



**ADDIS ABABA INSTITUTE OF TECHNOLOGY SCHOOL OF
GRADUTE STUDIES
SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING**

**EFFECTS OF THE DISTANCE BETWEEN SPEED HUMPS AND PEDESTRIAN
CROSSINGS ON GAP ACCEPTANCE BEHAVIOR OF PEDESTRIANS
(In the case of Tor hailoch to Bethel Road)**

*A Thesis Submitted to Addis Ababa University School of Graduate Studies for the
Partial Fulfilment of a Degree of Masters of Science in Civil Engineering
(Road and Transport Engineering)*

By

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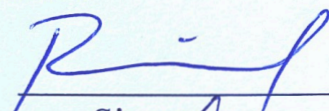
Addis Ababa University
Addis Ababa Institute of Technology School of Graduate
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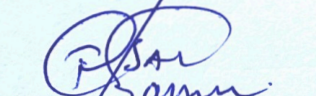
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ABSTRACT

Vehicles increase in numbers on a daily basis. In spite of the fact that they offer an improved convenience, they also have brought about negative effects. For instance, losses of lives and properties are considered as one of the major consequences. In relation to this, pedestrian crossings are critical places for road accidents involving pedestrians and motor vehicles.

Due to the relation between speed and severe injury the driver's speed has a crucial impact on pedestrian safety. To this end, controlling the speed of vehicles on various roads and streets is crucial in order to maintain the safety of people and to prevent any possibility of injury or death. Nowadays, in the city of Addis Ababa, speed humps are becoming a common physical measure installed near pedestrian crossings to reduce vehicle speeds to improve the safety and mobility of pedestrians at the crossing.

Taking in to account the practiced possible measures in reduction of the speed of vehicle, their familiarization with pedestrians' safety and comfort shall also be assessed properly. This thesis contains the detailed assessment and evaluation of the effectiveness of speed humps near crossings, along Tor Hailoch to Bethel road segment, in the reduction of the vehicle speed and its contribution on the mobility and comfort of pedestrians while crossing the road by categorizing the distance between speed humps and pedestrian crossings into shorter (less than 6m) and longer (more than 6m). In addition, by extracting the data from the total observation, the study also evaluates the mobility and comfort of children and the elderly pedestrians. Interview has also conducted with pedestrians that using both the shorter and the longer distances as found necessary.

From the total observation, it is noted that drivers give more way to pedestrians at crossings on the longer distances. In addition, it is noted that the gap acceptance behavior of pedestrians is impacted on the shorter distance sites as more pedestrians are stopped before crossing and change their pace and/or run while crossing. Moreover, it is observed that pedestrians cross comfortably at straight on the longer distances rather than the short distances. The results gained by extracting the children and elders from the total observed data also shows the same effect as the total observations.

Notwithstanding with the results found on the road users' behavior, the shorter distance exercises less vehicle speed on pedestrian crossing comparing to the longer distances. In connection, most of the interviewed pedestrians emphasized that they will not be sure whether the driver give them way or not on the shorter distances.

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1. INTRODUCTION

1.1. General

Over the last decade, in developing countries, the growth of personal vehicle usage is becoming unprecedented with limited road facilities development which has resulted in growing traffic accidents (Rothman, et al., 2015). Particularly, at road networks where mixed traffic prevails, these personal vehicles travel with a much higher speed other than slowly moving public vehicles. As a consequence of these factors, the augmented road accidents have further increased and are the growing threat for the road users. In relation to this, traffic accidents involving pedestrians have become a major safety problem, specifically in developing countries, due to high population density, rapid urbanization, and lack of adherence to traffic regulations by both drivers and pedestrians.

To this end, controlling the speed, speed management, of vehicles on various roads and streets is become crucial in order to maintain the safety of people and to prevent any possibility of injury as well as death. Speed management approaches that contain traffic engineering components are often called traffic calming. Traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users (Lockwood, 1997). Various traffic calming measures are quite common in the modern society. This kind of measures are physical design techniques that encourage or force drivers to drive slowly and/or in a constant speed. The main purpose of traffic calming measures is to reduce speed of vehicle and in return create a safer traffic environment. They highly prevent speeding and, on other hand, can increase overall road safety.

Traffic calming measures can also make streets more accessible and livable for other road users such as pedestrians, cyclists as well as for the nearby residents (Lockwood, 1997). From those various traffic calming measures, speed humps are one type of measures that is frequently used to reduce speed of motorized vehicles in residential areas. It is also a common type of physical speed controlling measure used to increase safety and comfort for pedestrians, basically, at crossings in built-up areas.

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While installing traffic calming measures, they should have to adapt the specific condition of each location mainly near to pedestrian crossings. As a result, the design speed humps should be ideal in order to make drivers hold their speed at least when they are crossing a speed humps. As the designs of speed humps influences experienced driving comfort and through that drivers speed, its clearance from pedestrian crossing also influences the pedestrian gap acceptance while crossing. This clearance distance between the speed hump and pedestrian crossing should lead to a comfortable crossing for pedestrians while crossing.

Speed humps are installed in different environments and on streets that have different characteristics. If the distance between speed humps and pedestrian crossings is not sufficient enough, so that the crossing discomfort in a way of gap accepting by pedestrians will exist. Therefore, this thesis is trying to assess and evaluate the effectiveness of speed humps in the reduction of the vehicle speed and its contribution on the mobility and comfort of pedestrians while crossing the road. In addition, it also evaluates whether variations in distance between speed humps and pedestrian crossings will contribute differently to the mobility and comfort of pedestrians especially children and the elderly, and if so, how.

1.2. Statement of the Problem

Nowadays, road traffic accidents in the city of Addis Ababa have become increased in alarming rate. In relation to this, it is well known that, due to the relation between the speed of vehicle and injury severity, the vehicle speed has a crucial impact on the road users' pedestrian safety. As such, minimizing the speed of motorized vehicles will contribute a vital role in reducing injury and fatality that could be caused on the road users. Accordingly, in the city, some mitigation measures that controls the speed of vehicles are being taken in order to minimize the frequency and severity of the accident.

In connection, it is also well known that there are various types of speed controlling and/or calming measures. From those vehicle speed control measures, currently, in Addis Ababa, speed humps are becoming widely used as a common physical measure by installing near pedestrian crossings to reduce vehicle speeds to improve the safety and mobility of pedestrians while crossing.

In this regard, it is being observed that the installed speed humps have different clearance distance from the pedestrian crossing, i.e. in some locations they have shorter distance and on other sites they have longer distance despite the geometric characteristics of the road and other related factors are the same.

Therefore, pedestrians comfort and gap acceptance behavior while crossing on pedestrian crossings around the practiced speed humps shall be critically evaluated in relation to the variance of the provided distance between speed humps and pedestrian crossings. In addition, the variation of the distance between speed humps and pedestrian crossings effect on reduction of vehicle speeds and on the driver's give way behavior at crossings shall also be assessed crucially since those factors will have direct impact on pedestrians' comfort while they are crossing.

1.3. Objective of the Research

1.3.1. General Objective

The general objective of this research is to assess and evaluate the effects of distance between speed humps and pedestrian crossings in the comfort and mobility of pedestrians while crossing.

1.3.2. Specific Objective

The paper will proceed through the following specific objectives:

- To check the level of vehicle speed reduction at crossings in relation to the different distance between speed humps and pedestrian crossings.
- To analyze how the provided speed humps near crossings enhance the comfort of pedestrians to cross the roads.
- To evaluate the effect of the distance between speed humps and pedestrian crossings in the driver's give way behavior.
- To study pedestrians' different gap acceptance behavior due to the variation of distance between speed humps and pedestrian crossings while crossing.

1.4. Research Questions

- Which distance (long or short) between the speed humps and pedestrian crossings can more reduce the speed of vehicles at the crossing?
- How pedestrians gap acceptance behavior affected by the variation of the distance between speed humps and pedestrian crossings while crossing?
- In which distance between speed humps and pedestrian crossings does pedestrians accept more gaps between successive vehicles and cross the road in comfort?
- In which distance between speed humps and pedestrian crossings does the drivers give more way to pedestrian at crossings?

1.5. Limitation of Study

The main objective of the research is to evaluate the gap acceptance behavior of pedestrians; as such, the researcher collects video recorded data for the analysis of pedestrians' and drivers' behavior. In this regard, there were a challenge in hiding the camera from the road users not to interrupt their free movement. As well as, the researcher spends most times to extract the video recorded data by manual technique into the developed analysis format due to lack of software to do the task.

1.6. Organization of the Thesis

This paper is organized in five chapters and appendices. The first chapter provides a brief overview of the general background of the study, statement of the problem, research question, general and specific objectives of the study, limitation of the research, and structure of the thesis. The second chapter reviews different literatures that are relevant and have important concepts on traffic calming approaches, speed humps and its effectiveness, pedestrians crossing and gap acceptance behavior, pedestrians and drivers' interaction, and spot speed surveys. The third chapter presents the research methods, materials, and procedures including the description study sites, sample size, data collection, and methods of analysis. The fourth chapter deals with the results obtained and discussions on the findings. The fifth chapter provides the conclusion and recommendations of the study; in which the study has been concluded. Accordingly, the appendices consist of the miscellaneous data used for the analysis.

2. LITERATURE REVIEW

2.1. Traffic Calming Approaches

Traffic calming measures generally refer to physical changes to the roadway that are designed to reduce speed of vehicles in order to reduce the negative effects that might occur by them and improve the non-motorized street users' conditions mainly by altering the vehicle drivers' behavior, especially in urban areas. In this regard, reduce the negative effects of motor vehicle use involves design and role of the street changing in order to minimize the negative effects of motor vehicles according to environmental and social aspects on individuals, i.e. volume, speeding, accidents. etc., and on society in general i.e. energy consumption, urban sprawl, pollution, etc. On the other hand, altering the drivers' behavior includes the traffic calming self-enforcement aspect by reducing aggressive driving and lowering the speed of vehicles, which in return increase in respect for non-motorized road users. In the same manner, improving the non-motorized street users' conditions addresses the promotion of walking and cycling, increase safety, and improvement of aesthetics (Beckwith & Hunter-Zaworski, 1997).

The desired goal for the application of traffic calming on residential areas are to make the streets safe and attractive, to improve the residents' quality of life, to promote active transport, like walking, bicycling and public transport uses, as well as to protect the environment from the negative effect of motor vehicles. Along with, traffic calming measures are used to increase safety for non-motorized road users and increase their safety perception by forcing motor vehicle drivers to move with optimum speed. In doing so, they will reduce the frequency and severity of collisions; as such the road environment will be enhanced.

2.1.1. Types of Traffic Calming Measures

Types of traffic calming Measures can be categorized into four groups as follows (Pannu, 1999):

A. Horizontal Deflection

- **Chicane:** a modification to the roadway by applying a series of staggered curb extensions on alternating sides of the street. Thus, vehicle drivers are expected to reduce their speed so as to keep their path in the lateral movement of horizontal deflection.
- **Curb Extension:** this traffic calming measure is formed by the intrusion of the curb into the street in order to reduce the width of the roadway. Most of the time, curb extensions are sited around pedestrian crossings; as such the exposure distance walked by pedestrians to cross the road are minimized due to the effect of the narrowed roadway.
- **Curb Radius Reduction:** the construction of smaller radius curb returns at intersections in order to reduce the existing larger radius of curb returns. As a result, the pedestrian crossing width are become shorten, the vehicle will exercise slower turning speeds and there will be an opportunity for landscaping.
- **Median Island:** also called island diverter, median diverter, intersection diverter and intersection barrier. Median islands are raised islands constructed on a two-way roadway centerline in order to reduce the width of the adjacent travel lanes at that location. Median island often used on local, collector or arterial roads.
- **On-Street Parking:** it reduces the roadway width which is available for the movement of vehicles and leading to slower driving experience. Therefore, by doing so, the pedestrian crossing width are become shorten and minimize the exposure.
- **Roundabout:** a type of an intersection with raised circular island which create a one directional pattern of circular flow characterized by yield rather than STOP controlled conditions at the entry of the intersection. They are used to reduce accidents by controlling the approaching vehicle speed and can be accepted as one of the safest intersection design.

B. Vertical Deflection

- **Rumble Strip:** closely spaced raised buttons or bars at regular intervals across the direction of travel, to alert drivers while approaching a danger spot or to warn them of a slowdown or stop ahead by causing a physical audible rumbling and vibration into the vehicle interior which is transmitted from the wheels of the vehicle.
- **Raised Pedestrian Crosswalks:** serve as traffic calming measures by elevating and raising the pedestrian crosswalk, with a ramp, to the same elevation as the adjacent curbs and crosswalks in order to make the pedestrians more visible to the approaching motor vehicle.
- **Raised Intersection:** serve as traffic calming measures by elevating and raising the center area of an intersection, including crosswalks, with a ramp on all approaches, to the same elevation as the adjacent curbs and crosswalks in order to make the pedestrians more visible to the approaching motor vehicle.
- **Speed Hump:** are a parabolic, circular or sinusoidal shaped vertical calming device extended across the roadway in order to reduce the motor-vehicle speeds on low volume and low speed roads by deflecting both the wheel and frame of the approaching vehicle.

C. Obstructions

- **Intersection Channelization:** using raised islands at an intersection in order to restrict specific movements so as to provide large uncontrolled pavement areas with better definition.
- **Directional Closure:** serve as traffic calming measures by intruding the curb into the roadway in order to prohibit the traffic from one direction of the road.
- **Diverter:** by placing a raised barrier diagonally across an intersection, the traffic will be forced to turn.

D. Signage

- A traffic calming measure using traffic signs that are designed to reduce and control the speed of vehicles. Some of those traffic signs are listed hereunder:

- ✓ Speed limit sign
- ✓ STOP sign
- ✓ Yield sign
- ✓ Special signs for school and playgrounds
- ✓ No through traffic sign
- ✓ One-way street signs
- ✓ Turn prohibition sign

2.2. Speed Humps

Speed humps are one of the most effective and commonly used physical traffic calming measures in urban areas. They are characterized by a gradual raised parabolic shaped area in the pavement surface, extending across the road at right angles to the traffic, which are composed of an abrupt raised area which discomfort the drivers to slowdown. Speed humps have been demonstrated to effectively reduce vehicle speeds and have been associated with the reduction of motor vehicle collisions (Canadian Institute of Transportation Engineers, 1998).

However, prior to investigating speed humps, it is preferable to consider traffic calming measures that modify visual fields and road width. Accordingly, in order to sufficiently control the speed of motor vehicles for new or redesigned roads, proper design shall be conducted. In this regard, in the following locations speed humps can be recommended:

- ✓ Urban areas with curbs and closed drainage so as to prevent drivers not to drive on the shoulder.
- ✓ Residential streets, school zones as well as playground zones.
- ✓ Streets that are desired low speeds.
- ✓ Streets where the speed limit is lesser than 50 km/hr.
- ✓ Streets with little through traffic that are not regularly accommodate emergency vehicle, public transit or trucking routes.

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In the same manner, in the following locations installation of speed humps should be avoided:

- ✓ On arterial roads, roads that accommodate frequent emergency vehicle, public transit or trucking routes, roads with through traffic as well as having four or more lanes of traffic.
- ✓ Streets where the speed limit is higher than 70 km/hr.
- ✓ On intersection approaches
- ✓ In curves or approaches to curves,
- ✓ Roads with a pronounced gradient slopes greater than 8%
- ✓ Locations at which minimum stopping sight distance couldn't maintained with not sufficiently visible or could surprise drivers by the installation of traffic calming measures so as to maintain the minimum stopping sight distance.

If the speed humps installed on the proper location, it is the most effective traffic calming measure in speed reduction. In addition, it might cost moderate as compared to other traffic calming measures. However, it might have little effect on speed reduction of two-wheel motorized vehicles in which they might prefer to cross at the edge of the curb not to reduce their speed. Moreover, due to the deceleration and acceleration on the approach of speed humps noise pollution can be increased. Thus, the noise pollution can be minimized by exercising shorter spacing between the speed control measures on the entire roads (Catherine, 2011).

2.3. Effectiveness of Speed Humps

Even if, only installing speed humps could not significantly reduce the number of traffic accidents with fatalities and non-fatal injuries, including permanent disabilities, but it could contribute in reducing some accidents as well as the cost of damage on urban roads. At this time, the implementation of speed humps becomes progressively more important, particularly on urban roads wherein pedestrian mobility is more intense and speed limit violation will be more likely owing to the lack of traffic congestion. Those restricted areas

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are neighborhood of hospitals, kinder gardens, residential areas, schools, sport facilities, and the like. Thus, if the speed of motorized vehicles are not being violated on such sensitive areas, the safety, mobility and comfort of all road users will be affected, mainly its effect on vulnerable ones could be high, such as for pedestrians, cyclists, children, the elderly, and the disabled (Gedik, Bilgin, Hilmi, & Hartan, 2018).

Speed humps are installed to near protective locations like near to intersections or crosswalks, to keep a low and uniform speed in a residential street, to serve as a pedestrian crosswalk and to achieve a smooth transition to a lower speed zone (Zaidel, Hakkert, & Pistiner, 1992). In relation to this, it is currently become one of the most popular and most effective traffic calming devices (i.e., 46% of all) in controlling the speed of vehicles on urban streets (Rahman, Takemoto, Sakamoto, & Kubota, 2005). As such, they provide a positive impact on safety with their deterrent impact on the motor vehicles who have the tendency to speed up as well as with their evident role in preventing or minimizing road accidents (Gitelman, Carmel, Pesahov, & Chen, 2017).

In order to evaluate safety and comfort issues in light-duty vehicles, field tests supported by numerical analyses were performed. Results indicated that, regarding safety, higher lateral acceleration was found to be the most crucial factor in losing vehicle control, whereas both lateral and vertical acceleration were the primary determinants of ride comfort (Neves, 2014).

According to (Gedik, Bilgin, Hilmi, & Hartan, 2018), seven parabolic speed humps were used in order to conduct field tests twice with different loads within the boundaries of Istanbul Technical University Ayazaga Campus Area. Five vehicle speeds were taken into account within the range of 15 km/h to 35 km/h with 5 km/h increments for the measurement of the vertical acceleration when crossing the speed humps, maximum vertical accelerations and root-mean-square values. The results of the study have demonstrated vehicle speed and parabolic speed hump height as the most important parameters affecting ride comfort and driving safety. It has also been confirmed that the weight of the vehicle is negatively associated with motorists' sense of discomfort and an increase in the length of speed humps results in slightly better ride comfort.

Moreover, (Pedersen, 1998) proposed that the objective be a ride as pleasant as possible while going over the hump below the speed limit and a disturbing ride when going too fast. The objective function was selected as the maximum acceleration that the driver's head would experience in a ride over the hump. The speed limit was selected as 30 km/h and the desired level of acceleration upon exceeding the speed limit was arbitrarily fixed at 40 m/s^2 . The optimization procedure included two kinds of vehicles, namely a sports utility vehicle and a generic car, and hump lengths were fixed at 4 m. The shape of the humps was controlled by amplitudes of basis orthogonal functions. The author concluded that significant improvement could be made on standard hump designs.

The speed control devices are the most important factors for efficiency in reducing maximum speed between devices, achieving a reduction of 50%–75% with speed humps, and a 10%–65% reduction of maximum speed in those which are trapezoidal shape (speed tables). The spacing between speed control devices does not significantly affect a vehicles speed upon passing over said devices, but it does have an impact on pollutant vehicle emissions and extra gasoline consumption (Obregon-Biosca, 2019).

2.4. Pedestrian Crossing Behavior

Over the last decade, in developing countries, the growth of personal vehicle usage is becoming unprecedented with limited road facilities development which has resulted in growing traffic accidents and increasing time share in traveling (Rothman, et al., 2015). In spite of the fact that vehicle usage offer an improved convenience, but, on the other hand, they have also brought negative effects on the road users. For instance, losses of properties and, to the extent, losses of lives can be considered as one of the major consequences caused by motor vehicles. In accidents occurred between vehicles and pedestrians, there are a lot of variables which are able to influence the severity of injuries. From those variables, the one and the most cause for severity of injuries is the speed of vehicles (Beckwith & Hunter-Zaworski, 1997).

It can be presumed that pedestrians tend to walk along secure and convenient walking streets. In view of this, pedestrians' sidewalk and street-using activity has been observed

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for different street environments and different conditions of traffic flow. Since it is more stochastic than deterministic that pedestrians decide to either use the sidewalk or the roadway. For survey roads that had different street environment conditions and levels of traffic, factors affecting the walking role of pedestrians were observed. The outcome indicates that with increased car speed and car traffic flow, the share of pedestrians using the sidewalks rises. However as pedestrians prefer to avoid conflict with each other, their using of the sidewalk also decreases with an increase in pedestrian traffic flow (Kwon, Morich, & Yai, 1998).

In this connection, as vulnerable road users, pedestrians are very important in analyzing the traffic safety of roadway (J. A. Oxley, 2005; Chapman, Wade, & Foot, 1982). The most critical type of pedestrian movement to be studied to analyze the traffic safety of road way should be while they are crossing the streets because of the high probability of collisions with moving vehicles (Waltz, Hoefliger, & Fehlmann, 1983). While pedestrians are tried to cross a roadway, they will ask themselves and decide when to cross between successive motor-vehicles which a term known as critical gap. On another definition, critical gap is the time gap in seconds, at which two successive motorized and/or non-motorized vehicles approaches some crossing spot, below which a pedestrian will not attempt to begin crossing the street. That means, it is assumed that the pedestrian will cross the road, if the available gap is greater than the critical gap. Otherwise, if the available gap is less than the critical gap, it is assumed that the pedestrian will not cross (Transportation Research Board of the National Academies, 2010). As well as, the term critical gap can also be defined as the sum of crossing time and safety margin. The crossing time is the time that a pedestrian need to cross a particular street (Chu & Baltes, 2001).

The selection of appropriate gaps depends on the pedestrians' judgments on the available time to complete the crossing and the speed of approaching vehicles. A remarkable finding on pedestrian crossing behavior was that pedestrians focused on only one lane at a time, rather than taking advantage of an adequate gap in each individual lane unlike the usual assumption that pedestrians wait for all lanes to clear before crossing (Brewer, Fitzpatrick, Whitacre, & Lord, 2006). In contrast, it is found that distance from the oncoming vehicle

was a better determinant for gap acceptance, instead of the speed of oncoming vehicle (Yannis, Papadimitrio, & Theofilatos, 2013).

It is well known that an increase in vehicle speed led to more unsafe and dangerous decisions. Therefore, pedestrians should keep their safety margin. Safety margin is given as the time difference between a pedestrian crosses the crossing spot and the next vehicle arrives at the crossing point. Three components namely, the supply of gaps, crossing time, and safety margin rule the pedestrian crossing behavior. It can be easily understood that speed had a significant effect on the time gap. As the speed of vehicles increased the time gap decreased. Safety margin also decreased with the increasing speed. According to study, lower time gaps has been accepted at higher speeds by the old participants (Richards, 2010). In relation to this, the authors extended their study to determine and understand whether the test characteristics is related with the source of the age related differences or not. They used a walk across the road task to investigate how pedestrians adapt their crossing behavior to the available time and to observe how they calibrate their perceptions with their actions. Accordingly, from the study, between the 70 and 80 years old group, a higher accepted time gap was seen (Lobjois & Cavallo, 2007).

2.5. Pedestrian Gap Acceptance Behavior

The willingness of different groups of pedestrians to choose suitable gaps depends on their ability to assess the speed of vehicles approaching and the time taken to cross the street. This skill mainly varies with age and physical constraints. A research with two studies to examine age differences in the ability to select secure traffic time gaps in a virtual task of road-crossing as well as some of the considerations involved in those rulings. The participants were divided into three age categories of younger (between 30 and 45 years old), young-old (between 60 and 69 years old), and old-old (75 years and older). In a simulated traffic environment in which time gaps and vehicle speed were systematically varied, the first experiment examined age differences in gap selection during road-crossing tasks. Under time pressure, participants were asked to make decisions, and the resulting mean decision times were substantially lower than in on-road observational studies. The authors considered that under time constraints, decisions should be taken primarily on the

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information most readily available and readily available, which was distance from the approaching vehicle. Speed judgments require vehicle information over time and can require a longer period of time to process with advancing age. It is also possible that participants will be more likely to base their decisions on the time difference (integrating distance and speed) if they are given more time to make a crossing decision than on distance alone. In the second experiment, these possibilities were examined by analyzing the impact of various presentation times of simulated traffic scenes on the ability to judge secure traffic gaps (Oxley, Ihsen, Fildes, Charlton, & Day, 2005).

The findings (Oxley, Ihsen, Fildes, Charlton, & Day, 2005) suggested that gap selection was mainly based on vehicle distance instead of arrival time for all age groups. Presentation time, as it turned out, made no difference to the younger group's proportion of acceptance responses. Distance and to a lesser degree, the time difference seemed to affect their decision to cross. That is, in very short periods of time, younger adults were able to process both the distance and speed of vehicles, even though their crossing decisions were focused solely on vehicle distance. These findings were very similar for the middle and oldest age groups, but relied more on longer observation periods. Thus, if forced to make a fast decision, older pedestrians are more likely to make incorrect decisions about the length of a crucial distance, which can lead to higher rates of collisions, accidents, and fatalities among older pedestrians.

The Americans with Disabilities Act mandates that all consumers, including pedestrians with disabilities, have access to public rights of way. A research project on the capacity of blind pedestrians to use their hearing to differentiate "crossable" gaps in traffic at roundabouts from gaps that are too short was performed by (Guth, Long, Ponchilla, Ashmead, & Wall, 2005). The research included six blind people and four sighted people, standing at three roundabout crosswalks and watching traffic to judge which distances were long enough to cross. The majority of gaps were so brief at two crosswalks that people walking at 4 ft/s would not have been able to cross entirely until the next vehicle arrived. It was normal to have gaps longer than 10 s at the third crosswalk, and there were numerous "all quiet" periods. Listening to these periods seemed to be helpful in recognizing suitable

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gaps there where blind and sighted participants seldom incorrectly suggested that it was necessary to cross.

At the first two crosswalks, however it was never all quiet, which allowed participants to judge when vehicles they could hear or see would arrive at the crosswalk. Usually, pedestrians need at least 5 s to cross to or from a divider island, which means that if they are driving at 20 mph, pedestrians need to know about vehicles that are about 150 ft away (Guth, Long, Ponchilla, Ashmead, & Wall, 2005). In addition to evaluating the accuracy of the judgments of participants on whether differences were appropriate, researchers also examined variations in the latency of these judgments. Blind participants made their decisions about 3s later than sighted participants, considering only appropriate differences that were correctly identified.

This seems to be because cars that have just cleared the crosswalk create engine and tyre noise that hides other sounds, interfering with the ability of blind pedestrians to hear if the crosswalk is approaching another car. Usually, sighted pedestrians can recognize the onset of a sufficient gap just before a vehicle clears the crosswalk, but blind pedestrians must allow the vehicle to pass and wait for several seconds for its sound to recede so that any approaching traffic can be heard (Guth, Long, Ponchilla, Ashmead, & Wall, 2005). The ability to accurately measure the length of a vital distance at a specific location will thus, enhance pedestrian safety at that site.

Using a rolling gap is a behavioral trend in reaction to large concentrations of traffic on a multilane approach. In order to take advantage of an appropriate gap in each individual lane, pedestrians frequently timed their crossing maneuvers and thus completed their crossings even though the approach as a whole did not have a crucial gap during their crossings. Although rolling gaps are a behavioral adaptation created by many pedestrians, the design expectation that pedestrians will wait for all lanes to clear creates a more cautious design that minimizes the potential for pedestrians who do not acknowledge rolling gaps for accidents and injuries (Brewer, Fitzpatrick, Whitacre, & Lord, 2006).

2.6. Pedestrians and Drivers Interaction

Several psychological studies investigated the attitudes of drivers and pedestrians prior to crossing incidents. Usually, the following factors are considered: the probability of the driver yielding, driver knowledge of the pedestrians and their decision-making. Several factors affecting these behaviors have been identified: vehicle speed and time to collision (TTC) gap size between vehicles, geometry and other road characteristics (signs and delineation), weather conditions, conditions of crossing (whether pedestrians are crossing from a standstill or walking), number of pedestrians crossings, gender and age of the drivers and pedestrians, eye contact between the driver and the pedestrian etc. (Rasouli, Kotseruba, & Tsotsos, 2017).

Communication between pedestrians and vehicles is formally defined by legislation and informally by signs of communication, including gestures, eye contact and braking (Kitazaki & Myrhe, 2015; Walker, 2005). Informal communication increases the attention of the road users involved to each other and is especially important where there are little or unclear regulations, such as parking areas, cycling lanes or cross-roads for pedestrians.

Eye contact is the most common technique that we use to communicate our emotions. Having eye contact will tell others that you are paying attention to him and make the interaction more harmonious. In order to show that eye contact plays a crucial role in our everyday communication, several studies have been carried out. Eye contact between the pedestrian and the driver, for instance, increases the possibility that the pedestrian is given priority and has been shown to increase the time for collision as the driver has more time to respond with gentle braking (Guéguen, Meineri, & Eyssartier, 2015; Ren, Jiang, & Wang, 2016). Informal contact also has an important influence on encounters between pedestrians and drivers of manual vehicles. Informal communication will lose its functionality with vehicle automation, as it is marked by subtlety, complexity, dynamism and elements that are difficult for the automated vehicle to understand. In essence, the pedestrian would have to maintain eye contact with a vehicle that is no longer controlled by a human being, possibly contributing to mistrust and insecurity. The automated vehicles should have communication facilities that allow interactions to take place comfortably and

securely, in addition to pedestrian detection and interpretation (Vissers, van der Kint, van Schagen, & Hagenzieker, 2016).

In a road setting, pedestrians do not feel safe, nor do they expect drivers to leave their way to stop for them. Pedestrians should be made aware of the significance of traffic signals as a countermeasure (Many pedestrians were confused about the meaning of the flashing DON'T WALK sign). The installation of placards outlining the significance of pedestrian signals may be helpful if a local community does not have the resources for a robust awareness campaign. In addition, it would be good to improve education on state pedestrian laws and the rights of pedestrians, as it would make pedestrians aware of the need to exercise caution and improve their visibility at night for drivers (Redmon, 2003).

In order to improve drivers' behavior, the biggest influence tends to be more robust law compliance. Sadly, drivers were affected more by the idea of having a ticket than by endangering a lifetime. Moreover, in drivers' education classes, pedestrian laws should be strengthened. Most of the participants in the driver focus groups said that in their drivers' education classes, pedestrian laws were not protected (Redmon, 2003).

2.7. Spot Speed Surveys

The collection of vehicle speeds is critical as it provides information about travel conditions, service levels, and traffic flow quality. Speed is a very significant parameter of road design, in the general sense of setting design specifications, and in the simple sense of calculating the impact of small changes on a traffic system (such as installing a traffic control device or widening a curve) (AACRA, 2004).

Accordingly, classification of speed in traffic engineering can be categorized into four groups (Austroads, 1988):

i. Spot Speed

Spot speed, also called time speed, is a vehicle's instantaneous speed at a given point on a lane. When the car accelerates or brakes, the spot velocity of a vehicle varies continuously. The non-peak times of traffic flow are normally concerned with spot speed surveys, when

speeds are higher. For instance, where free flow velocities are necessary to set speed limits, periods of low volume and good weather are explicitly selected.

ii. Journey Speed

The effective speed of the vehicle on a trip between two points which is the distance between the two points divided by the total time taken for the vehicle to complete the journey including any stopped time.

iii. Operating Speed

Operating speed is the sustained running speed at which a vehicle can travel under the existing traffic and environmental conditions.

iv. Running Speed

This is the average speed sustained by a vehicle over a given stretch of highway while the vehicle is actually in motion; the "while the vehicle is actually in motion" clause is important since the running speed is determined by dividing the stretch length by the time the vehicle is in motion. The running time excludes that part of the journey time for which the vehicle suffers delay, for example, at controlled intersections.

In the analysis of driver behavior, spot speed data is beneficial for traffic engineers because it offers estimates of the predominant distribution of speeds at a site under various environmental conditions and of the range of probable vehicle speeds. Speed distributions include indications of traffic conditions at the observation site and are critical for the evaluation of the need for sufficient traffic control equipment, speed limits or speed advisory signatures.

In this regard, spot speed survey data are very important in the determination of the need for devices for traffic management, determination of velocity range and magnitude as a basis for the formulation of concept standards, evaluating the effectiveness of traffic improvements, finding a relation between speeds and accidents or between geometric characteristics and speeds, as well as for carrying out an economic analysis (Austroads, 1988).

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Spot speeds measurement, as the name indicates, are conducted from a set location on the road in order to obtain vehicles' instantaneous speed at a given point on a lane. Spot speed measurement data can be collected in the following ways (AACRA, 2004).

i. Manual Short-Base Method

Measuring the travel time of a vehicle between two detectors separated by a specified fixed distance e.g. by timing over a measured distance using a stop watch The location of the survey should be at the center of a road connection and should also be correctly positioned in order to achieve the study goals (eg. at a pedestrian crossing, to investigate an accident problem). The lengths of the short-base should be selected based on speeds of the vehicles on the road whereas with longer bases are needed for higher speeds.

Table 2. 1: The Relation between Average Speed and Short-Base Lengths (Transport Research Laboratory, 1993)

Average Speed of Traffic (km/h)	Short-Base Length (m)
Below 40	25
40-65	50
Above 65	75

The ends of the short-base length are marked with paint, chalk, or tape lines on the road surface; the lines should be as inconspicuous as drivers can be. Alternatively, the downstream line can be described on the opposite curb by the surveyor standing directly opposite a roadside object (for instance, a power pole or tree). The Surveyor must always be at the downstream end.

The n^{th} vehicle or any other method of ensuring an accurate sample shall be selected at the sampling line and which vehicles should be surveyed should be specified by the survey supervisor. This may be any n^{th} vehicle or any other method of ensuring an accurate sample (For example, when the surveyor looks up, he notices the first vehicle to cross the sampling line in any lane and selects the next vehicle to cross the sampling line in any lane. The Surveyor begins the stopwatch as the sample vehicle crosses the start line upstream, and stops it as the downstream line is crossed by the same vehicle. Along with the type of vehicle and whether or not it was the following vehicle in a platoon, the time is reported

on the survey form. The procedure is repeated for the next vehicle, and so on through the survey period (Transport Research Laboratory, 1993).

ii. Electronic Timing Method

There are advanced data acquisition systems for vehicle detection available. These systems record a vehicle's passage time between two axle detectors that are located apart at a fixed distance. Compared to manually using a stop watch, the electronic data recording capability ensures that this approach offers higher levels of precision. For speed, volume and vehicle classification data collection, other commercially produced automatic recording equipment is also available. These units are pneumatic tube and/or inductive loop detectors and can be worked without continuous supervision for prolonged periods of time (AACRA, 2004).

iii. Video-Recording Method

Another tool for gathering spot velocity data is time-lapse photography using video-cassette recording devices. There are specialized systems available that record the distance traveled by a vehicle over a selected short period of time (perhaps a couple of frames). The speed of the vehicle can then be calculated. This method has its own advantages and disadvantages. Form its advantages, it offers a complete, continuous traffic flow record that can always be re-analyzed and re-examined at a later level and adds supplementary information like classification of cars, flows, headways, special phenomena, overtaking. On other hand, as a disadvantage a significant amount of time is needed after the survey to extract the data from the video record. In order to overcome this limitation, computer-based automated data extraction programs usually included in commercially available advanced video cassette recording systems (AACRA, 2004).

iv. Direct Speed Measurements by Radar

Radar speed meter operates by sending a continuous beam of high frequency microwaves towards a vehicle and measures the difference in frequency between the reflected waves and the transmitted waves. The frequency change, known as the Doppler Effect, is directly proportional to the speed of the target vehicle relative to the velocity of the radar meter, so that a direct speed measurement is obtained. The speed observed is independent of the direction of motion of the target vehicle, i.e. whether the vehicle is travelling to or away

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from the radar device does not matter. Radar speed meters are ideal for relatively narrow roads at low to medium flow speeds as individual vehicles fly past the observer. However, they are not ideal for large volumes of traffic, congestion or multi-lane roads (AACRA, 2004).

3. METHODOLOGY

The methodology used for the data collection of this thesis has three parts, which are field survey, spot speed measurement and video recording. Field survey is conducted for verifying the road data, like the geometric condition of the road section, and to measure the actual distance between the speed hump and pedestrian crossing of the studied locations. In addition, it was helpful to observe and understand whether there are other factors that might affect the study or not.

In the same manner, spot speed study is conducted to measure the speed of free vehicles, which are not being interacted with other road users, before and after approaching the speed hump. Moreover, video recording is conducted to acquire the actual behavior of the pedestrians while they are crossing near to speed humps.

3.1. Description of the Study Area

This study is conducted on Tor Hailoch to Bethel road segment. In the recent time, Bethel is becoming desirable place for residential area as well residents from the newly developed location, locally called 'Alem Bank' are also used this road section mostly. In relation to this, the road is serving most of private car users especially during morning and evening time as well as other different types of motorized vehicles.

As the study is conducted along one route, no major geometric configuration difference has not been observed. To this end, the significant features of the field survey are detailed as follows:

- ✓ The road section has split level section for a total of about 1.4km, from NOC Gas station to St. Gabriel church.
- ✓ The road section has three lanes in one direction, however, it has two lanes on the split level section along Bethel to Tor hailoch direction.
- ✓ In relation to the split level section and the medians are fenced, the pedestrians are forced to cross only using pedestrian crossings.
- ✓ Yield signs has not been presented on the road section.

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Accordingly, this road section has been selected in view of that the road accommodates different types of motorized vehicles and a lot of speed humps have been installed in both directions to control speed of vehicles so as to secure pedestrians' movement since most of the road section traverses through residential areas. From those speed humps located near pedestrian crossings, 4 of them are selected for the study that have different clearance distances in a range from 3m to 11m. The selected locations local names are used for the study, i.e. at 'St. Gabriel Church', 'Mendida', 'Zebra', and Medhanealem Mewcha'.

i. At 'St. Gabriel Church'

In this study site, the distance between the speed hump and pedestrian crossing is about 4m. The speed hump has had marking on its surface, so that any drivers can visualize the same. This location has also a median and walkway which may be used as refuge for pedestrians at crossings in both directions.



Figure 3. 1: Pedestrian crossing at 'St. Gabriel Church' (4m)

ii. At 'Mendida'

In this study site, the distance between the speed hump and pedestrian crossing is about 3m. The speed hump has had marking on its surface, so that any drivers can visualize the same. This location has also a median and walkway which may be used as refuge for pedestrians at crossings in both directions.

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Figure 3. 2: Pedestrian Crossing at 'Mendida' (3m)

iii. At 'Zebra'

In this study site, the distance between the speed hump and pedestrian crossing is about 8m. The speed hump has had marking on its surface, so that any drivers can visualize the same. This location has also a median and walkway which may be used as refugee for pedestrians at crossings in both directions.



Figure 3. 3: Pedestrian crossing at 'Zebra' (8m)

iv. At ‘Medhanealem Mewcha’

In this study site the distance between the speed hump and pedestrian crossing is around 11m. The speed hump has had marking on its surface, so that any drivers can visualize the same. This location has also a median and walkway which may be used as refuge for pedestrians at crossings in both directions.



Figure 3. 4: Pedestrian crossing at ‘Medhanealem Mewcha’ (11m)

The reason to conduct the study on one route is to eliminate some other factors that might affect the study relating to different road environments while conducting the study on different locations. Therefore, this road section is a critical place in order to achieve the desired objective of the research.

3.2. Sample Size

The sample size of pedestrians for the video recording is determined by using the equation illustrated hereunder, Eq. 3.1. Accordingly, 95% confidence interval has been taken for the pedestrian sample proportion. In this regard, since the pedestrian sample proportion

approximation couldn't be known, the assumption of the sample proportion has been taken as 0.5 so as to get the sample size sufficiently large to guarantee an accurate prediction (Bluman, 2009). In addition, it is also assumed that the maximum error of the estimate shall not be greater than 5%.

$$n = \hat{p}\hat{q} \left(\frac{z_{\alpha/2}}{E} \right)^2 \dots\dots\dots\text{Eq. 3.1}$$

Where, n = sample size

\hat{p} = sample proportion

$\hat{q} = 1 - \hat{p}$

$z_{\alpha/2} = 1.96$, for 95% confidence interval

E = maximum error of the estimate

Accordingly, by substituting the abovementioned assumptions in to the equation the minimum sample size of the pedestrian to be studied in the category becomes approximately 384. In this regard, more than 384 pedestrians at crossings has been studied while they crossing on the shorter and longer distances so as to minimize the error of the estimate and to maximize the confidence interval.

3.3. Data Collection

To attain the stated objectives of the study, previous research studies that are found to be relevant to the objectives of this research are being reviewed. Accordingly, the reviewed literatures provide a broad background of the existing knowledge. The knowledge and experience gained during this period helps in developing reliable, efficient and effective study approach to focus on stated goals of this research.

Before carrying out data collection, training is being provided to the enumerators in order to support them with knowledge on how to gather reliable data relating to the study. Accordingly, after the training data collection from the study site has been commenced and recorded. The traffic volume is relatively high during 7:30 AM to 9:30 AM and 5:00 PM to 7:30 PM on working days; and from 8:00 AM to 11:00 AM and 5:30 PM to 8:00 PM

during weekends. Even if vehicle and pedestrian traffic is high during the hours, no congestion and other related factors that will affect the study observed on each study locations. Thus, the data collection has conducted on the abovementioned hours. During the fieldwork, the following three types of data are gathered.

- ✓ Distance between speed humps and pedestrian crossings,
- ✓ Vehicle speed before and after approaching speed humps, and
- ✓ Pedestrian crossing and gap acceptance behavior.

3.3.1. Distance between Speed Humps and Pedestrian Crossings

In the study site, a lot of speed humps have been installed in both directions in order to control speed of vehicles and secure pedestrians' movement from traffic accident. From those speed humps located near pedestrian crossings, 4 of them are selected as ideal representative sample for the study that have different clearance distances in a range from 3m to 11m.

In this regard, the distance between speed humps and pedestrian crossing is primarily measured manually on each study sites using a tape. The analysis is concerned on the effect of various distances between the speed hump and the crossing on pedestrian and driver behavior. The pedestrian crossings that are analyzed in this study are those nearest to the speed humper. Besides, the distance between the outer edge of speed humper and pedestrian crossing is being grouped as long, which has a clearance of more than 6m, or short which has a clearance of less than 6m. The length less than 6m is taken as short distance is considering the accommodation of only one medium vehicle length between the speed hump and pedestrian crossing. Similarly, the length more than 6m can accommodate more than one medium vehicle, thus it is considered as long distance.

As such, the first two study sites, i.e. at 'St. Gabriel Church' and at 'Mendida', are categorized into shorter distance. On the other hand, the study site at 'Zebra' and at 'Medhanealem Mewcha' are grouped into longer distance.

Accordingly, the analysis is conducted using different parameters, like the effect of the distance on the speed of vehicle at crossings, on pedestrians' gap acceptance behavior in terms of their convenience while crossing, on drivers' behavior in terms of how they give way to pedestrians at the selected crossings as well as on the interaction of drivers' and pedestrians' behavior.

3.3.2. Vehicle Speed

In order to measure the spot speed of the vehicles manual short-base method is being used. The travel time of a vehicle is measured between two detectors by timing over a measured distance using a stop watch. The lengths of the short-base is selected as per the relation between average speed and short-base lengths discussed in Table 2.1. Accordingly, the lengths of the short-base on each study sites are selected to be 50m, which is selected based the vehicles speed on the road is in a range between 40 km/h to 65 km/h.

Thus, in order to obtain the vehicles speed before and after crossing the speed hump, the spot speed 15m before reaching the speed hump and speeds at the pedestrian crossing is measured. The ends of the short-base length are marked with a tiny rope across the road not to distract the drivers, for the study of vehicles speed.

In relation to this, the data has been collected without getting the drivers' attention not to distract the drivers' behavior. On the spot speed survey, only the speeds of free vehicles are measured by sampling them before entering into the sampling line; as such the vehicle drivers which are not being interacted with other road users are considered on the study to acquire reliable data. During the survey, vehicles that take less than 2 seconds to traverse the short-base have been rejected, since if a vehicle is within the stated speed range, the time required to cross the end of short-base is more than 2 seconds. Accordingly, the study was conducted both on working days and on weekends, before and afternoon.

3.3.3. Pedestrians' Gap Acceptance Behavior

Since, the study is concerned on the effect of various clearance distances between the speed hump and the crossing on pedestrians' and drivers' behavior, the pedestrians gap acceptance behavior while they are crossing shall properly analyzed. In relation to this,

pedestrians' gap acceptance behavior is being analyzed on those pedestrians which are crossing the road nearest to the speed hump.

At each study site, various road users are being encountered during the study period. To capture the actual behavior of road users video recordings and visual inspections from different angles is executed. Hence, the video recording is chosen other than questionnaire is owing to the fact that questionnaire may not address all pedestrians and might not give the actual action and response by the pedestrians as well as it might be difficult for pedestrians to interpret their behavior especially for the children and the elderly whereas the research will give more attention to the behavior of them. An interview has also been conducted with some pedestrians on their overall observation the longer and the shorter distances. However, only the video recording is used for the statistical analysis.

3.4. Methods of Analysis

Data entry from field survey, video recordings and additional visual inspections are carried out manually in Excel in accordance with the parameters given below. The parameters are placed into the following three groups:

- ✓ Description of pedestrians and their behavior
 - Pedestrians' run before arriving at the curb
 - Pedestrians' change their pace and/or run while crossing
 - Pedestrians' run after crossing
 - Pedestrian whether stops at edge of the pavement when first driver comes
 - Pedestrians whether cross straight or diagonal on the pedestrian crossing
- ✓ Description of the vehicle and driver behavior, and
 - Given way by any driver
 - Speed of vehicle before approaching and at the crossing
- ✓ Description of the interaction between them.

As illustrated on the foregoing sections, the study is conducted by categorizing the distance between speed humps and pedestrians' crossings into short distance and long distance depending on the clearance distance between them. In view of that the crossings located at

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locally called 'St. Gabriel Church' and 'Mendida' are selected study of the short distance. On the other hand, the crossings located at locally called 'Zebra' and 'Medhanealem Mewcha' are selected for the study of long distance.

Accordingly, the excel data have been categorized into short and long distance depending on the site condition. After data categorization, the analysis has been done using Statistical Package for the Social Sciences (SPSS) software, by importing the data from the excel.

From the software, the frequency distribution and the mean of the observed data are being used for the analysis and comparison of the results. To acquire reliable behavioral data, an analysis form was well designed by categorizing different parameters. The parameters studied and used for the analysis are described as follows:

- ✓ pace before crossing
- ✓ whether they stop at edge of the pavement, curb
- ✓ pace while crossing
- ✓ whether they cross diagonally or straight
- ✓ driver behavior in giving way
- ✓ long or short distance to speed humper
- ✓ age (children and elder pedestrians)

On the spot speed study, the vehicle drivers which are not being interacted with other road users are considered to acquire the actual and undisturbed speed of vehicles. Accordingly, the collected spot data are encoded into SPSS software to generate the frequency distribution table and other statistical analysis.

In this regard, the speed of vehicles before approaching and at pedestrians crossing among each study sites have been analyzed by categorizing them into short and long distance for the ease of analysis.

Further, by extracting from the observed behavioral data, separate analysis on the crossing behavior of children and old age category, i.e. Children (0-14), and Old (>51), has been conducted using all parameters for comparison; as such, young and adult age categories are not studied separately owing to most of the study sample relies on them and by taking into account, people in young and adult category are more active road users than children and elders age category.

4. RESULTS AND DISCUSSIONS

The main objective of studying the effects of the distance between the speed humps and pedestrian crossings on the gap acceptance behavior of pedestrians is to assess and evaluate the effectiveness of speed humps in the reduction of the vehicles speed and its contribution on the comfort and mobility of pedestrians in connection with their different distance from nearby pedestrian crossings.

Thus, this chapter describes the analysis results and discussions on each indicative parameters towards addressing the intended goal of this research. Accordingly, the conducted analysis and results includes field study, video recording analysis and results, and spot speed analysis and results; as such, they are labeled in to three categories and discussed in this chapter. In this regard, the first section explains about the spot speed analysis and results. On the second section, analysis and results of video recording on each study sites are illustrated. Then, the last section demonstrates about the comparison of the effects between the long and the short distance between speed humps and pedestrian crossings on gap acceptance behavior of pedestrians.

4.1. Effects on Vehicle Speed

In connection, the recorded spot speed data are encoded to the SPSS software and the resulted frequency distribution and mean speed of the traffic stream before approaching the speed hump and at the pedestrian crossing are generated at each study site. As such, the frequency distribution chart and mean spot speed data obtained from the software are described in the figures below for each study area.

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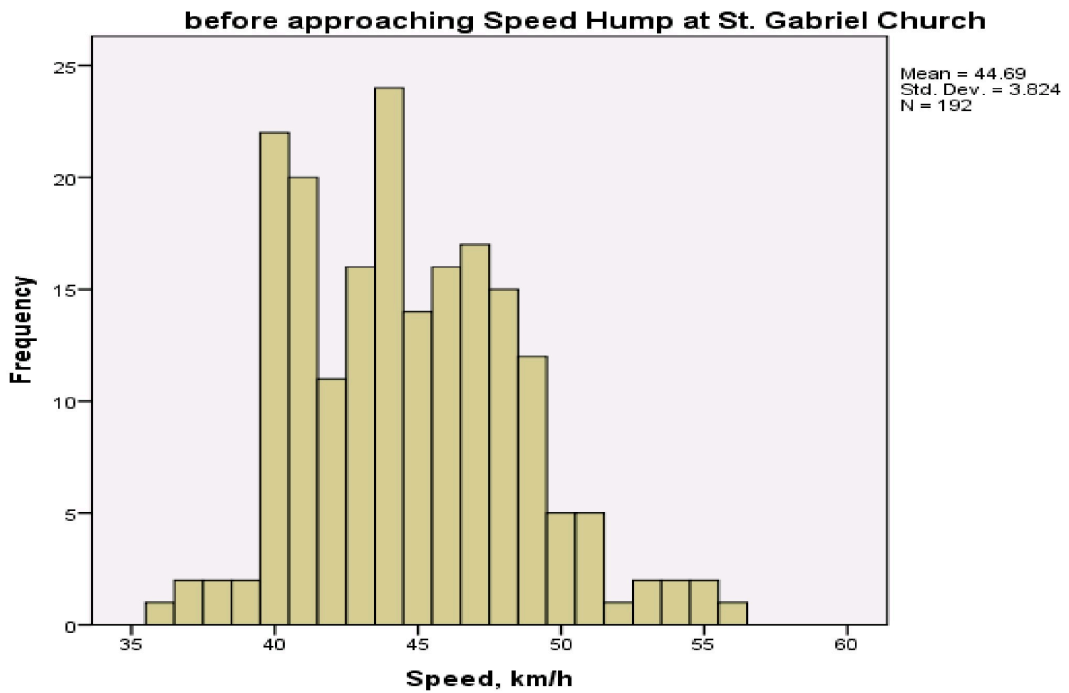


Figure 4. 1: Frequency Distribution Chart for speed data before approaching the speed hump at St. Gabriel Church

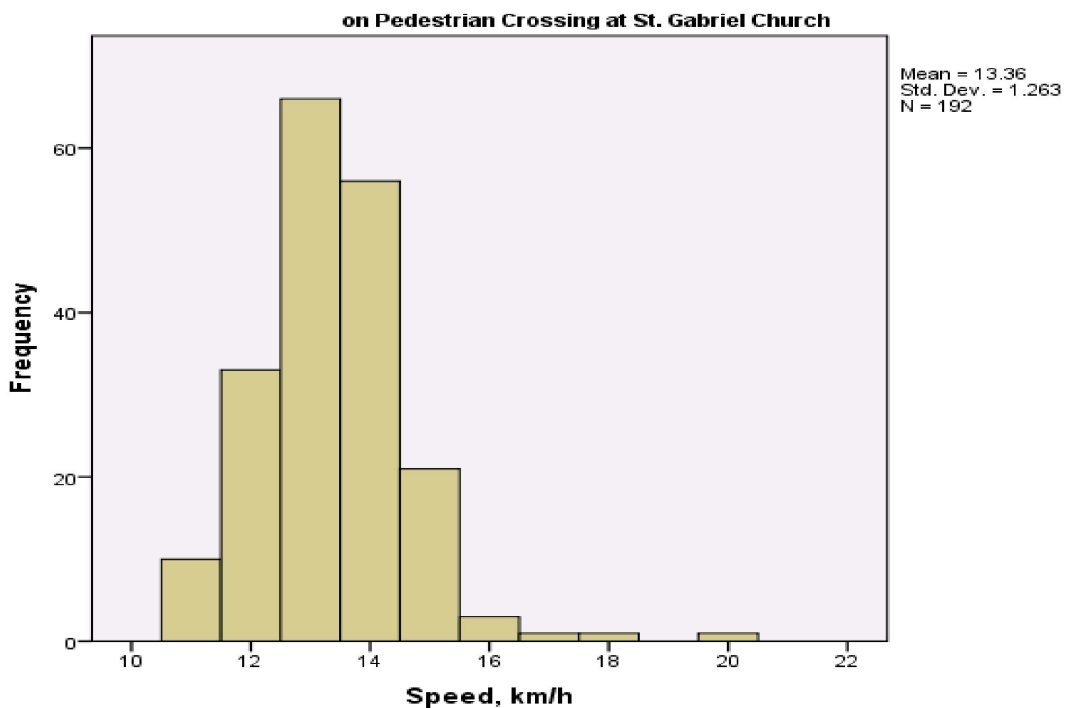


Figure 4. 2: Frequency Distribution Chart for speed data on pedestrian crossing at St. Gabriel Church

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As such, the frequency distribution table and the resultant histogram chart has been generated from the software for the remaining study areas which can be seen in the Appendix B of this paper.

Similarly, the average mean speed for each study sites has been generated for the comparison as presented in the table below.

Table 4. 1: Comparison of mean speed

Distance between Speed Hump and Pedestrian Crossing	Location	Mean Speed, km/h	
		before approaching the speed hump	on pedestrian crossing
Shorter	At St. Gabriel Church	45	13
	At Mendida	44	14
Longer	At Zebra	46	18
	At Medhanealem Mewcha	45	16

As can be seen from the Table 4.1, owing to the study is conducted along one stretch and have same geometric condition, the average speed of vehicles before approaching the respective speed humps are almost similar. Whereas, on the pedestrian crossing the speed of vehicles are become slightly dissimilar, i.e. pedestrian crossings that has shorter distance from the speed hump exercises minimal speed as compared to the mean speed of the longer ones.

4.2. Effects on Road Users Behavior

It is well known that the road users' behavior can be affected by different parameters. However, in this study, the effects of environmental and other geometric characteristics of the road, among others, is minimal; as the study is conducted on one stretch. Accordingly, the overall observed behavior has described in following sections. In addition, the observed behaviors have also analyzed by age categories at each study locations.

In this study, a total number of 1,713 pedestrians which crossing using the pedestrian crossing were observed; whereas 1,248 (72.85%) of them are encountered a vehicle. As such, those pedestrians encountered a vehicle are used for the analysis of the results.

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4.2.1. Shorter Distance

i. At ‘St. Gabriel Church’

The total observed pedestrians on this section are 328. The results of the analysis are described hereunder.

Table 4. 2: Drivers give way to pedestrians

	Frequency	Percent	Valid Percent	Cumulative Percent
Given way by the Driver	113	34.5	34.5	34.5
Valid Do not given way by the Driver	215	65.5	65.5	100.0
Total	328	100.0	100.0	

Table 4. 3: Pedestrians run before crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrian run before crossing	18	5.5	5.5	5.5
Valid Pedestrian do not run before crossing	310	94.5	94.5	100.0
Total	328	100.0	100.0	

Table 4. 4: Pedestrians Stop before crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians stop before crossing	220	67.1	67.1	67.1
Valid Pedestrians do not stop before crossing	108	32.9	32.9	100.0
Total	328	100.0	100.0	

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Table 4. 5: Pedestrian run while crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians run while crossing	83	25.3	25.3	25.3
Valid Pedestrians do not run while crossing	245	74.7	74.7	100.0
Total	328	100.0	100.0	

Table 4. 6: Pedestrians crossing straight on the crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians crossing straight	257	78.4	78.4	78.4
Valid Pedestrian crossing diagonal	71	21.6	21.6	100.0
Total	328	100.0	100.0	

From the total observed 328 pedestrians at ‘St. Gabriel Church’ and analysis conducted, the result shows that drivers given way for only 113 (34.5%) of the observed pedestrian, 220 (67.1%) pedestrians stopped and wait for drivers to give them way. Similarly, 83 (25.3%) pedestrians changed their crossing pace and/or run while crossing despite 18 (5.5%) pedestrians run before crossing and looks hurry to cross, and 71 (21.6%) pedestrians crosses diagonally in fear of the approaching vehicle.

ii. At ‘Mendida’

The total observed pedestrians on this section are 286. The results of the analysis are described hereunder.

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Table 4. 7: Drivers give way to pedestrians

	Frequency	Percent	Valid Percent	Cumulative Percent
Given way by the Driver	91	31.8	31.8	31.8
Valid Do not given way by the Driver	195	68.2	68.2	100.0
Total	286	100.0	100.0	

Table 4. 8: Pedestrians run before crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrian run before crossing	23	8.0	8.0	8.0
Valid Pedestrian do not run before crossing	263	92.0	92.0	100.0
Total	286	100.0	100.0	

Table 4. 9: Pedestrians Stop before crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians stop before crossing	196	68.5	68.5	68.5
Valid Pedestrians do not stop before crossing	90	31.5	31.5	100.0
Total	286	100.0	100.0	

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Table 4. 10: Pedestrian run while crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Pedestrians run while crossing	76	26.6	26.6	26.6
Valid Pedestrians do not run while crossing	210	73.4	73.4	100.0
Total	286	100.0	100.0	

Table 4. 11: Pedestrians crossing straight on the crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Pedestrians crossing straight	209	73.1	73.1	73.1
Valid Pedestrian crossing diagonal	77	26.9	26.9	100.0
Total	286	100.0	100.0	

From the total observed 286 pedestrians at ‘Mendida’ and analysis conducted, the result shows that drivers given way for only 91 (31.8%) of the observed pedestrian, 196 (68.5%) pedestrians stopped and wait for drivers to give them way. Similarly, 76 (26.6%) pedestrians changed their crossing pace and/or run while crossing despite 23 (8.0%) pedestrians run before crossing and looks hurry to cross, and 77 (26.9%) pedestrians crosses diagonally in fear of the approaching vehicle.

iii. Overall Statistical Analysis for Shorter Distance

From the above analysis, the overall statistical evaluation of road users’ behavior for the shorter distance is summarized as presented in Table 4.12 and Table 4.13 herein below.

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Table 4. 12: Statistical analysis for ‘St. Gabriel Church’ study site

		Drivers give way to pedestrians	Pedestrians run before crossing	Pedestrians Stop before crossing	Pedestrian run while crossing	Pedestrians crossing straight on the crossing
N	Valid	328	328	328	328	328
	Missing	0	0	0	0	0
	Mean	1.66	1.95	1.33	1.75	1.22
	Std. Error of Mean	.026	.013	.026	.024	.023
	Std. Deviation	.476	.228	.471	.435	.412

Table 4. 13: Statistical analysis for ‘Mendida’ study site

		Drivers give way to pedestrians	Pedestrians run before crossing	Pedestrians Stop before crossing	Pedestrian run while crossing	Pedestrians crossing straight on the crossing
N	Valid	286	286	286	286	286
	Missing	0	0	0	0	0
	Mean	1.68	1.92	1.31	1.73	1.27
	Std. Error of Mean	.028	.016	.028	.026	.026
	Std. Deviation	.467	.272	.465	.442	.444

As can be seen in the above tables, Standard error of mean of this distribution sample mean is kin with the true mean with 95% confident interval and that of 5% maximum error of the estimate; as such, the standard error of mean is less than maximum error of the estimate. To this effect, the observed results can be taken as reliable and more accurate which supports to conclude the analysis.

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

4.2.2. Long Distance

i. At 'Zebra'

The total observed pedestrians on this section are 303. The results of the analysis are described hereunder.

Table 4. 14: Drivers give way to pedestrians

	Frequency	Percent	Valid Percent	Cumulative Percent
Given way by the Driver	118	38.9	38.9	38.9
Valid Do not given way by the Driver	185	61.1	61.1	100.0
Total	303	100.0	100.0	

Table 4. 15: Pedestrians run before crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrian run before crossing	11	3.6	3.6	3.6
Valid Pedestrian do not run before crossing	292	96.4	96.4	100.0
Total	303	100.0	100.0	

Table 4. 16: Pedestrians Stop before crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians stop before crossing	179	59.1	59.1	59.1
Valid Pedestrians do not stop before crossing	124	40.9	40.9	100.0
Total	303	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Table 4. 17: Pedestrian run while crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Pedestrians run while crossing	65	21.5	21.5	21.5
Pedestrians do not run while crossing	238	78.5	78.5	100.0
Total	303	100.0	100.0	

Table 4. 18: Pedestrians crossing straight on the crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Pedestrians crossing straight	249	82.2	82.2	82.2
Pedestrian crossing diagonal	54	17.8	17.8	100.0
Total	303	100.0	100.0	

From the total observed 303 pedestrians at ‘Zebra’ and analysis conducted, the result shows that drivers given way for only 118 (38.9%) of the observed pedestrian, 179 (59.1%) pedestrians stopped and wait for drivers to give them way. Similarly, 65 (21.5%) pedestrians changed their crossing pace and/or run while crossing despite 11 (3.6%) pedestrians run before crossing and looks hurry to cross, and 54 (17.8%) pedestrians crosses diagonally in fear of the approaching vehicle.

ii. At ‘Medhanealem Mewcha’

The total observed pedestrians on this section are 331. The results of the analysis are described hereunder.

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Table 4. 19: Drivers give way to pedestrians

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Given way by the Driver	134	40.5	40.5	40.5
Do not given way by the Driver	197	59.5	59.5	100.0
Total	331	100.0	100.0	

Table 4. 20: Pedestrians run before crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Pedestrian run before crossing	16	4.8	4.8	4.8
Pedestrian do not run before crossing	315	95.2	95.2	100.0
Total	331	100.0	100.0	

Table 4. 21: Pedestrians Stop before crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Pedestrians stop before crossing	187	56.5	56.5	56.5
Pedestrians do not stop before crossing	144	43.5	43.5	100.0
Total	331	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Table 4. 22: Pedestrian run while crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Pedestrians run while crossing	62	18.7	18.7	18.7
Valid Pedestrians do not run while crossing	269	81.3	81.3	100.0
Total	331	100.0	100.0	

Table 4. 23: Pedestrians crossing straight on the crossing

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Pedestrians crossing straight	286	86.4	86.4	86.4
Valid Pedestrian crossing diagonal	45	13.6	13.6	100.0
Total	331	100.0	100.0	

From the total observed 331 pedestrians at ‘Medhanealem Mewcha’ and analysis conducted, the result shows that drivers given way for only 134 (40.5%) of the observed pedestrian, and 187 (56.5%) pedestrians stopped and wait for drivers to give them way. Similarly, 65 (21.5%) pedestrians changed their crossing pace and/or run while crossing despite 16 (4.8%) pedestrians run before crossing and looks hurry to cross, and 54 (17.8%) pedestrians crosses diagonally in fear of the approaching vehicle.

iii. Overall Statistical Analysis for Longer Distance

From the above analysis, the overall statistical evaluation of road users’ behavior for the longer distance is summarized as presented in the table herein below.

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Table 4. 24: Statistical analysis for Zebra study site

		Drivers give way to pedestrians	Pedestrians run before crossing	Pedestrians Stop before crossing	Pedestrian run while crossing	Pedestrians crossing straight on the crossing
N	Valid	303	303	303	303	303
	Missing	0	0	0	0	0
	Mean	1.61	1.96	1.41	1.79	1.18
	Std. Error of Mean	.028	.011	.028	.024	.022
	Std. Deviation	.488	.187	.493	.411	.383

Table 4. 25: Statistical analysis for Medhanealem Mewcha study site

		Drivers give way to pedestrians	Pedestrians run before crossing	Pedestrians Stop before crossing	Pedestrian run while crossing	Pedestrians crossing straight on the crossing
N	Valid	331	331	331	331	331
	Missing	0	0	0	0	0
	Mean	1.60	1.95	1.44	1.81	1.14
	Std. Error of Mean	.027	.012	.027	.021	.019
	Std. Deviation	.492	.215	.497	.391	.343

As can be seen in the above tables, Standard error of mean of this distribution sample mean is within the true mean with 95% confident interval and that of 5% maximum error of the estimate; as such, the standard error of mean is less than maximum error of the estimate. To this effect, the observed results can be taken as reliable and more accurate which supports to conclude the analysis.

4.2.3. Effects by Age Category

i. Children

In this study, a total number of 397 children pedestrians which crossing using the study site pedestrian crossing were observed; whilst 274 (69.02%) of them are encountered a vehicle. As such, those children encountered a vehicle are used for the analysis of the results. The result of the analysis among each parameter at each study sites are summarized herein below.

Table 4. 26: Summary of observed behavior for children

	Shorter Distance		Longer Distance	
	At St. Gabriel Church	At Mendida	At Zebra	At Medhanealem Mewcha
Number of Total Observations	72	49	66	87
Drivers give way to pedestrians	26 (36.1%)	17 (34.7%)	24 (36.4%)	38 (43.7%)
Pedestrians run before crossing	11 (15.3%)	8 (16.3)	7 (10.6%)	9 (10.3%)
Pedestrians Stop before crossing	56 (77.8%)	37 (75.5%)	48 (72.7%)	63 (72.4%)
Pedestrian run while crossing	29 (40.3%)	21 (42.9%)	24 (36.4%)	28 (32.2%)
Pedestrians crossing straight on the crossing	53 (73.6%)	33 (67.3%)	51 (77.3%)	69 (79.3%)

Please note that the generated output results of the analysis from the software are enclosed in Appendix C.

ii. Elders

A total number of 253 elder pedestrians which crossing the study sites using pedestrian crossing were observed; among them 187 (73.91%) of them are encountered a vehicle. As such, those elder pedestrians encountered a vehicle are used for the analysis of the results.

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

The result of the analysis among each parameter at each study sites are summarized herein below.

Table 4. 27: Summary of observed behavior for elders

	Shorter Distance		Longer Distance	
	At St. Gabriel Church	At Mendida	At Zebra	At Medhanealem Mewcha
Number of Total Observations	54	39	43	51
Drivers give way to pedestrians	19 (35.2%)	13 (33.3%)	16 (37.2%)	20 (39.2%)
Pedestrians run before crossing	2 (3.7%)	2 (5.1%)	1 (2.3%)	1 (2.0%)
Pedestrians Stop before crossing	36 (66.7%)	27 (69.2%)	25 (58.1%)	33 (64.7%)
Pedestrian run while crossing	10 (18.5%)	8 (20.5%)	7 (16.3%)	8 (15.7%)
Pedestrians crossing straight on the crossing	44 (81.5%)	31 (79.5%)	36 (83.7%)	45 (88.2%)

Please note that the generated output results of the analysis from the software are enclosed in Appendix D.

4.3. Comparison of Results and Discussion

In this section describes about the overall summary for comparison of each study site with regard to the respective parameters of the study so as to evaluate the overall comfort and convenient of pedestrian while crossing by categorizing the distance between the speed hump and pedestrian crossing into shorter and longer, as described in the above section.

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Table 4. 28: Comparison of each study site

	Shorter Distance		Longer Distance	
	At St. Gabriel Church	At Mendida	At Zebra	At Medhanealem Mewcha
Number of Total Observations	328	286	303	331
Drivers give way to pedestrians	34.5%	31.8%	38.9%	40.5%
Pedestrians run before crossing	5.5%	8.0%	3.6%	4.8%
Pedestrians Stop before crossing	67.1%	68.5%	59.1%	56.5%
Pedestrian run while crossing	25.3%	26.6%	21.5%	18.7%
Pedestrians crossing straight on the crossing	78.4%	73.1%	82.2%	86.4%

From the Table 4.28, it can be noted that a total number of 614 and 634 observations has been conducted for the shorter distance and longer distance, respectively. While reviewing the results among each study parameters, it is noted that some differences on the results has been observed.

The drivers give way for more than 38% for pedestrian on the longer distance and the same is less than 35% on the shorter distance. In addition, more than 25% of pedestrians are increasing their pace or running while crossing in the shorter distance despite less than 8% of them were also running before approaching the crossing. On the other hand, the pedestrians increasing their pace or running while crossing at the longer distance is not more than 21.5% despite less than 4.8% of them were also running before approaching the crossing.

Moreover, more than 67% of pedestrians were stopped at the median and walkways before crossing at the shorter distance. Whereas, the pedestrians stopped at the longer distances is

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

not more than 59.1%; as such, it can be concluded that pedestrians accept gaps and cross more on the longer distances.

Furthermore, pedestrians crossing on straight at the shorter distances are not more than 78.4%; whilst more than 82.2% of the observed pedestrians are crossing on straight on the crossings at the longer distances.

In connection with this, the results gained by extracting the children and elders from the total observed data also shows the same effect as the total observations (refer Table 4.29 and Table 4.30).

Notwithstanding with the results found on the road users' behavior, the shorter distance exercises less vehicle speed on pedestrian crossing while comparing to the longer distances (refer Table 4.4). Bearing this in mind, an interview was conducted with pedestrians that using both the shorter and the longer distances. Most of them are emphasized that they will not have the information whether the driver give them way or not on the shorter distance; whereas on the longer distances they illustrated that they may guess or force the driver to give them way by entering to the crossing as the vehicle speed is already reduced at the speed hump and the driver may have enough space to stop the vehicle before approaching them.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

This paper assesses and evaluate the effectiveness of speed humps in the reduction of the vehicle speed and its contribution on the comfort and mobility of pedestrians in connection with their different distance from nearby pedestrian crossings.

From the study conducted and the results obtained, the following conclusions are drawn:

- From the recorded spot speed data, it is noted that the speed of vehicles is reduced at crossings in both shorter and longer distances comparing to their approaching speed. However, while comparing shorter and longer distances the vehicle speed on the shorter distance is less than that of the speed on longer distances.
- Drivers give more way to pedestrians at crossings on the longer distance than the shorter distance.
- Pedestrians accept more gaps between vehicles and cross more comfortably on longer distances than that of the shorter. As such, lesser pedestrians are stopped at the edge of the pavement, waiting for the critical gap, before crossing along the longer distances as compared to the smaller distances.
- In addition, it is observed that more pedestrians moved comfortably without changing their pace and on straight while crossing at the longer distances. The pedestrians have also emphasized that they cannot guess whether the encountered vehicle driver stop and give them way or not at the shorter distances.

5.2. Recommendations

Based on the analysis conducted to study the gap acceptance behavior and comfort of pedestrians while crossing at the shorter and longer distances between speed humps and pedestrian crossings, the following recommendations are summarized as follows:

- Vehicle speed is reduced at crossings on both categories of the study, i.e. the shorter and longer distances. As such, installation of speed humps near crossings are recommended at crossings.
- Based on road users' behavioral analysis, the longer distance between speed humps and pedestrian crossings is recommended, for the gap acceptance behavior and comfort of the pedestrian while crossing. The same will also have positive impact on the pedestrians to distinguish if a driver is going to stop or not. However, further study shall be conducted on the modelling of the effective distance between the speed hump and pedestrian crossing.
- Drivers that given way to pedestrians at crossings are still minimum disregarding the installed speed humps near to crossings. Thus, awareness creation program shall be conducted and other forcing mechanism shall also be exercised to overcome the issue and to provide better crossing environment for pedestrians.

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APPENDICES

Appendix A: Spot Speed Data

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME		Site Ref. No.		Surveyor(s) and Supervisor		Sketch	
At St. Gabriel Church				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
2/19/2022	4:00	6:00	Clear				
Arm Name		Direction		Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
		Torhailoch to Bethel		3.4	50	TP: Timing Point	<u>1</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	4.01	N	45	Cars	0.92	N	14
Cars	4.41	N	41	Cars	0.94	N	13
Lights	4.98	B	36	Lights	0.92	X	14
Cars	4.11	N	44	Cars	0.99	N	13
Cars	4.12	N	44	Cars	0.91	N	14
Cars	3.81	N	47	Cars	0.88	N	14
Cars	3.51	N	51	Cars	0.96	N	13
Cars	3.59	N	50	Cars	0.89	X	14
Cars	3.68	N	49	Cars	0.96	N	13
Cars	4.07	N	44	Cars	0.88	N	14
Cars	3.89	N	46	Cars	0.95	N	13
Lights	4.71	B	38	Lights	1.03	N	12
Cars	3.3	N	55	Cars	0.85	N	15
Cars	3.29	N	55	Cars	0.88	N	14
Cars	3.48	N	52	Cars	0.94	N	13
Cars	3.75	N	48	Cars	0.80	N	16
Cars	3.31	N	54	Cars	0.89	N	14
Cars	3.53	N	51	Cars	1.04	N	12
Cars	3.4	N	53	Cars	0.97	X	13
Cars	3.66	N	49	Cars	0.88	N	14
Cars	3.62	N	50	Cars	0.89	N	14
Cars	4.06	N	44	Cars	0.87	N	15
Cars	3.42	N	53	Cars	0.90	N	14
Cars	3.31	N	54	Cars	0.93	N	14
$Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)$							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME		Site Ref. No.		Surveyor(s) and Supervisor		Sketch	
At St. Gabriel Church				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
2/19/2022	4:00	6:00	Clear				
Arm Name		Direction		Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
		Torhailoch to Bethel		3.4	50	TP: Timing Point	<u>2</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	3.85	N	47	Cars	0.98	N	13
Lights	4.72	B	38	Lights	0.88	B	14
Cars	3.73	N	48	Cars	0.93	N	14
Cars	3.98	N	45	Cars	0.89	N	14
Cars	4.39	N	41	Cars	0.92	N	14
Cars	4.06	N	44	Cars	1.06	N	12
Cars	3.86	N	47	Cars	0.83	N	15
Cars	4.41	N	41	Cars	0.88	N	14
Cars	3.75	N	48	Cars	1.00	N	13
Cars	3.98	N	45	Cars	0.97	N	13
Cars	4.34	N	41	Cars	0.93	N	14
Cars	3.85	N	47	Cars	0.91	N	14
Cars	3.94	N	46	Cars	0.86	N	15
Cars	3.96	N	45	Cars	0.89	N	14
$Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)$							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (>4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME		Site Ref. No.		Surveyor(s) and Supervisor		Sketch	
At St. Gabriel Church				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
2/19/2022	4:00	6:00	Clear				
Arm Name		Direction		Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
		Torhailoch to Bethel		3.4	50	TP: Timing Point	<u>3</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	4.07	N	44	Cars	1.02	N	12
Cars	3.79	N	47	Cars	0.99	N	13
Cars	4.17	N	43	Cars	0.85	N	15
Cars	3.75	N	48	Cars	1.04	N	12
Cars	4.23	N	43	Cars	1.02	N	12
Cars	4.16	N	43	Cars	0.97	N	13
Cars	4.37	N	41	Cars	0.93	N	14
Cars	4.06	N	44	Cars	0.95	N	13
Cars	3.74	N	48	Cars	1.03	N	12
Cars	3.76	N	48	Cars	0.86	N	15
Lights	4.48	N	40	Lights	0.92	N	14
Cars	4.25	N	42	Cars	0.88	N	14
Cars	3.91	N	46	Cars	1.00	N	13
Cars	3.76	N	48	Cars	1.06	N	12
Cars	4.18	N	43	Cars	1.04	N	12
Cars	3.63	N	50	Cars	0.90	N	14
Cars	4	N	45	Cars	0.97	N	13
Cars	3.72	N	48	Cars	0.90	N	14
Cars	4.2	N	43	Cars	1.02	N	12
Cars	3.92	N	46	Cars	0.90	N	14
Cars	4.34	N	41	Cars	1.13	N	11
Cars	4.17	N	43	Cars	0.82	N	15
Medium	4.48	N	40	Medium	0.97	N	13
Cars	4.42	N	41	Cars	0.86	N	15
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME		Site Ref. No.		Surveyor(s) and Supervisor		Sketch	
At St. Gabriel Church				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
2/19/2022	4:00	6:00	Clear				
Arm Name		Direction		Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
		Torhailoch to Bethel		3.4	50	TP: Timing Point	<u>4</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/ Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/ Delays	Speed (km/h)
Cars	4.01	N	45	Cars	1.04	N	12
Cars	3.73	N	48	Cars	0.96	N	13
Cars	4.32	N	42	Cars	0.93	N	14
Cars	3.85	N	47	Cars	0.83	N	15
Cars	4.02	N	45	Cars	0.92	N	14
Cars	3.92	N	46	Cars	1.08	N	12
Cars	4.18	N	43	Cars	1.03	N	12
Cars	3.77	N	48	Cars	0.97	N	13
Cars	3.63	N	50	Cars	0.85	N	15
Cars	4.34	N	41	Cars	0.95	N	13
Cars	4.05	N	44	Cars	1.02	N	12
Cars	3.9	N	46	Cars	0.89	N	14
Lights	4.49	N	40	Lights	0.95	N	13
Cars	4.09	N	44	Cars	1.01	N	13
Cars	3.77	N	48	Cars	0.97	N	13
Lights	4.54	B	40	Lights	1.01	B	13
Cars	3.85	N	47	Cars	1.03	N	12
Cars	4.47	N	40	Cars	0.92	N	14
Cars	3.92	N	46	Cars	1.02	N	12
Cars	4.1	N	44	Cars	0.90	N	14
Cars	3.92	N	46	Cars	0.96	N	13
Cars	3.56	N	51	Cars	0.97	N	13
Cars	3.56	N	51	Cars	0.95	N	13
Cars	4.08	N	44	Cars	1.07	N	12
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At St. Gabriel Church				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
2/19/2022	4:00	6:00	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhailoch to Bethel	3.4	50	TP: Timing Point	<u>5</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	3.86	N	47	Cars	0.94	N	13
Cars	4.41	N	41	Cars	1.04	N	12
Cars	4.45	N	40	Cars	0.88	N	14
Lights	4.65	B	39	Lights	1.12	B	11
Cars	4.46	N	40	Cars	1.01	N	13
Cars	4.17	N	43	Cars	0.83	N	15
Cars	3.7	N	49	Cars	0.97	N	13
Cars	3.91	N	46	Cars	0.99	N	13
Cars	4.08	N	44	Cars	0.85	N	15
Cars	4.36	N	41	Cars	0.94	N	13
Cars	3.86	N	47	Cars	0.83	N	15
Cars	4.25	N	42	Cars	0.93	N	14
Cars	4.42	N	41	Cars	0.88	N	14
Cars	3.75	N	48	Cars	0.97	N	13
Lights	4.53	B	40	Lights	1.13	B	11
Cars	4.34	N	41	Cars	0.95	N	13
Cars	3.82	N	47	Cars	0.99	N	13
Cars	3.64	N	49	Cars	1.07	N	12
Cars	3.97	N	45	Cars	0.95	N	13
Cars	4.25	N	42	Cars	0.89	N	14
Cars	3.99	N	45	Cars	0.97	N	13
Cars	4.08	N	44	Cars	1.03	N	12
Cars	4.22	N	43	Cars	0.95	N	13
Lights	4.49	N	40	Lights	0.90	N	14
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At St. Gabriel Church				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
2/19/2022	4:00	6:00	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhailoch to Bethel	3.4	50	TP: Timing Point	<u>6 of 8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Lights	4.51	B	40	Lights	1.13	B	11
Cars	4.11	N	44	Cars	0.97	N	13
Cars	3.65	N	49	Cars	0.94	N	13
Cars	4.3	N	42	Cars	1.06	N	12
Cars	3.73	N	48	Cars	0.97	N	13
Cars	4.31	N	42	Cars	0.88	N	14
Cars	3.95	N	46	Cars	0.97	N	13
Cars	4.38	N	41	Cars	0.99	N	13
Cars	4.07	N	44	Cars	0.88	N	14
Cars	4.1	N	44	Cars	0.96	N	13
Cars	4.48	N	40	Cars	0.77	N	16
Lights	4.5	B	40	Lights	1.11	B	11
Cars	3.9	N	46	Cars	0.91	N	14
Cars	3.97	N	45	Cars	0.84	N	15
Cars	4.16	N	43	Cars	0.88	N	14
Cars	4.19	N	43	Cars	0.98	N	13
Cars	3.93	N	46	Cars	0.92	N	14
Cars	4.01	N	45	Cars	0.83	N	15
Cars	4.11	N	44	Cars	0.87	N	14
Lights	4.65	B	39	Lights	1.00	B	13
Medium	4.45	N	40	Medium	0.64	N	20
Cars	3.82	N	47	Cars	0.92	N	14
Cars	3.83	N	47	Cars	0.82	N	15
Cars	4.39	N	41	Cars	0.92	N	14
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchrochments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At St. Gabriel Church				Eyob Shumet, Keanan Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
2/19/2022	4:00	6:00	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhailoch to Bethel	3.4	50	TP: Timing Point	<u>7</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	4.42	N	41	Cars	1.10	N	11
Cars	4.18	N	43	Cars	0.87	N	14
Cars	4.44	N	41	Cars	0.85	N	15
Cars	3.64	N	49	Cars	0.98	N	13
Cars	4.12	N	44	Cars	1.00	N	13
Lights	4.47	N	40	Lights	1.03	N	12
Cars	4.32	N	42	Cars	0.99	N	13
Cars	4.47	N	40	Cars	0.95	N	13
Cars	4.38	N	41	Cars	1.13	N	11
Cars	4.42	N	41	Cars	1.07	N	12
Cars	3.71	N	49	Cars	0.87	N	14
Cars	4.3	N	42	Cars	1.00	N	13
Cars	3.96	N	45	Cars	0.98	N	13
Cars	4.45	N	40	Cars	0.87	N	14
Cars	3.87	N	47	Cars	1.00	N	13
Cars	3.95	N	46	Cars	0.98	N	13
Cars	4.22	N	43	Cars	0.87	N	14
Lights	4.93	B	37	Lights	1.12	B	11
Cars	3.98	N	45	Cars	0.90	N	14
Cars	4.33	N	42	Cars	1.01	N	12
Cars	3.95	N	46	Cars	0.79	N	16
Cars	4.45	N	40	Cars	1.01	N	12
Cars	3.85	N	47	Cars	1.03	N	12
Cars	4.2	N	43	Cars	0.90	N	14
$Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)$							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME		Site Ref. No.		Surveyor(s) and Supervisor		Sketch	
At St. Gabriel Church				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
2/19/2022	4:00	6:00	Clear				
Arm Name		Direction		Width (m)	Baseline Length (m)		SP: Survey Point
		Torhailoch to Bethel		3.4	50		TP: Timing Point
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	4.43	N	41	Cars	1.00	N	13
Cars	3.88	N	46	Cars	1.00	N	13
Cars	4.3	N	42	Cars	0.93	N	14
Cars	4.05	N	44	Cars	0.86	N	15
Cars	3.97	N	45	Cars	1.02	N	12
Cars	4.13	N	44	Cars	0.82	N	15
Cars	3.82	N	47	Cars	1.00	N	13
Cars	3.95	N	46	Cars	1.01	N	12
Cars	3.84	N	47	Cars	1.03	N	12
Cars	3.83	N	47	Cars	0.93	N	14
Medium	4.49	N	40	Medium	1.07	N	12
Cars	4.46	N	40	Cars	0.89	N	14
Lights	4.47	N	40	Lights	0.95	N	13
Cars	3.64	N	49	Cars	0.88	N	14
Cars	4.23	N	43	Cars	1.05	N	12
Cars	4.49	N	40	Cars	0.96	N	13
Cars	3.71	N	49	Cars	1.06	N	12
Cars	4.06	N	44	Cars	0.95	N	13
Lights	4.5	B	40	Lights	1.11	B	11
Cars	3.76	N	48	Cars	1.03	N	12
Cars	4.07	N	44	Cars	0.95	N	13
Cars	4.19	N	43	Cars	0.97	N	13
Cars	4.06	N	44	Cars	0.88	N	14
Cars	3.63	N	50	Cars	0.91	N	14
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME		Site Ref. No.		Surveyor(s) and Supervisor		Sketch	
At Mendida				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Clear	Notes			
	From	To					
2/29/2022	4:00	6:00					
Arm Name		Direction		Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
		Bethel to Torhailoch		3.4	50	TP: Timing Point	<u>1</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	3.78	N	48	Cars	1.01	N	14
Cars	3.82	N	47	Cars	1.11	N	13
Cars	4.07	N	44	Cars	0.98	N	15
Cars	4.29	N	42	Cars	1.19	N	12
Cars	4.18	N	43	Cars	1.13	N	13
Cars	4.39	N	41	Cars	1.04	N	14
Cars	3.95	N	46	Cars	0.94	N	15
Cars	4.4	N	41	Cars	1.22	N	12
Cars	4.01	N	45	Cars	1.25	N	11
Cars	4.32	N	42	Cars	1.17	N	12
Cars	3.87	N	47	Cars	1.03	N	14
Cars	4.36	N	41	Cars	0.94	N	15
Lights	4.42	N	41	Lights	1.11	N	13
Cars	4.21	N	43	Cars	1.19	N	12
Medium	4.46	N	40	Medium	1.26	N	11
Cars	3.77	N	48	Cars	1.01	N	14
Cars	4.46	N	40	Cars	1.31	N	11
Cars	4.28	N	42	Cars	1.23	N	12
Cars	3.92	N	46	Cars	1.07	N	14
Cars	3.78	N	48	Cars	1.01	N	14
Cars	3.75	N	48	Cars	0.95	N	15
Cars	4.01	N	45	Cars	0.99	N	14
Cars	3.95	N	46	Cars	0.96	N	15
Cars	4.19	N	43	Cars	1.19	N	12
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE								
SITE NAME		Site Ref. No.	Surveyor(s) and Supervisor		Sketch			
At Mendida			Eyob Shumet, Kenean Sisay and Milkyas Kassie					
Date	Time		Clear	Notes				
	From	To						
2/29/2022	4:00	6:00						
Arm Name		Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet		
		Bethel to Torhailoch	3.4	50	TP: Timing Point	<u>2</u> of <u>8</u>		
Before Crossing the Speed Hump				After Crossing the Speed Hump				
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	
Cars	4.16	N	43	Cars	1.07	N	13	
Cars	3.84	N	47	Cars	1.22	N	12	
Cars	3.92	N	46	Cars	1.17	N	12	
Cars	4.04	N	45	Cars	1.21	N	12	
Lights	4.44	N	41	Lights	1.18	N	12	
Cars	4.29	N	42	Cars	0.95	N	15	
Cars	3.97	N	45	Cars	1.13	N	13	
Cars	4.62	B	39	Cars	1.28	B	11	
Cars	3.9	N	46	Cars	0.89	N	16	
Cars	3.86	N	47	Cars	0.95	N	15	
Cars	3.94	N	46	Cars	1.14	N	13	
Cars	4.33	N	42	Cars	0.99	N	14	
Cars	4.43	N	41	Cars	1.07	N	14	
Cars	3.74	N	48	Cars	1.03	N	14	
Cars	4.18	N	43	Cars	0.95	N	15	
Cars	4.16	N	43	Cars	1.15	N	13	
Lights	4.65	B	39	Lights	0.89	B	16	
Cars	4.47	N	40	Cars	0.85	N	17	
Cars	4.32	N	42	Cars	1.11	N	13	
Cars	3.96	N	45	Cars	1.21	N	12	
Cars	4.03	N	45	Cars	1.21	N	12	
Cars	4.35	N	41	Cars	1.01	N	14	
Cars	4.43	N	41	Cars	1.14	N	13	
Cars	4.4	N	41	Cars	1.05	N	14	
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)								
Vehicle Type				Reasons for Delay		Notes		
Group	Description	Group	Description	S = Signals	Roadworks			
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident			
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes			
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments			
Lights	Large Bus			K = Parked	Police intrvention			
	Single rear axle truck			N = Not delayed	Unknown-other			
				X = Following vehicle				

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME		Site Ref. No.		Surveyor(s) and Supervisor		Sketch	
At Mendida				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Clear	Notes			
	From	To					
2/29/2022	4:00	6:00					
Arm Name		Direction		Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
		Bethel to Torhailoch		3.4	50	TP: Timing Point	<u>3</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	3.97	N	45	Cars	0.99	N	14
Cars	4.45	N	40	Cars	1.09	N	13
Cars	4.38	N	41	Cars	1.13	N	13
Cars	4.29	N	42	Cars	0.99	N	14
Cars	4.26	N	42	Cars	1.15	N	12
Cars	4.42	N	41	Cars	1.10	N	13
Cars	3.97	N	45	Cars	1.02	N	14
Cars	4.32	N	42	Cars	1.04	N	14
Cars	3.78	N	48	Cars	1.12	N	13
Cars	4.3	N	42	Cars	1.06	N	14
Cars	4.46	N	40	Cars	1.07	N	13
Cars	3.71	N	49	Cars	1.11	N	13
Cars	4.08	N	44	Cars	0.99	N	14
Cars	3.9	N	46	Cars	1.05	N	14
Cars	4.21	N	43	Cars	1.06	N	14
Cars	4.38	N	41	Cars	1.01	N	14
Cars	3.96	N	45	Cars	1.17	N	12
Cars	3.9	N	46	Cars	0.98	N	15
Cars	4.16	N	43	Cars	1.07	N	13
Cars	4.27	N	42	Cars	0.98	N	15
Cars	3.91	N	46	Cars	1.05	N	14
Lights	4.43	N	41	Lights	0.99	N	14
Cars	3.94	N	46	Cars	1.04	N	14
Cars	3.98	N	45	Cars	0.97	N	15
$Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)$							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME		Site Ref. No.		Surveyor(s) and Supervisor		Sketch	
At Mendida				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Clear	Notes			
	From	To					
2/29/2022	4:00	6:00					
Arm Name		Direction		Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
		Bethel to Torhailoch		3.4	50	TP: Timing Point	<u>4</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	3.85	N	47	Cars	0.89	N	16
Cars	4.26	N	42	Cars	0.96	N	15
Cars	4.18	N	43	Cars	1.12	N	13
Cars	4.34	N	41	Cars	1.18	N	12
Cars	4.01	N	45	Cars	1.10	N	13
Cars	4.48	N	40	Cars	1.07	N	13
Cars	4.3	N	42	Cars	1.01	N	14
Cars	4.46	N	40	Cars	1.05	N	14
Cars	4.05	N	44	Cars	1.12	N	13
Cars	4.17	N	43	Cars	1.04	N	14
Cars	4.4	N	41	Cars	0.97	N	15
Cars	4.45	N	40	Cars	1.07	N	13
Cars	4.17	N	43	Cars	1.09	N	13
Cars	3.9	N	46	Cars	1.04	N	14
Cars	3.94	N	46	Cars	1.07	N	13
Cars	3.96	N	45	Cars	1.06	N	14
Cars	3.91	N	46	Cars	1.02	N	14
Cars	3.89	N	46	Cars	0.96	N	15
Lights	4.59	B	39	Lights	1.11	B	13
Cars	4.42	N	41	Cars	1.03	N	14
Cars	4.01	N	45	Cars	1.12	N	13
Cars	3.99	N	45	Cars	1.04	N	14
Cars	3.97	N	45	Cars	1.02	N	14
Cars	4.26	N	42	Cars	1.14	N	13
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Mendida				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Clear	Notes			
	From	To					
2/29/2022	4:00	6:00					
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Bethel to Torhailoch	3.4	50	TP: Timing Point	<u>5</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	3.85	N	47	Cars	0.99	N	14
Cars	4.18	N	43	Cars	1.05	N	14
Cars	4.44	N	41	Cars	1.19	N	12
Cars	4.39	N	41	Cars	1.15	N	12
Cars	4.1	N	44	Cars	1.09	N	13
Cars	3.89	N	46	Cars	1.01	N	14
Cars	4.21	N	43	Cars	0.96	N	15
Cars	4.47	N	40	Cars	1.21	N	12
Cars	4.16	N	43	Cars	1.06	N	14
Cars	4.06	N	44	Cars	1.11	N	13
Cars	4.33	N	42	Cars	1.10	N	13
Cars	4.42	N	41	Cars	0.97	N	15
Cars	3.93	N	46	Cars	0.94	N	15
Cars	4.07	N	44	Cars	1.02	N	14
Cars	4.03	N	45	Cars	1.05	N	14
Cars	4.24	N	42	Cars	1.02	N	14
Lights	4.71	B	38	Lights	1.07	B	13
Cars	3.75	N	48	Cars	1.10	N	13
Cars	4.1	N	44	Cars	0.99	N	14
Cars	4.32	N	42	Cars	1.07	N	13
Cars	4.14	N	43	Cars	1.04	N	14
Cars	4.43	N	41	Cars	1.02	N	14
Cars	3.71	N	49	Cars	0.89	N	16
Cars	4.14	N	43	Cars	1.18	N	12
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Mendida				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Clear	Notes			
	From	To					
2/29/2022	4:00	6:00					
Arm Name		Direction		Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
		Bethel to Torhailoch		3.4	50	TP: Timing Point	<u>6 of 8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	4.27	N	42	Cars	1.02	N	14
Cars	3.89	N	46	Cars	0.91	N	16
Cars	4.44	N	41	Cars	1.10	N	13
Cars	4.05	N	44	Cars	1.05	N	14
Cars	3.95	N	46	Cars	1.01	N	14
Cars	3.87	N	47	Cars	1.07	N	13
Cars	3.93	N	46	Cars	0.97	N	15
Cars	3.98	N	45	Cars	1.05	N	14
Cars	4.42	N	41	Cars	1.02	N	14
Cars	4.26	N	42	Cars	0.95	N	15
Cars	3.88	N	46	Cars	0.93	N	16
Cars	4.21	N	43	Cars	0.99	N	14
Cars	3.72	N	48	Cars	1.05	N	14
Cars	4.16	N	43	Cars	1.07	N	13
Cars	4.04	N	45	Cars	0.90	N	16
Cars	3.83	N	47	Cars	0.87	N	17
Cars	4.25	N	42	Cars	1.06	N	14
Cars	3.81	N	47	Cars	1.01	N	14
Cars	4.2	N	43	Cars	1.04	N	14
Cars	3.93	N	46	Cars	1.09	N	13
Cars	3.76	N	48	Cars	0.96	N	15
Cars	3.92	N	46	Cars	0.89	N	16
Cars	4.46	N	40	Cars	1.13	N	13
Cars	3.98	N	45	Cars	1.07	N	13
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME		Site Ref. No.		Surveyor(s) and Supervisor		Sketch	
At Mendida				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Clear	Notes			
	From	To					
2/29/2022	4:00	6:00					
Arm Name		Direction		Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
		Bethel to Torhaloch		3.4	50	TP: Timing Point	<u>7</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	4.02	N	45	Cars	1.04	N	14
Lights	4.68	B	38	Lights	0.99	B	14
Cars	4.27	N	42	Cars	0.98	N	15
Cars	3.8	N	47	Cars	0.82	N	18
Cars	4.45	N	40	Cars	1.07	N	13
Cars	3.87	N	47	Cars	0.97	N	15
Cars	4.16	N	43	Cars	0.98	N	15
Cars	3.79	N	47	Cars	1.10	N	13
Cars	3.96	N	45	Cars	1.06	N	14
Medium	4.48	N	40	Medium	1.02	N	14
Cars	4.25	N	42	Cars	0.99	N	14
Cars	4.21	N	43	Cars	1.04	N	14
Cars	3.72	N	48	Cars	0.86	N	17
Cars	3.78	N	48	Cars	0.90	N	16
Cars	4.36	N	41	Cars	1.18	N	12
Cars	3.75	N	48	Cars	0.93	N	16
Cars	4.26	N	42	Cars	0.99	N	14
Cars	3.94	N	46	Cars	1.02	N	14
Cars	3.91	N	46	Cars	1.09	N	13
Cars	3.96	N	45	Cars	1.07	N	13
Cars	4.29	N	42	Cars	1.04	N	14
Cars	3.97	N	45	Cars	1.02	N	14
Cars	3.91	N	46	Cars	1.10	N	13
Cars	4.1	N	44	Cars	1.13	N	13
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Mendida				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Clear	Notes			
	From	To					
2/29/2022	4:00	6:00					
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Bethel to Torhailoch	3.4	50	TP: Timing Point	<u>8</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	4.37	N	41	Cars	1.17	N	12
Lights	4.49	N	40	Lights	1.11	N	13
Cars	4.44	N	41	Cars	1.01	N	14
Cars	4.12	N	44	Cars	1.06	N	14
Cars	4.19	N	43	Cars	0.97	N	15
Cars	4.43	N	41	Cars	0.94	N	15
Cars	4.49	N	40	Cars	1.08	N	13
Cars	4.14	N	43	Cars	1.17	N	12
Cars	4.39	N	41	Cars	1.05	N	14
Cars	3.94	N	46	Cars	1.13	N	13
Cars	4.08	N	44	Cars	1.23	N	12
Cars	4.49	N	40	Cars	1.06	N	14
Cars	4.19	N	43	Cars	0.94	N	15
Cars	3.84	N	47	Cars	1.11	N	13
Cars	4.34	N	41	Cars	1.25	N	11
Cars	4.07	N	44	Cars	1.17	N	12
Cars	3.76	N	48	Cars	1.22	N	12
Lights	4.53	B	40	Lights	1.30	B	11
Cars	4.08	N	44	Cars	0.94	N	15
Cars	4.01	N	45	Cars	1.09	N	13
Cars	3.95	N	46	Cars	0.96	N	15
Cars	3.92	N	46	Cars	1.25	N	12
Cars	3.87	N	47	Cars	1.26	N	11
Cars	3.91	N	46	Cars	0.80	N	18
$Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)$							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Zebra				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/5/2022	4:00 PM	6:00 PM	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhaioch to Bethel	3.4	50	TP: Timing Point	<u>1</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/ Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/ Delays	Speed (km/h)
Cars	3.69	N	49	Cars	1.62	N	18
Cars	3.84	N	47	Cars	1.36	N	21
Cars	3.72	N	48	Cars	1.48	N	19
Lights	4.54	B	40	Lights	1.67	B	17
Cars	3.76	N	48	Cars	1.38	N	21
Cars	3.54	N	51	Cars	1.43	N	20
Cars	3.17	N	57	Cars	1.69	N	17
Cars	4.48	N	40	Cars	1.84	N	16
Lights	5.5	B	33	Lights	1.96	B	15
Cars	3.4	N	53	Cars	1.65	N	17
Cars	4.04	N	45	Cars	1.71	N	17
Lights	4.77	B	38	Lights	2.03	B	14
Cars	3.03	N	59	Cars	1.67	N	17
Cars	3.59	N	50	Cars	1.81	N	16
Cars	3.83	N	47	Cars	1.48	N	19
Cars	3.62	N	50	Cars	1.53	N	19
Cars	3.12	N	58	Cars	1.74	N	17
Cars	4.1	N	44	Cars	1.8	N	16
Cars	3.65	N	49	Cars	1.61	N	18
Cars	3.18	N	57	Cars	1.57	N	18
Cars	4.03	N	45	Cars	1.73	N	17
Cars	3.63	N	50	Cars	1.75	N	16
Cars	4.02	N	45	Cars	1.48	N	19
Cars	3.11	N	58	Cars	1.89	N	15
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Zebra				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/5/2022	4:00 PM	6:00 PM	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhaioch to Bethel	3.4	50	TP: Timing Point	<u>2</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	3.4	N	53	Cars	1.46	N	20
Cars	4.16	N	43	Cars	1.63	N	18
Cars	3.62	N	50	Cars	1.29	N	22
Cars	3.76	N	48	Cars	1.54	N	19
Lights	4.51	B	40	Lights	2.06	B	14
Cars	4.09	N	44	Cars	1.97	N	15
Cars	3.75	N	48	Cars	1.81	N	16
Cars	3.83	N	47	Cars	1.74	N	17
Cars	3.96	N	45	Cars	1.62	N	18
Lights	4.59	B	39	Lights	2.14	B	13
Cars	3.4	N	53	Cars	1.85	N	16
Cars	3.42	N	53	Cars	1.73	N	17
Cars	3.88	N	46	Cars	1.28	N	23
Cars	3.83	N	47	Cars	1.92	N	15
Cars	3.55	N	51	Cars	1.89	N	15
Cars	3.15	N	57	Cars	1.83	N	16
Lights	5.66	B	32	Lights	2.22	B	13
Cars	3.44	N	52	Cars	1.85	N	16
Cars	3.1	N	58	Cars	1.36	N	21
Cars	3.98	N	45	Cars	1.62	N	18
Cars	4.04	N	45	Cars	1.69	N	17
Cars	4.19	N	43	Cars	1.91	N	15
Lights	4.69	B	38	Lights	1.99	B	14
Cars	4.01	N	45	Cars	1.53	N	19
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Zebra				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/5/2022	4:00 PM	6:00 PM	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhailoch to Bethel	3.4	50	TP: Timing Point	<u>3 of 8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	3.99	N	45	Cars	1.6	N	18
Cars	4.43	N	41	Cars	1.46	N	20
Cars	4.33	N	42	Cars	1.31	N	22
Cars	3.85	N	47	Cars	1.37	N	21
Cars	3.71	N	49	Cars	1.43	N	20
Cars	4.27	N	42	Cars	1.18	N	24
Cars	3.62	N	50	Cars	1.24	N	23
Lights	4.98	B	36	Lights	2.17	B	13
Cars	3.14	N	57	Cars	1.49	N	19
Cars	4.15	N	43	Cars	1.84	N	16
Cars	3.49	N	52	Cars	1.98	N	15
Cars	3.82	N	47	Cars	1.47	N	20
Lights	4.49	N	40	Lights	1.93	B	15
Lights	4.82	B	37	Lights	2.02	B	14
Cars	3.29	N	55	Cars	1.78	N	16
Cars	3.87	N	47	Cars	1.84	N	16
Cars	4.01	N	45	Cars	1.53	N	19
Cars	3.91	N	46	Cars	1.8	N	16
Cars	4.07	N	44	Cars	1.59	N	18
Cars	3.77	N	48	Cars	1.61	N	18
Cars	3.65	N	49	Cars	1.32	N	22
Cars	4.2	N	43	Cars	1.67	N	17
Cars	3.31	N	54	Cars	1.44	N	20
Cars	3.61	N	50	Cars	1.65	N	17
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Zebra				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/5/2022	4:00 PM	6:00 PM	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhaioch to Bethel	3.4	50	TP: Timing Point	<u>4</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/ Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/ Delays	Speed (km/h)
Cars	4.01	N	45	Cars	1.82	N	16
Cars	4	N	45	Cars	1.63	N	18
Cars	3.68	N	49	Cars	1.35	N	21
Cars	3.42	N	53	Cars	1.74	N	17
Cars	4.16	N	43	Cars	1.68	N	17
Cars	4.19	N	43	Cars	1.59	N	18
Cars	4.02	N	45	Cars	1.81	N	16
Cars	3.76	N	48	Cars	1.27	N	23
Cars	3.42	N	53	Cars	1.66	N	17
Cars	3.99	N	45	Cars	1.72	N	17
Cars	3.71	N	49	Cars	1.85	N	16
Cars	4.21	N	43	Cars	1.47	N	20
Cars	3.88	N	46	Cars	1.76	N	16
Cars	3.63	N	50	Cars	1.29	N	22
Cars	3.2	N	56	Cars	1.43	N	20
Cars	3.44	N	52	Cars	1.54	N	19
Cars	3.31	N	54	Cars	1.68	N	17
Cars	4.15	N	43	Cars	1.67	N	17
Cars	4.05	N	44	Cars	1.91	N	15
Cars	3.53	N	51	Cars	1.24	N	23
Cars	4.18	N	43	Cars	1.87	N	15
Cars	3.76	N	48	Cars	1.31	N	22
Cars	4.28	N	42	Cars	1.39	N	21
Cars	4.14	N	43	Cars	1.42	N	20
$Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)$							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Zebra				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/5/2022	4:00 PM	6:00 PM	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhaioch to Bethel	3.4	50	TP: Timing Point	<u>5</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	4.21	N	43	Cars	1.45	N	20
Cars	3.96	N	45	Cars	1.68	N	17
Cars	4.28	N	42	Cars	1.64	N	18
Cars	3.72	N	48	Cars	1.59	N	18
Cars	3.84	N	47	Cars	1.76	N	16
Cars	3.79	N	47	Cars	1.33	N	22
Cars	4.38	N	41	Cars	1.52	N	19
Cars	3.61	N	50	Cars	1.57	N	18
Cars	4.23	N	43	Cars	1.75	N	16
Cars	4.13	N	44	Cars	1.69	N	17
Cars	4.38	N	41	Cars	1.74	N	17
Lights	4.53	B	40	Lights	1.27	N	23
Cars	4.4	N	41	Cars	1.63	N	18
Cars	3.56	N	51	Cars	1.66	N	17
Cars	4.26	N	42	Cars	1.72	N	17
Cars	3.61	N	50	Cars	1.8	N	16
Cars	3.55	N	51	Cars	1.31	N	22
Cars	3.65	N	49	Cars	1.63	N	18
Cars	3.79	N	47	Cars	1.69	N	17
Cars	3.65	N	49	Cars	1.71	N	17
Cars	3.85	N	47	Cars	1.56	N	18
Cars	3.76	N	48	Cars	1.49	N	19
Cars	3.73	N	48	Cars	1.74	N	17
Cars	4.2	N	43	Cars	1.88	N	15
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Zebra				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/5/2022	4:00 PM	6:00 PM	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhaioch to Bethel	3.4	50	TP: Timing Point	<u>6</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	3.43	N	52	Cars	1.62	N	18
Cars	3.7	N	49	Cars	1.78	N	16
Cars	4.13	N	44	Cars	1.55	N	19
Cars	4.39	N	41	Cars	1.19	N	24
Cars	3.96	N	45	Cars	1.42	N	20
Cars	4.28	N	42	Cars	1.49	N	19
Cars	4.29	N	42	Cars	1.56	N	18
Cars	3.87	N	47	Cars	1.39	N	21
Cars	3.8	N	47	Cars	1.42	N	20
Cars	4.14	N	43	Cars	1.50	N	19
Cars	3.83	N	47	Cars	1.39	N	21
Medium	4.48	N	40	Medium	1.65	N	18
Cars	3.57	N	50	Cars	1.59	N	18
Cars	3.76	N	48	Cars	1.55	N	19
Cars	3.51	N	51	Cars	1.31	N	22
Cars	3.53	N	51	Cars	1.68	N	17
Cars	4.3	N	42	Cars	2.01	N	14
Cars	4.04	N	45	Cars	1.87	N	15
Cars	3.61	N	50	Cars	1.41	N	20
Cars	3.9	N	46	Cars	1.77	N	16
Cars	3.87	N	47	Cars	1.85	N	16
Cars	4.06	N	44	Cars	1.70	N	17
Cars	3.7	N	49	Cars	1.44	N	20
Cars	3.95	N	46	Cars	1.65	N	18
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE								
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch		
At Zebra				Eyob Shumet, Kenean Sisay and Milkyas Kassie				
Date	Time		Weather	Notes				
	From	To						
3/5/2022	4:00 PM	6:00 PM	Clear					
Arm Name			Direction	Width (m)	Baseline Length (m)		SP: Survey Point	
			Torhaioch to Bethel	3.4	50		TP: Timing Point	
				7 of 8				
Before Crossing the Speed Hump				After Crossing the Speed Hump				
Vehicle Type	Time Taken (sec)	Notes/Delays		Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	
Cars	4.16	N		43	Cars	1.68	N	
Lights	5.17	B		35	Lights	2.32	B	
Cars	4.29	N		42	Cars	2.10	N	
Cars	4.38	N		41	Cars	1.94	N	
Cars	3.59	N		50	Cars	1.89	N	
Cars	4.1	N		44	Cars	1.62	N	
Lights	4.87	B		37	Lights	2.42	B	
Cars	3.74	N		48	Cars	1.93	N	
Cars	3.55	N		51	Cars	1.30	N	
Cars	3.95	N		46	Cars	1.39	N	
Cars	4.2	N		43	Cars	1.92	N	
Cars	4.27	N		42	Cars	1.36	N	
Cars	3.69	N		49	Cars	1.76	N	
Cars	3.81	N		47	Cars	1.63	N	
Cars	4.06	N		44	Cars	1.74	N	
Cars	4.37	N		41	Cars	1.98	N	
Cars	4.19	N		43	Cars	1.67	N	
Lights	5.04	B		36	Lights	2.27	B	
Cars	4.27	N		42	Cars	1.84	N	
Cars	4.39	N		41	Cars	1.58	N	
Cars	3.82	N		47	Cars	1.60	N	
Cars	4.04	N		45	Cars	1.57	N	
Cars	3.99	N		45	Cars	1.47	N	
Cars	3.52	N		51	Cars	1.38	N	
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)								
Vehicle Type				Reasons for Delay		Notes		
Group	Description	Group	Description	S = Signals	Roadworks			
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident			
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes			
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments			
Lights	Large Bus			K = Parked	Police intrvention			
	Single rear axle truck			N = Not delayed	Unknown-other			
				X = Following vehicle				

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Zebra				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/5/2022	4:00 PM	6:00 PM	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhaioch to Bethel	3.4	50	TP: Timing Point	<u>8</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	4.48	N	40	Cars	1.51	N	19
Cars	4.35	N	41	Cars	1.69	N	17
Cars	3.66	N	49	Cars	1.53	N	19
Cars	3.86	N	47	Cars	1.61	N	18
Cars	3.65	N	49	Cars	1.28	N	23
Cars	3.73	N	48	Cars	1.34	N	22
Cars	3.88	N	46	Cars	1.41	N	20
Cars	4.17	N	43	Cars	1.87	N	15
Cars	4.05	N	44	Cars	1.54	N	19
Cars	3.87	N	47	Cars	1.65	N	18
Lights	4.85	B	37	Lights	2.50	B	12
Cars	4.48	N	40	Cars	1.78	N	16
Cars	3.79	N	47	Cars	1.30	N	22
Cars	4.47	N	40	Cars	1.45	N	20
Cars	4.32	N	42	Cars	1.42	N	20
Cars	3.66	N	49	Cars	1.74	N	17
Cars	4.01	N	45	Cars	1.66	N	17
Cars	3.77	N	48	Cars	1.81	N	16
Cars	4.45	N	40	Cars	1.50	N	19
Lights	5.26	B	34	Lights	2.37	B	12
Cars	4.08	N	44	Cars	1.39	N	21
Cars	3.79	N	47	Cars	1.61	N	18
Cars	4.04	N	45	Cars	1.54	N	19
Cars	3.98	N	45	Cars	1.46	N	20
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME		Site Ref. No.		Surveyor(s) and Supervisor		Sketch	
At Medhanealem Mewcha				Eyob Shumet, Keanan Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/12/2022	4:00 PM	6:00 PM	Clear				
Arm Name		Direction		Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
		Torhailoch to Bethel		3.4	50	TP: Timing Point	<u>1</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	3.99	N	45	Cars	2.07	N	19
Cars	4.22	N	43	Cars	1.92	N	21
Cars	3.89	N	46	Cars	3.00	N	13
Cars	3.9	N	46	Cars	2.23	N	18
Cars	4.23	N	43	Cars	2.72	N	15
Cars	3.67	N	49	Cars	1.98	N	20
Cars	4.01	N	45	Cars	2.23	N	18
Cars	4.46	N	40	Cars	1.81	N	22
Cars	3.75	N	48	Cars	2.40	N	16
Cars	3.7	N	49	Cars	2.09	N	19
Lights	4.53	B	40	Lights	2.77	B	14
Cars	3.57	N	50	Cars	2.28	N	17
Cars	3.98	N	45	Cars	2.72	N	15
Cars	4.38	N	41	Cars	2.29	N	17
Cars	4.4	N	41	Cars	1.93	N	20
Cars	3.72	N	48	Cars	2.64	N	15
Cars	3.83	N	47	Cars	2.78	N	14
Cars	4.12	N	44	Cars	3.19	N	12
Cars	3.86	N	47	Cars	2.94	N	13
Cars	3.73	N	48	Cars	3.06	N	13
Cars	4.14	N	43	Cars	1.79	N	22
Cars	3.63	N	50	Cars	2.00	N	20
Cars	3.91	N	46	Cars	2.51	N	16
Cars	3.64	N	49	Cars	2.44	N	16
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME		Site Ref. No.		Surveyor(s) and Supervisor		Sketch	
At Medhanealem Mewcha				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/12/2022	4:00 PM	6:00 PM	Clear				
Arm Name		Direction		Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
		Torhailoch to Bethel		3.4	50	TP: Timing Point	<u>2</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	3.68	N	49	Cars	2.11	N	19
Cars	4.12	N	44	Cars	2.75	N	14
Cars	3.73	N	48	Cars	2.69	N	15
Cars	4.48	N	40	Cars	2.45	N	16
Cars	4.19	N	43	Cars	1.85	N	21
Cars	4.23	N	43	Cars	2.73	N	14
Cars	3.78	N	48	Cars	1.87	N	21
Cars	4.03	N	45	Cars	2.99	N	13
Cars	3.83	N	47	Cars	2.06	N	19
Cars	3.77	N	48	Cars	2.86	N	14
Cars	4.21	N	43	Cars	2.55	N	16
Cars	3.8	N	47	Cars	1.73	N	23
Cars	4.16	N	43	Cars	2.55	N	16
Cars	4.47	N	40	Cars	2.28	N	17
Cars	4.31	N	42	Cars	1.79	N	22
Lights	4.51	B	40	Lights	3.28	B	12
Cars	4.3	N	42	Cars	1.96	N	20
Cars	3.53	N	51	Cars	2.18	N	18
Cars	3.7	N	49	Cars	3.06	N	13
Cars	3.67	N	49	Cars	2.66	N	15
Cars	3.89	N	46	Cars	2.18	N	18
Cars	3.66	N	49	Cars	1.96	N	20
Cars	4.47	N	40	Cars	1.85	N	21
Cars	3.99	N	45	Cars	2.03	N	20
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Medhanealem Mewcha				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/12/2022	4:00 PM	6:00 PM	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhailoch to Bethel	3.4	50	TP: Timing Point	<u>3</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	4.26	N	42	Cars	2.98	N	13
Cars	4.14	N	43	Cars	2.47	N	16
Cars	4.46	N	40	Cars	2.06	N	19
Cars	3.82	N	47	Cars	2.52	N	16
Cars	3.91	N	46	Cars	2.79	N	14
Cars	4.28	N	42	Cars	2.14	N	19
Cars	4.14	N	43	Cars	2.87	N	14
Cars	3.55	N	51	Cars	2.63	N	15
Cars	4.43	N	41	Cars	2.6	N	15
Cars	3.6	N	50	Cars	2.14	N	19
Cars	3.88	N	46	Cars	2.86	N	14
Medium	4.48	N	40	Medium	2.03	N	20
Cars	4.1	N	44	Cars	2.32	N	17
Cars	4.12	N	44	Cars	2.8	N	14
Cars	3.61	N	50	Cars	2.54	N	16
Cars	3.63	N	50	Cars	2.58	N	15
Cars	4.06	N	44	Cars	2.08	N	19
Cars	3.53	N	51	Cars	2.48	N	16
Cars	3.83	N	47	Cars	2.65	N	15
Cars	4.08	N	44	Cars	2.69	N	15
Cars	3.62	N	50	Cars	2.06	N	19
Cars	3.61	N	50	Cars	2.83	N	14
Cars	3.94	N	46	Cars	2.86	N	14
Cars	3.71	N	49	Cars	2.81	N	14
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (>4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Medhanealem Mewcha				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/12/2022	4:00 PM	6:00 PM	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhailoch to Bethel	3.4	50	TP: Timing Point	<u>4</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	4.18	N	43	Cars	2.4	N	17
Cars	3.92	N	46	Cars	2.23	N	18
Cars	3.7	N	49	Cars	2.58	N	15
Cars	3.81	N	47	Cars	2.2	N	18
Cars	4.4	N	41	Cars	2.52	N	16
Cars	4.05	N	44	Cars	2.64	N	15
Cars	3.88	N	46	Cars	2.74	N	14
Cars	4.37	N	41	Cars	2.54	N	16
Cars	3.69	N	49	Cars	2.19	N	18
Cars	4.1	N	44	Cars	2.4	N	17
Lights	4.46	N	40	Lights	2.58	N	15
Cars	3.96	N	45	Cars	2.61	N	15
Cars	3.53	N	51	Cars	2.24	N	18
Cars	3.91	N	46	Cars	2.39	N	17
Cars	4.24	N	42	Cars	2.41	N	16
Cars	3.66	N	49	Cars	2.52	N	16
Cars	3.81	N	47	Cars	2.71	N	15
Cars	3.7	N	49	Cars	2.11	N	19
Cars	4.09	N	44	Cars	2.87	N	14
Cars	3.93	N	46	Cars	2.03	N	20
Cars	3.89	N	46	Cars	2.19	N	18
Cars	4.38	N	41	Cars	2.81	N	14
Cars	4.34	N	41	Cars	2.57	N	15
Cars	4.46	N	40	Cars	2.08	N	19
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME		Site Ref. No.		Surveyor(s) and Supervisor		Sketch	
At Medhanealem Mewcha				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/12/2022	4:00 PM	6:00 PM	Clear				
Arm Name		Direction		Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
		Torhailoch to Bethel		3.4	50	TP: Timing Point	<u>5</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	3.6	N	50	Cars	2.17	N	18
Cars	3.81	N	47	Cars	2.21	N	18
Cars	4.44	N	41	Cars	2.83	N	14
Cars	3.98	N	45	Cars	2.58	N	15
Cars	3.91	N	46	Cars	2.81	N	14
Cars	4.3	N	42	Cars	2.66	N	15
Cars	3.63	N	50	Cars	2.62	N	15
Cars	4.37	N	41	Cars	2.47	N	16
Cars	4.01	N	45	Cars	2.06	N	19
Cars	4.07	N	44	Cars	2.46	N	16
Cars	3.62	N	50	Cars	1.98	N	20
Cars	3.92	N	46	Cars	2.27	N	17
Cars	4.43	N	41	Cars	2.94	N	13
Cars	3.66	N	49	Cars	1.82	N	22
Cars	4.06	N	44	Cars	2.58	N	15
Cars	4.25	N	42	Cars	2.41	N	16
Cars	3.62	N	50	Cars	1.96	N	20
Cars	4.15	N	43	Cars	2.11	N	19
Medium	4.49	N	40	Medium	2.52	N	16
Cars	4.31	N	42	Cars	2.18	N	18
Cars	4.42	N	41	Cars	2.62	N	15
Cars	4.1	N	44	Cars	2.49	N	16
Cars	4.38	N	41	Cars	2.59	N	15
Cars	3.96	N	45	Cars	2.57	N	15
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Medhanealem Mewcha				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/12/2022	4:00 PM	6:00 PM	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhailoch to Bethel	3.4	50	TP: Timing Point	<u>6</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	4.49	N	40	Cars	2.76	N	14
Lights	4.66	B	39	Lights	3	B	13
Cars	3.8	N	47	Cars	2.73	N	15
Cars	4.01	N	45	Cars	2.92	N	14
Cars	4.3	N	42	Cars	2.61	N	15
Cars	4.27	N	42	Cars	2.93	N	14
Cars	3.79	N	47	Cars	2.18	N	18
Cars	3.55	N	51	Cars	2.6	N	15
Medium	4.48	N	40	Medium	2.93	N	14
Cars	3.71	N	49	Cars	2.76	N	14
Cars	3.73	N	48	Cars	2.61	N	15
Cars	4.39	N	41	Cars	2.89	N	14
Cars	4.22	N	43	Cars	2.77	N	14
Cars	3.98	N	45	Cars	2.48	N	16
Cars	3.91	N	46	Cars	2.74	N	14
Cars	4.03	N	45	Cars	2.36	N	17
Cars	4.37	N	41	Cars	2.79	N	14
Cars	3.65	N	49	Cars	2.11	N	19
Cars	3.72	N	48	Cars	2.47	N	16
Cars	4.23	N	43	Cars	2.62	N	15
Cars	3.58	N	50	Cars	2.78	N	14
Cars	4.39	N	41	Cars	2.6	N	15
Lights	4.52	B	40	Lights	3.08	B	13
Cars	3.93	N	46	Cars	2.92	N	14
$Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)$							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME			Site Ref. No.	Surveyor(s) and Supervisor		Sketch	
At Medhanealem Mewcha				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/12/2022	4:00 PM	6:00 PM	Clear				
Arm Name			Direction	Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
			Torhailoch to Bethel	3.4	50	TP: Timing Point	<u>7</u> of <u>8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	4.17	N	43	Cars	2.74	N	14
Cars	3.8	N	47	Cars	2.97	N	13
Cars	4.45	N	40	Cars	2.26	N	18
Cars	3.97	N	45	Cars	2.13	N	19
Cars	3.85	N	47	Cars	2.44	N	16
Cars	4.37	N	41	Cars	2.36	N	17
Cars	3.75	N	48	Cars	2.99	N	13
Cars	3.56	N	51	Cars	2.83	N	14
Cars	4.04	N	45	Cars	2.48	N	16
Cars	3.93	N	46	Cars	2.69	N	15
Cars	3.57	N	50	Cars	2.89	N	14
Cars	4.3	N	42	Cars	2.1	N	19
Cars	3.86	N	47	Cars	2.41	N	16
Cars	3.53	N	51	Cars	2.82	N	14
Cars	4.24	N	42	Cars	2.98	N	13
Cars	4.17	N	43	Cars	2.66	N	15
Cars	4.38	N	41	Cars	2.07	N	19
Cars	3.97	N	45	Cars	2.23	N	18
Cars	4.15	N	43	Cars	2.22	N	18
Cars	3.97	N	45	Cars	2.8	N	14
Cars	4.04	N	45	Cars	2.92	N	14
Cars	3.65	N	49	Cars	2.89	N	14
Cars	4.28	N	42	Cars	2.6	N	15
Cars	3.82	N	47	Cars	2.96	N	13
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

SPEED SURVEY ALONG MEASURED BASELINE							
SITE NAME		Site Ref. No.		Surveyor(s) and Supervisor		Sketch	
At Medhanealem Mewcha				Eyob Shumet, Kenean Sisay and Milkyas Kassie			
Date	Time		Weather	Notes			
	From	To					
3/12/2022	4:00 PM	6:00 PM	Clear				
Arm Name		Direction		Width (m)	Baseline Length (m)	SP: Survey Point	Sheet
		Torhailoch to Bethel		3.4	50	TP: Timing Point	<u>8 of 8</u>
Before Crossing the Speed Hump				After Crossing the Speed Hump			
Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)	Vehicle Type	Time Taken (sec)	Notes/Delays	Speed (km/h)
Cars	3.69	N	49	Cars	2.17	N	18
Cars	4.33	N	42	Cars	2.05	N	19
Cars	4.29	N	42	Cars	2.38	N	17
Cars	3.72	N	48	Cars	2.84	N	14
Cars	3.64	N	49	Cars	2.39	N	17
Cars	4.11	N	44	Cars	2.83	N	14
Lights	4.58	B	39	Lights	3.17	B	8
Cars	3.93	N	46	Cars	2.44	N	10
Cars	4.09	N	44	Cars	2.66	N	9
Cars	3.7	N	49	Cars	2.09	N	12
Cars	4.35	N	41	Cars	2.03	N	12
Cars	4.16	N	43	Cars	2.18	N	12
Cars	4.11	N	44	Cars	2.70	N	9
Cars	3.85	N	47	Cars	2.40	N	10
Cars	3.67	N	49	Cars	2.58	N	10
Cars	3.62	N	50	Cars	2.56	N	10
Cars	4.43	N	41	Cars	2.44	N	10
Lights	4.5	B	40	Lights	3.32	B	8
Cars	3.64	N	49	Cars	2.55	N	10
Cars	3.59	N	50	Cars	2.06	N	12
Cars	3.68	N	49	Cars	1.96	N	13
Cars	4.17	N	43	Cars	1.87	N	13
Cars	4.35	N	41	Cars	2.17	N	12
Cars	4.31	N	42	Cars	2.37	N	11
Speed (km/h) = 3.6 * Baseline Length (m) / Time Taken (sec)							
Vehicle Type				Reasons for Delay		Notes	
Group	Description	Group	Description	S = Signals	Roadworks		
Cars	Standard Car	Medium	Dual rear axle truck	J = Other junction	Accident		
	Wagon & Pickup	Heavy	4 axle truck	P = Pedestrians	Weather extremes		
	Minibus & Van	Articulated	Large truck (> 4 axle truck)	B = Bus	Enchroachments		
Lights	Large Bus			K = Parked	Police intrvention		
	Single rear axle truck			N = Not delayed	Unknown-other		
				X = Following vehicle			

Appendix B: Frequency Distribution for Spot Speed Data

Spot Speed data before approaching Speed Hump at St. Gabriel Church

	Frequency	Percent	Valid Percent	Cumulative Percent
36	1	.5	.5	.5
37	2	1.0	1.0	1.6
38	2	1.0	1.0	2.6
39	2	1.0	1.0	3.6
40	22	11.5	11.5	15.1
41	20	10.4	10.4	25.5
42	11	5.7	5.7	31.3
43	16	8.3	8.3	39.6
44	24	12.5	12.5	52.1
45	14	7.3	7.3	59.4
46	16	8.3	8.3	67.7
Valid	47	8.9	8.9	76.6
48	15	7.8	7.8	84.4
49	12	6.3	6.3	90.6
50	5	2.6	2.6	93.2
51	5	2.6	2.6	95.8
52	1	.5	.5	96.4
53	2	1.0	1.0	97.4
54	2	1.0	1.0	98.4
55	2	1.0	1.0	99.5
56	1	.5	.5	100.0
Total	192	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

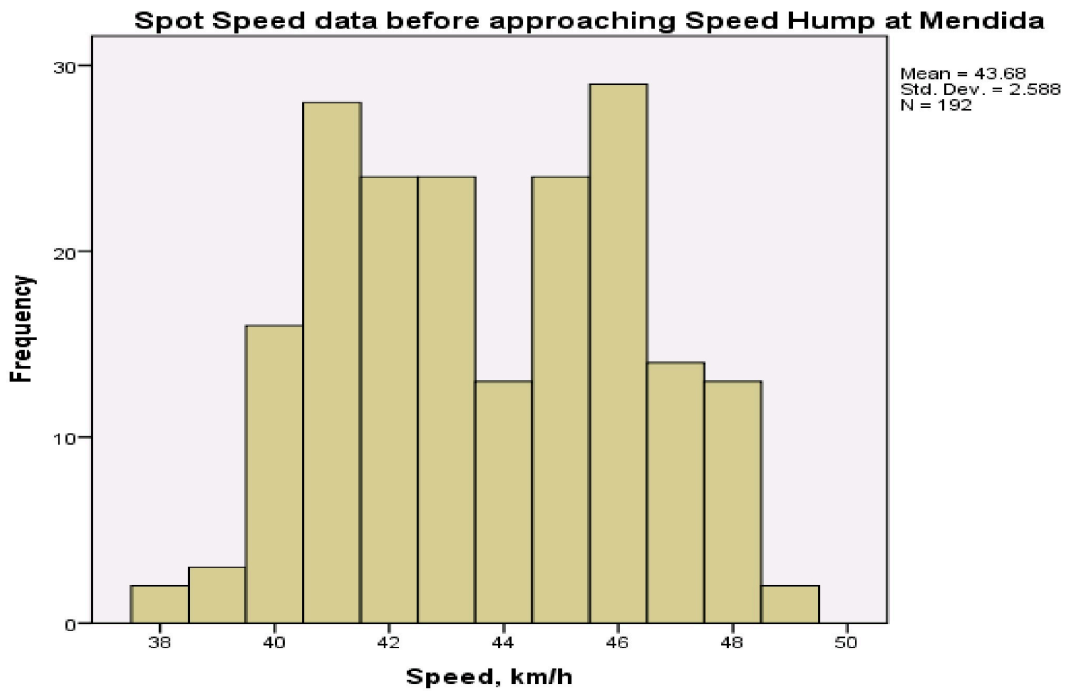
Spot Speed data on Pedestrian Crossing at St. Gabriel Church

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 11	10	5.2	5.2	5.2
12	33	17.2	17.2	22.4
13	66	34.4	34.4	56.8
14	56	29.2	29.2	85.9
15	21	10.9	10.9	96.9
16	3	1.6	1.6	98.4
17	1	.5	.5	99.0
18	1	.5	.5	99.5
20	1	.5	.5	100.0
Total	192	100.0	100.0	

Spot Speed data before approaching Speed Hump at Mendida

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 38	2	1.0	1.0	1.0
39	3	1.6	1.6	2.6
40	16	8.3	8.3	10.9
41	28	14.6	14.6	25.5
42	24	12.5	12.5	38.0
43	24	12.5	12.5	50.5
44	13	6.8	6.8	57.3
45	24	12.5	12.5	69.8
46	29	15.1	15.1	84.9
47	14	7.3	7.3	92.2
48	13	6.8	6.8	99.0
49	2	1.0	1.0	100.0
Total	192	100.0	100.0	

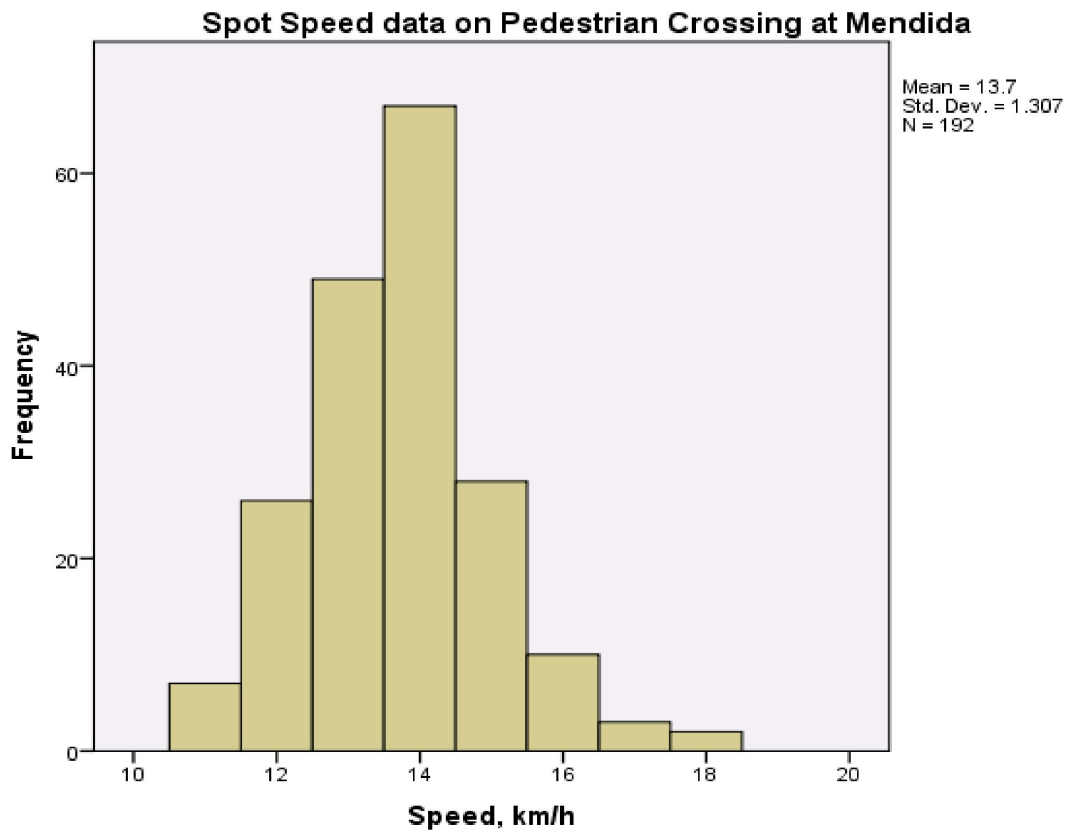
Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)



Spot Speed data on Pedestrian Crossing at Mendida

	Frequency	Percent	Valid Percent	Cumulative Percent
11	7	3.6	3.6	3.6
12	26	13.5	13.5	17.2
13	49	25.5	25.5	42.7
14	67	34.9	34.9	77.6
Valid 15	28	14.6	14.6	92.2
16	10	5.2	5.2	97.4
17	3	1.6	1.6	99.0
18	2	1.0	1.0	100.0
Total	192	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)



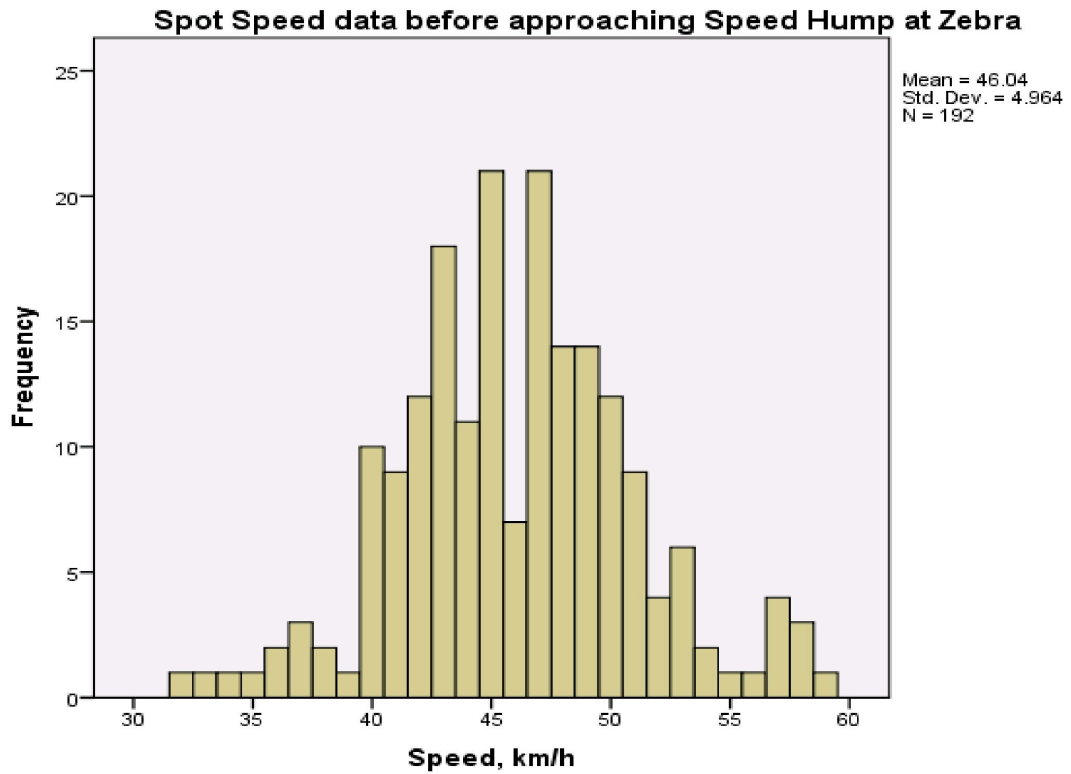
Spot Speed data before approaching Speed Hump at Zebra

	Frequency	Percent	Valid Percent	Cumulative Percent
32	1	.5	.5	.5
33	1	.5	.5	1.0
34	1	.5	.5	1.6
35	1	.5	.5	2.1
36	2	1.0	1.0	3.1
37	3	1.6	1.6	4.7
38	2	1.0	1.0	5.7
39	1	.5	.5	6.3
40	10	5.2	5.2	11.5
41	9	4.7	4.7	16.1
42	12	6.3	6.3	22.4
43	18	9.4	9.4	31.8
Valid				

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

44	11	5.7	5.7	37.5
45	21	10.9	10.9	48.4
46	7	3.6	3.6	52.1
47	21	10.9	10.9	63.0
48	14	7.3	7.3	70.3
49	14	7.3	7.3	77.6
50	12	6.3	6.3	83.9
51	9	4.7	4.7	88.5
52	4	2.1	2.1	90.6
53	6	3.1	3.1	93.8
54	2	1.0	1.0	94.8
55	1	.5	.5	95.3
56	1	.5	.5	95.8
57	4	2.1	2.1	97.9
58	3	1.6	1.6	99.5
59	1	.5	.5	100.0
Total	192	100.0	100.0	

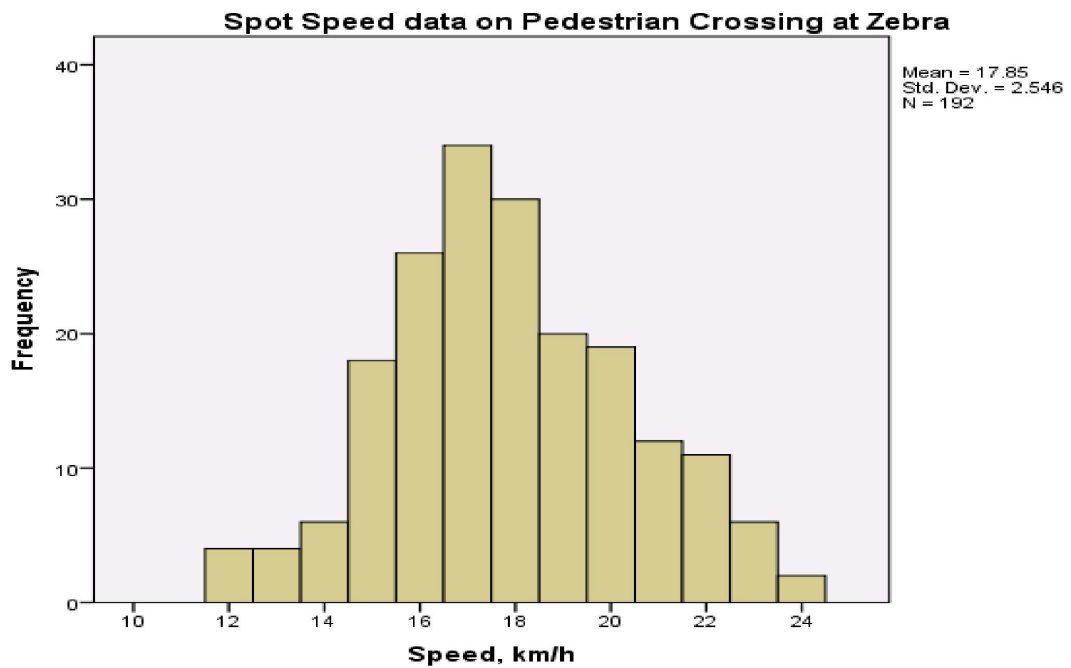
Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)



Spot Speed data on Pedestrian Crossing at Zebra

	Frequency	Percent	Valid Percent	Cumulative Percent
12	4	2.1	2.1	2.1
13	4	2.1	2.1	4.2
14	6	3.1	3.1	7.3
15	18	9.4	9.4	16.7
16	26	13.5	13.5	30.2
17	34	17.7	17.7	47.9
18	30	15.6	15.6	63.5
19	20	10.4	10.4	74.0
20	19	9.9	9.9	83.9
21	12	6.3	6.3	90.1
22	11	5.7	5.7	95.8
23	6	3.1	3.1	99.0
24	2	1.0	1.0	100.0
Total	192	100.0	100.0	

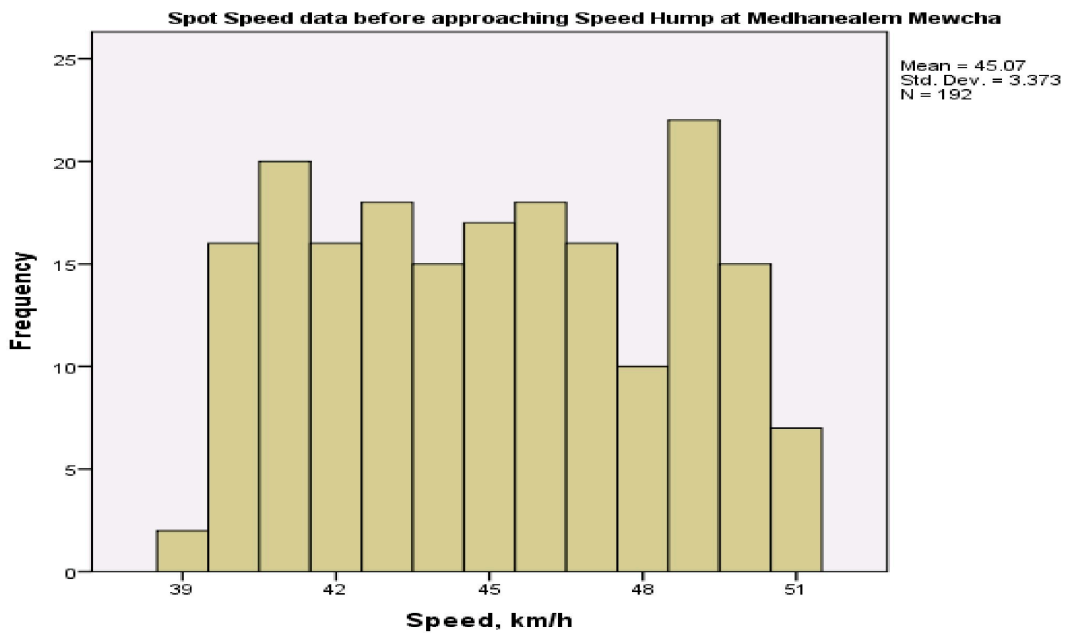
Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)



Spot Speed data before approaching Speed Hump at Medhanealem Mewcha

	Frequency	Percent	Valid Percent	Cumulative Percent
39	2	1.0	1.0	1.0
40	16	8.3	8.3	9.4
41	20	10.4	10.4	19.8
42	16	8.3	8.3	28.1
43	18	9.4	9.4	37.5
44	15	7.8	7.8	45.3
45	17	8.9	8.9	54.2
46	18	9.4	9.4	63.5
47	16	8.3	8.3	71.9
48	10	5.2	5.2	77.1
49	22	11.5	11.5	88.5
50	15	7.8	7.8	96.4
51	7	3.6	3.6	100.0
Total	192	100.0	100.0	

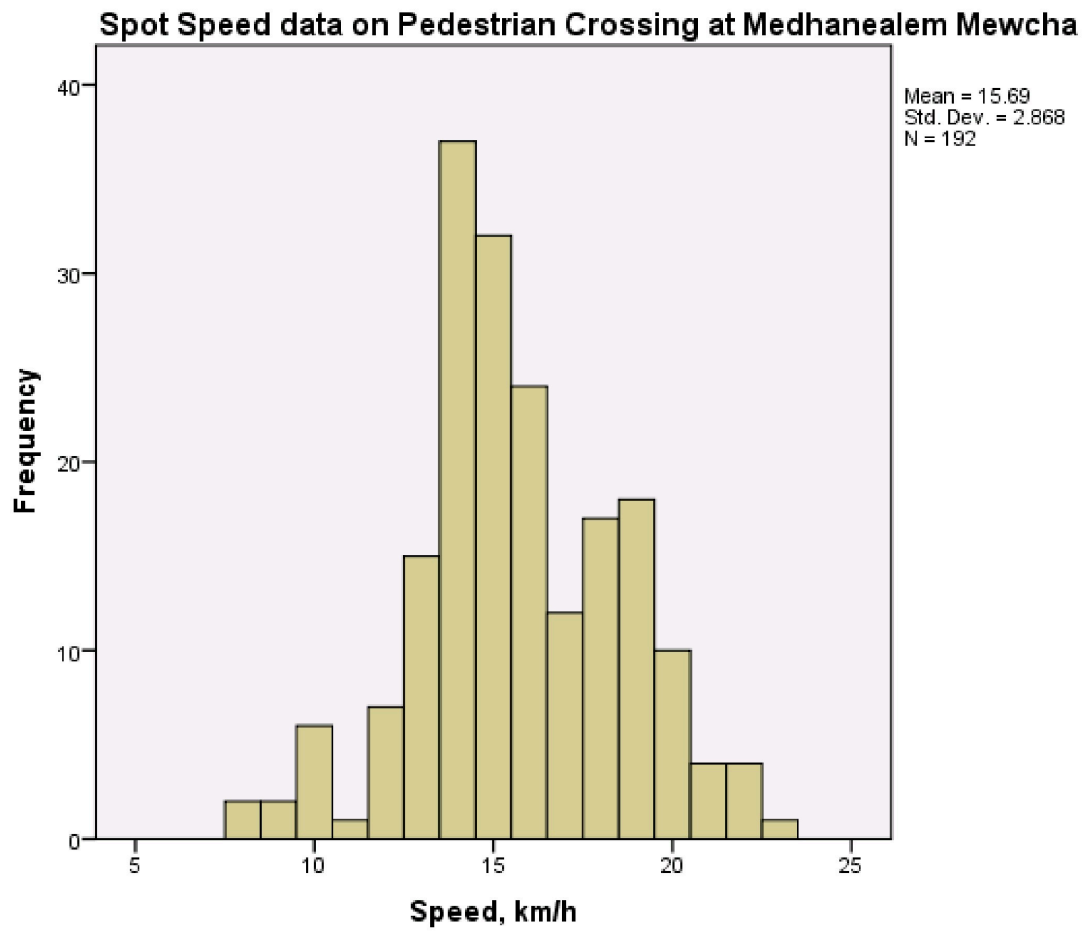
Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)



Spot Speed data on Pedestrian Crossing at Medhanealem Mewcha

	Frequency	Percent	Valid Percent	Cumulative Percent
8	2	1.0	1.0	1.0
9	2	1.0	1.0	2.1
10	6	3.1	3.1	5.2
11	1	.5	.5	5.7
12	7	3.6	3.6	9.4
13	15	7.8	7.8	17.2
14	37	19.3	19.3	36.5
15	32	16.7	16.7	53.1
Valid 16	24	12.5	12.5	65.6
17	12	6.3	6.3	71.9
18	17	8.9	8.9	80.7
19	18	9.4	9.4	90.1
20	10	5.2	5.2	95.3
21	4	2.1	2.1	97.4
22	4	2.1	2.1	99.5
23	1	.5	.5	100.0
Total	192	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)



Appendix C: Frequency Distribution Table for Children Road Users

Drivers give way to pedestrians at St. Gabriel Church

	Frequency	Percent	Valid Percent	Cumulative Percent
Given way by the Driver	26	36.1	36.1	36.1
Valid Do not given way by the Driver	46	63.9	63.9	100.0
Total	72	100.0	100.0	

Pedestrians run before crossing at St. Gabriel Church

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrian run before crossing	11	15.3	15.3	15.3
Valid Pedestrian do not run before crossing	61	84.7	84.7	100.0
Total	72	100.0	100.0	

Pedestrians Stop before crossing at St. Gabriel Church

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians stop before crossing	56	77.8	77.8	77.8
Valid Pedestrians do not stop before crossing	16	22.2	22.2	100.0
Total	72	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Pedestrian run while crossing at St. Gabriel Church

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians run while crossing	29	40.3	40.3	40.3
Valid Pedestrians do not run while crossing	43	59.7	59.7	100.0
Total	72	100.0	100.0	

Pedestrians crossing straight on the crossing at St. Gabriel Church

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians crossing straight	53	73.6	73.6	73.6
Valid Pedestrian crossing diagonal	19	26.4	26.4	100.0
Total	72	100.0	100.0	

Drivers give way to pedestrians at Mendida

	Frequency	Percent	Valid Percent	Cumulative Percent
Given way by the Driver	17	34.7	34.7	34.7
Valid Do not given way by the Driver	32	65.3	65.3	100.0
Total	49	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Pedestrians run before crossing at Mendida

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrian run before crossing	8	16.3	16.3	16.3
Valid Pedestrian do not run before crossing	41	83.7	83.7	100.0
Total	49	100.0	100.0	

Pedestrians Stop before crossing at Mendida

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians stop before crossing	37	75.5	75.5	75.5
Valid Pedestrians do not stop before crossing	12	24.5	24.5	100.0
Total	49	100.0	100.0	

Pedestrian run while crossing at Mendida

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians run while crossing	21	42.9	42.9	42.9
Valid Pedestrians do not run while crossing	28	57.1	57.1	100.0
Total	49	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Pedestrians crossing straight on the crossing at Mendida

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians crossing straight	33	67.3	67.3	67.3
Valid Pedestrian crossing diagonal	16	32.7	32.7	100.0
Total	49	100.0	100.0	

Drivers give way to pedestrians at Zebra

	Frequency	Percent	Valid Percent	Cumulative Percent
Given way by the Driver	24	36.4	36.4	36.4
Valid Do not given way by the Driver	42	63.6	63.6	100.0
Total	66	100.0	100.0	

Pedestrians run before crossing at Zebra

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrian run before crossing	48	72.7	72.7	72.7
Valid Pedestrian do not run before crossing	18	27.3	27.3	100.0
Total	66	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Pedestrians Stop before crossing at Zebra

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians stop before crossing	7	10.6	10.6	10.6
Valid Pedestrians do not stop before crossing	59	89.4	89.4	100.0
Total	66	100.0	100.0	

Pedestrian run while crossing at Zebra

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians run while crossing	24	36.4	36.4	36.4
Valid Pedestrians do not run while crossing	42	63.6	63.6	100.0
Total	66	100.0	100.0	

Pedestrians crossing straight on the crossing at Zebra

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians crossing straight	51	77.3	77.3	77.3
Valid Pedestrian crossing diagonal	15	22.7	22.7	100.0
Total	66	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Drivers give way to pedestrians at Medhanealem Mewcha

	Frequency	Percent	Valid Percent	Cumulative Percent
Given way by the Driver	38	43.7	43.7	43.7
Valid Do not given way by the Driver	49	56.3	56.3	100.0
Total	87	100.0	100.0	

Pedestrians run before crossing at Medhanealem Mewcha

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrian run before crossing	9	10.3	10.3	10.3
Valid Pedestrian do not run before crossing	78	89.7	89.7	100.0
Total	87	100.0	100.0	

Pedestrians Stop before crossing at Medhanealem Mewcha

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians stop before crossing	63	72.4	72.4	72.4
Valid Pedestrians do not stop before crossing	24	27.6	27.6	100.0
Total	87	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Pedestrian run while crossing at Medhanealem Mewcha

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians run while crossing	28	32.2	32.2	32.2
Valid Pedestrians do not run while crossing	59	67.8	67.8	100.0
Total	87	100.0	100.0	

Pedestrians crossing straight on the crossing at Medhanealem Mewcha

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians crossing straight	69	79.3	79.3	79.3
Valid Pedestrian crossing diagonal	18	20.7	20.7	100.0
Total	87	100.0	100.0	

Appendix D: Frequency Distribution Table for Elder Road Users

Drivers give way to pedestrians at St. Gabriel Church

	Frequency	Percent	Valid Percent	Cumulative Percent
Given way by the Driver	19	35.2	35.2	35.2
Valid Do not given way by the Driver	35	64.8	64.8	100.0
Total	54	100.0	100.0	

Pedestrians run before crossing at St. Gabriel Church

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrian run before crossing	2	3.7	3.7	3.7
Valid Pedestrian do not run before crossing	52	96.3	96.3	100.0
Total	54	100.0	100.0	

Pedestrians Stop before crossing at St. Gabriel Church

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians stop before crossing	36	66.7	66.7	66.7
Valid Pedestrians do not stop before crossing	18	33.3	33.3	100.0
Total	54	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Pedestrian run while crossing at St. Gabriel Church

	Frequency	Percent	Valid Percent	Cumulative Percent
pedestrians run while crossing	10	18.5	18.5	18.5
Valid Pedestrians do not run while crossing	44	81.5	81.5	100.0
Total	54	100.0	100.0	

Pedestrians crossing straight on the crossing at St. Gabriel Church

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians crossing straight	44	81.5	81.5	81.5
Valid Pedestrian crossing diagonal	10	18.5	18.5	100.0
Total	54	100.0	100.0	

Drivers give way to pedestrians at Mendida

	Frequency	Percent	Valid Percent	Cumulative Percent
Given way by the Driver	13	33.3	33.3	33.3
Valid Do not given way by the Driver	26	66.7	66.7	100.0
Total	39	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Pedestrians run before crossing at Mendida

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrian run before crossing	2	5.1	5.1	5.1
Valid Pedestrian do not run before crossing	37	94.9	94.9	100.0
Total	39	100.0	100.0	

Pedestrians Stop before crossing at Mendida

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians stop before crossing	27	69.2	69.2	69.2
Valid Pedestrians do not stop before crossing	12	30.8	30.8	100.0
Total	39	100.0	100.0	

Pedestrian run while crossing at Mendida

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians run while crossing	8	20.5	20.5	20.5
Valid Pedestrians do not run while crossing	31	79.5	79.5	100.0
Total	39	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Pedestrians crossing straight on the crossing at Mendida

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians crossing straight	31	79.5	79.5	79.5
Valid Pedestrian crossing diagonal	8	20.5	20.5	100.0
Total	39	100.0	100.0	

Drivers give way to pedestrians at Zebra

	Frequency	Percent	Valid Percent	Cumulative Percent
Given way by the Driver	16	37.2	37.2	37.2
Valid Do not given way by the Driver	27	62.8	62.8	100.0
Total	43	100.0	100.0	

Pedestrians run before crossing at Zebra

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrian run before crossing	1	2.3	2.3	2.3
Valid Pedestrian do not run before crossing	42	97.7	97.7	100.0
Total	43	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Pedestrians Stop before crossing at Zebra

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians stop before crossing	25	58.1	58.1	58.1
Valid Pedestrians do not stop before crossing	18	41.9	41.9	100.0
Total	43	100.0	100.0	

Pedestrian run while crossing at Zebra

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians run while crossing	7	16.3	16.3	16.3
Valid Pedestrians do not run while crossing	36	83.7	83.7	100.0
Total	43	100.0	100.0	

Pedestrians crossing straight on the crossing at Zebra

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians crossing straight	36	83.7	83.7	83.7
Valid Pedestrian crossing diagonal	7	16.3	16.3	100.0
Total	43	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Drivers give way to pedestrians at Medhanealem Mewcha

	Frequency	Percent	Valid Percent	Cumulative Percent
Given way by the Driver	20	39.2	39.2	39.2
Valid Do not given way by the Driver	31	60.8	60.8	100.0
Total	51	100.0	100.0	

Pedestrians run before crossing at Medhanealem Mewcha

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrian run before crossing	1	2.0	2.0	2.0
Valid Pedestrian do not run before crossing	50	98.0	98.0	100.0
Total	51	100.0	100.0	

Pedestrians Stop before crossing at Medhanealem Mewcha

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Pedestrians stop before crossing	33	64.7	64.7	64.7
Pedestrians do not stop before crossing	18	35.3	35.3	100.0
Total	51	100.0	100.0	

Effects of the Distance between Speed Humps and Pedestrian Crossings on Gap Acceptance Behavior of Pedestrians (In the case of Tor Hailoch to Bethel Road)

Pedestrian run while crossing at Medhanealem Mewcha

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians run while crossing	8	15.7	15.7	15.7
Valid Pedestrians do not run while crossing	43	84.3	84.3	100.0
Total	51	100.0	100.0	

Pedestrians crossing straight on the crossing at Medhanealem Mewcha

	Frequency	Percent	Valid Percent	Cumulative Percent
Pedestrians crossing straight	45	88.2	88.2	88.2
Valid Pedestrian crossing diagonal	6	11.8	11.8	100.0
Total	51	100.0	100.0	