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An Explicit Study of Pedestrian and Vehicular Traffic at the Kampala International University Western Campus Junction, Ishaka Crossing Point to Determine If a Pedestrian Crossing Facility is Justified (Uganda)

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***Abstract**: This study sets to investigate the pedestrian and vehicular characteristics at the Kampala International University (KIU) western campus junction, Ishaka, Uganda, where a hunch was made that a formal pedestrian crossing point was required. This is due to the fact that it was hypothesized that the vehicular volume and speed were high in effect that it made crossing of the road section by pedestrians difficult. Traffic accidents involving pedestrians have become a major safety problem all over the world, particularly in developing countries, due to high population density, rapid urbanization, and lack of adherence to traffic regulations by both drivers and pedestrians. This made this research critical and hence the need to be undertaken. The major task was to determine if a formal pedestrian n crossing point was required at Kampala International University (KIU) western campus junction, Ishaka. Specifically, the average traffic volume and speed during peak hours, average pedestrian volume during peak hours at Kampala International University (KIU) western campus junction, Ishaka and the pedestrian behavior such as overall time used in completing a crossing maneuver, crossing trajectory and comfort when crossing the highway segment was analyze. Characteristics such as vehicular speed, pedestrian crossing and waiting times, pedestrian and vehicular volume were all investigated. Data was acquired majorly through manual tallying. After acquiring these data, it was scientifically analyzed to prove if indeed there was conflict in that area using the PV^2 method which relates the pedestrian and vehicular volume. A value more than would necessitate a formal crossing point. Other site characteristics such as route to school, shops and community facilities were also investigated to establish the importance of the crossing point. The collected data was then presented in tabular form and also graphically and later analyzed mathematically to identify if a formal pedestrian crossing point was required. It was observed that a value of PV^2 exceeded the required limit by a considerable amount, also, during the peak periods the average pedestrians and vehicles passing through that section which is basically high. The average crossing time used to safely complete a crossing maneuver was also basically high compared to 10 seconds that is actually required. Crossing was compromised in comfort and safety as most of the time pedestrians were running across. This necessitated the need for a formal crossing point. Appropriate recommendations were later on drawn at the end of the project so as to come up with an apparent solution to the crossing problem.*

Keywords—Pedestrian traffic; Kampala International University; Explicit study; Vehicular traffic; Ishaka; Justified; Crossing point; Crossing facility.

1. INTRODUCTION

1.1 Background of the study

Over the recent past, many traffic engineering breakthroughs have engulfed our world. Traffic engineering inventions like the early traffic signal invented in 1923 by Garret Morgan have been a huge success globally and have eased traffic, more so vehicular traffic and greatly reduced the number of vehicular collisions and vehicle-pedestrian collisions. On the contrary side, one aspect of Transportation and Traffic Engineering has been neglected, that is the pedestrian traffic. A pedestrian is a person traveling on foot, whether walking or running. Pedestrians also have an equal right to road/highway access as vehicles do and so their facilities should be considered as well.

Traffic accidents involving pedestrians have become a major safety problem all over the world, particularly in developing countries, due to high population density, rapid urbanization, and lack of adherence to traffic regulations by both drivers and pedestrians.

The National Road Safety Council (NRSC) reports that each year nearly 5,000 pedestrians die in motor vehicle related accidents, and approximately 76,000 pedestrians in 2016 suffered injuries when hit by a car or truck. These accidents can occur when pedestrians cross the highways. Statistics indicate that Uganda loses at least 3,500 people annually from road traffic accidents, with nearly half being pedestrians. In fact, the NRSC reports that the number of pedestrians who have lost their lives annually on the roads has dropped to 1004 by December 12, 2016. This is according to the latest NRSC statistics. This is attributed to increased road safety campaigns and awareness that the Authority is carrying out across the country. NRSC Director (Kasiima et al, (2016)) Reference **[1]**, attributed the major cause of these accidents to be speed and inadequate pedestrian facilities. With the support from the private sector, there can be quick results in reversing the trend by providing speed guns, providing safe crossings for pedestrians and continuous pedestrian education.

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Globally, pedestrians generate trips e.g. going to school, workplace accessing social amenities, recreational facilities etc. Most of the trips generated usually require them to move across the road to access them. However due to large vehicular traffic on our roads and highways, pedestrians are forced to wait beside the road for long periods of time waiting for traffic streams to clear. Once incoming stream is clear, they partially cross the road i.e. they cross halfway to the kerbed island if available and still have to wait again for the oncoming stream to be clear, before actually crossing the full road. This has been observed in highways mostly with large carriageways and lanes, e.g. Busheyi-Mbarara road connecting Ishaka town to KIU campus at Kampala International University (KIU) Ishaka junction. This junction is a highly populated area with people from all walks of life, mostly the middle class and the low class originating from Kampala International University (KIU) Ishaka campus, Lagos quarter, Abuja quarter, Bassajjabalaba secondary school and Government primary school. Mostly children, the physically disabled and the elderly finding it very difficult to cross the highway and go about their business. Many young people reside in these areas hence making many trips by foot. In addition, the population largely constitutes the low and middle class who mainly don't have access to personal vehicles and hence make most of their trips on foot.

In desperate attempts, the study population has been seen to literally run across the road to avoid being knocked or run down by an oncoming vehicle. This is a very dangerous exercise as it may lead to fatal accidents and sever casualties and millions of losses to the economy.

The government of Uganda through Vision 2030 is striving to develop and maintain existing road networks in order to improve access as well as spur movement of people and goods, raise efficiency and quality of infrastructure projects and increase their timely implementation. This makes my project well in line with that vision.

Having considered the above, an explicit survey will be carried out in the study area to establish pedestrian characteristics while crossing i.e. crossing patterns, comfort, age and vehicular traffic characteristics such as speed and volume and determine if and which type of pedestrian facility is actually needed to solve this crisis e.g. overpass, underpass, zebra crossing, light controlled crossing or traffic calming. Studies will be majorly carried out during peak hours for exclusive analysis and conclusions to be drawn.

1.2 Statement of the Problem

High vehicular speeds and large traffic volumes at the Kampala International University (KIU) Ishaka junction along Busheyi-Mbarara road crossing section, makes it difficult for the ever growing population of the area to access amenities across the other side of the Busheyi-Mbarara road highway. The crossing area posses a great risk for the pedestrians who wish to cross to the other side. Children, the elderly and the young population in general are usually discouraged and intimidated by fast moving and high number of traffic against taking such trips. A lot of time is usually wasted in waiting for traffic streams to clear out. In addition, the crossing behavior by some of the population involve running across to the other side which is a great risk as it might cause road accidents and great loss to the society and to the economy.

1.3 Justification of the study

The purpose of this study therefore is to investigate the pedestrian-vehicular characteristics at Kampala International University (KIU) Ishaka junction along Busheyi-Mbarara road i.e. vehicle speeds, vehicle volume, pedestrian volume, crossing speeds, waiting time, crossing behavior and determine if a safe and fast method to help in pedestrian crossing is needed by providing a formal crossing point.

The study here undertaken was selected since the problem was critical to the society, children and the elderly were heavily affected hence need for swift action. The extent/area coverage was 2km of the highway segment at Kampala International University (KIU) Ishaka junction along Busheyi-Mbarara road. Once realized and implemented, great importance will be noticed as conflict between vehicles and pedestrians will be minimized and comfort while crossing will be achieved. Risks and near misses will be low and pedestrian safety will be achieved.

1.4 Research Objectives

1.4.1 Research Objectives

To determine if a formal pedestrian crossing point is required at Kampala International University (KIU) Ishaka junction crossing.

1.4.2 Research Objectives

- To determine the average traffic volume and speed during peak hours at Kampala International University (KIU) Ishaka junction.
- To obtain the average pedestrian volume during peak hours at Kampala International University (KIU) Ishaka junction.
- To investigate the pedestrian behavior such as overall time used in completing a crossing maneuver, crossing trajectory and comfort when crossing the highway segment.

1.5 Research Questions

- ✓ What is the average traffic volume and speed of vehicular traffic at the Kampala International University (KIU) Ishaka junction crossing zone during peak hours?
- ✓ What is the average pedestrian volume at the Kampala International University (KIU) Ishaka junction crossing zone during peak hours?
- ✓ Which crossing trajectory, time and behavior do the pedestrians use while crossing the road segment?

1.6 Research Hypothesis

- ❖ Traffic volume and speed through the Kampala International University (KIU) Ishaka junction crossing area is high.

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- The average pedestrian volume during peak hours at Kampala International University (KIU) Ishaka junction zone is high.
- Pedestrians use more time than necessary to complete a crossing maneuver which is compromised in comfort and safety.

1.7 Significance of the study

The study undertaken will go a great mile in solving the road crossing problem currently faced by the populous Kampala International University (KIU) Ishaka junction area. Through it, transportation policies towards the pedestrians will be achieved and hence development observed through enforcement. A better understanding of Traffic Engineering terminologies and phenomenon will occur and as a result promote scholarly knowledge. If the crossing facility is justified and implemented, pedestrian safety will be realized and hence a positive impact to the local community.

1.8 Scope of the study

Physically, the area shown below will be covered by the study. It will extend from the junction between Busheyi-Mbarara road and the slip way towards KIU Teaching Hospital, KIU staff quarters (Abuja) and also Bassajjabalaba Secondary School, Bassajjabalab Primary School down to the area near KIU staff quarters (Lagos). Area covered will be 2km of both sides of the roadway section on. Subject coverage will constitute Traffic Engineering and Highway Engineering as been practice in Engineering.

1.9 Limitations

The study will be limited to peak hours during the day only and not late at night. It will also be limited to the research area previously shown and not other neighboring areas.

1.10 Assumptions

The daily pedestrians and motorist day by day activities and involvements are not affected and remain constant.

1.11 Definition of terms

- **Peak hour**: This represents the most critical period of operations and has the highest capacity requirements
- **Formal crossing point:** A way specifically designated for pedestrian travel either exclusively or with other traffic
- **Capacity** : The maximum sustainable flow rate at which vehicles or persons reasonably can be expected to traverse a point or uniform segment of a lane or roadway during a specified time period under given roadway, geometric, traffic, environmental and control conditions, usually expressed as vehicles per hour, passenger cars per hour or persons per hour.
- **Delay:** The additional travel time experienced by a driver, passenger or pedestrian.
- **Demand:** The number of users desiring service on the highway system.
- **Pedestrian:** An individual travelling on foot.
- **Zone:** A geographic aggregation defined by land use, which generates trips within a corridor.

2.0 LITERATION REVIEW

2.1 Introduction

According to the Highway Capacity Manual A.K.T (2011) Reference **[2]**, a Pedestrian is an individual travelling on foot. Pedestrians walk all around the world for various purposes i.e. they generate trips which are attracted to where they end them.

According to Hobbs (1979) Reference **[3]**, trip generations depend on household size, household structure, household income, vehicle ownership, residential density and accessibility while trip attractions depends on land-use and employment by category (that is Industrial, Commercial or Services), and accessibility. Some basic definitions are appropriate before addressing the classification of trips in detail. Krishna, (2011) Reference **[4]** attempts to clarify the meaning of a journey, home based trip and non-home based trips. He defines a journey as an out way movement from a point of origin to a point of destination, whereas the word "trip" denotes an outward and return journey. If either origin or destination of a trip is the home of the trip maker then such trips are called home based trips and the rest of the trips are called non home based trips.

Martin, (2010) Reference **[5]** in the book Highway engineering classifies trips by trip purpose, trip time of the day, and by person type. The trips can be classified based on the purpose of the journey as trips for work, trips for education, trips for shopping, trips for recreation and other trips. Among these the work and education trips are often referred to as mandatory trips and the rest as discretionary trips. All the above trips are normally home based trips and constitute about 80 to 85 percent of trips. The rest of the trips namely non home based trips, being a small proportion are not normally treated separately.

The second way of classification is based on the time of the day when the trips are made. The broad classification is into peak trips and off peak trips.

The third way of classification is based on the type of the individual who makes the trips. This is important since the travel behavior is highly influenced by the socio-economic attribute of the traveler. This project will focus more on the pedestrians.

Typical types of pedestrian trips include: To and from work and school, social visits and events, appointments, health and exercise, errands and deliveries, recreation, extracurricular activities, multimodal trips (walking to a bus stop).

Pedestrian speed is among the most important characteristic of pedestrian facility. Among several factors that influence walking speed are; density, gender, size of platoon, percentage of elderly population, handicapped pedestrian population and child pedestrian population. An average speed of 1.3m/s is appropriate for typical pedestrian groups. The amount of space required by a queued or standing pedestrian is (HCM (A.K.T), 2011) [2].

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Pedestrians need adequate gaps in traffic to cross a road. In relatively low speed urban environments (up to around 50km/h) a gap of seconds is adequate for most able bodied adult pedestrians to cross a 7m wide two lane road. Child and elderly pedestrians may have more difficulty judging speed and safe gaps in traffic and therefore will require longer gaps.

Visually impaired pedestrians, wheelchair users and people with walking difficulties will require longer gaps of around seconds. The number of safe gaps decreases with the increase in traffic volume and hence different forms of crossing are appropriate for different sites. The availability of safe gaps can be determined by site survey and compared with crossing demand (National Roads Authority, (2011)) Reference **[6]**.

In the past, transport planning has tended to concentrate on providing for the needs of vehicular movement, to the detriment of pedestrians, cyclists and, especially, disabled people. This has resulted in an imbalance in the provision of quality transport, an imbalance which is particularly serious in view of the importance of walking and the increased interest in cycling (Leake, 2006) Reference **[7]**. The demand for pedestrian and cycle facilities is influenced by a number of factors, of which some of the most important are:

1. The influence of topography: Cycling and pedestrian activities, particularly the former, tend to be at a higher level in fiat areas than in hilly ones.
2. The nature of the local community: Cycling and walking are more likely to occur in a community that has a high proportion of young people.
3. Car ownership: The availability of the private car reduces the amount of walking and cycling, even for short journeys.
4. Local land use activities: Walking and cycling are primarily used for short distance trips. Consequently the distance between local origins and destinations (e.g. homes and school, homes and shops) is an important factor influencing the level of demand, particularly for the young and the elderly.
5. Quality of provision: If good quality pedestrian and cyclist facilities are provided, then the demand will tend to increase.
6. Safety and security: It is important that pedestrians and cyclists perceive the facilities to be safe and secure. For pedestrians this means freedom from conflict with motor vehicles, as well as a minimal threat from personal attack and the risk of tripping (particularly important for elderly persons and pregnant women) on uneven surfaces. For cyclists, there is also the security of the parked cycle at the journey destination.

2.2 Identifying priorities of need when planning for pedestrians and disabled people.

In planning any transport proposals safety must be of prime importance. It is then it is clear that any proposals which can provide safer facilities for these two traveler groups will contribute significantly to the achievement of both national and local safety targets. One way of prioritizing is to identify locations (existing and future) where accident risk is high.

To date most risk assessments have been concerned with establishing pedestrian risk when crossing the road, where pedestrian risk was defined as: C,A. O'flaherty, (2006) Reference **[8].** Pedestrian Risk =

$$\text{Pedestrian Risk} = \frac{\text{Causalities/year} \times 10^2}{\text{Pedestrian flow/hour}}$$

Similar ratios can be established for cycling. From such simple measurements the worst safety locations for pedestrians and/or cyclists can be identified and prioritized.

Conflict

Accident risk, based on actual accidents, is not the only measure which needs to be taken into account. Luckily accidents are a relatively rare event at any particular location, but conflicts between competing travellers are much more common and often result in 'near misses'. In the UK, the Department of Transport has set up a formal design procedure for establishing whether formal pedestrian road crossing facilities are necessary based on the volume of potential conflicts between pedestrians and vehicles. C,A.O'flaherty, (2006) **[8]**.

The procedure is based on the expression $\mathbf{PV^2}$, where:

P = pedestrian flow (ped/h) across a 100 m length of road centered on the proposed crossing location

V = number of vehicles on the road in both directions (veh/h).

The $\mathbf{PV^2}$ value is the average over the four busiest hours of the day. A formal crossing is normally justified if the value of $\mathbf{PV^2} \geq \mathbf{1} \times \mathbf{10^8}$

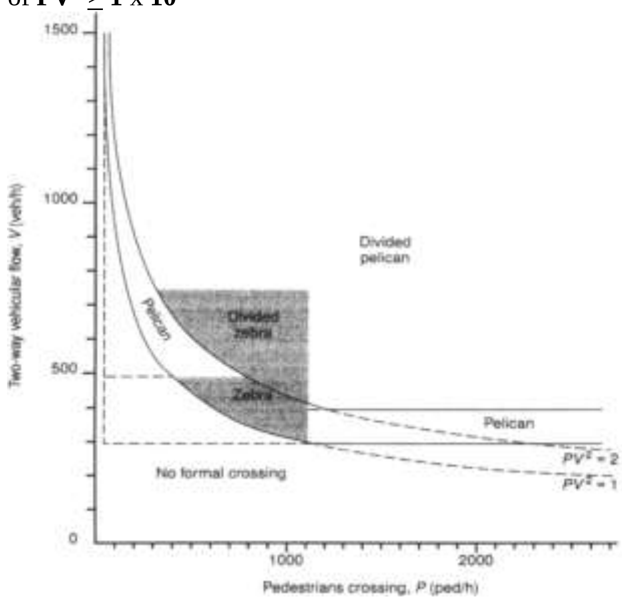

Figure 2.1: Design warrant for deciding on appropriate crossing facility

Satisfying policy objectives

The satisfying of any formal transport policy objectives must be an important factor when identifying priorities. For example, if an important local transport policy objective is to provide an extensive pedestrian route system aimed at increasing the amount of walking by elderly and disabled people, then those road crossing points in the vicinity of

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concentrations of such groups of people are likely to have a higher priority than those elsewhere.

Cost effectiveness

Because of the competing demands for finance within the transport sector, all proposals given top priority on the basis of the above three criteria should be subjected to an appropriate cost-effectiveness analysis. This would be aimed at establishing the benefits to pedestrians and/or cyclists resulting from reduced delays, easier movement and increased safety, and to compare these benefits with possible increased delays incurred by vehicle occupants and the capital and maintenance costs of construction.

2.3 Site survey

A site survey over a length of approximately 50m either side of the proposed crossing location should first be done. It may be necessary to survey a number of different lengths if there is no single specific crossing desire line (National Roads Authority, 2011) **[6]**.

The site survey should include the following items:

- Surrounding vehicle and pedestrian movement generators such as schools, shops, public transport stops or stations, hospitals, sheltered housing, disabled persons meeting and living centers, leisure facilities and community facilities.
- Number and type of pedestrians who will use the crossing, identifying age and ability.
- The difficulty of crossing and the crossing delay.
- Speed of vehicles passing the proposed location.
- Number and type of vehicles approaching the proposed crossing location.

2.4 Traffic survey

The traffic survey consists of a pedestrian survey and a vehicle survey. The surveys are generally undertaken over the 12 hour period 7am – 7pm. This will cover the morning and evening peak hours plus lunch times and any other busy periods such as school starting and finishing times and local peaks for movements relating to employment, leisure and shopping facilities. A shorter survey period can be undertaken if required but it should include all potential main pedestrian movement times.

These surveys should be carried out either by trained and experienced staff or by a specialist traffic counting firm. The recording of crossing difficulty will automatically highlight this situation in the survey. The crossing difficulty should be measured by noting the average length of time that pedestrians spend waiting at the kerb for a reasonable gap in traffic before crossing.

Separate values should be noted for able bodied and for elderly or disabled people. A numerical rating of between 1 and 5 can then be assigned to the location according to these lengths of time. Usually surveys should be carried out on a typical weekday during school term time.

Passenger Car Units (PCU)

A traffic stream normally consists of different kinds of vehicles. To allow for capacity measurements for roads, traffic volumes are normally expressed in Passenger Car Units (PCU). As different kinds of vehicles affect the capacity of rural roads, urban roads and junctions in varying degrees, the weight of each class of vehicle has to be varied to suit the purpose for which it is to be used (Kadiyali, 1987) Reference **[9]**. Table 2.1 below shows the main conversion factors for various vehicle types that have been used for this study.

TABLE 2.1 PCU FOR DIFFERENT TYPES OF VEHICLES.

Vehicle Type	PCU
Motorcycles	0.33
Cars	1
Vans and Minibuses	2
Buses	2.5
Trucks	3

Source: Ministry of Transport and Communication, 2007

Pedestrian volumes should also be weighted using the below factors**.**

TABLE 2.2 PEDESTRIAN WEIGHTING FIGURES

Pedestrian type	Factor
Adult	1
Unaccompanied Children, elderly, disabled	2

Source: National Roads Authority

2.5 Crossing need assessment

Once the surveys are complete, the need for a crossing can be determined using the numerical **PV^2** method, which measures the existing conflict between vehicles and pedestrians, but also includes an evaluation of latent demand and of the other indicators of crossing need that have been collected in the Site Survey.

Calculating PV^2

As a first step a numerical value of **PV^2** is calculated using the values of P and V gathered in the traffic survey. Higher values indicate a greater need for a crossing.

- P = pedestrians crossing per hour
- V = two **-** way vehicle flow per hour

A single value of P and a single value of V are determined for each hour of the survey period.

The P value for each hour is weighted to account for the increased need if there is a large number of unaccompanied children under 16 years old, elderly pedestrians and disabled pedestrians.

The V value for each hour is also weighted to account for high proportions of heavy vehicles and buses.

A value of **PV^2** is then calculated for each hour. The two highest hourly values should be identified and averaged to give one value.

2.6 Crossing behaviour of pedestrians

Previous researches have made theoretical and methodological contribution to a practical understanding of pedestrian's behavior and the interaction between the driver and the pedestrian at pedestrian crossings. Pedestrians arriving at the pedestrian crossing look for acceptable gaps between vehicles in the traffic stream. They either accept or reject such gaps. Rejection of prevailing gaps leads to longer waiting time at the curb side. Pedestrian crossing behavior is divided here into four categories namely "one stage", "two-stage", "perpendicular direction" and "oblique direction". Each of these serves to minimize crossing time while still providing a degree of safety.

2.7 Factors affecting crossing behaviour of pedestrians

Pedestrian crossing behavior is usually get influenced by various factors related to pedestrian characteristics, pedestrian movements, traffic conditions, road conditions and environmental surroundings.(Rosenbloom, Ben-Eliyahu and Nemrodov, (2008)) Reference **[10]** observed unsafe crossing behavior of children, like not stopping at the curb, not looking before crossing, attempting to cross when a vehicle is nearing and running across the road. Female pedestrians are observed accepting more gaps and less risk compared to male pedestrians. Experimental studies on the effect of age of a pedestrian in gap selection have been done. They reported that, for all age groups, gap selection is primarily based on vehicle distance and speed (Oxley, Ihsen, Fildes, Charlton and Day, (2005)) Reference **[11]**.

Hamed (2010) Reference **[12]** reported that approaching traffic volume and vehicle speeds are instrumental in determining the pedestrian's waiting time (delay) and the number of crossing attempts. Pedestrians, who accept higher risk, have to cease their waiting time, whereas pedestrians, who are likely to lower the risk, have to extend their waiting time at pedestrian crossings. Yagil (2011) Reference **[13]** reported that pedestrian's belief, motives and situational factors can affect their crossing behavior at signal controlled crossings. Situational factors like presence of other pedestrians and their behavior towards 'Walk' and 'Don't Walk' signs affect the behavior of female pedestrians and traffic volume affect the behavior of male pedestrians at signalized crossings (Jain, Gupta and Rastogi, (2014)) Reference **[14]**.

2.8 Pedestrians crossing

Pedestrian crossings are provided to give people a safer place to cross the road. These crossing points are located at sites where there are high volumes of traffic and pedestrians. There are several different types of crossings in use International Journal for Traffic and Transport Engineering Reference **[15].**

- At grade crossing
- Grade separated crossing

2.8.1 At grade crossings

At grade crossings, the pedestrians cross the carriageway at the same level as that of vehicular movement. It is very common in cities and towns. It may be controlled and uncontrolled. There are three forms of at grade pedestrian crossing generally available for use on national roads:

- Uncontrolled crossing, often with a central refuge island.
- Controlled Zebra crossing, with black & white road markings and amber flashing beacons.
- Controlled Signalized crossing, with a pushbutton facility for the pedestrian.

Uncontrolled crossing (often with a central refuge island).

Pedestrians crossing a single carriageway road without a refuge island have to wait for a gap in traffic in both directions of traffic movement. Often there is a gap in one direction but not the other. On busy roads this can lead to problems with pedestrians feeling that it is unsafe to cross, or making risky crossing movements such as standing unprotected in the middle of the road.

Children, the elderly and disabled people can find it very difficult to cross wider and busier roads and feel in danger. Refuge islands are a comparatively cheap form of uncontrolled crossing facility. They offer pedestrians the benefit of being able to cross streams of traffic separately with a safe haven in the middle of the road.

- ✓ **Zebra controlled crossing**

They are indicated by black and white bands painted on the carriageway. Pedestrians on the crossing have priority over vehicles. A zebra crossing is suitable for low approach speeds (up to 50km/h) and low traffic volumes (less than 500 vehicles per hour two way without a refuge island or 750 vehicles per hour two ways with a refuge island). They are not suitable for areas of high pedestrian movements such as busy shopping streets or near train stations, as high or continuous pedestrian flows can cause excessive traffic delay.

- ✓ **Signal controlled crossing**

A signal controlled pedestrian crossing is suitable for a wider variety of pedestrians and traffic flows but is more expensive to install and maintain than a zebra crossing. It offers pedestrians the advantage of a more positive form of control with a signaled green man crossing period where traffic is held on red.

Visually impaired pedestrians often prefer using signal controlled crossings because of the tactile push button units and audible bleeper.

- ✓ **Pelican crossing:**

Pedestrian light controlled crossing. It is activated by pedestrian pushing the button. A "red/green man" signal on far side of the carriageway shows pedestrian when to cross.

- ✓ **Puffin crossing:**

Pedestrian User-Friendly intelligent crossing. They are also activated by the pedestrian pushing a button. Intended as a replacement for the Pelican, it monitors the presence of pedestrians waiting and crossing and lengthens or shortens the crossing time accordingly. The "red/ green man" signal is located on the near side to the pedestrian.

- ✓ **Toucan crossing:**

"Two can cross."Toucan crossings allow pedestrians and cyclists to cross at the same time without requiring cyclists to dismount and walk across the road. This would typically be used where an off road cycle way crosses a road at the same location as pedestrians do.

2.8.2 Grade seperated

Grade separated pedestrian crossings are installed when it is necessary to physically separate the crossing of a heavy volume of pedestrians from a roadway with heavy motor vehicle traffic (including freeways and expressways).The effectiveness of grade separated crossings depends on their perceived ease of accessibility by pedestrians. An overpass or underpass will not necessarily be used simply because it improves safety since they require high costs for grade-separated facilities to be set up.

2.9 Design and installation of a pedestrian crossing

1. Visibility

Visibility is a key safety issue at pedestrian crossings. It is important that drivers approaching a crossing have good visibility of the crossing and of any pedestrians about to cross. Similarly, pedestrians must be able to see approaching vehicles. Any trees, bushes, street furniture or other objects that could restrict visibility should be removed or relocated.

2. Positioning relative to side road

If the crossing is to be positioned close to a side road then the following minimum distances should be maintained between the stop line marking for the crossing and the position of a driver waiting at the side road stop or yield line; 5m for a Zebra crossing and 20m for a signal controlled crossing.

Wherever a controlled crossing of the main road is to be located near a busy side road junction the preferred position is to the right hand side of the side road. Crossings positioned to the left hand side can cause visibility problems, as drivers turning left out of the side road tend to look only to their right for approaching traffic, and do not look to their left hand side until the left turn maneuver is already underway.

If the pedestrian desire line is in this position then it is preferable to place the crossing immediately at the junction, where it is within the immediate vision of the driver on the side road pulling up to the stop line.

3. Crossing width

The minimum width of the crossing walkway should generally be 2.8m, although this can be reduced to 2.4m width at difficult sites if necessary. Wider crossings can be provided up to 5m width in areas of high pedestrian crossing movements (over 600 pedestrians per hour).

4. Road markings and signs

These should be placed to give information about the existence of the crossing facility.

5. Lighting

If the existing street lighting is not sufficient then additional lighting should be provided at pedestrian crossing points. This additional lighting throws a band of light across the road at the crossing location and shines directly onto pedestrians waiting at the kerb, ensuring that there is good visibility of pedestrians on and approaching the crossing during the hours of darkness.

6. Skid resistance of road surface

Approaches to crossings are generally high stress areas with frequent braking action. If vehicles cannot stop in time there is a greater risk of collisions with a pedestrian on the crossing or of rear end shunts on the approaches. Consequently the approaches need to provide a high level of skid resistance.

This can be achieved by provision of a new wearing course incorporating a high Polished Stone Value chipping material or application of a high friction surface.

7. Drainage at the crossing

Unless the crossing is well constructed there may be drainage problems leading to ponding at the crossing points which could be a particular problem in wet or icy conditions.

Crossing points should therefore be well drained but care should be taken not to place any drainage gullies within the crossing walkway.

8. Dropped kerbs and tactile paving

Dropped kerbs should be provided at all crossings to ensure good access for mobility impaired pedestrians and those with pushchairs or prams. The kerb up stands should be flush with the carriageway up to a maximum of 6mm. The footpath cross fall at these locations should preferably be 1:20, with a maximum of 1:12, to allow ease of use. Tactile paving should be provided for visually impaired pedestrians.

9. Guard railing

Guard rail should only be used where it is needed to prevent hazardous crossing.

3.0 RESEARCH METHODOLOGY

3.1 Introduction

Research proceeds along a methodology. It is 'a coherent set of rules and procedures which can be used to investigate a phenomenon or situation within the framework dictated by epistemological and ontological ideas.'

Research methodology may be described as including all the scientific procedures a researcher adopt to generate, analyze, interpret and present data. The adoption and rationale of a particular methodological approach is usually a function of the researcher's theoretical framework to construct. Warf (2006) describes methodology as 'a meso-level theoretical construct that allows researchers to translate their epistemological and ontological assumptions into data'. This chapter deals with the discussions on the research methodological framework used in this study.

3.2 Study area

The area where the study will be conducted is in Kampala International University, Western Campus junction, along Busheyi-Mbarara road, Ishaka.

3.3 Research design

This refers to the overall strategy chosen to integrate the different components of the study in a coherent and logical way, thereby ensuring the effective address to the research problem. It constitutes the blueprint for collection, measurement and analysis of data. It includes the set of methods and procedures in collecting and analyzing measures of the variables specified in the research problem. The design of a study defines the study types which include: Descriptive e.g. case study, correlation e.g. case control, semi-experimental, experimental, review e.g. literature review and meta- analytic. Methods of collection of data included observation, photogrammetric, and literature review of existing texts and analyzed by the Ms Excel program.

3.4 Nature/type of data and data sources

3.4.1 Secondary sources of data

These can be seen as already existing data. According to, this sort of data is used for research work other than that for which it was originally collected. This further use of data allows for both efficiency in data collection and the conduct of comparative studies (across space and time) that otherwise will be impossible.

The added advantage is that it enables the researcher to have a basis for corroborating upon or filling the gaps in existing knowledge. However, it may be difficult for a researcher to adopt and adapt to some secondary data since they might either be irrelevant or unsuitable to a particular topic of research interest.

It was obtained mainly through literature review of the existing work by various scholars and researches on vehicular and pedestrian traffic characteristics, Desk review of relevant national and international publications and records, textbooks from the library and lecture notes.

3.4.2 Secondary sources of data

Refers to data collected first hand from the field, i.e. through observation, photography and manual counts

3.4.3 Primary sources of data

Refers to data collected first hand from the field, i.e. through observation, photography and manual counts.

3.5 Data collection

Entails the process of gathering and measuring information on variables of interest in an established systematic fashion that enables the answering of stated research questions, test hypotheses, and evaluate outcomes.

This chapter compares the findings of the study with benchmarks established in the review of literature.

Data was collected using various methods as discussed below

3.5.1 Site survey

A site survey was done over a length of approximately 2km either side of the proposed crossing location at the area of interest, Kampala International University, western campus, Ishaka junction, to determine the physical environment and nearby amenities and generators of pedestrian traffic, More specifically where the pedestrian desire line was very high.

It included the following:

- Photographs of the proposed site.
- Details of the road and footpath layout and widths.
- The visibility for approaching drivers of the proposed crossing location and of pedestrians approaching the crossing.
- The visibility for pedestrians at the proposed crossing point of vehicles approaching the crossing.
- Local traffic facilities or restrictions such as speed limit, street lighting, loading and parking restrictions, public transport stops, nearby side roads and accesses, nearby pedestrian crossings and school crossing warden locations.
- Surrounding vehicle and pedestrian movement generators such as schools, shops, public transport stops or stations, hospitals, doctor's surgeries, sheltered housing, disabled persons meeting and living centers, leisure facilities and community facilities.
- Number and type of pedestrians who will use the crossing, identifying age and ability.
- The difficulty of crossing and the crossing delay.

Speed of vehicles passing the proposed location

3.5.2 Data review

Traffic reports and publications were reviewed once again to obtain information relevant to the study problem herein undertaken. This helped in designing the tally sheets that would be used in the study. The map for the study area was obtained from Google maps in the internet and was crucial for identifying the aerial composition of the area.

3.5.3 Direct observation

This was crucial when surveying the site. This helped identify the pedestrian movement generators such as schools, shops, public transport stops or stations and settlements.

3.5.4 Traffic counts

Traffic counts were carried out only during the morning and evening peak hours at intervals of fifteen minutes at the study area on the 29th February 2020. A total of three trained observers were positioned to clearly see the traffic they were counting. Counting was manually done and recorded on the pre prepared tally sheets.

3.5.5 Pedestrian counts

Just like vehicular traffic counts, pedestrian counts were done during the morning and evening peak hours at intervals of fifteen minutes at the study area on the 17th February 2020.Other pedestrian behavior while crossing the road was determined on 16th February 2020 and lastly 12th March, 2020. To avoid confusion of double counting and due to simplicity of the work, only one trained observer was utilized. The tallying method of counting was used and findings plotted on the pre prepared tally sheets ready for analysis.

3.6 Techniques for data analysis and presentations of findings.

Data was analyzed using computer based analysis using MS EXCEL program to help in understanding of the situation and presented in form of graphs, tables, charts, pictures, diagrams and maps.

4.0 RESULTS AND DATA ANALYSIS

TABLE 4.1: PEDESTRIAN CROSSING SITE ASSESSMENT

SITE ASSESSMENT	
Name of site	KIU junction, Ishaka crossing zone

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Location description	KIU junction, Ishaka, near Bassajjabalaba secondary school and Bassajjabalab primary school, 100m from the junction of KIU road to Total station road towards KIU staff quarters (Lagos and Abuja).
Carriageway type	Dual, two-way
Carriageway width	Dimensions: 12m Comments: four lanes
Footpath width	Dimensions: 4m Comments: Rough, ruggered, potholed and dusty
Refuge island (if existing)	Dimensions: 3m Comments: Rough and dusty
Visibility	Comments: Good visibility, no obstructing trees and buildings
Bus stops	Mark bus stops on plan *Bus stops located near proposed crossing site?* Yes *Bus stops need re-sitting to avoid blocking of crossing or visibility?* No Comments: Bus stops unmarked and not clearly defined
Nearby junctions and Accesses	Distance from crossing to vehicle in side road / access: Junctions mark start point of crossing. Comments: Bassajjabalaba, New road and Kabirizi road junctions
Other pedestrian crossings close by	No pedestrian crossing present
School Warden crossing Nearby	*If present: School crossing warden site?* Yes *Signs and markings present?* No
Time to cross the road	Able pedestrians (sample) 44 seconds Elderly or disabled people (sample) 64 seconds
Difficulty of crossing	Indicate degree of difficulty 1 - 5: 1 No difficulty, 1 or 2 second wait at peak times 2 Wait of 3 - 20 seconds for gap at peak times (able person) ~~3 Wait of 20 – 40 seconds for gap at peak times (able person)~~ 4 Wait of more than 40 seconds at peak times (able person) 5 Impossible to cross safely at all times
Surrounding facilities likely to generate pedestrian demand	*Route to/from a school?* Yes *Route to/from shops?* Yes *Route to/from sheltered housing?* Yes *Route to/from bus station or stop?* Yes *Route to/from leisure facilities?* No *Route to/from community facility?* Yes Comments: Schools:Kampala International University, western campus, Bassajjabalaba secondary school, Bassajjabalab primary school, KIU teaching hospital.
Speed of traffic	22 km/h
Summary of pedestrian flow at peak times	440 per hour
Summary of vehicle flow at peak times	2920 per hour

TABLE 4.2: PEDESTRIAN COUNT SURVEY SUMMARY

PEDESTRIAN COUNT SUMMARY SHEET									
Site	KIU junction,WC Ishaka crossing zone								
Time period starting (¼ hourly)	Counts				Weighted				Weighted Total P
	Adult	Child (under 16yrs)	Elderly	Disable	Adult x1.0	Child x2.0	Elderly x 2.0	Disaled x 2.0	
07.00	102	20	0	0	102	40	0	0	142
07.15	93	23	1	0	93	46	2	0	141
07.30	91	18	1	0	91	36	2	0	129
07.45	90	15	3	0	90	30	6	0	126
08.00	112	7	0	0	112	14	0	0	126
08.15	175	2	1	2	175	4	2	4	185
08.30	120	1	7	0	120	2	14	0	136
08.45	99	1	3	0	99	2	6	0	107
09.00	104	1	1	1	104	2	2	2	110
09.15	78	0	2	0	78	0	4	0	82
09.30	53	0	0	0	53	0	0	0	53
09:45	44	0	1	0	44	0	2	0	46
10:00	40	0	4	0	40	0	8	0	48
16:00	40	9	0	0	40	18	0	0	58
16:15	41	4	0	0	41	8	0	0	49
16:30	76	29	0	0	76	58	0	0	134
16:45	95	23	4	1	95	46	8	2	151
17:00	80	63	3	0	80	126	6	0	212
17:15	82	37	2	1	82	74	4	2	162
17:30	80	14	1	0	80	28	2	0	110
17:45	83	16	1	0	83	32	2	0	117
18:00	70	11	0	0	70	22	0	0	92
18:15	60	9	0	0	60	18	0	0	78
18:30	63	4	0	0	63	8	0	0	71
18:45	50	2	0	0	50	4	0	0	54
19:00	39	0	0	0	39	0	0	0	39
Total	2060	309	35	5	2060	618	70	10	2758

TABLE 4.2: VEHICLE COUNT SURVEY SUMMARY

PEDESTRIAN COUNT SUMMARY SHEET								
Site	KIU junction,WC Ishaka crossing zone							
Time period starting (¼ hourly)					Weighted 2-way count			Weighted Total 2way **V**
	Car /Van	Bus/HCV/ Truck	Cycle / M Cycle		Car / Van Weighting x 1.0	Bus / HCV / Truck Weighting x 2.0	Cycle / M Cycle Weighting x 0.5	
07.00	383	88	111		383	176	56	725
07.15	376	92	98		376	184	49	707
07.30	413	101	101		413	202	51	766
07.45	463	98	128		463	196	64	851
08.00	489	113	132		489	226	66	913
08.15	500	110	120		500	220	60	900
08.30	486	111	121		486	222	61	889
08.45	555	119	110		555	238	55	958
09.00	460	108	115		460	216	58	848
09.15	442	110	95		442	220	48	804
09.30	423	100	91		423	200	46	804

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09:45	415	115	84		415	230	42	804
10:00	412	103	78		412	206	69	805
16:00	411	101	104		411	202	52	769
16:15	423	98	96		423	196	48	763
16:30	428	100	100		428	200	50	778
16:45	431	114	117		431	228	59	834
17:00	453	106	119		453	212	60	843
17:15	498	119	121		498	238	61	917
17:30	514	121	133		514	242	66	956
17:45	572	100	121		572	200	61	953
18:00	493	111	118		493	222	59	892
18:15	477	113	111		477	226	56	869
18:30	460	115	101		460	230	51	841
18:45	489	110	88		489	220	44	841
19:00	455	113	90		455	226	45	816
Total	11921	2789	2803		11921	5578	1408	**21,846**

TABLE 4.3: PEDESTRIAN CROSSING NEED ASSESSMENT (PV^2 CALCULATION)

CALCULATION OF PV^2						
Site	KIU junction,WC Ishaka crossing zone					
Time period starting	**P Pedestrian (weighted)**	**V** Vehicles (weighted)	**P/hour. Hour Starting**	**V/hour. Hour Starting**	**$PV^2/10^8$. Hour Starting**	2 highest **PV^2(x 10^8)** Hourly value
07:00	142	615	538	2613	36.73	
07.15	141	609	522	2779	40.31	
07:30	129	666	566	2950	49.26	
07:45	126	723	573	3053	53.41	
08:00	126	781	554	3178	55.95	
08:15	185	780	538	3131	52.74	
08:30	136	769	435	3061	40.76	
08:45	107	848	352	2961	30.86	
09:00	110	734	291	2800	22.81	
09:15	82	710	229	2723	16.98	
09:30	53	669	-	-	-	
09:45	46	687	-	-	-	
10:00	48	657	-	-	-	
16:00	58	665	392	2728	29.17	
16:15	49	667	546	2788	42.44	
16:30	134	678	659	2918	56.11	
16:45	151	718	635	3063	59.58	59.58
17:00	212	725	601	3178	60.70	60.70
17:15	162	797	481	3227	50.09	
17:30	110	823	397	3189	40.37	
17:45	117	833	358	3107	34.56	
18:00	92	774	295	3027	27.03	
18:15	78	759	242	2929	21.48	
18:30	71	741	-	-	-	
18:45	54	753	-	-	-	
19:00	39	726	-	-	-	
Average PV^2 ($1x10^8$) from 2 busiest hours						**60.14**

TABLE 4.4: PV^2 SUMMARY

SUMMARY OF TOTAL PV^2	
Site	KIU junction,WC Ishaka crossing zone
Calculated PV^2 value ($\times 10^8$)	60.14
Route to/from school	Yes
Route to/from shops	Yes
Route to/from sheltered housing / hospital / doctor's surgery	Yes
Route to/from rail / bus station or stop	Yes
Route to/from leisure facilities	No
Route to/from community facility	Yes
Crossing difficulty rating of 4 or 5	Yes

From the above tables, the **PV^2** for the road section exceeds **1×10^8** for each and every hour available. This is a sure indication that the number of vehicles and pedestrians using that stretch of road is considerably high. The sections on either side of the carriageway also prove very important to the pedestrians as it forms their major route to schools, shops, housing, bus stops and community facilities.

4.4 Peak hour speed runs

A road section about 50 m was taken as the primary distance and a series of 10 vehicles randomly timed during the peak hour to identify speed.

TABLE 4.5: PEAK HOUR SPEED RUNS

Time taken (seconds)	Speed (m/s)	Speed (km/hr)
9.23	5.4171	19.5016
8.33	6.0024	21.6086
8.06	6.2035	22.3325
8.77	5.7013	20.5245
7.35	6.8027	24.4898
7.46	6.7024	24.1287
7.81	6.4020	23.0474
8.77	5.7013	20.5245
8.20	6.0976	21.9512
7.69	6.5020	23.4070
Average Speed	**22.1516 Km/hr**	

Sample:

Speed = Ditance/Time
= **50/9.23**
= **5.4171 m/s**

The traffic in the road section used an average of 22 Km/hr to travel through that crossing zone. This speed proved challenging for pedestrians as they were forced to wait longer for adequate gaps to cross the road since the traffic volume was considerably high.

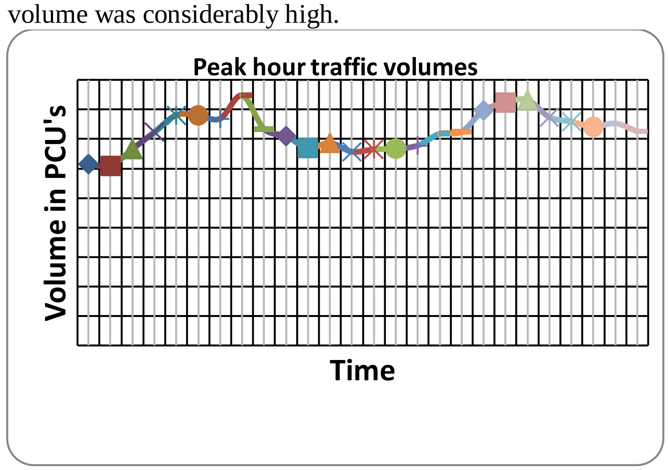

Figure 4.1: Graph showing peak hour volumes

The figure 4.1 indicates how the traffic volume was considerably high over the two major periods of the day, morning peak hours and evening peak hours.

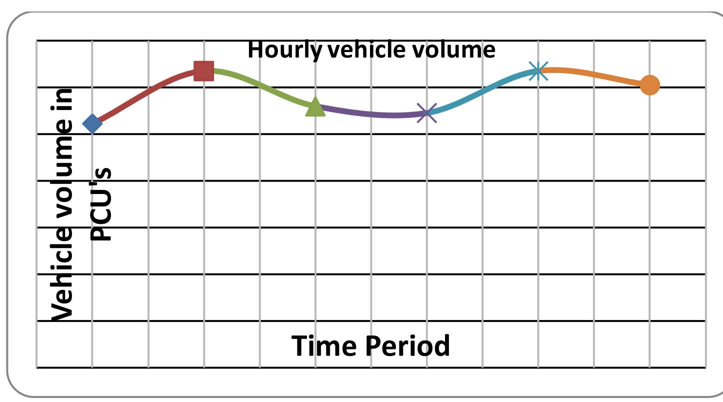

Figure 4.2: Graph showing hourly vehicle volume

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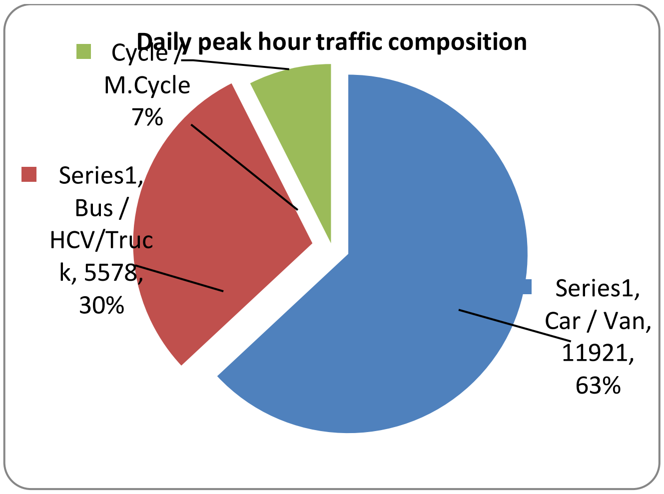

FIGURE 4.3: PIE CHART SHOWING PEAK HOUR VOLUMES

From the graphs, it is seen that traffic volume is considerably higher in the peak hours of the day as commuters are either reporting to work in the morning or going back home in the evening. Most of them used personal cars or public transportation vans i.e. bodas hence their large composition of the main traffic as seen in the pie chart.

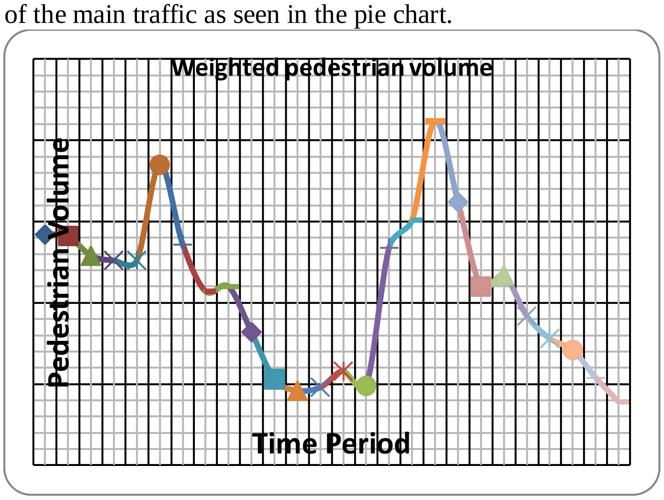

Figure 4.4: Graph showing weighted pedestrian volume

The highest number of pedestrians using the road section was established to be in the morning and evening peak hours when they were either going or coming out of their work places.

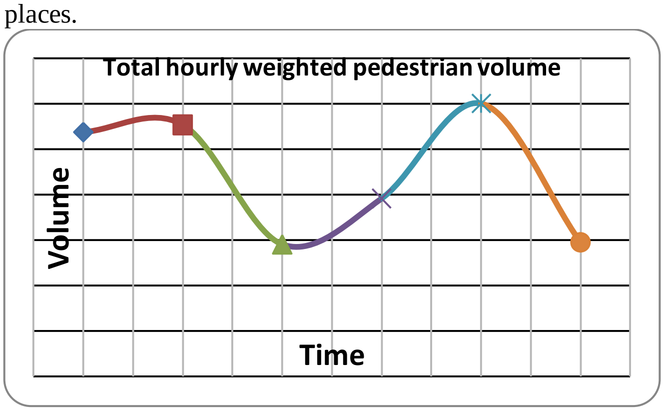

Figure 4.5: Graph showing peak hour volumes

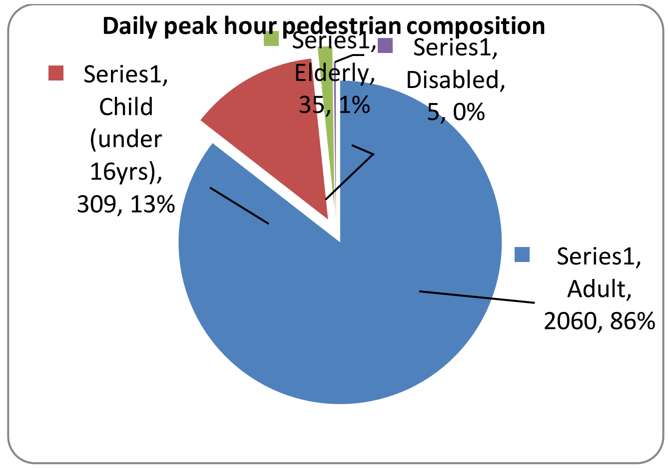

Figure 4.6: Pie chart showing daily peak hour pedestrian composition

Similar to vehicular traffic, the pedestrian volume was considerably high during the peak hour of morning and evening due to the fact that people were either reporting to their work places, business centers or schools in the morning and out from them in the evening periods. Majority of the pedestrian composition was made up of adults and about 13% children who were mostly school going children.

Time taken to accept first gap (s)	Time taken to cross first half of road (s)	Waiting time at median (s)	Time taken to cross second half of road (s)	Total time used (s)
31	4	22	3	60
22	3	43	4	72
31	3	54	4	73
23	4	44	2	73
27	2	39	3	71
30	2	28	2	62
44	2	41	4	91
54	4	42	3	103
21	4	44	4	73
19	4	47	4	74
10	4	50	5	69
5	4	33	4	46
17	3	32	3	55
25	2	41	4	72
27	2	43	2	74
33	2	21	4	60
31	4	26	3	64
41	4	27	3	75
40	3	31	2	76
47	2	33	4	86
52	3	40	4	99
51	2	49	4	106
54	4	50	2	110
16	4	41	4	65
23	3	43	4	73
31	4	47	2	84
36	4	40	4	84
28	5	38	1	72
31	4	31	4	70
40	3	30	3	76

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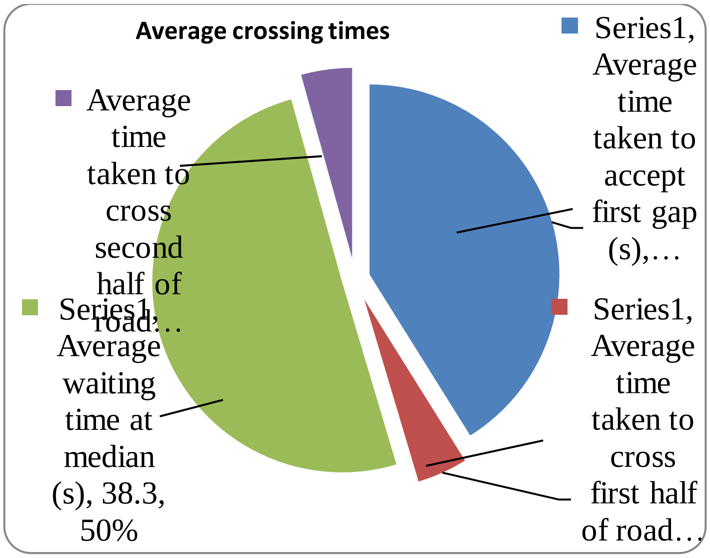

FIGURE 4.7: PIE CHART SHOWING AVERAGE PEDESTRIAN CROSSING TIME

There is evidence to the fact that it takes relatively long (up to 31 seconds) for pedestrians to find adequate gaps in the traffic stream so as to cross. This induces anxiety in pedestrians to the extent that they now want to literally run across the roadways, which may lead to fatal accidents. The 1.1m/s walking speed is the average literature value quoted for an ordinary pedestrian taking into cognizance sickness, pregnancy and many other factors like old age (Highway Capacity Manual, 2000)**[2]**. Considering a walking speed of about $1.1m/s^2$ for pedestrians, the minimum time needed to comfortably/safely cross a 7m carriageway would be 7.7 seconds for a two-lane roadway like the one in study. They however do this in 3.3 seconds implying that they cross hurriedly when stressed and nervous, hence uncomfortable or by running across which is dangerous. This is evident by the next chart.

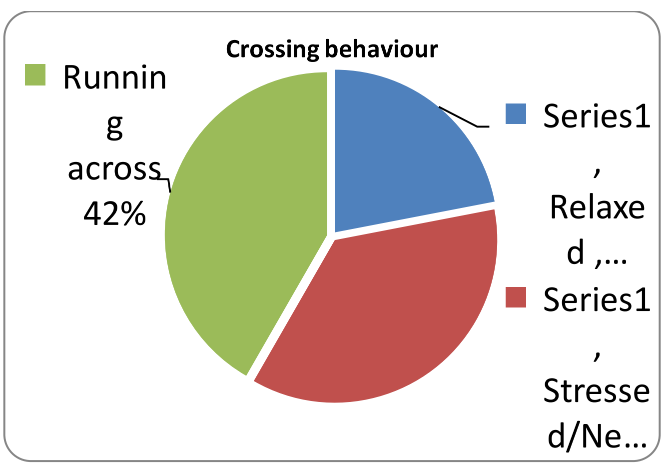

FIGURE 4.8: PIE CHART SHOWING PEDESTRIAN CROSSING BEHAVIOR

TABLE 4.7: PEDESTRIAN CROSSING BEHAVIOR

Relaxed	Stressed/Nervous	Running across
78	129	148

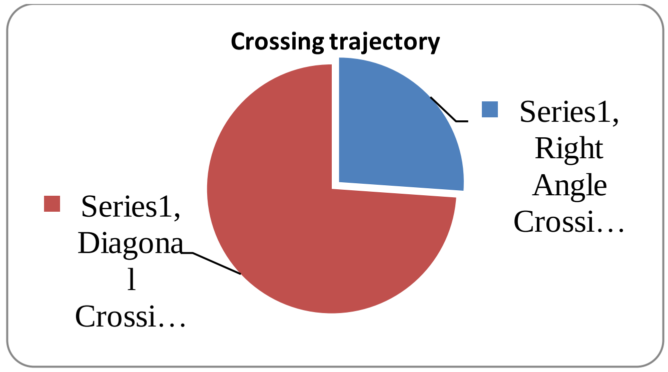

FIGURE 4.9: PIE CHART SHOWING PEDESTRIAN CROSSING TRAJECTORY

TABLE 4.7: PEDESTRIAN CROSSING TRAJECTORY

Right angle crossing	Diagonal crossing
59	167

Disproportionate numbers of pedestrians cross the roadway in a diagonal manner, which is indicative of inadequate gaps for crossing at these points.

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The study has demonstrated that a large volume of pedestrians undertake trips for various reasons for instance going to work or school around KIU, WC, Ishaka junction area. In so doing, they cross the road section, but since vehicular volume is also high and fast around the area, they are forced to wait by the kerbside for long periods of time. Walking is found to be common due to financial constraints among the majority of the study population. From the study, it has been established that a formal crossing facility is necessary to be provided to solve this phenomena.

5.2 Conclusion

Inadequate attention has been demonstrated to provide for accessibility of non drivers. It appears that agencies involved in infrastructure development have not given pedestrian infrastructure the necessary attention and as such need to be sensitized. The pedestrian observation method is a low-cost method for evaluating the severance imposed on pedestrians as a result of high speed roads in urban centers. It could also serve as a method for identifying hazardous locations along a road. However, it would require some level of training for good results.

From the studies conducted in the research area, the following can be drawn:

1. It has been scientifically proven that there is need for a formal pedestrian crossing point at the KIU, WC, Ishaka junction area. This is so the $\mathbf{PV^2}$ for the road section exceeds $1\times\mathbf{10^8}$ for each and every hour with the highest being $\mathbf{60.14\times10^8}$ during the peak period which necessitates the need for a formal crossing point. This was the main objective of the study and has been proved so.
2. During the peak periods, an average of 460 pedestrians use the section of the road for crossing while an average of 2900 vehicles pass through that

section which is basically high, this makes the research hypothesis true.

3. 76.2 seconds was found to be the average crossing time used to safely complete a crossing maneuver which is basically high compared to 10 seconds that is actually required.
4. Crossing is also compromise in comfort and safety as most of the time pedestrians were running across. This confirms the last hypothesis.
5. In addition, the crossing route at that section is critical to the community since it forms the major route to schools, shops and community facilities. A critical observation made is that school going children form a larger part of those who use the highway section and usually encounter problems during crossing, i.e. wasting a lot of time waiting for adequate gaps or running across the road.

5.3 Recommendations

1. Since a formal crossing facility is justified, footbridge or underpass would be ideal for the road section at KIU, WC, Ishaka junction. However, the existing area is of small areal extent, it would be desirable so to first install speed reducing bumps which will eliminate excessive speeds where through traffic would represent accident risks, a zebra crossing and guard rails which will help pedestrians concentrate at one formal safe crossing point.

2. Road signs should be introduced at the area to notify motorists and pedestrians of the crossing zone and other road conditions such as existence of road bumps.

3. The existing road conditions were noticed to be poor and in bad shape e.g. footpaths; they should be greatly improved to encourage amenity and make the area more appealing to the pedestrians.

4. Bus bays should also be provided in the area since it was noticed that taxis/bodas stop at pedestrian footpaths to pick or drop passengers.

5. The government should impose strict restrictions to all drivers who do not obey and respect the zebra crossing point.

6 Acknowledgment

The writer wishes to thank the following people for their expertise and their willingness to provide valuable insights into the investigation of the explicit study of pedestrian and vehicular traffic at the kampala international university, western campus junction, ishaka crossing point to determine if a pedestrian crossing facility is justified in Uganda, and without whose participation, this report could not have been written:

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Counsellor/Head of Chancery of the High Commission of the Federal Republic of Nigeria in Uganda

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7 References

[1] Kasiima S., J.K. Balikuddembe., D. Khorasani-Zavareh., P. Sinclair., A. Ardalan., A. Nejati. (2016). Mainstreaming road safety in the regional integration of the East African Community to reduce road traffic injuries. *African Safety Promotion Journal, Vol. 15, No. 1, June 2017*

[2] A.K.T. (2011). Introduction to Transportation Engineering

[3] Hobbs, R. (1979). Traffic Planniang and Engineering. Michigan: Pergamon Press

[4] Krishna, T. (2011). Introduction to Transportation Engineering.

[5] Martin (2010). Highway Engineering

[6] National Road Authority (Uganda) (2011). Pedestrians Crossing Specification and Guidance.

[7] Leake, G. (2006), Planning for Pedestrian, Cyclists and Disabled people. Britain: Elsevier.
[8] C.A.O'flaherty (2006), Transportation Planning and Traffic Engineering. Elsevier.
[9] Kadiyali, L. (1987). Traffic Engineering and Transportation Planning, New Delhi:Khanna publishers.
[10] Rosenbloom, T., Ben-Eliyahu, A., and Nemrodov, D.(2008). Children's crossing behaviour with an accompanying adult, safety science. Retrieved from DOI: http://dx.doi.org/10.1016/j
[11] Oxley, J., Ihen, E., Fidelis, B., Chariton, J., and Day, R. (2005). Crossing Roads Safety: An Experimental study of age differences in gap selection by pedestrians, Accidents analysis and prevention.
[12] Hamed, M. (2010). Analysis of Pedestrians behaviour at pedestrian crossing, safety science.
[13] Yagil, D. (2011). Transportation Research part F: Traffic Psychology and Behaviour. In beliefs, motives and situational factors related to pedestrians self-reported behaviours at signal-controlled crossing.
[14] Jain, A., Gupta, A., and Rastogi, R. (2014). Pedestrians crossing behaviours analysis at intersections. In international journal for traffic and transportation engineering (pp. 103-116)
[15] International Journal for Traffic and Transport Engineering (2014)