STUDY OF ACCIDENTS AT MID-BLOCK PEDESTRIAN CROSSINGS IN SRI LANKA

Rasiah Gobalarajah

138307N

Thesis submitted in partial fulfilment of the requirements for the Master of Engineering in Highway and Traffic Engineering

Department of Civil Engineering

University of Moratuwa

Sri Lanka

January 2016

Declaration of the candidate and supervisor

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my thesis, in whole or in part in print, electronic or other media. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature: date:

The above candidate has carried out research for the master thesis under my supervision.

Signature of the supervisor: date:

ACKNOWLEDGEMENT

I would like to express my sincere thanks and appreciation to my supervisor Eng. Loshaka Perera, Senior Lecturer, Transportation Engineering Division of department of Civil Engineering, University of Moratuwa for his support, thoughtful guidance and encouragement.

My sincere gratitude is also extended to Prof. J.M.S.J Bandara, Professor, Transportation Engineering Division of Department of Civil Engineering, University of Moratuwa for the valuable advice and encouragement.

I would like to thank Prof: W.K. Mampearachchi and Dr .H.R. Pasindu for sharing their knowledge and experience with me, which were very valuable inputs for this research outcome.

Special thanks to Police Department for the given accident records.

Further I would like to express my thanks to Central Engineering Consultancy Bureau for support given throughout the research period.

Finally I would like to convey my gratitude to my colleagues at Transportation Engineering Division of department of Civil Engineering, University of Moratuwa.

R. Gobalarajah

138307N

University of Moratuwa.

ABSTRACT

Pedestrian involved accidents in Sri Lanka in the last four years from 2010 to 2013 vary between 17% and 21%. Among these pedestrian involved accidents, 17.9%, 15.2%, 17.9% and 18.2% accidents have been occurred on pedestrian crossing in years 2010, 2011, 2012 and 2013 respectively. Out of the accidents occurred on pedestrian crossings, mid-block pedestrian crossing accidents are 81.9%, 79.6%, 81.2% and 77.1% for the period 2010-2013. Thus, mid-block pedestrian crossings have contributed to more than 75% of the pedestrian crossing accidents. Hence, this study focus on identifying factors that have contributed to the higher percentage of pedestrian crossing related accidents at mid – block pedestrian crossings. The method used to evaluate this is quantitative, which analyses mid-block pedestrian crossing accidents for 400 kilometres off our main trunk roads (A03, A12, A09 and A20) and personal interviews of 100 drivers and pedestrians.

At present 40% of the 'A' Class roads in Sri Lanka have standard two lane asphalted pavements. Maximum allowed speed in these roads is 70 km/h. Speed control mechanisms are not strictly followed in Sri Lanka compared to developed countries. Thus, 70% of the interviewed drivers have accepted that they have driven over the speed limit during the trip for which they were interviewed. Drivers admit that they face difficulties to control speed at pedestrian crossing especially at mid-block sections unless proper prior warning is received.

Survey revealed that 100% of the pedestrian crossing constructions are not designed for handicapped people and 65% do not have proper studs and material. Based on interviewed data, 50% of the drivers and 45% of pedestrians do not use pedestrian crossing in the appropriate manner. Due to the Head and Dim light illumination of vehicles, visibility of a pedestrian crossing is affected. Some of the vehicles such as three wheelers head light brightness is higher than that of other vehicles. This also affects the visibility of a pedestrian crossing. Along these road stretches, 10% sign boards have been found to be not at the proper location. Visibility of these signboards is affected by obstacles such as trees and poles. Crossing visibility is affected by sag, crest and super elevation at of the 15% pedestrian crossings. It is observed through night time field observation that at white colour road markings visibility is higher at night than the yellow colour markings used for pedestrian markings.

The results indicate that mid-block pedestrian crossings accidents are mainly influenced by combination of design of road and vehicles and factors affecting visibility of pedestrian crossings. Further, attitude of pedestrian and drivers has also contributed towards high numbers to a certain extent.

Keywords

Accidents, pedestrians, mid-block crossings, road safety

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

Transportation in Sri Lanka is mainly based on the road and rail network where road transport represents around 93% of the total transport. According to the Road Development Authority report of October 2015, Sri Lankan road network consists of 12,210 km of "A" and "B" class roads and 169 km of expressways.

Pedestrian crossings in Sri Lanka can be divided into two categories namely Intersection and Mid-block pedestrian crossings. Intersection pedestrian crossings are located at junctions whereas Mid-block pedestrian crossings are located in between junctions.

Since intersection pedestrian crossings are located at the junctions, police monitoring is higher than that of mid-block pedestrian crossing. From the field observations, it is observed that generally the number of people using intersection pedestrian crossing is higher than that of mid-block pedestrian crossing. According to police report, more than 75% of pedestrian crossing accidents have occurred on mid- block crossings and therefore this study has focused on mid-block pedestrian crossing accidents to find causal factors and to propose counter measures.

1.1 Problem Statement

Roads in Sri Lanka are being reconstructed at an accelerated rate after 2009 with the help of foreign and local fund. Many foreign and local clients, consultants and contractors are responsible for these projects. Per capita income of middle class Sri Lankan has increased over the years considerably, as well as the number of vehicles imported has gone up significantly (Sri Lanka Socio – Economic Data, 2014). As a result number of vehicles on roads has been increased rapidly. According to the formal interview made with residents in the research area, proper consultation with public had not been made as public couldn't get enough information regarding road development projects. As a result, road designs have not been given proper attention to the requirements of the pedestrians. When importing vehicles, designs of the lighting system of vehicles have not been taken much into consideration. Neon under glow lighting in vehicles is a great barrier for road users in the nights

(www.LEGALSTREET.com). No camera monitoring systems are available for any of the roads. Further penalty for road users who do not follow road signs is less compared to a developed country. An integrated programme of road safety education is lacking in school education syllabus. School children are not taught regarding road safety and road usage, because they are not in their educational syllabus. There is lack of coordination between different stakeholders working in the field of traffic. Therefore, School children are not aware about pedestrian crossings. (Kumarage, Abeygoonawardena & Wijesundera, 2013) .Therefore in this research, information about mid-block pedestrians crossings is furnished so that appropriate authorities could take necessary action to reduce pedestrian related accidents.

1.2 Report Organisation

First section of this study, details the overview of the problem and the problem statement. Then, related academic information is analysed with supportive evidence in the literature review section. Research methodology section deals with the scientific methods used to perform the case study. Finally, the result is analysed scientifically and conclusion is developed based on the result.

2 LITERATURE REVIEW

Pedestrians are among the main users of road network in any country. Even in developed countries, public transport is the mainly used transportation to travel which is integrated with the pedestrian network. Pedestrian network is the beginning and ending part of road network, which helps you to reach the destination with comfort and ease. Irrespective of the country, pedestrian crossing should conform to the same minimum standards as through footpaths, especially in the maximum permissible cross fall, overhead clearances and protrusions, the surface standard and not containing grades and covers. All crossing points should be designed to minimize distance between pedestrian crossings, which ensures that they are at right angles of the direction of the road and the roadway is as narrow as possible at the crossing point.

Pedestrian crossings should be located on a desirable pedestrian line. If it is not possible or unsafe, use environmental and/or tactical clues to guide pedestrians to the crossing point. Street furniture should be located well away from the crossing, and vegetation should be regularly trimmed to get clear visibility of crossing. Parking should be prohibited for at least 15m either side of the crossing point (RDA Design manual 1995). To ensure compliance, additional infrastructure could be installed. Some crossings are raised to the same level as the footpath, while others require pedestrian to change grade. In both cases, it is important to ensure that all types of pedestrians can make the crossing safely and easily. All pedestrian crossing points must be monitored to ensure that their location is appropriate for operating safely and efficiently. Designing of crossing points considers the followings. The cost and ease of maintenance, repair, reinstatement and replacement, especially in the materials used and the implications of maintenance for pedestrian and other road users. If a pedestrian crossing is not used much, a usability research has to be performed to identify problems associated with the particular mid-block crossing. Over dimension, load transport is also an issue designing pedestrian crossing points, especially on routes commonly used for this purpose. At most crossing points pedestrians need to choose gaps in the traffic stream to cross safely which distance, known as the crossing sight distance, is a critical element in ensuring safe crossing of the roads by pedestrians.

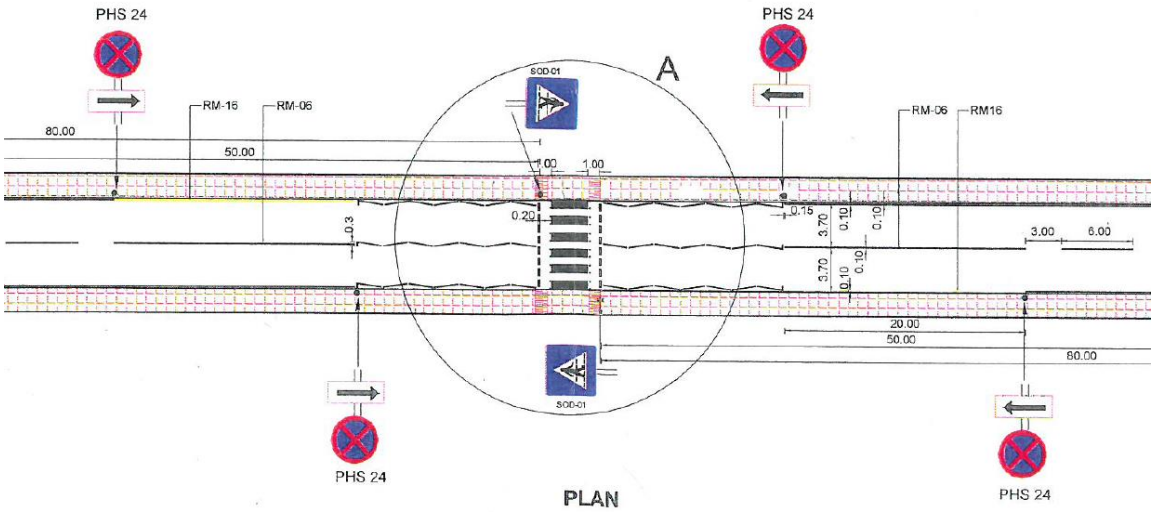


Figure 2.1: Mid-Block Crossing

Pedestrian crossing in Sri Lanka can be decided into two categories namely intersection and mid-block pedestrian crossings (Figure 2.1). Intersection pedestrian crossings are located at Junctions whereas mid-block pedestrian crossings are located in between junctions. Pedestrian are the most vulnerable road users and are at a greater risk of being injured in a traffic crash than any occupant in a vehicle. According to the police reports of the last few years pedestrian crossing accidents has increased due to the rehabilitation of roads, Conditions of vehicles, increase in the number of vehicles and road users' behaviours (Kumarge & Fernado, 2011).An extensive study is performed to understand the accidents at mid-block crossing in north-west region of Sri Lanka. In this section, a study on design consideration of crossings, selecting the appropriate facility, issues on pedestrian crossing, treatments of crossings, traffic engineering measures, influence factors in accidents and Sri Lankan road safety are detailed with supportive facts.

2.1 Design consideration of crossings

The principal objective of design of a pedestrian crossing is pedestrian safety. Other objectives are as follows.

- There should be separate direction indicators for each direction at a corner
- The kerb crossing should be in the direct line of the pedestrian through route. When this is not possible, environmental or tactile uses should guide people to the crossing point.

- Kerb should be perpendicular to the pedestrian throughout the route.
- Drivers should be able to identify pedestrians who are about to leave the kerb.
- Vehicle turning speeds should be slow. Pedestrian design should incur some techniques to force the driver to reduce the speed such as hump.

Identifying location of a pedestrian crossing is a crucial part of a designing the pedestrian network. The number of injuries is high at mid-block crossings compared to intersection (Centre for Urban Transportation Research. 2006). Selection of location is based on the number of users (traffic), visibility of the pedestrian crossing, crossing site distance, etc. A standard methodology to select the location of the mid-block is developed which consists the feedback from the users of the mid-block, consultation of police officers, traffic engineer and local bodies. The selection of the location should have minimum exposure for accidents.

$$\text{Crossing sight distance} = \frac{\text{crossing distance (m)} * 85^{\text{th}} \text{ percentile vehicle speeds (km/h)}}{\text{walking speed (m/s)} * 3.6}$$

Crossing site distance can be calculated using the above formula. Crossing sight distance should be calculated carefully to take account of conditions at the site. For example,

- The pedestrian line visibility may be obscured by permanent or temporary obstructions.
- Walking speed can vary due to pedestrian's age and physical condition, route gradients, pedestrian densities and environmental conditions.
- Some pedestrians may take additional time to start crossing, because of mobility or double checking that it is safe.
- The signed speed limit in the area should not be used as an indication of actual vehicle speeds. Actual speeds are usually faster than posted limits.
- As walking speeds can vary, the one assumed at a crossing point should generally be biased towards slower pedestrians.

If required crossing signal distances cannot be provided, they can be reduced with devices such as kerb extensions or refuges, or the traffic speed can be slowed. If neither

is possible, facilities which would encourage pedestrians to cross at that point should not be installed (Centre for Urban Transportation Research, 2006).

In addition to the sight distance, the design should include the required sign-boards which support the driver to prepare him/her to stop his/her vehicle if a pedestrian is on the mid-block crossing. Drivers should be able to see all crossing easily to adjust breaking easily. They can be aware of their speed and be aware of the potential for pedestrians to step into the roadway. Therefore, they should be able to see the crossing over at least the appropriate approach sight distance (Chu & Battes, 2001).

User preference based on the type of user must be considered during the design phase. For example, if the mid-block crossing is located near a school, required safety precaution should be implemented. Necessary treatment has to be implemented. The frequency of the usage of the crossing is high before and after the school time. Elders may take long to cross the road. If the user is an abnormally disabled person, he /she should have facilities to cross the road safely.

When designing the mid-block, it should be considered whether the area belongs to the urban or rural council. The traffic is high in urban areas. In urban areas, pedestrian desire lines for zebra crossing may be located very close to, or at, the lighting used for driveway. It is not safe, because pedestrian route may be blocked. The visibility is heavily impaired due to a parked vehicle. This scenario must be taken into account during the design of a mid-block crossing. If it is a 4-lane two way road, the visibility for the driver who drives the vehicle near the median is not in a required level. This aspect has to be considered and resolved by fixed mirrors which support the driver to see the pedestrian who is crossing the road.

Finally, fixing signal and setting the timing of the signal, greatly affects accident rates. Taking this into consideration the safety of pedestrians crossing the road will improve. When pedestrian signals are installed they have to be activated regularly. If these signals are not activated regularly, it would lead to safety issues. Safe operation of signals requires high levels of pedestrian compliances. Therefore, the signals should respond promptly to pedestrian demand. System coordination needs to be considered for efficient traffic flow. There are two ways of improving signal responsiveness of pedestrians. Such as.

- Exclude the mid-block pedestrian signals from the coordinated system and rely on the system to correct the delays.
- Consider the wider area and determine if the system reflects the road use hierarchy. Shorten the system cycle times accordingly.

2.2 Issues on pedestrian crossing

The highest numbers of pedestrian crashes occur in mid-block Pedestrian crossings. They said that pedestrian crash risk is influenced by bus stops, road width, number of traffic lanes and volume of pedestrian and vehicles (Diogenes & Lindau, 2010)

Enhancement of Pedestrian crossing by skid resistant surfacing enables drivers to stop more easily. Flashing road studs help to alert drivers the presence of the crossings. Raising crossing helps drivers to slow down their vehicles. Adding refuge help pedestrians to cross at a time. (Martin, 2006)

Fatal pedestrian crashes were more likely to occur during night time hours while non-fatal pedestrian crashes were more likely to occur during daytime hours (Tracy, 2012). According to the Sri Lankan police record, fatal pedestrian crashes occur in nights especially at mid-block crossings.

Many pedestrian believe that they have the right of way (ROW) only in marked crosswalk (Center for Urban Transportation Research, 2006).There was significantly lower potential for conflict if pedestrian crosses at an intersection instead of crossing at a mid-block location (Cui & Nambisan, 2012)

Pedestrian Countdown Signal was generally ineffective in preventing the entry violations from becoming exit violation over there. Many pedestrians felt safe enough to walk over a short crossing with no apparent vehicular traffic in sight instead of waiting for a green signal (Supernak, Verma & Supernak, 2013). Pedestrian and drivers are intended to move fast when the signal is about to change such as green to yellow. Even further, it is observable that the vehicles which are far from the signal, violate mostly and pedestrian attempt to run when the signal is about to change.

Pedestrian injury severity is an outcome in automobile crashes that occur at signalized intersections. He further concluded that vehicle type, gender, land use, some road and intersectional characteristics such as speed limit, traffic volume and the presence of

side walk, as well as visual obstruction significantly influence pedestrian injury. He further stated that female drivers and pedestrians are found to be disproportionately involved in crashes than male. Passenger cars, sport utility vehicles and pickups which are found to be associated with less severe pedestrian injuries (Obeng2013).

Comparing these results with those of previous research, some consistencies and deviations are observed. For example, the finding that more females than males are involved in these crashes is inconsistent with Obeng & Rokonuzzaman whereas the finding that road, intersection and traffic characteristics as well as land use affect these crashes is consistent with the results of Obeng & Rokonuzzaman. Additionally, the finding that passengers, cars, sport utility vehicles and vans cause less injury in these crashes is consistent with Obeng & Rokonuzzaman.

George and David's research provides a quantitative comparison between several common options for signalizing mid-block pedestrian crossing at varied geometrics. Their consistent findings indicate that two phase signal timing and the innovative high intensity significantly improves cross walk and vehicle operations over one phase timing and other signals (George & David, 2009). Jitka Rokytova and Michal sklena said that driving speed was a crucial parameter of road safety (Jitka Rokytova & Michal sklena, 2001). According to him consequences of accidents are significantly aggravated with increasing speed.

Pedestrian could survive a vehicle crash when vehicle speed is 50 km/h. If a vehicle driven at 30 km/h speed crashes with a pedestrian, pedestrian will suffer only a mild injury. (Jitka Rokytova & Michal sklena, 2001).

2.3 Treatments of crossings

During the design, treatments of crossings are selected in order to improve the safety of the pedestrians. Treatments are like dressing a crossing when additional components are implemented. Treatments for the roads in the urban areas and rural areas are different. Similarly, the treatments of main road and by roads differ based on the requirements. In this section, different types of treatment are detailed with description.

The choice of crossing facilities should always be appropriate to the prevailing environment and climate conditions. Pedestrian islands should be built as kerbed

islands and be of a different colour from the road. The chicane design is also useful as it offers space for hand rails and can hold more pedestrians on narrow roads.

Medians may be flush or raised. Raised medians are similar to pedestrian islands in many respects. Flush medians help pedestrians to cross the road in many locations. But it should ensure that kerb ramps are at suitable locations for the mobility impaired to cross roads. Raised medians should be consistent with pedestrian islands.

Kerb extensions should be designed on a case by case basis. In each case, access to the crossing point should be facilitated by kerb ramps installed partly or wholly within the kerb extensions. Extensions installed at intersection should enable large vehicles to form safely and without mounting the kerb. Kerb extensions facility has enough space for cyclists and vehicles to pass each other through the crossing.

Pedestrian platforms are raised above the level of the surrounding road. Platforms have more priority, when they are marked as a zebra crossing. Their exact design depends on the following factors.

- The number of pedestrian
- The number of vehicles
- The street width
- The street function
- Whether the crossing is controlled or uncontrolled
- Landscape/ streetscape factors
- The types of vehicles
- Vehicle speed
- The roadway surface slope and drainage

Zebra crossing should not normally be sited within 100 m of any other pedestrian crossing point on the same route, a major intersection unless located at the intersection (Martin, 2006).

Figure 2.2: A mid-block crosswalk with 70 feet right-of-way. Source: Northwest Urbanist

The pedestrian crossing visibility should not be affected by landscaping. Branches of the trees should be cut down to ensure the visibility of the midblock crossing. The above figure (Figure 2.2) depict a midblock crossing where trees are planted far from midblock crossing. The visibility is not affected by the trees. Pedestrian crossing is not blocked by grass siding. The pedestrian crossing area is neat and tidy. Loose materials is not spilled into the pedestrian route.

When designing kerb ramps, following should be considered.

- If there is a kerb ramp on one side of the roadway, there is also one on the other to prevent pedestrians being stranded on the roadway itself.
- There are no low points in the gutter where water can collect
- If installed at a pedestrian crossing point, the whole kerb ramp should be within the crossing marking

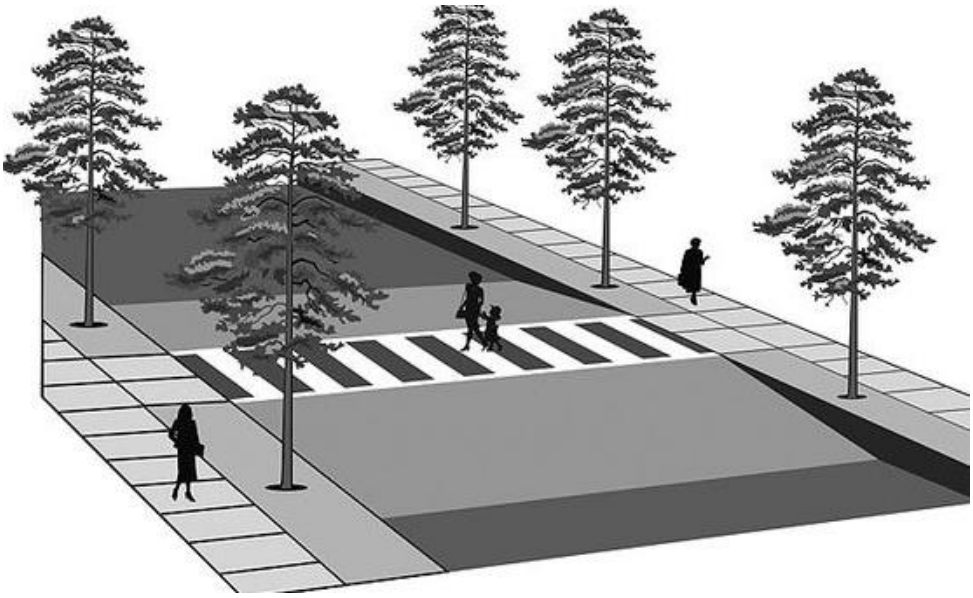


Figure 2.3: Ramp along the road side Source: Kimley-Horn and Associates, Inc

In the figure 2.3, kerb ramp is constructed along the road side. The kerb ramp described in the above figure could act as a speed breaker for vehicles. This will enhance the safety of the pedestrian. This type of crossing is much suitable for the places where traffic is high and monitoring is low such as school, town, and main road in the rural areas. Other type of kerb ramp is along the right direction of the road.

Every kerb ramp comprises the followings.

- The ramp, which is the area pedestrians cross to change their grade.
- The top landing, which is where pedestrians move between the ramp and footpath
- The approach, which is the section of footpath next to the top landing.
- The gutter, which is the drainage trough at the roadway edge.
- Flared sides, which are sloping areas next to the ramp, help to prevent pedestrians tripping on the ramp edges. Some ramps also have a bottom landing. If the kerb ramp is carefully located within the street furniture zone or at a kerb extension return kerbs can be used (Martin, 2006).

However overpasses and underpasses have some common features they are fundamentally different in their grade changes. When pedestrians cross, they should ideally stay at the same grade. If necessary, the road should be elevated or underpass. In planning for new areas where a grade separated crossing is required, it can be

achieved by terrain. If this is not possible, ramps and steps that comply with best practice are required. Both over and under passes usually are unlikely to be used where the walking distances is more than 50 percentage greater than the grade distance. Even when less than this, some pedestrians will try to take the shortest route. Therefore, fences may be appropriate. These should prevent people walking around the ends. Both over – under passes, pedestrian have to be concerned of their personnel security, particularly if they are not familiar with these.

To overcome this, the following practices should be adopted.

- Structures should be well lit, potentially on a continuous basis.
- Sky light should be provided in underpass when possible.
- Pedestrian should always be able to see their whole route without any obstructions or recesses, and from a public place some distances away.
- The route should include direction guides.
- Closed circuit television installations may be used (cctv).
- Each entry/exit should have natural surveillance from adjacent buildings.

For crossing assistance for school children, zebra crossing should be designed. It may include kerb extensions, pedestrian platforms and Pedestrian Island. In addition to the usual signal and markings, the word SCHOOL can be painted on the approach lane between the standard diamond and the crossing itself.

There are several design issues that have to be addressed for locations where pedestrians cross a railway line. The footpath across the railway lines should be at the same level as the top of the rails to avoid pedestrian tripping on the rails. The flange gap needs to consider minimizing the risk of trapping the wheels of a wheelchair. Railway crossing must be accessible for all types of pedestrian, including those using walking aids. Warning must be given to pedestrians who are entering a hazardous area. Tactile warning indicators should be provided with the nearest edge no closer than 3 m from track center line and at right angle to the pedestrian direction of travel. Exposure is minimized by ensuring that crossings are perpendicular to the railway lines (Martin, 2006).

2.4 Traffic engineering measures

Following general traffic engineering measures have to be considered.

- Central islands
- Lighting of the road: Lighting of pedestrian crossing should have a high intensity, eventually it should be painted with a color different from the color of previous and following stretches of the road.
- Physically separating the carriageway from other road surfaces (eg. Parking, stop lane)
- Installation of traffic lights: Suitable to be provided also upon demand.
- Special provision for pedestrian crossing

2.4.1 Recommended measures for 2 lane roads

Following recommended measures have to be concluded for 2 lane roads.

- Planted surfaces at pavements
- The surface is raised. (e.g. bus pulling the pavement surface through an interrupted parking lane)
- Traffic refuges at stops
- Surfaces interrupting a vehicle lane between a public transport stop and a pavement.
- Local narrowing of vehicles lanes.
- Humps (raised areas)

2.4.2 Measure for 4-lane roads

It is not recommended to install pedestrian crossing on road stretches with 2 and more lanes without a special provision which does not apply for pedestrian crossing at junctions.

2.4.3 Defining high speed

While defining the speed limit, the following aspects have to be considered.

- Traffic volume

- Demand for crossing
- Frequency of pedestrian and cyclists
- Characteristics of surrounding area (Mead, Zegeer, Bushell, 2014)

2.5 Influence factors in accidents

Raghuram and Vedagiri concluded with the following: Due to the increase in economic growth of the country, there has been rapid urbanization and increase in traffic growth in Indian cities. It has resulted in increase in urban sprawl and further resulted in increase in the use of public transportation trips that are usually connected to walk trips either origin or destination or both and sometimes at mode transfer points. A pedestrian may need to cross the road for many reasons. Due to their urgency or value of time, pedestrian follow non complaint behaviour while crossing the road. The traffic on the roads of Indian cities is highly heterogeneous in nature encompassing vehicles with wide range of static and dynamic characteristics. (Raghuram Kadali & Vedagiri, 2013). These results are consistent with Raghuram Kadali & Vedagiri. According to them, due to economic growth, there are more than ten different types of vehicles present in the traffic on major roads of Indian cities. All these different types of vehicles move on the same road space occupying any position on the road depending on availability of free space at a given instant of time without complying to any lane discipline. This heterogeneity in traffic and jaywalking behaviour of pedestrian leads to severe conflicts with motorized vehicles and result in a decline of pedestrian safety (Raghuram Kadali &Vedagiri, 2013).

Jiang bi Hu and Yang Yang explained that, highway traffic safety is a dynamic system that is affected by the combined actions of road users, vehicles, roads conditions, environmental conditions, vehicle speed, driver workload and driver behavioural characteristics (Jiang-bi Hu & Yang Yang, 2009). This result is consistent with Hu, Jiang bi Hu & Yang Yang's research.

Sudipta and Richard discussed about accidents in Bangladesh. According to them due to the fault in designing of crossing, majority of crashes between pedestrians and motor vehicles occur. To address this it is important to develop pragmatic pedestrian safety action plans. A pedestrian safety action plan has to comprise a comprehensive set of

programs and activities that improve pedestrian safety through the use of street redesign and engineering counter measures, as well as other safety related treatments and programs that involve the whole community (Sarkar, Tay & Hunt,2011).

Porter, Irani and Mondor concluded that growing vehicle technology such as warning signals, backup sensors and navigation systems helps immense to assist drivers to prevent from accidents. They found that major cause of accidents are due to divide attention between driving and a secondary task such as talking on a cell phone (Porter, Irani & Mondor, 2008)

New portable Global Positioning System (GPS) based road safety devices are being designed to warn drivers about impending traffic situations such as pedestrian crosswalk, dangerous intersections, and photo-enforced intersections as well as whether they are exceeding the speed limit. Distraction and driver inattention are known to be major causes of traffic crashes (Porter, Irani & Mondor, 2008). It is consistent with the result of Michalle and Pourang. They further concluded that relative to younger drivers, older drivers are either to a greater extent or make modification to their driving behaviour to accomplish the primary driving task as well as secondary task, for decreasing speed.

Somasundaraswaran and Shafip discussed the following: Increasing road accidents in Sri Lanka is due to the increasing number of vehicles. They also discussed, accidents by fresh drivers are higher than that of experienced drivers due to insufficient skill and lack of experience. Further they said that reckless attitude of city drivers in pedestrian crossing cause many accidents. The most vulnerable at the crossings are school children, the old people and the infirm. According to them, money earning attitude and madness of the drivers are main courses for these pathetic conditions. They said following recommendations have to be adapted to this problem. Proper training arrangements should strictly implement for road users. During an accident scenario, bystanders have taken the law into their hands to deal with motorists irrespective of who is at fault. As in Sri Lanka, traffic rules and regulations are very loose or/and badly practiced. Many bad drivers could easily get away from any madness in their driving. These types of drivers have to be sent to re-training school for a certain mandatory period and only at the end of successful completion of the course, his/her

driving license will be returned. This practise is similar to that in Germany (Somasundaraswaran & Shafip, 2004).

2.5.1 Unsignalized pedestrian crossing

Huang, Zegeer and Nassi discussed about innovative treatments at un-signalized pedestrian crossing locations. They discussed following: Crossing streets at uncontrolled locations can pose a serious risk to pedestrians. Based on average daily traffic, pedestrian volumes, and other warrants local agencies may or may not paint crosswalk at uncontrolled locations. Even at a crosswalk that has been painted across the roadway the driver may not notice the crosswalk marking due to the high vehicle volume and speed, the street width may not be enough. Due to the limited visibility for motorist at night, crosswalk and pedestrians can be extremely difficult for motorists to see in time to stop. According to them, following measures has been adopted by some countries to resolve this problem. To make crosswalk more visible, some local agencies use high visibility crosswalk. Many different types of signs and crosswalk marking have been used by countries at uncontrolled crossing locations. Variations of crosswalk marking include parallel lines, ladder, continental style, zebra, and crosswalks painted completely in white. Zebra crossing consist of high visibility crosswalk markings on the roadway which helps to alert motorists. Some developed countries have pedestrian crossovers at mid-block crossing. These consist of internally illuminated overhead signs (with an 'X' symbol) and beacons that flash when activated by a push button. On multi-lane roads, advance stop lines can be used to encourage motorists to stop farther back from a crosswalk. When motorists stop too close to a crosswalk, their vehicles block the view of pedestrians to drivers in adjacent lanes, and a multiple threat pedestrian crash could result. When motorists stop farther back, sight distances improve between pedestrians and drivers in adjacent lanes, allowing them a better opportunity to avoid a crash. Advance pavement marking are used at some multi-lane zebra crossing in foreign countries. Motorists' night time visibility of pedestrian can be enhanced by crosswalk lighting and flashing lamps such as using sodium lamps, resulted in a significant decrease in night time pedestrian accidents. In some countries, due to combined illumination and signal system at nights pedestrian accidents considerably decrease. Flashing crosswalks can help to alert motorists to

pedestrians in a crosswalk, especially at night. These consist of lights embedded in the roadway on both sides of the crosswalk (Huang, Zegeer and Nassi, 1996).

Sylvain and Eleonora concluded that pedestrians are mainly exposed to the risk of road accident when crossing a road in urban areas. According to them, the following circumstances in traffic light system a pedestrian can be hit by a moving vehicle. Traffic controlled junctions or mid-blocked locations, at junctions with traffic lights, two phase for pedestrian crossing can be considered: one when the lights are green for pedestrians (ie they are red for vehicles, with the possible exception of turning movements) and one when the lights are red for pedestrians (ie they are green for vehicles). When the lights are green for pedestrians, a pedestrians may be exposed to two types of risk: one resulting from the flow of turning vehicles (from or into adjacent roads), and another one resulting from vehicles not complying with the red light. When the lights are red for pedestrians, pedestrian is exposed if he chooses to disregard them and attempts to cross the road (Lassarre, Papadimitriou, Yannis&Golias, John. 2007).

2.6 Sri Lankan road safety

National Road safety conference was held in Colombo on 11th May 2011. Several road safety aspects were discussed. Summary of the discussion is detailed below.

2.6.1 Increase of traffic

Traffic has been increased due to the following reasons.

- Rapid increase of operational vehicle.
- Heavy traffic volume
- Shifting from public transport to private vehicles due to various reasons including poor condition of public transportation and greater flexibility

2.6.2 Deficient system and regulations

Deficient system and regulations are found in following systems.

- Deficiencies in the enforcement mechanism in relation to detecting, prosecuting and punishing offenders.

- Short coming in issuing licenses including examining suitability of applicants when issuing and renewing licenses as well as adding de-merit points to the licenses of offending drives.
- Delay in prosecuting traffic cases in the courts

2.6.3 Unfavourable Road conditions

Unfavourable road conditions are caused due to following reasons.

- Poorly designed roads- lack of pedestrian foot walks, wide shoulder, adequate lighting, and lack of crossing, road marking and traffic signals.
- Frequent damages done to the roads due to laying underground electricity cables, telephone cables and water pipes.

Erosion of the roads due to rain water flow created by inadequate drainage system.

2.6.4 Errant Driving

Errant driving is found due to following reasons.

- Indiscipline driving including speeding, overtaking at inappropriate places, turning without signals and driving which account for more than half the accidents.
- Inexperienced driver
- Driver fatigue where long of hours of driving and lack of rest contributes to accidents.

2.6.5 Errant pedestrian

Errant pedestrians are found due to following reasons.

- Carelessness of pedestrians
- Negligence of road rules

2.6.6 Mechanical defects of vehicles

Mechanical defects are found in following ways.

- Using vehicles which have to be condemned cause accidents in Sri Lanka.

- Running vehicles have mechanical defects like ineffective brakes, no head light, front lights and signals (Ministry of Transport, 2011)

3 METHODOLOGY

3.1 Sampling: Selection of region for research

Research area- interested region for research is selected in the busiest road network of north-west region of Sri Lanka. Since Colombo, capital of Sri Lanka is in the western part of Sri Lanka, all the other part of Sri Lanka is connected to western province in the road network. Road network in the north-west region is the longest in Sri Lanka. It is selected as the research area, which is 400 km length road which consists of A-003, A-020, A-012 and A-009 Roads as follow:

- A-003 From Colombo to Puttalam- 138 km
- A-012 From Puttalam to Anuradhapura- 68 km
- A-020 From Anuradhapura to Rambewa- 20 km
- A-009 From Rambewa to Jaffna- 174 km

As the sampling region, the above mentioned area is selected and the selected road network is further divided into four sub regions as listed above. In this region, 392 mid-block pedestrian crossings are selected for study regarding accidents. Data is collected at the mid-block pedestrian crossing based on the observation and throughout interviews.

Figure 3.1: Research Area in Sri Lanka

3.2 Sources and Data Collection

In this research, primary source of data are obtained via observation sheet and interview questionnaire. As mentioned earlier, interviews were conducted for drivers and pedestrians. In addition to this data, accident data from police is collected which contains data from year 2010 to year 2013. The data from police records is further processed by selecting accidents which happened on pedestrian crossings.

3.2.1 Data Observation

Three hundred and ninety two mid-block pedestrian crossings are identified along 400 km of roads in concern. Four days and four nights were spent on observation of mid-block crossing. Each day and night 100 km road was observed. A point nearer to the pedestrian crossing (about 100 meters) is selected to perform the observation. The following aspects were carefully observed and remarked.

- Chainage – chainage is the identity of the mid-block pedestrian crossing. In this observation, the location of the crossing is marked. For example, using the kilometre post, the distance in the road (kilometre) is marked. A vehicle is hired and its meter reading is used for this purpose. This observation is matched with road development authority's kilometre post.
- Lighting – The observation is made to check whether the mid-block pedestrian crossing is facilitated with proper lightning facility or not, (constructed by electricity board).
- Stud – Observation is to prove that stud (cat eyes) is fixed on the mid-block.
- Marking visibility – In this category, clarity of marking of the mid-block pedestrian crossing is observed.
- Location type - In this observation, the type of elevation such as sag, crest and super elevation is marked.

- Sign board – mid-block pedestrian should be facilitated with appropriate signboard. Our observation is confirmed, that pedestrian crossing signboard and warning signboard are installed on a given mid-block crossing.

- Any other Obstruction - Using the hired vehicle, all type of obstruction was observed. (When the vehicle is in front of the mid-block, away from 100 meter). Obstructions such are trees, advertisement board, etc.

- Handicap – The mid-block pedestrian crossing should have facilities for people with various disabilities. This observation indicates whether the mid-block pedestrian crossing is disabled friendly or not.

In addition to the observation of identified mid-block (site visits), behaviour of the pedestrian and behaviour of drivers are observed by addressing the following questions: .The following questions was answered to address the drivers' behaviour at mid-block pedestrian crossing.

1. Does the driver slow down the vehicle at crossing?
2. Does the driver indicate the signals properly?
3. Does the driver threaten the pedestrian?
4. Does the driver drives at annotated speed?

3.2.2 Data from interview

Interview were conducted for drivers and pedestrians. In this research, hundred drivers and hundred pedestrian were randomly selected throughout the study area. Two days and night were used for this purpose. Random sampling technique is used to select location. First hundred pedestrian and drivers are selected as sample (sample population). 10 locations were randomly selected to conduct interview (in A003 - 0+100, 2+500, 7+200, 16+800 and 42+400, in A002 -1+300 and 44+200 and in A-09 - 144+100, 221+000 and 294+200). Sample (population) merely covered all types of people, such as students, male, female, handicapped people, elderly people and working people. Two questionnaires were prepared to capture the factors which affect the mid-block accident rate including visibility of the road marking, attitude of drivers and safety precautions.

Following features are included in the questionnaire which was prepared to interview selected pedestrians in order to analysis, safety cautiousness and the behaviour of drivers and pedestrians. (Questionnaire attached – Annex I).

1) Age
2) Sex
3) Location
4) Educational qualification
5) Is he/she a differently impaired person
6) Whether mid-block pedestrian crossing is located at the appropriate location or not based on pedestrian's perspective.
7) Perception of drivers' behavior at pedestrian crossing
8) Visibility of pedestrian crossing includes marks and illumination at nights.

Following features are included in the questionnaire which is prepared to interview selected drivers. (Questionnaire attached – Annex II)

1) Age
2) Sex
3) Location of the mid-block crossing based on drivers' perspective.
4) Driving experience
5) Visibility of pedestrian crossing such as effects of landscaping, lightning, illumination, improper marking, stud visibility and night vision.
6) Dim and Head light effect which affect the visibility of pedestrians who is crossing or intended to cross the road at pedestrian crossing.

This was a challenging task because many drivers didn't support when interviewing them. They were in a rush to finish the interview. Observation and interviewing was done separately but from the same point which is used to observe the pedestrian crossing. Pedestrians were requested to fill the questionnaire. Similarly, drivers were requested to stop and fill the questionnaire. 100 questionnaires were filled by pedestrians and another 100 by drivers. Obtaining data from pedestrians was not challenging compared to interviewing drivers.

3.3 Data Analysis Techniques

In this study, Excel is used to record information and to analysis the information. Information captured by observation, interview (through questionnaire) and the police records is on paper. The information is entered in excel sheets for further analysis. Excel graph are used to visualise the data based on given condition such as accident happened at every hour interval, seasonal impact on accidents, etc. Statistical analysis is also used to summarise the data. Additionally, photography is used to analyse the visual impact of mid-block pedestrian crossing.

3.4 Limitation of methodology and ethical consideration

Due to time limitation, site visits, observation and interview was performed in the selected region (north-west of Sri Lanka). The selected region's landscape is almost flat but in hilly areas the landscape significantly differs from selected region. This impact of landscape is not fully captured including the impact of physical features of the earth. Some pedestrians and many drivers didn't provide information. Some drivers didn't stop their vehicles. The information from questionnaire may contain false information which can't be verified.

4 RESULT AND DISCUSSION

4.1 Accidents in Sri Lanka

The Following table 1 describe the Total accidents, Pedestrian crossing accidents and mid-block pedestrian crossing accidents from 2010 to 2013 based on Police record. Total accidents refer to the total number of accidents that happened in Sri Lanka. This is an all island figure for accident of all types including fatal accidents, vehicles accidents, non-fatal accidents, etc. In the form (Appendix IV) for accident, section "A25" is allocated to indicate any involvement of pedestrian. In 2010, there are 7866 accidents which involve pedestrians (20.89 %). These accidents include accidents on pedestrian crossing, accidents of pedestrian crossing within 50 meters and others (pedestrian involved). Type one is to indicate on pedestrian crossing accidents. In 2010, 1407 accidents on pedestrian crossings. Mid-block pedestrian crossing accidents are identified when section "A25" indicates type one and type of location (Section A24) is stretch of road, no junction within 10 meters. According to police records of accidents (table 4.1 Summary of Accidents in Sri Lanka), mid-block pedestrian crossing accidents are more than 75% of pedestrian crossing accidents during the period from 2010 to 2013.

Table 4.1 : Summary of Accidents in Sri Lanka

Year	**2010**	**2011**	**2012**	**2013**
Total Accidents (a)	37654	40263	42146	37881
Pedestrian accidents (b)	7866	7110	7390	7013
% (b/a)	20.89%	17.65%	17.53%	18.51%
Pedestrian Crossing Accidents (c)	1407	1081	1319	1274
% (c/b)	17.89%	15.20%	17.85%	18.17%
Mid-block pedestrian crossing accidents (d)	1152	860	1071	982
% (d/c)	81.88%	79.56%	81.20%	77.08%

4.2 Observed data

The following table 4.2 illustrate my observations on night time.

Table 4.2 : Site visit Observed Data

Factor	Non-existent at A03 (%)	Non-existent at A12 (%)	Non-existent at A9 (%)	Non-existent at A20 (%)	Average (%)
Lighting facility at pedestrian crossing	70	82	90	86	82
Visibility of stud	60	61	80	63	66
Visibility of pedestrian crossing	30	41	60	45	44
Visibility of Sign board	8	10	10	12	10
Obstruction (tree, buildings and advertisement boards)	10	2	3	5	5
Disable friendly facilities at mid-block crossing	100	100	100	100	100

According to the table 4.2, 82% mid-block pedestrian crossings have improper or no lighting at night time. Sri Lanka is one of the developing countries and as a result there are many geographical areas where electricity is not distributed yet. Nearly 70% the road section under concern is in village areas. In some village areas electricity has not yet been provided. Therefore in these places lighting facilities are not found due to improper coordination between Road Development Authority and Ceylon Electricity Board. Improper lighting system is found in some places. By installing solar panels in un-electrified villages this problem has been solved to a considerable level.

Figure 4.1: When vehicle approaching at that pedestrian crossing (A03 Road)

From the observations it was revealed that 66% mid-block pedestrian crossings have improper or unavailability of stud (see figure 4.1). This is due to unclear stud illumination during nights. There are number of stud suppliers. As a result price and quality of studs differ. Damaged studs have not been replaced by the appropriate authority. Thus, at night high illumination stud has to be selected. Further, damaged studs should be replaced. According to RDA design specification, studs (cat eyes) must be installed on "A" class road.

In 44% of mid-block pedestrian crossings visibility is found to be improper. Marking of pedestrian crossing wear off to vehicles tyres. Unfortunately, these markings are not remarked by relevant authority on time. In addition, in some places pedestrian markings are marked by proper material, which further expedite the wear off process. At night, visibility of white road marking is clear than that of yellow colour markings. As the pedestrian crossings are yellow, their visibility is poor at night (Figure 4.2).

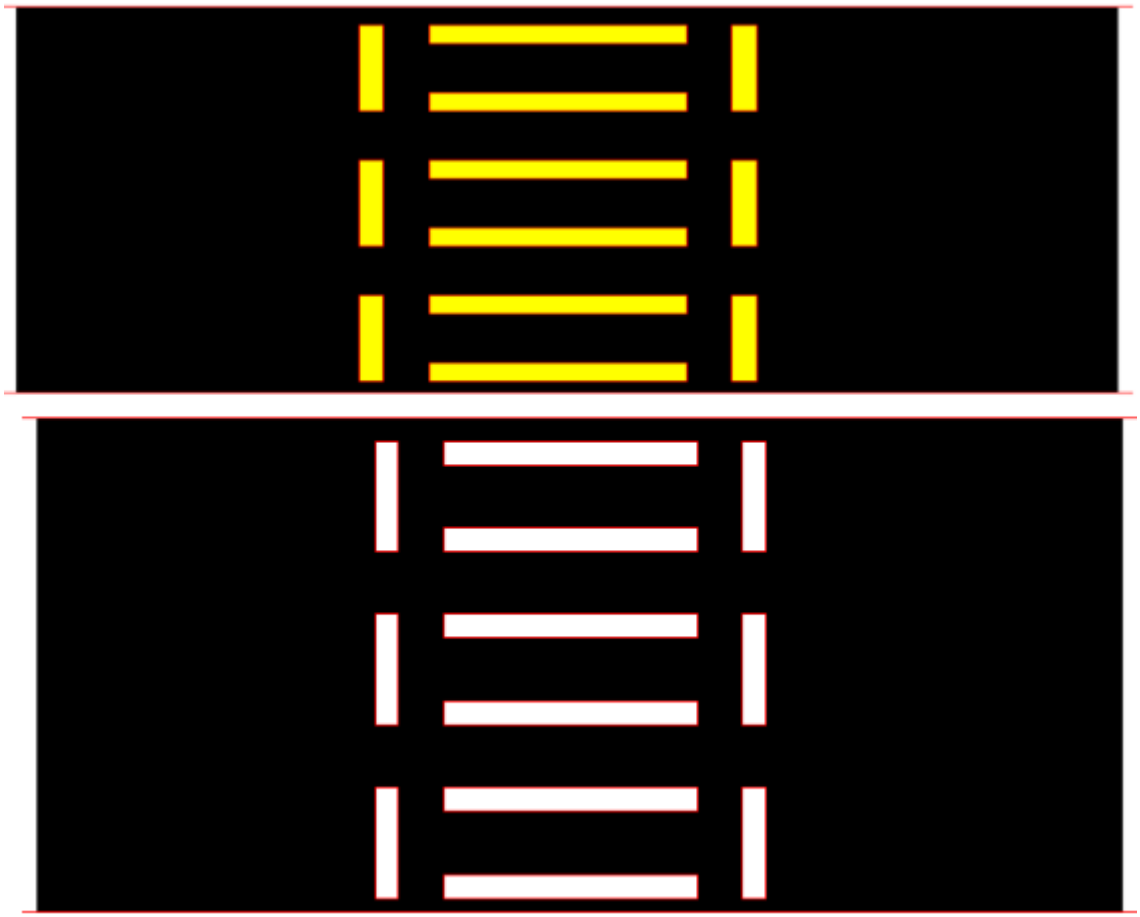


Figure 4.2: Yellow colour, White colour pedestrian crossing

Visibility of sign board and obstruction are improper in 10% and 5% of mid-block pedestrian crossing. In some places proper materials are not used for sign board. For example, low illumination paints are used for sign boards. In some places sign boards are not in the proper location. For example, in some places pedestrian crossing sign boards are not located at a standard distance. Obstruction of sign board is due to trees, utility services, advertisement board etc.

Figure 4.3: Obstruction of signboard by electric post and tree (A3 Road)

All the mid-block pedestrian crossings are improper or unavailable for differently impaired persons (Figure 4.3). Even though, in some places mid-block pedestrian crossings are constructed for differently abled people, they are improper due to water stagnation, obstruction by signboard and trees, vehicle parking, no connectivity, etc.

4.3 Interviewed data with pedestrians

Hundred pedestrians were interviewed. They are classified in the following table (table 4.3). In the people interviewed column, each factor (age, sex and educational qualification) is sub divided and sub totals have been calculated. For example, total number of elders is 30 and total number of males interviewed is 50. 18 pedestrians out of thirty agreed that they follow pedestrian rules which are 60% among the elderly pedestrians. This is captured in the last column.

Table 4.3 : Interviewed Data from Pedestrians

Factors	people interviewed		Number of people obeyed pedestrian crossing rules	
	In numbers	In Percentage	In numbers	In Percentage
1) Age				
a) Elders (above 65)	30	30%	18	60%
b) Middle (between 30-65)	40	40%	26	65%
c) Young (below 30)	30	30%	15	50%
2) Sex				
a) Male	50	50%	22	44%
b) Female	50	50%	37	74%
3) Educational Qualification				
a) Primary	35	35%	16	46 %
b) Secondary	45	45%	29	55%
c) Tertiary	20	20%	14	70%

According to the table 4.3, 40% interviewed people are of middle age group, 30% are elders and remaining are of the younger age group. Among this, middle age group people cross the road in the correct manner than that of other groups which is 65% of middle age people. Young age group people cross wrongly than that of other groups which is 50% of young age people. Entertainment media such as music and FM channels become indispensable need for young people while driving. They walk on the road while using these equipment. Thus their concentration is not fully focused on the road. Therefore half of the young people cross wrongly.

Equal amount of male and female were interviewed, among them female cross correctly than the male which is 75%. Tertiary educated people cross correctly than that of other groups, which is 70%, when education level increases, the amount of correctly crossed people increase. Thus, there is positive correlation between education level and correct crossing.

The following table (table 4.4) represent the pedestrians' opinion about the features of mid-block pedestrian crossing. Location of the mid-block crossing is based on the distance between two pedestrian crossing and the requirements upon traffic of the given road. Landscaping is the primary factor which affects the visibility of a pedestrian crossing. Driver's behaviour is assessed based on rules followed by drivers.

Table 4.4: Pedestrians opinion about the features of midblock crossing

Features	Number of people not agreed with given feature (in percentage)
Mid-block pedestrian crossing location correct	10%
Visibility of pedestrian crossing is good	30%
Driver behaviour is acceptable	58%

Visibility of pedestrian crossing is not clear for 30% of the interviewed people. They said visibility is affected by wear off marking, low elimination of stud and unclear road signs. 58% of pedestrian are not satisfied about the driver behaviour. There are many reasons for not accepting driver's behaviour includes threatening pedestrians whilst driving, not stopping the vehicle, raising the engines of vehicles, applying horns unnecessarily and stopping vehicles on the pedestrian crossing.

4.4 Observed data for pedestrians

In this section, the data from observation is summarised and analysed. This observation is performed separately from a point closer to the mid-block pedestrian crossing. The result slightly differs from the result obtained from interview. For example, 45% of the pedestrian behaviour is not acceptable, based on observation (Table 4.5). During interview (table 4.3), 41% agreed that they don't follow pedestrian rules.

Table 4.5 : Observation Data for Pedestrian

Factor	Total (in Percentage)(not obey)
Pedestrian behavior	45%
Driver behavior	50%
Mid-block pedestrian crossing location correct	10%
Speed limit	70% over speed

Both observed and interviewed data table 4.5, 10% mid-block pedestrian crossings are in improper location. During road construction, proper consultation is not normally done with local authorities regarding the location of pedestrian crossing. 70% drives fast which is annotated as over speed (visually judged). 50% pedestrian said that driver's behaviour is not satisfactory for them. They said that they were affected by following ways,

1. Drivers did not slow on pedestrian crossing
2. Drivers apply horn and do not allow the pedestrian to cross
3. When pedestrian are crossing on left side drivers tend go through the right side.
4. Drivers intend to threaten pedestrians.

4.5 Interviewed data for drivers

Following table 4.6 illustrates category of data and the detail of the drivers who obey the driving rules at mid-block pedestrian crossing. According to the data, 65% of the drivers have 5-10 years of experience, 20% have less than 5 years of experience and 30% have more than 10 years.

Table 4.6 : Category of Driver

category	Drivers Interviewed		Drivers obey rules	
	In Number	In Percentage	In Number	In Percentage
Driving experience				
1) Less than 5 years	5	5%	1	20%
2) 5-10 years	65	65%	49	70%
3) More than 10 years	30	30%	27	90%

There is a tendency that the experienced driver obeys the driving rules. Drivers who have more than 10 years of experience obey mid-block crossings properly than those of other groups. This is due to their age and experience. Drivers, who have less than 5 years of experience, cross the mid-block improperly than that of other group from the observation of the researcher. Drivers in this category are the younger aged group. It was found that young drivers use mobile phone or drive talking with the person seated next while driving. This causes distraction on the road while driving.

70% drivers are male and the rest are females. Female drivers obey road signs correctly than males which is 70%. The 30% percentage of the interviewed drivers has more than 10 years of experience. Among them 90% cross correctly. There is direct correlation between driving experience and driving behaviour. When driving experience increases percentage of proper drivers increase.

Table 4.7: External factors affect driving

Factor	Affected on safe driving (in Percentage)
Dim and Head light effect of opposite vehicle	55%
Improper marking and Stud visibility	40%

55% of the drivers said, head and dim light were improper. Head and dim light problem is categorised into following three manners:

Category 1: If vehicles on both directions use dim light

28% of drivers agreed that they feel difficult to see the pedestrian when the vehicle from opposite direction also travels with dim light. When two vehicles come in opposite direction with dim lights there is a blind area in between them. Therefore street light should be provided to overcome this problem. Figure 4.4 depicts the blind area when two vehicles are travelling in opposite directions. When the distance between the vehicles is between 100 – 150 meters, the pedestrian is at a high risk of meeting with an accident.

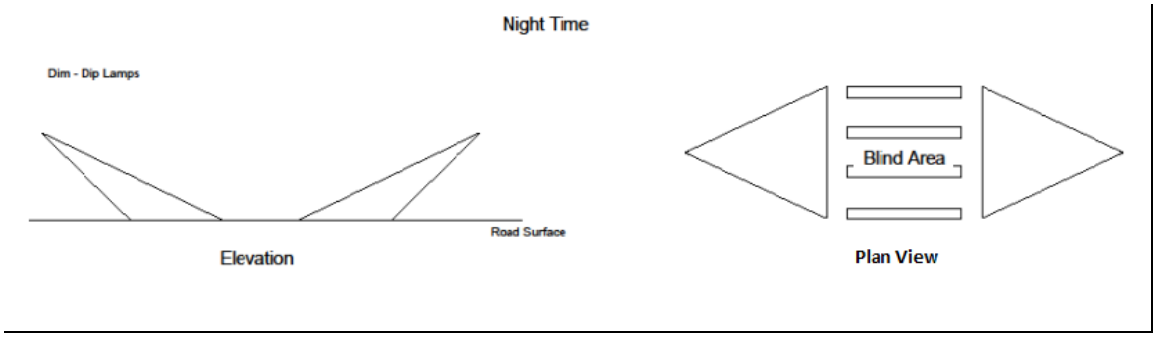


Figure 4.4: Vehicles on both directions using dim light

Category 2: If both opposite vehicles use head light

Seventeen (17%) percent of the drivers agree that they have difficulties to see the pedestrian in the blind area. When two vehicles come in opposite direction with head lights there is a blind area in between them as showed in figure 4.5. If street light is provided there will be no problem with this blind area.

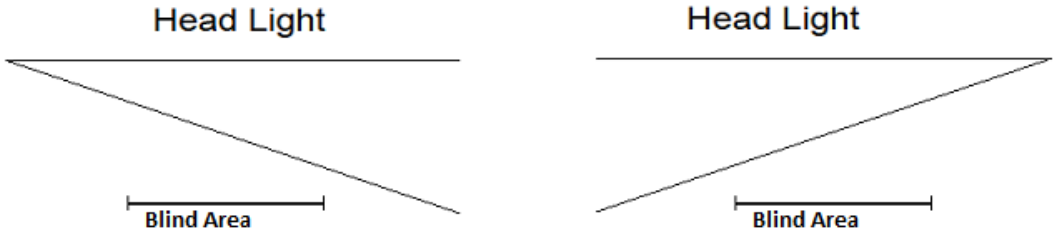


Figure 4.5: Both opposite vehicles using head light

Category 3: One vehicle using head light and other vehicle using dim light

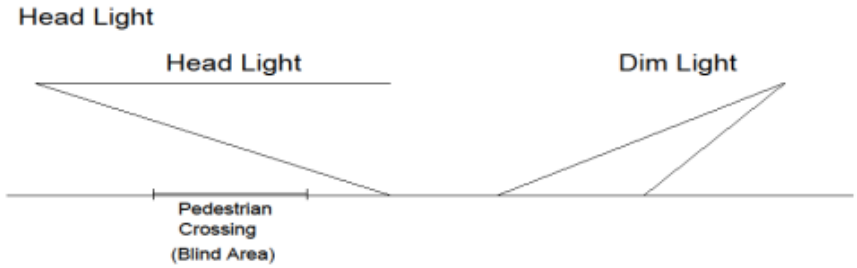


Figure 4.6: One vehicle on the opposite using head light whilst the other in the other direction is on dim light

When two vehicles come in opposite directions with head and dim lights there is blind area in between them. 10% of the drivers are affected when approaching pedestrian crossings in this type of blind area. If street light is provided there will be no problem by this blind area. Above figure 4.6 noticeably shows the blind area. In figure 4.7, the pedestrian crossing in the blind area is not visible.

Figure 4.7: Head and Dim light effect (A9 – 210 km)

Seventy (70%) observed drivers drove at a higher speed whilst others drove at a normal speed at pedestrian crossings. This may be due to the good condition of roads, vehicles and lack of law enforcement as well as inconsiderate attitude.

Forty (40%) of the drivers said, the improper stud and road marking affect their driving through pedestrian crossing. This may be due to poorly illuminated studs and wear off

of pedestrian crossings. They also said white colour marking on roads is clearer than that of yellow colour markings. (See Figure 4.8)

Figure 4.8: White colour marking is clear than the yellow colour road marking (Night Vision)

5 CONCLUSION

Mid-block pedestrian crossing accidents in Sri Lanka is a serious issue since it causes 3 percentage of the total accidents. When compared to pedestrian accidents it covers 15 percentage. The increase in the vehicle imported doesn't have strong evident for the rate of mid-block pedestrian crossing accidents. Mid-block pedestrian crossing accident rate is significantly affected by visibility of the mid-block crossing, drivers' behaviour, pedestrian behaviour, location, accessibility and landscaping of the mid-block pedestrian crossing.

Visibility of the mid- block pedestrian crossing is not in an acceptable standard in the nights. As more than 75% roads have improper lighting system, Proper lighting system must be installed with the cooperation of proper authorities. In villages where electricity is not available, solar system can be introduced. Pedestrian crossing markings should be laid by suitable material and colour. Head and dim light that affects vehicles also contributes to pedestrian crossing accidents. In effect the visibility of the mid-block crossing, illumination of stud is a problem for both pedestrian and drivers. Therefore high quality studs should be used. Further broken studs should be replaced. At the moment solar studs are available in the market. . Solar studs can be used.

Driver's behaviour is vulnerable for pedestrians in Sri Lanka. Many drivers do not have the mentality that pedestrians are also primary users of the road network. Their driving attitude is not acceptable on several situations. In general, they prefer speed driving to safe driving. They don't have the concern about non recoverable losses. At the same time, pedestrian are also not concerned about their safety. Road safety education should be implemented from childhood as in developed countries. Further awareness programmes regarding pedestrian crossing accidents should be carried out by proper authorities all over the island. Proper monitoring and evaluation mechanisms should be implemented to monitor pedestrian and driver behaviour. People who do not abide to the pedestrian crossing rules must be punished.

Pedestrian crossing should be made in proper locations after discussions with the local authority. Most locations are inappropriate and inaccessible to the people. 100% mid-block pedestrian crossings are not suitable for the handicapped. According to the UN report the number of handicapped people in Sri Lanka is increasing due to war and

accidents (UN report, 2015). Therefore when designing and constructing pedestrian crossings handicapped people should be taken into consideration. In many locations, landscaping has not been properly constructed. Improving the landscaping will reduce the mid-block pedestrian crossing accidents.

References

1. Chu.X, &Baltes.M. (2001). Pedestrian Mid- block Crossing Difficulty. National Centre for Transit Research. University of Florida.
2. Central Bank. (2013).*Sri Lanka Socio-Economic Data*. Rajagiriya, Sri Lanka: Central Bank of Sri Lanka.
3. Centre for Urban Transportation Research. 2006. *Pedestrian Safety at Midblock Locations:* Florida Department of Transportation.
4. Cui, Z., &Nambisan, S. (2012). Methodology for evaluating the safety of Mid-block Pedestrian Crossing. *Transportation Research Record*. 03-4422, 75-83.
5. Diogenes, M., &Lindau, L.A. (2010). Evaluation of Pedestrian safety at mid-block crossing. *Journal of the transportation research Board*. 2193, 37-43.
6. George.,&David.A.(2009). Pedestrian crossing at mid-block location: A Fuzzy logic solution for Existing signal operations. *Prepared for the 88th Annual meeting of the Transportation Research Board.*Washington,DC
7. Huang, Herman.,Zegear, Charles ., &Nassi, Richard. (1996). Innovative Treatments at Unsignalized Pedestrian crossing locations.
8. JitkaRokytovaand., & Michal. (2001). Analysis of Road accidents on Pedestrian Crossing caused by speeding. *15th ICTCT workshop* .Transport Research centre, Czech Republic.
9. Jiang- bi Hu ., & Yang, Yang. (2009). Safety of driving behavior on low volume Roads in China. *Case study of Qinghai- Tibet Highway.*
10. Kusano, K.D., & Gabler, H.C. Characterization of opposite direction road departure crashes in the United States. *Journal of the Transportation Research Board* . 2377, 14-20.
11. Kumarge, A.S.,& Fernando,N.B.S.(2011). A study of pedestrian safety in Sri Lanka (master thesis).
12. Kumarage.A.,Abeygoonawardena.C.R.,&Wijesundera.R. (2013). *Identifying causal factors of traffic accidents in Sri Lanka (M.Phil thesis)*.Moratuwa. Sri Lanka: University of Moratuwa.
13. Kortum, E.,Leka, S., & Cox, T. (2010). Psychosocial risks and work related stress in developing countries: Health impact, Priorities, Barriers and Solutions. *International journal for occupational medicine and environmental health*. 23(3), 225-238.

14. Lassarre, S., Papadimitriou, E., Yannis, G., &Golias, J. (2007). Measuring accident risk exposure for pedestrians in different micro-environments. ELSEVIER. 39(2007), 1226-1238.
15. Martin, A. (2006). *Factors influencing Pedestrian Safety*. London Road Safety Unit: Transport for London.
16. Ministry of transport. 2011. *Road safety in Sri Lanka*: National council for road safety.
17. Mead.J.,Zegeer.C.,&Bushell.M.(2014). *Evaluation of Pedestrian Related Roadway Measures*.University of Moratuwa.
18. Northwest Urbanist, *Redesigning 15th Avenue NE,* photograph, viewed March 2017,https://thenorthwesturbanist.com/2014/03/29/redesigning-15th-avenue-ne/
19. Obeng, K., &Rokonuzzaman, M.D. (2013). Pedestrian Injury Severity in Automobile Crashes. *Open journal of safety science and Technology*. 3, 9-17.
20. Orange County Transportation Authority. *Bus Stop Safety and Design Guidelines.* Kimley-Horn and Associates, Inc., July 2004, viewed March 2017, http://www.ite.org/css/online/DWUT09.html
21. Porter,M., Irani, P ., &Mondor, T. (2008). Effect of Auditory Road Safety Alerts on Brake Response Times of Younger and Older Male Drivers. *Transportation Research Record.* 2069, 41-47.
22. RaghuramKadali, B., &Vedagiri, P. (2013). Modelling pedestrian road crossing behavior under mixed traffic condition. *European Transport*. 55, 1-17.
23. Supernak, J.,Verma, V., &Supernak, I.(2013) . Pedestrian Countdown Signals: What Impact on safe crossing?. Open journal of civil Engineering. 3, 39-45.
24. Sudipta Sarkar, Richard Tay.,& John Douglas Hunt. (2011). Logistic Regression Model of Risk of fatality in vehicle pedestrian crashes on National Highway in Bangladesh. Transportation Research Record. *Journal of the Transportation Research Record* .2264, 128-137.
25. Somasundaraswaran, A.K., Shafip, S.A., Sundarakumar, T., &Firanz, Z.A.A. (2004) . Post-accident questionnaire to identify the remedial measures in Srilanka. *Proceedings of the Third Academic Sessions*. Galle. Sri Lanka: University of Ruhuna.

26. Tracy, E. (2012). *Effects of Pedestrian Perceptions of Safety (Bachelor Thesis)*, San Diego. America: University of California.

Appendix I – Questionnaire for Pedestrians

Questionnaire Survey for Pedestrian

1	Pedestrian Crosssing				obey		not obey
2	Age limit						
	Below 30		30- 65		Above 65		
3	Education level			Primary			
				Secondary			
				Tertiary			
4	Sex	Male		Female			
5	Road	A3	A20	A12	A9		
6	Location _						
7	Pedestrian Crossing Marking						
			Good Codition				
			Prober location				
			Improber location				
	Any others _____						
8	Stud		Good				
			Not clear				
	Any others _____						
9	Lighting			Effect			
				Not Effect			
	Any others _____						
10	Pedestrian Crossing			Visible			
				Not visible			
	Any others _____						
11	Time		Day				
			Night				
12	Driver behaviour			obey			
				Not obey			
	Any others _____						
13	Any others Comments _____						

Appendix II – Questionnaire for Drivers

Questionnaire Survey for Driver

1 Driver ☐ obey ☐ not obey obey

2 Age limit

Below 30 ☐ 30- 60 ☐ Above 60 ☐

3 Education level ☐ Primary

☐ Secondary

☐ Tertiary

4 Sex Male ☐ Female ☐

5 Road A3 ☐ A20 ☐ A12 ☐ A9 ☐

6 Location _

7 Pedestrian Crossing Marking

☐ Good Codition

☐ Prober location

☐ Improber location

Any others _____

8 Stud ☐ Good

☐ Not clear

Any others _____

9 Front Vehicle light ☐ Effect to drive

☐ Not Effect to drive

Any others _____

10 Pedestrian Crossing ☐ Visible

☐ Not visible

Any others _____

11 Time ☐ Day

☐ Night

12 Front Vehicle speed ☐ Effect to drive

☐ Not Effect to drive

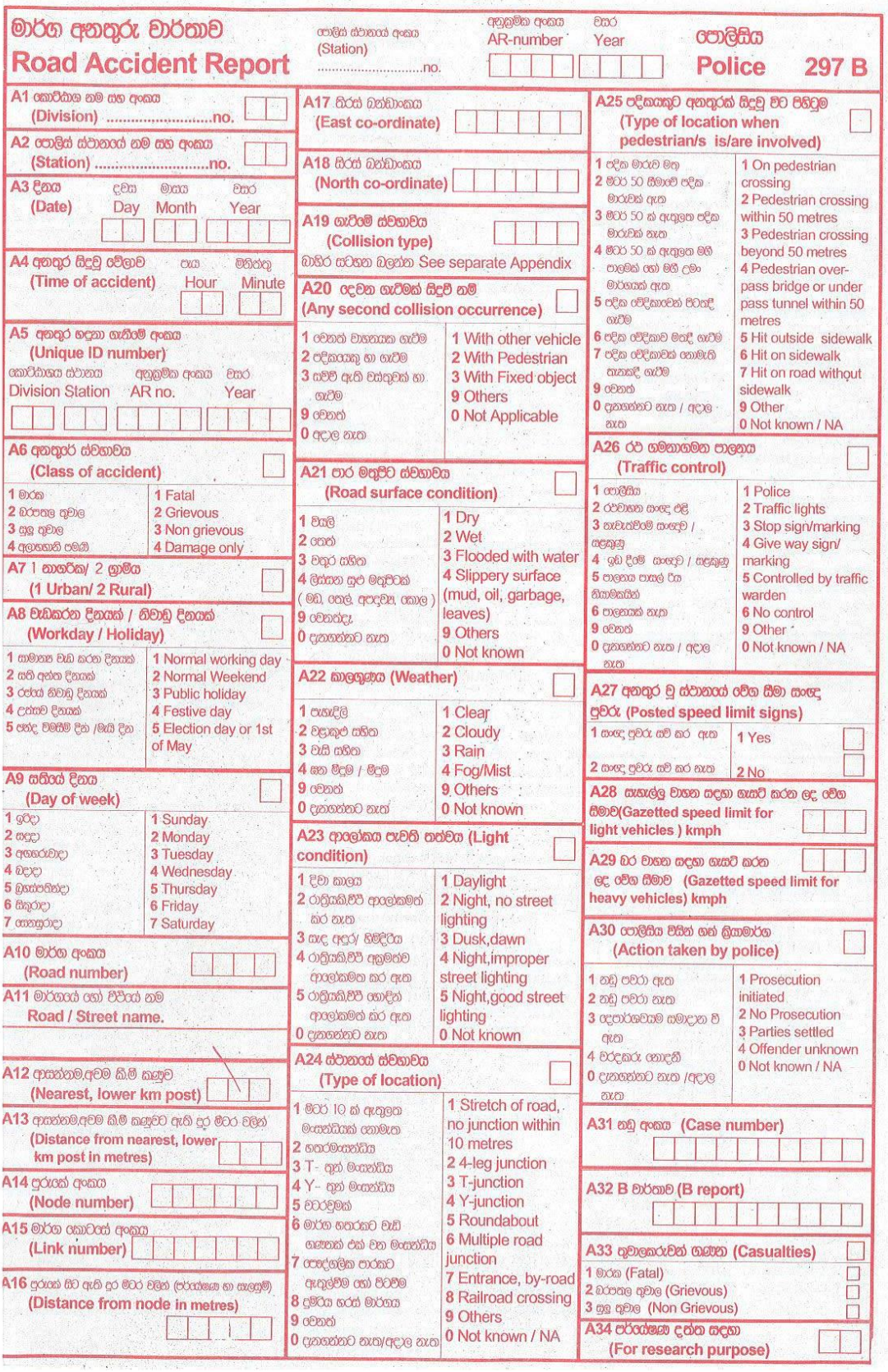
Any others _____

13 Any others Comments _____

Appendix III – Photos of mid-block crossing

The following pedestrian crossing are not suitable for differently abled person.

Appendix IV – Form for Road Accident Report Use by Department of Police



මාර්ග අනතුරු වාර්තාව
Road Accident Report

පොලිස් ස්ථානයේ අංකය (Station) .....no.

අනුක්‍රමික අංකය AR-number

වසර Year

පොලිසිය Police 297 B

A1 කොට්ඨාශය නම සහ අංකය (Division) .....no.

A2 පොලිස් ස්ථානයේ නම සහ අංකය (Station) .....no.

A3 දිනය (Date) දවස Day මාසය Month වසර Year

A4 අනතුර සිදුවූ වේලාව (Time of accident) පැය Hour මිනිත්තු Minute

A5 අනතුර හඳුනා ගැනීමේ අංකය (Unique ID number)
කොට්ඨාශය Division ස්ථානය Station අනුක්‍රමික අංකය AR no. වසර Year

A6 අනතුරේ ස්වභාවය (Class of accident)

1 මාරක	1 Fatal
2 බරපතල තුවාල	2 Grievous
3 සුළු තුවාල	3 Non grievous
4 අලංගසහති පමණි	4 Damage only

A7 1 නාගරික/ 2 ග්‍රාමීය (1 Urban/ 2 Rural)

A8 වැඩකරන දිනයක් / නිවාඩු දිනයක් (Workday / Holiday)

1 සාමාන්‍ය වැඩ කරන දිනයක	1 Normal working day
2 සති අන්ත දිනයක්	2 Normal Weekend
3 රජයේ නිවාඩු දිනයක්	3 Public holiday
4 උත්සව දිනයක්	4 Festive day
5 ඡන්ද විමසීම් දින /මැයි දින	5 Election day or 1st of May

A9 සතියේ දිනය (Day of week)

1 ඉරිදා	1 Sunday
2 සඳුදා	2 Monday
3 අඟහරුවාදා	3 Tuesday
4 බදාදා	4 Wednesday
5 බ්‍රහස්පතින්දා	5 Thursday
6 සිකුරාදා	6 Friday
7 සෙනසුරාදා	7 Saturday

A10 මාර්ග අංකය (Road number)

A11 මාර්ගයේ හෝ වීථියේ නම Road / Street name.

A12 ආසන්නම,අඩම කිලී කණුව (Nearest, lower km post)

A13 ආසන්නම,අඩම කිලී කණුවට ඇති දුර මීටර වලින් (Distance from nearest, lower km post in metres)

A14 පුරුක් අංකය (Node number)

A15 මාර්ග ලකුටක් අංකය (Link number)

A16 පුරුක් සිට ඇති දුර මීටර වලින (ප්‍රරම්භය හා අවසානය) (Distance from node in metres)

A17 නිරස් බන්ධාංකය (East co-ordinate)

A18 සිරස් බන්ධාංකය (North co-ordinate)

A19 ගැටීමේ ස්වභාවය (Collision type)
බාහිර සටහන බලන්න See separate Appendix

A20 දෙවන ගැටීමක් සිදුවී නම් (Any second collision occurrence)

1 වෙනත් වාහනයක ගැටීම	1 With other vehicle
2 පදිකයෙකු හා ගැටීම	2 With Pedestrian
3 ස්ථිර ඇති වස්තුවක් හා ගැටීම	3 With Fixed object
9 වෙනත්	9 Others
0 අදාල නැත	0 Not Applicable

A21 පාර මතුපිට ස්වභාවය (Road surface condition)

1 වියළි	1 Dry
2 තෙත්	2 Wet
3 වතුර සහිත	3 Flooded with water
4 ලිස්සන සුළු මතුපිටක් (මඩ, තෙල්, අපද්‍රව්‍ය, කොළ)	4 Slippery surface (mud, oil, garbage, leaves)
9 වෙනත්ද,	9 Others
0 දැනගන්නට නැත	0 Not known

A22 කාලගුණය (Weather)

1 පැහැදිලි	1 Clear
2 වළාකුළු සහිත	2 Cloudy
3 වැසි සහිත	3 Rain
4 සහ මීදුම / මීදුම	4 Fog/Mist
9 වෙනත්	9 Others
0 දැනගන්නට නැත	0 Not known

A23 ආලෝකය පැවති තත්වය (Light condition)

1 දිවා කාලය	1 Daylight
2 රාත්‍රියකි,වීථි ආලෝකමත් කර නැත	2 Night, no street lighting
3 හැඳ අඳුර/ හිමිදිරිය	3 Dusk,dawn
4 රාත්‍රියකි,වීථි අක්‍රමවත් ආලෝකමය කර ඇත	4 Night,improper street lighting
5 රාත්‍රියකි,වීථි හොඳින් ආලෝකමත් කර ඇත	5 Night,good street lighting
0 දැනගන්නට නැත	0 Not known

A24 ස්ථානයේ ස්වභාවය (Type of location)

1 මීටර 10 ක් ඇතුලත මංසන්ධියක් නොමැත	1 Stretch of road, no junction within 10 metres
2 හතරමංසන්ධිය	2 4-leg junction
3 T- ආන මංසන්ධිය	3 T-junction
4 Y- ආන මංසන්ධිය	4 Y-junction
5 වටරවුමක්	5 Roundabout
6 මාර්ග හතරකට වැඩි ගණනක් එක් වන මංසන්ධිය	6 Multiple road junction
7 පොදුගලික පාරකට ඇතුල්වීම හෝ පිටවීම	7 Entrance, by-road
8 දුම්රිය හරස් මාර්ගය	8 Railroad crossing
9 වෙනත්	9 Others
0 දැනගන්නට නැත/අදාල නැත	0 Not known / NA

A25 පදිකයෙකුට අනතුරක් සිදුවූ විට පිහිටුම (Type of location when pedestrian/s is/are involved)

1 පදික මාරුව මත	1 On pedestrian crossing
2 මීටර 50 සීමාවේ පදික මාරුවක් ඇත	2 Pedestrian crossing within 50 metres
3 මීටර 50 ක් ඇතුලත පදික මාරුවක් නැත	3 Pedestrian crossing beyond 50 metres
4 මීටර 50 ක් ඇතුලත මහ පාලමක් හෝ මහ උමං මාර්ගයක් ඇත	4 Pedestrian over-pass bridge or under pass tunnel within 50 metres
5 පදික වේදිකාවෙන් පිටතදී ගැටීම	5 Hit outside sidewalk
6 පදික වේදිකාව මතදී ගැටීම	6 Hit on sidewalk
7 පදික වේදිකාවක් නොමැති තැනකදී ගැටීම	7 Hit on road without sidewalk
9 වෙනත්	9 Other
0 දැනගන්නට නැත / අදාල නැත	0 Not known / NA

A26 රථ ගමනාගමන පාලනය (Traffic control)

1 පොලිසිය	1 Police
2 රථවාහන සංඥා ආලි	2 Traffic lights
3 නැවැත්වීම් සංඥාව / ඇඳුනුම	3 Stop sign/marking
4 ඉඩ දීමේ සංඥාව / ඇඳුනුම	4 Give way sign/ marking
5 පාලනය පාසල් රිය නිලධාරීන්	5 Controlled by traffic warden
6 පාලනයක් නැත	6 No control
9 වෙනත්	9 Other
0 දැනගන්නට නැත / අදාල නැත	0 Not known / NA

A27 අනතුර වූ ස්ථානයේ වේග සීමා සංඥා පුවරු (Posted speed limit signs)

1 සංඥා පුවරු තිබී කර ඇත	1 Yes
2 සංඥා පුවරු තිබී කර නැත	2 No

A28 සැහැල්ලු වාහන සඳහා ගැසට් කරන ලද වේග සීමාව(Gazetted speed limit for light vehicles) kmph

A29 බර වාහන සඳහා ගැසට් කරන ලද වේග සීමාව (Gazetted speed limit for heavy vehicles) kmph

A30 පොලිසිය විසින් ගත් ක්‍රියාමාර්ග (Action taken by police)

1 නඩු පවරා ඇත	1 Prosecution initiated
2 නඩු පවරා නැත	2 No Prosecution
3 පාර්ශවයන් සමඳානම් වී ඇත	3 Parties settled
4 වරදකරු නොදනී	4 Offender unknown
0 දැනගන්නට නැත /අදාල නැත	0 Not known / NA

A31 නඩු අංකය (Case number)

A32 B වාර්තාව (B report)

A33 අවාලකරුවන් ගණන (Casualties)

1 මාරක (Fatal)	
2 බරපතල තුවාල (Grievous)	
3 සුළු තුවාල (Non Grievous)	

A34 පර්යේෂණ දත්ත සඳහා (For research purpose)

E1 අනතුරට හේතුවූ දෑ (Element type)

01 කාරය	01 Car
02 ද්විත්ව කාර්ය වාහනය	02 Dual purpose vehicle
03 ලොරිය	03 Lorry
04 පාපැදිය	04 Cycle
05 යතුරුපැදිය, මොපෙඩ්	05 Motor cycle, Moped
06 ත්‍රිරෝද රථය	06 Three wheeler
07 ඇද රථය, අර්ධේ ඇදගෙන යන වාහනය	07 Articulated vehicle, prime mover
08 ලංගම මහ ප්‍රවාහන බස්රථය	08 SLTB bus
09 පෞද්ගලික මහ ප්‍රවාහන බස්රථය	09 Private bus
10 අන්තර්නගර මහ ප්‍රවාහන බස්රථය	10 Intercity bus
11 ඉඩම් වාහනය /ට්‍රැක්ටරය	11 Land vehicle/ Tractor
12 සතකු ඇදගෙන යන වාහනයක් හෝ සතකු පිටනැඟි පුද්ගලයෙක්	12 Animal drawn vehicle or rider on animal
13 පදික‍යා	13 Pedestrian
19 වෙනත්	19 Others
00 දැනගන්නට නැත	00 Not known

E5 වාහනයේ අයිතිය (Vehicle ownership)

1 පෞද්ගලික වාහනයක්	1 Private vehicle
2 පෞද්ගලික ආයතනයක වාහනයක්	2 Private company own vehicle
3 රජයේ වාහනයක්	3 Government vehicle
4 අර්ධරාජ්‍ය, ආයතනයක වාහනයක්	4 Semi Government vehicle
5 සමුදා වාහනයක්	5 Service vehicle
6 පොලිස් වාහනයක්	6 Police vehicle
0 දැනගන්නට නැත	0 Not Known

E7 රියදුරුගේ/ පැදිකරුගේ/ පදිකයාගේ ස්ත්‍රී පුරුෂ භාවය (Driver / Rider / Pedestrian Sex)

1 පුරුෂ	1 Male
2 ස්ත්‍රී	2 Female
0 දැනගන්නට නැත	0 Not known

E10 රියදුරු බලපත්‍රයේ වලංගුභාවය (Validity of driving license)

1 වාහනය සඳහා වලංගු බලපත්‍රයක් ඇත	1 Valid license for the vehicle
2 වාහනය සඳහා වලංගු බලපත්‍රයක් නැත	2 Without valid license for the vehicle
3 පුහුණුවීම් බලපත්‍රයක් ඇත	3 Learner permit
4 තාවකාලික බලපත්‍රය	4 Probation license
5 ජාත්‍යන්තර බලපත්‍රය	5 International license
0 දැනගන්නට නැත / අදාල නැත	0 Not known / NA

E13,E14 අනතුර සිදුවීමට රියදුරාගෙන් බලපෑ මූලික හේතු (Human pre crash factors contributing to accident)

01 අධික වේගය	01 Speeding
02 අවධානම් / නොසැලකිලිමත් රිය පැදවීම	02 Aggressive / negligent driving
03 වැරදි විනිශ්චය	03 Error of judgment
04 මධ්‍යසාර / මත්ද්‍රව්‍ය වල බලපෑම	04 Influenced by alcohol / drugs
05 විඩාව / නින්ද යාම	05 Fatigue / fall asleep
06 අවධානයෙන් බැහැරවීම (ගුවන් විදුලිය ශ්‍රවා කරවීම, ජංගම දුරකථන, මානසික ආතතිය ආදී)	06 Distracted/ inattentiveness (handling radio, mobile phone, mental stress etc.)
07 අක්ෂි පෙනීමේ දුර්වලතා	07 Poor eye sight
08 හදිසි රෝගී තත්වයක්	08 Sudden illness
09 වෙනත් වාහන වල එළි / හිරුරැස්	09 Blinded by another vehicle / sun
19 වෙනත්	19 Others
00 දැනගන්නට නැත / අදාල නැත	00 Not known / NA

E15 අනතුර සිදුවීමට පදිකයාගෙන් බලපෑ හේතුව (Pedestrian pre crash factor contributing to accident)

1 බලාපොරොත්තු නොවූ පදිකයකුගේ හැසිරීමක්	1 Unexpected pedestrian movement
2 අපයා ඇති පදිකමාර්ග නොතැකීම	2 Disobey designated crossing
3 මධ්‍යසාර / මත්ද්‍රව්‍ය වල බලපෑම	3 Influenced by alcohol / drugs
4 පෙනෙවිලිව නොපෙනීම	4 Poor visibility (clothing)
9 වෙනත්	9 Other
0 දැනගන්නට නැත / අදාල නැත	0 Not known / NA

E16 අනතුර සිදුවීමට මාර්ගයෙන් බලපෑ හේතුව (Road pre crash factor contributing to accident)

1 මතුපිට සහ නොසලකා හරින ලද මාර්ග, ලිස්සනසුලු මාර්ග, වතුර වලවල්, මහ කැඩිති, විශාල පැලිති, උස් හෝ පහත් කාණු, කාණු ආවරණ ආදිය	1 Defective road surface, slippery road, pot holes, water puddles, large cracks, high or low sewer covers etc.
2 කැඩුණු, කිසිපරිදි නඩත්තු නොකරන ලද මාර්ග සලකුණු හෝ සංඥා හෝ මාර්ග සලකුණු හෝ සංඥා කිසිවක් දක්නට නොමැතිවීම	2 Defective, absent or badly maintained road markings or signs
3 නිමාවත රථ වාහන පාලන සංඥා නොමැතිව මාර්ගයේ වැඩ කරන අවස්ථා	3 Road works without adequate traffic control devices
4 කාලගුණ තත්ත්වයන්	4 Weather conditions
5 දුර්වල ලෙස ආලෝකමත් වී ඇති	5 Poor street lighting
9 වෙනත්	9 Other
0 දැනගන්නට නැත / අදාල නැත	0 Not known / NA

E17 අනතුර සිදුවීමට වාහනයෙන් බලපෑ හේතුව (Vehicle pre crash factor defects contributing to accident)

1 තිරිංග	1 Brakes
2 ටයර් / රෝද	2 Tyres, wheels
3 ඍජුකාමම	3 Steering
4 විදුලි එළි, ලාම්පු	4 Lights, lamps
5 දුර්වල යාන්ත්‍රික තත්ත්වයක්	5 Poor mechanical condition
6 වැඩියෙන් බර පැටවූ හෝ වැරදි ලෙස බර පැටවූ වාහනයක්	6 Overloaded or wrongly loaded vehicle
9 වෙනත්	9 Other
0 දැනගන්නට නැත/අදාල නැත	0 Not known / NA

E18 අනතුර බරපතලකමට හේතුවූ කරුණු (Crash factor contributing to accident severity)

1 ගසක ගැටීම	1 Hitting tree
2 කණුවක ගැටීම	2 Hitting pole / post
3 විශාල ගලක ගැටීම	3 Hitting stone or boulder
4 මාර්ග ගැටියක් ගඟක ගැටීම	4 Hitting road island, curb etc.
5 බාධකයක හෝ ආරක්ෂක වැටක ගැටීම	5 Hitting barrier or guard rail
6 සවිව ඇති වෙනත් වස්තුවක් සමග ගැටීම	6 Hitting other fixed object
7 පෙරළීම	7 Rolled over
0 දැනගන්නට නැත/අදාල නැත	0 Not known / NA

E19 වෙනත් හේතු (Other factors)

1 අනතුරක් වැළැක්වීමට ගැනෙන නොනවත්වා පලායාම	1 Avoiding maneuver
2 නොනවත්වා පලායාම	2 Hit and run
3 පාර වැඩ කරමින් සිටීම	3 Road works
4 අනතුරෙන් පසු සිදුවිය කළඹල	4 Post crash violence
5 ත්‍රාස්කම්කරන ලද වාහනයක්	5 Stolen vehicle
0 දැනගන්නට නැත/අදාල නැත	0 Not known / NA

E20 මධ්‍යසාර පරීක්ෂාව (Alcohol test)

1 මධ්‍යසාර භාවිතා කර නැත හෝ නම්මත ප්‍රමාණයට අඩුවෙන්	1 No alcohol or below legal limit
2 නම්මත ප්‍රමාණය ඉක්මවා ඇත	2 Over legal limit
3 පරීක්ෂා කර නැත	3 Not tested

E21 රියදුරු/පැදිකරු/පදිකයා අනතුරට වගකිවයුතු (Driver/ Rider/ Pedestrian at fault)

1 ඔව්	1 Yes
2 නැත	2 No
0 දැනගන්නට නැත/අදාල නැත	0 Not known / NA

තුවාලකරු පිළිබඳ විස්තර (CASUALTY DETAILS)

C1 අනතුරට හේතුවූ දෑහි අංකය (Traffic element number)

රියදුරෙක් හෝ මගියෙක් තුවාල වී නම් තුවාලකරු ගමන්කළ වාහනයෙහි දැහි අංකය දක්වන්න	If a driver or passenger casualty indicate the vehicle's element number In which the casualty traveled.
පදිකයෙක් තුවාල වී නම් පදිකයාගේ දැහි අංකය දක්වන්න	If a pedestrian casualty indicate the element number for the pedestrian

C2 දණ්ඩ නීති සංග්‍රහයට අනුව තුවාලකරුගේ ස්වභාවය (Severity according to penal code)

1 මරක	1 Fatal
2 බරපතල තුවාල	2 Grievous
3 සුලු තුවාල	3 Non grievous

C3 වර්ගය (Category)

1 රියදුරු /පැදිකරු	1 Driver / Rider
2 පදිකයා	2 Pedestrian
3 මගියා / රියදුරු පැදියක හෝ පාපැදියක පිටුපස ගමන්	3 Passenger / pillion rider
4 මගියා / රියදුරු පැදියක හෝ පාපැදියක පිටුපස ගමන් වාහනයෙන් වැටීම	4 Passenger/pillion rider falling off vehicle
5 මගියා බසයකට නැගීම හෝ බසයෙන් බැසීම	5 Passenger entering or leaving bus
0 දැනගන්නට නැත	0 Not known

C4 ස්ත්‍රී පුරුෂ භාවය (Sex)

1 පුරුෂ	1 Male
2 ස්ත්‍රී	2 Female
0 දැනගන්නට නැත	0 Not known

C6 ආරක්ෂාව (Protection)

1 ආරක්ෂක වදපට පළඳා ඇත	1 Safety belt, worn
2 ආරක්ෂක වදපට පළඳා නැත	2 Safety belt, not worn
3 ආරක්ෂක හිස්වැසුම් පළඳා ඇත	3 Helmet, worn
4 ආරක්ෂක හිස්වැසුම් පළඳා නැත	4 Helmet, not worn
5 ළමා ආරක්ෂක ආසනය භාවිතාකර ඇත	5 Child restrain seat used
0 දැනගන්නට නැත/අදාල නැත	0 Not known / NA

C7 රෝහල් ගත කිරීම (Hospitalized)

1 තුවාල සිදුවීම හා අවම වශයෙන් එක් දිනක් හෝ රෝහල් ගත කිරීම	1 Injured and admitted to hospital at least 1 day
2 තුවාල සිදුවීම. නමුත් රෝහලට ඇතුල් කොට්ටම් හෝ එක් දිනකට අඩු කාලයක් සඳහා රෝහල් ගත කිරීම	2 Injured but not admitted to hospital or admitted less than 1 day

අනතුරට හාජනය වූ වාහනයේ අංකය (TRAFFIC ELEMENT)	අංක Traffic Element No.	අංක Traffic Element No.	අංක Traffic Element No.
E1 අනතුරට හාජනය වූ ද්‍ර. (Element type)			
E2 වාහනයේ ලියාපදිංචි අංකය (Vehicle Registration number)			
E3 වාහනය නිපදවූ වර්ෂය (Vehicle year of manufacture)			
E4 වාහනය කොපමණ පැරණිද යන වග (Age of vehicle)			
E5 වාහනයේ අයිතිය (Vehicle ownership)			
E6 ගමන් කරන දිශාව (Direction of movement)			
E7 රියදුරුගේ / පැදිකරුගේ / පදිකයාගේ ස්ත්‍රී පුරුෂ භාවය (Driver / Rider / Pedestrian sex)			
E8 රියදුරුගේ / පැදිකරුගේ / පදිකයාගේ වයස (Driver / Rider / Pedestrian age)			
E9 රියදුරු බලපත්‍රයේ අංකය (Driving License number)			
E10 රියදුරු බලපත්‍රයේ වලංගු භාවය (Validity of Driving License)			
E11 රියදුරු බලපත්‍රය නිකුත් කළ වර්ෂය (Year of issue of Driving License)			
E12 රියදුරු බලපත්‍රය නිකුත් කළ අවස්ථාවේ සිට කාලය (අවුරුදු) (Number of years since first issue of driving license)			
E13 අනතුර සිදුවීමට රියදුරාගෙන් බලපෑ පළමු හේතුව (Human pre crash factor 1 contributing to accident)			
E14 අනතුර සිදුවීමට රියදුරාගෙන් බලපෑ දෙවන හේතුව (Human pre crash factor 2 contributing to accident)			
E15 අනතුර සිදුවීමට පදිකයාගෙන් බලපෑ හේතුව (Pedestrian pre crash factor contributing to accident)			
E16 අනතුර සිදුවීමට මාර්ගයෙන් බලපෑ හේතුව (Road pre crash factor contributing to accident)			
E17 අනතුර සිදුවීමට වාහනයෙන් බලපෑ හේතුව (Vehicle pre crash factor contributing to accident)			
E18 අනතුර බරපතලකමට හේතුවූ කරුණ (Crash factor contributing to accident severity)			
E19 වෙනත් හේතු (Other factors)			
E20 මධ්‍යසාර පරීක්ෂාව (Alcohol test)			
E21 රියදුරු / පැදිකරු /පදිකයා අනතුරට වගකිවයුතුද ? (Driver / Rider / Pedestrian at fault ?)			
E22 පර්යේෂණ දැනට සඳහා (For research purpose)			

තුවාලකරු (CASUALTIES)	A	B	C	D	E	F	G
C1 අනතුරට හාජනය වූ වාහනයේ අංකය (Traffic element number)							
C2 දණ්ඩ නීති සංග්‍රහයට අනුව තුවාලකරුගේ ස්වභාවය (Severity according to penal code)							
C3 වර්ගය (Category)							
C4 ස්ත්‍රී පුරුෂ භාවය (Sex)							
C5 වයස (Age)							
C6 ආරක්ෂාව (Protection)							
C7 රෝහල් ගත කිරීම (Hospitalized)							

ගැටීමේ සටහන
(Collision Sketch)

අතිරේක තොරතුරු හෝ අනතුර සිදුවූ ආකාරය පිළිබඳ ලඝු සටහනක්
(Discription of accident & additional information)

.....

.....

.....

.....

විමර්ශන කරන නිලධාරියා විසින් මෙම වාර්තාව සකස් කරන ලදී. නම / අත්සන:
This Report has been prepared by the investigating Officer. Name / Signature: .....

ස්ථානාධිපති (රථ වාහන) විසින් මෙම වාර්තාව නිවැරදි බව සහතික කරන ලදී. නම / අත්සන:
This Report is certified to be correct by OIC (traffic). Name / Signature: .....

සංකේත ලිපිකරු විසින් සටහන් හා සංකේත යෙදීම පරීක්ෂා කරන ලදී
Entring and Coding checked by coding clerk Name / Signature: .....

ස්ථානාධිපති (සංඛ්‍යාලේඛණ කොට්ඨාශය) විසින් සටහන් හා සංකේත යෙදීම පරීක්ෂා කරන ලදී
Entring and Coding checked by OIC (Statistics Division) Name / Signature: .....

H 036008 – 30,000 (2010/11) ශ්‍රී ලංකා රජයේ මුද්‍රණ දෙපාර්තමේන්තුව Swe/28.05.2k3