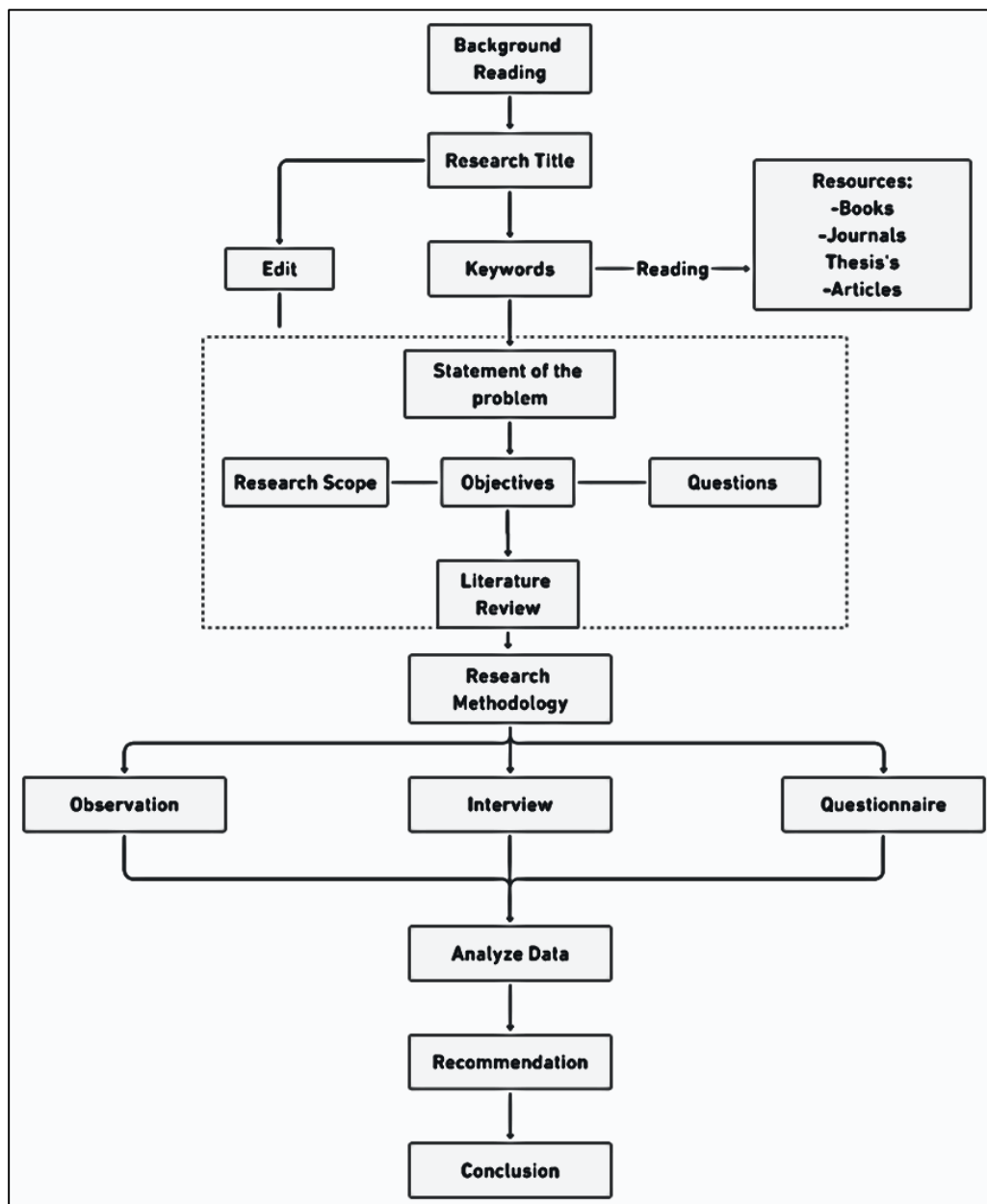


Figure 2: Flow Chart of Methodology

2.1 Location Identification

Muar district was chosen as the location of this study because that is a crowded place as it is often the attraction of many peoples. The study cases are located close to bus stations, petrol stations, wet market, supermarket, car parking, restaurants and a few rows of shophouses. For the study case, there are many footbridges here but only two locations of footbridges were chosen as a study field. As mentioned, the two footbridges that will be analyzed are in front of Astaka Shopping Mall Center, Muar (Figure 3) and near Bentayan Bus Station, Muar (Figure 4). Both are considered suitable locations for this study because of strategic places and the attraction of many pedestrians.



Figure 3: Footbridge in front of the Astaka Shopping Mall, Muar



Figure 4: Bentayan Bus Station, Muar

2.2 Data Collection

This research focuses on analyzing primary data which is observation, questionnaire and interview methods.

2.2.1 Primary Data

In primary data, three methods have been used which are observation, questionnaire and interview.

2.2.1.1 Observation

For the observation method, it has to carry out the objectives of this study that to investigate the main factors that influenced the pedestrian's behavior during crossing roads. Other than that, the observation method also to reviews the footbridge performance and structural safety features of the footbridge. The researchers used research instruments such as observation forms, checklists, and snapshots to carry out site observations. More efficiently, the checklist has been carried out during peak times, which is on Thursday for weekdays and the weekend is on Friday. It focused on pedestrians who used the footbridge and did not use the footbridge when crossing the road. It will help this study to get

accurate data as evidence to shows the use of footbridges for this study area was lack. Furthermore, it can improve the function of existing and future footbridges. Lastly, the snapshot performs in this study. It focuses on the damaged parts of the footbridge that can affect the use of using the footbridge. It will be processed in detail so that the objective of the study will be achieved. So, the checklist and snapshot in the observation method are related to obtaining accurate and suitable data for this study. It is because both observation methods can make it easier for researchers to get and an analysis the data of the study conducted.

2.2.1.2 Questionnaire

The second method used is a questionnaire. Google Form has been used because the data obtained will be stored and easily analyze in detail. Besides, this medium can contribute and answer by the various number of respondents without consideration of their ethnicities, religion and race. In this questionnaire, the questions posed to the respondents were based on three main aspects, namely, the perspective of pedestrians toward the footbridge, the condition of the footbridge, and law enforcement. These three aspects need to consider as this can lead to non-use of the footbridge by pedestrians. This questionnaire also consists of two types of question forms, namely scaled questions and straightforward questions. The selection of this type of question is to make it easy for the respondent to answer quickly and well. In addition, these two types of questions also make it easier to analyze the questions using the data obtained. From the question that will be given out to passersby, the data obtained can show the level of understanding about the importance of using footbridges.

2.2.1.3 Interview

In this study, the interview method was conducted to obtain the information of the purpose for this study which is to investigate the main factors that influenced the pedestrian's behavior during crossing roads and the structure of the footbridge conditions. These interviews were conducted by targeting several small hawkers in shops around the study area because they are sightseeing and bus drivers. It is because they are the closest group of observers in the study area. It will make it easier to get the necessary information.

2.3 Data Analysis

In the questionnaire, it was constructed into 2 types of questions, which are a scale-type question and straight forward question. The scope of the questionnaire covers 3 main categories for this research, which are the pedestrians' perspective towards the usage of a footbridge, law enforcement in enhancing the usage of a footbridge and lastly, the footbridge itself. The main reason for these divisions is to give a better and a comprehensive understanding of the factors that influence the pedestrians' behavior in using the footbridge.

Respondents were selected not based on their gender, religion or level of education, but they were selected based on criteria in which they were seen crossing the road without using footbridges, and respondents were also selected to are workers that working near footbridges. This is because, for workers to reach their workplaces, they must cross the road, but what differentiates them is the path they take to cross the road, either by using a footbridge or simply crossing the road directly. However, every behavior they adopt has its reasons. Therefore, several questions are asked in identifying the factors that influence their way of crossing the road.

For the pedestrians' perspective towards the footbridge, it asked respondents regarding with their daily usage of footbridge and they were given a situation or scenario that will shows their response towards it. As for example, respondents were given a situation in which the roads ahead of them is having a traffic jam and respondents were asked whether they will use the footbridge or just walk through the traffic in order for them to cross roads. From the question, it will show either they are using the footbridge due to the road condition or they use it because of their understandings towards the

purpose of using footbridge that will prevent pedestrians from the traffic that will reduce the possibilities of having an accident.

As for the next categories, the questionnaire asked respondents regarding the law enforcement by the local authorities in enhancing the usage of a footbridge. This is to have a better understanding of either the local authorities played an important role to advocate people to use footbridges or not. Respondents were asked whether they had ever been fined by the local authorities for the offense of not using a footbridge to crossroads. Besides that, respondents were also asked either they had ever seen any advertisement or brochure encouraging people to use the footbridge and explaining to them the purpose and benefits of using the footbridge. From these questions, it will show impact the impact of local authorities' work in increasing the rate of footbridge usage.

Last but not least, the questionnaire also asked respondents regarding the footbridge. Respondents were asked either the condition of the footbridge meets with their satisfaction or not. For example, respondents were asked either they feel satisfies with the footbridge's maintenance in preserving the footbridge from any defects and whether or not they have seen any cracks on the footbridge's structure. Besides that, respondents were also asked about the design of the footbridge including the width and height of the stairs, the lighting and the accessibility to use the footbridge, either the footbridge is user friendly or not, that can be used not only by the normal pedestrians but also by the disabled pedestrians. From these questions, it can show either the footbridge was designed according to the needs of the pedestrians or not.

3. Results and Discussion

This section presents the result of the research obtained through the questionnaire that focusing on targeted people around Muar city. This result of the research shows in terms of tables to make it clear and easy to understand. Regarding the number of data, it is collected from 75 respondents.

3.1 Scale Question

Table 1 shows the summary of answers given by 75 respondents in total from the questionnaire for scale questions.

Elements	Questions	Strongly Disagree (1)	2	3	4	Strongly Agree (5)
Footbridge's Condition	Footbridge's structure is safe.	5 (6.7)	11 (14.7)	10 (13.3)	26 (31.4)	23 (30.3)
	Footbridge's maintenance satisfactory.	17 (22.7)	17 (22.7)	18 (24)	11 (14.7)	12 (16)
	The footbridge's lighting is good.	13 (17.3)	20 (26.7)	15 (20)	14 (18.7)	13 (17.3)
	The footbridge is user friendly (able to be use by pedestrians and handicapped)	26 (34.7)	20 (26.7)	13 (17.3)	10 (13.3)	6 (8)
	Satisfactory of the footbridge's width and height	11 (14.7)	17 (22.7)	5 (6.7)	20 (26.7)	22 (29.3)
Pedestrian Perspective	Frequency of using footbridge.	11 (14.7)	28 (37.3)	25 (33.3)	7 (9.3)	5 (5.3)

Notes: number of respondents (percentage %)

Table 1 presents the elements that were covered in the questionnaire, which is regarding the condition of the footbridge and the pedestrians' point of view towards the footbridge. Based on the table, it is clear that the pedestrians strongly disagreed that the footbridge is not user-friendly (34.7%). This is because there is no exclusive lane provided for the handicapped and this condition does not consider the disabled people that want to crossroads through a footbridge. This finding is contrary to the characteristics of a good footbridge that was mentioned by [6] that stated that footbridge must be able to access not just pedestrians, but also people with disabilities. The next section of the question asked respondents regarding their satisfaction with the footbridge's lighting. Out of 75 people who answers the questionnaire, 26.7% of the total respondents claimed that they are not satisfied with the footbridge's lighting. Several people mentioned that if the frequency of people that used the footbridge during the day is low, let alone during the night with the bad lighting especially during the night. That statement correlates with the next question as it shows 37.3% of the respondents rarely use footbridges whenever they want to crossroads. This situation must be solved by providing a safe condition for users whenever they want to use a footbridge by providing good lighting, especially at night as was mentioned by [7].

3.2 Straight Forward Questions

Table 2 shows the summary of answers given by 75 respondents in total from the questionnaire for scale questions.

Table 2: Straight Forward Question

Elements	Questions	Yes	Sometimes	No
Footbridge's Condition	Have you ever seen any cracks on the footbridge's structure?	38 (50.7)	-	37 (49.3)
	I cross the road without using footbridge to save time.	45 (60)	19 (25.3)	11 (14.7)
	I use the footbridge if the road is busy.	39 (52)	15 (20)	21 (28)
	I will not the footbridge if the road is disserted.	47 (62.7)	13 (17.3)	15 (20)
Pedestrians' Perspective	I will use the personal torchlight when using the footbridge in the dark (Example: At night).	33 (44)	31 (28)	21 (28)
	If you had the choice of either using the footbridge or not, what would be your choice? (If the footbridge is located far from you)	36 (48)	-	39 (52)
	Have you ever been fined for not using a footbridge?	4 (5.3)	-	71 (94.7)
Law Enforcement	Have you seen advertisements or announcements regarding the campaign to promote the use of footbridge to the community?	9 (12)		66 (88)

Notes: number of respondents (percentage %)

Table 2 represented the respondents' choice of the question studied and is divided into 3 elements that are relevant to the condition of the footbridge, pedestrians' perspective and law enforcement. Based on the question of the footbridge's condition, 50.7% of the respondents answered Yes, which means they have seen any cracks on the bridge's structure and the rest of the total number of respondents answered No (49.3%). This result indicates that majority of the respondents pays an attention to the surrounding of the footbridge. Meanwhile, another question shows the majority of respondents (62.7%) which is 47 persons admitted that they did not use the footbridge if the road is disserted. This statement related to the other questions which is the result indicates that 60% of the respondents did not waste their time to use the footbridge because if they used it will take time to cross the road. Apart from that, 48% of respondents stated that they would not use the footbridge if it was far away from them.

According to the research conducted by Migual Landa-Blanco in 2020, that attitudes still occur towards them because they believe that they are faster to cross the road [3].

These findings show that the pedestrians did not use the footbridge to cross the road, even the traffic flow is not busy. However, contrary to this statement 52% of respondents said they use the footbridges when the road is busy. It is because they did not take risks towards them and also to protect their safety. Besides that, out of 75 people who answer the questionnaire, 44% of respondents stated that in the dark they will use the help of a torchlight when using the footbridges. This statement shows that the situation of the footbridge which does not have a good lighting system causes most pedestrians to use torchlight when using the footbridge. The safety of pedestrian overpass use depends on a good lighting system. This is because the footbridge was created to protect the safety of users when crossing the road, but an insufficient lighting system might turn the footbridge into a facility that which is can also threaten their safety. When the two elements of this study are compared, it is clear that law enforcement systems against pedestrians and responsible parties need to be taken seriously and improved. This is because the overall respondents had never been fined for not using a footbridge (94.7%). The legal emphasis on compliance with pedestrian rules is taken lightly by enforcers, causing pedestrians to frequently take easy and risky steps to cross the road directly, despite the availability of footbridges in the area. Moreover, exposure to advertisements and announcements about campaigns to promote the use of footbridges to the community is poor (12%). It was suggested that awareness and safety programs for the community should be enhanced by responsible parties such as the Royal Malaysian Police (PDRM) and the Malaysian Institute of Road Safety Research (MIROS). To solve the problems with the use of footbridges, the mindset and behavior of pedestrians must be modified by providing them with sufficient education and knowledge on road safety education and campaigns.

3.3 Interview

Based on **Table 3**, shows the types of questions and the summary from the interview sessions that have been conducted.

Table 3: Interview Questions

Types of Questions	Summary
Scale-Type Question	According to two sightseeing bus drivers, the statistics of the maintenance on the footbridge, especially at Bentayan Bus Station, Muar, was less because the municipal council took a long time to repair the damaged footbridge structure. For example, the roof's footbridge at Bentayan Bus Station Muar has leaked, but the maintenance took up to 5 to 6 months to repair. It will be inconvenient for footbridge users when using it, especially when it is raining.
Straight Forward Question	According to an interview with a small hawker, the usage of footbridges is very low used by pedestrians. According to the interview, they saw most of these pedestrians prefer to cross the road without using the footbridge to save their time.

4. Conclusion and Recommendation

Based on the study was conducted at two selected footbridges namely Astaka Shopping Center Sdn. Bhd and Bentayan Bus Station, the main objective of this study has been achieved. The analysis obtained from a total of 75 respondents shows that the major factors contribute to pedestrians' usage and behavior on footbridge are based on footbridge condition and pedestrians' perspective. The statement on the condition of the footbridge was supported based on 22.7% of the respondents expressed dissatisfaction with the maintenance of the footbridge while 26.7% of the respondents were dissatisfied with the footbridge lighting. Other than that, 34.7% of the respondents stated the footbridge is not user-friendly to the elderly and handicapped. Meanwhile, 60.7% of the respondents showing the perspective that they do not use footbridges to save time. Results from the interview session found that the performance of the footbridges in these two footbridges is quite worrying and needs to be improved in maintenance to ensure the safety of users when crossing the road. This is evidenced by the results of the questionnaire which showed 22.7% strongly agreed that the maintenance of the footbridge is at an unsatisfactory level, moreover, one of the locals we interviewed stated that the authorities will take maintenance action only after receiving many complaints. In this context, local authorities need to take this problem seriously by improving the safety system of existing footbridge facilities and addressing the weaknesses that exist immediately so that the lives of pedestrians are not endangered and at the same time increase the use of footbridges. However, law enforcement and the implementation of campaigns to encourage the use of footbridges should be improved so that the pedestrian is more serious in taking the right action to cross the road by using the existing footbridge facilities. Therefore, local authorities need to emphasize pedestrian safety measures on the road to ensure the management of facilities and pedestrian safety in our country is more strategic and safer thus contributing to the excellence of the road safety system in Malaysia in line with vision 2030 which is committed to making Malaysia a developing and prosperous nation.

There are some recommendations for improving this study for the future. Firstly, the researchers need to continue the research by studying the concept of better and user-friendly footbridge design especially for the disabled person and the elderly by examining the factors that influence pedestrian behavior so that the provision of footbridges can be improved from time to time to drive the development of better public facilities in line with other developed countries. Secondly, the researchers must identify the location of footbridges that has a history of frequent accidents by referring to local authorities such as police stations to get the secondary data before started the research. Hence, the results and information of the study can be strengthened with an authentic source.

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