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Street Crossing Infrastructure for the people with Disability in Addis Ababa: The Case of Visually Impaired Persons

A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Masters of Science in Architectural Engineering

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Dec, 2021
Addis Ababa, Ethiopia

Title

This research is submitted to EiABC, AAU in fulfillment of Masters of Science in Architectural Engineering entitled *Street crossing infrastructure for the people with disability in Addis Ababa: The case of visually impaired Persons*.

Declaration

I declare that this thesis entitled *"Street crossing infrastructure for the people with disability in Addis Ababa: The case of visually impaired Persons*" is my work and that all sources of materials used for this thesis have been appropriately acknowledged. This thesis is submitted in partial fulfillment of the requirements for Master's degree in Architectural Engineering at Addis Ababa University, EiABC. I seriously declare that this thesis is not submitted to any other institution anywhere for the award of any degree or diploma. The thesis will be deposited at the University Library to make available to borrowers under rules of the Addis Ababa University Library.

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Confirmation

This is to certify that the research entitled *"Street crossing infrastructure for the people with disability in Addis Ababa: The case of visually impaired Persons"* have been submitted for examination with my approval as institute advisor.

Advisor Name: Mr. **Dagnachew Adugna (PhD)**

Signature: _____

Addis Ababa University

School of graduate studies

This Thesis is submitted to the School of Graduate Studies of Ethiopian Institute of Architecture Building Construction and City Development in Addis Ababa University for Partial Fulfillment of the Requirements for the Degree of Masters of Science in Architectural Engineering for obeying the Thesis Regulation of the University on the Originality and Quality of the Thesis.

Tittle of the thesis: *Street crossing infrastructure for the people with disability in Addis Ababa*: The case of visually impaired Person's.

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Abstract

Street crossing is the most common infrastructural issue worldwide for disability as it is the basic space and needs treatment to fully function particularly for visually impaired people. In the case of developing countries, the street crossing barriers are numerous; that the disable person needs the special consideration in every design and construction of engineering structure. Therefore, the increased risks of the visually impaired persons were multi-factorial events in both their causes and outcomes. The objectives of this thesis are identifying the major barriers occurred on visually impaired persons while crossing the streets, identify and map the major street crossing problematic areas for the visually impaired persons, investigate the major problems linked with poor street crossings for the visually impaired persons. The research aims to give a resource for the researcher's as primary information for further investigation about the problem. Most important element of problem analysis was to evaluate the street crossing problems for disables versus street infrastructure in Addis Ababa City. This research was, therefore, an attempt to address these issues and to require a systematic analysis to evolve possible solutions and their counter measures to solve the problem. The research methods which were employed in this study includes survey, historical analysis, case studies etc. and use the research case study for the qualitative approach as a strategy for these proposals. The findings of the study reveal on the major squares of Ethiopia the problems that the visually impaired persons face was very high due to the high population density, cars, street furniture, street signals, vegetation, and the design and construction materials used. To minimize the problems on the visual and visually impaired person the well corporation of the street furniture and designing the street crossing tunnel and bridge were needed by taking the design philosophy from the well designed and developed city of the world.

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List of Acronyms

Agronomies	Words
A.A.	Addis Ababa
AACRA	Addis Ababa City Administration road authority
AutoCAD	Computer-aided drafting software program
COMS	Continuous Opacity Monitoring Systems
CSA	Central Statistical Agency
DC’s	Developing Country
UD	Universal Design
UNEP	United Nations Environment Programme
WHO	world health organization
AACC	Addis Ababa City Council

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Chapter One: Introduction

1.1. Background of the study

A pedestrian is any person who is travelling by walking. In addition to the ordinary form of walking, a pedestrian may be using various modifications and aids to walking such as wheelchairs, motorized scooters, walkers, canes, skateboards, and roller blades. The person may carry items of varying quantities, held in hands, strapped on the back, placed on the head, balanced on shoulders, or pushed/pulled along. A person was also considered a pedestrian when running, jogging, hiking, or when sitting or lying down in the roadway (Tulu et al., 2013).

Cities are searching for more creative ways to activate public spaces to serve the public health of communities, while simultaneously working towards the increased active transportation goals of their city. In recent years, several cities have shown the economic benefits that come from increased bike and pedestrian traffic in downtown areas. Active transportation infrastructure upgrades are necessary for vibrant, walk- and bike-friendly cities (Gohringer, 2017).

The importance of safe walking is all pedestrians. Walking is a basic and common mode of transport in all societies around the world. Virtually every trip begins and ends with walking (Mohammed, 2015). Walking comprises the sole means of travel on some journeys, whether a long trip or a short stroll to a shop. In other journeys, a person may walk for one or more portion of the trip, for example, walking to and from bus stops, with a bus trip in between. Walking has well established health and environmental benefits such as increasing physical activity that may lead to reduced cardiovascular and obesity-related diseases, and many countries have begun to implement policies to encourage walking as an important mode of transport. Unfortunately, in some situations increased walking can lead to increased risk of road traffic crashes and injury. Due to the dramatic growth in the number of motor vehicles and the frequency of their use around the world – as well as the general neglect of pedestrian needs in roadway design and land-use planning – pedestrians are increasingly susceptible to road traffic injury. Pedestrian vulnerability is further heightened in settings where traffic laws are inadequately enforced (Mohammed, 2015).

Addis Ababa is urbanizing and growing at a rapid pace and the capital, largest city of Ethiopia and the country's commercial, manufacturing, political, and cultural

center. It has many nodal points characterized by concentration of activity including services, markets, administration, transportation; and junctions. They have great role in social, economic, physical aspects because they provide services, create job opportunity, generate high amount of income for city from taxes and land rent, attract investors, and also connect different areas. But in recent times those nodes characterized by the absence of quality public realm which fulfill the above human need and the presence of abundant space, high speed flow of vehicle, wide traffic lane and parking place (Mohammed, 2015).

In the capital city of Ethiopia main nodes as I investigate in the areas physically impaired persons is variously walking on pedestrian streets safe to walk unless they are walking on the asphalt street even though they are walking on the pedestrian the open duct manholes, misplaced electric and Ethio-telecom poles and the dry disposal bins are an obstacle in the way of their walking. When come to the road crossing however the crossing areas signed in street painting majorly for those groups there is no more consideration than cutting the side stone at crossing junction in some areas, they are using their cane or stick to give a signal for the vehicle drivers. Mainly in the cross road where traffic lights are exists physically impaired persons directly crossing both ways without no rest in between two ways this causes the accident barrier on them. There are relatively more physically impaired persons in Addis Ababa than other capital cities in Ethiopia. Specifically, many physically impaired persons live around Sidist kilo for education and searching for various services. The road crossings are not suitable for the disables.

The condition of road crossing in Addis Ababa city because of the street complexity and the high crowed problem in energy section of the city mainly on the main activity areas the road crossings are not comfortable in a certain cases for example lack of standardize pedestrian crossing points designs, lack of quality of the construction and lack of quality of the construction and lack of construction material quality and need of additions service infrastructures for the special need people.

However, the problem had seen by the governmental body's there are some design modification and re-construction reconstruction of pedestrian street and

crossing points there are many obstacles that physically imparted persons fate on the street which is as discussed on the above paragraph. Currently the physically impaired persons are not satisfied on the infrastructure of the study area as Ethiopia is the lower developing country there is insufficient infrastructure to learn, to work and to participate in a social activity at the regional stats even though the capital city has a better infrastructure by this cause physically impaired persons mostly select the Addis Ababa.

1.2. Problem statement

In much of urban areas in Ethiopia especially in Addis Ababa walking is unpleasant experience. Streets are often overcrowded, footpaths are narrow, and roads are difficult to cross. In many areas there are not enough places to sit, inadequate protection from the weather and footpaths are so crowded that pedestrians are forced into the road.

Pedestrians and cyclists were able to enjoy a cleaner, quieter, safer city center environment with the removal of through car traffic. Also, a combination of road narrowing and increased street furniture will seek to slow traffic along the road, and pedestrians will be providing with a safe crossing point.

The major and clear problems seen in the selected sites are; overcrowding along narrow footpaths and difficulties in crossing the road at ground level, Poor signage, and barriers to pedestrian movement. An unwelcoming environment for the physically disabled, Safety problems in relation to traffic and in areas those are poorly lit or badly maintained and Lack of free and walk able pedestrian paths especially for disable part of the society, Lack of proper finishing of road construction quality and urban elements such as Open Manhole, sewage lines, ditches and related. The quality of pedestrian walk way fails to make up for the poverty and unappealing atmosphere.

The number of disable people in Addis Ababa city as per the CSA 2010 report estimated at 32,630 (CSA, 2010). Most of the pedestrian routes in Addis Ababa city lack a proper infrastructure for people with disability, for example, the intersection light signals are for those who can see the light. Whereas for visually impaired people there is a limited facility aided for them. The other major challenge is at white stripes crossings where the roads have a continuous median, which is a serious problem for disable especially for visually impaired persons.

The presence of unfinished pedestrian walkways in the city is becoming a dangerous for disabled people mobility due to the presence of uncovered manholes, unpaved surface and poor linkage between roads of different hierarchy, damped soils and stones and at the street crossing points there are related problems faces them because of the lack of proper street infrastructure.

There is no compatible pedestrian and street crossing infrastructure to meet the need of the Addis Ababa visually impaired persons, which resulted in the seriousness of the issue. Among the challenges of the street crossing infrastructure for visually impaired persons first was dangerous access to workplace, education, health and other services due to the problem of street infrastructure for visually impaired persons and second inconvenient infrastructure for crossing street safely. If these challenges and other associated problems are occurred every time, they would have a direct impact on the life of those who are visually impaired persons live in the city which directly affects the live hood of the disabled residents.

Therefore, the increased risks of the visually impaired persons are multi-factorial events in both their causes and outcomes. The most important element of problem analysis is to evaluate the street crossing problems for disables versus street infrastructure in Addis Ababa City. This research is, therefore, an attempt to address these issues and to require a systematic analysis to evolve possible solutions and their counter measures to solve the problem.

1.3. Objectives of the Study

1.3.1. General objective

The general objective of this study was to investigate the existing and anticipated street crossing infrastructure problems and to recommend how to improve street crossings for visually impaired persons in Addis Ababa.

1.3.2. Specific objective

The specific objectives of the study were to:

1. To identify the existing pedestrian crossing facilities for visually impaired persons.
2. To identify and map the major challenges in pedestrian crossing areas for the target group.
3. To investigate the major problems linked with poor street crossings for the visually impaired persons in comparison with the non-visual person.

1.4. Research questions

This research would attempt to answer the following questions:

1. What were the existing and anticipated problems of visually impaired peoples on street crossing?
2. What were Crosswalk problems for visually impaired persons? And Where does delivering the pedestrian routes are necessary?
3. How could reduce the existing street crossing problem for the target group?

1.5. Significance of the study

The study aims to contribute to bringing this research gap by addressing the urban planning and street design for visually impaired peoples. Thus, this study would try to identify the major street crossings problems which could be valuable inputs this attempt constitutes a contribution to the ongoing scientific discourse which makes this study a pioneering research in the field of urban planning and design.

This study focus was supported by the fact that many visually impaired peoples have started as conventional areas have not been successful in planning spatial settlements. It is intended that the findings of this research would help urban planning and traffic management authorities to assess and evaluate the current existing street crossing infrastructures problems on the physical features. These findings would also help to rethinking about the integration of street crossing infrastructure with road network planning and traffic management.

Moreover, interested researches in this field would utilize the findings of this study and identify the gaps for further research topics.

1.6. Scope and limitation of the study

1.6.1. Scope of the Study

This study focused only on street crossings problem encountered by the visually impaired persons. The other groups of disables were not considered in this study. Moreover, spatially this study was conducted in Addis Ababa with a special emphasis on Merkato, Piassa, Megenagna, Arat kilo and Sidist kilo localities which might be representative to the other parts of Addis Ababa.

1.6.2. Limitation of the Study

- It is unthinkable for any research process without limitations or challenges; the situation is similar to this research. The study was not smoothly accomplished. There were different challenges the researcher faced while doing this research including absence of well-organized secondary data,

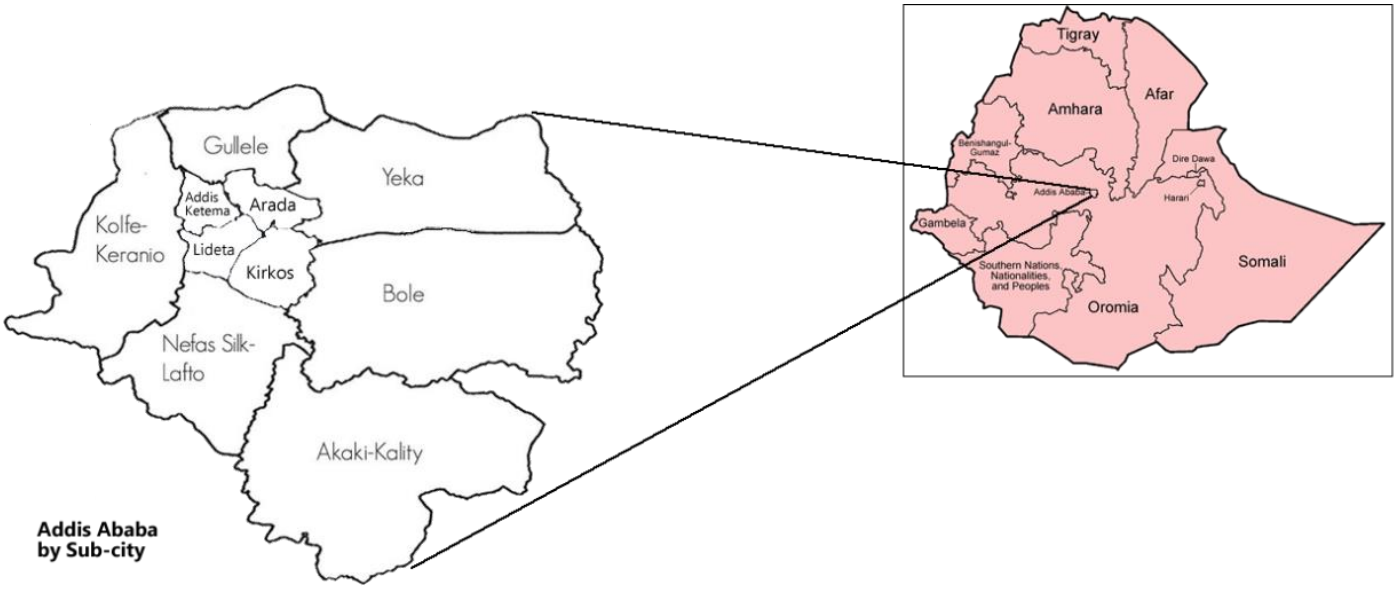
duration of data collection, researcher fatigue, sensitive information, Problem of willingness of some respondents, challenges to communicate those who are impaired person's some of them were aggressive and not willing to have an interview about the issue.

1.7. Description of the Study Area

The study focused on the largest sub cities of Addis Ababa which is the capital city of Ethiopia located Between 8055' and 9005' North Latitude and between 38040' and 38050' East Longitude. The city has served as the major administrative, political, economic, and diplomatic center. The establishment of Addis Ababa date was 19th century during the reign of Emperor Menelik II and Empress Taitu. Since the first settlement, the city has grown spatially and demographically. In 2007 Addis Ababa has a total number of 3,384,569 populations.

Since the city is capital, transport system is crucial to move from one corner to another. Even if there are some changes in the transport system in Addis Ababa city, in reality, there is a big difference between the demanded of the people and the actual transport system.

The situation is even not so good for those with visually impaired people. Therefore, in this study, the researcher will evaluate the transport system for disables' regarding policy implementation in Addis Ababa city will be evaluated and pertinent solutions will be recommended.



Source: - Administrative map of Addis Ababa city and its sub-cities

1.8. Operational Definition of Key Terms

The operational definition is as follows:

- **Blindness**: Snellen chart reading (<3/60) or refractive field loss of <10° relative to the point of fixation
- **Sever visual impairment**: Snellen chart reading (<6/60–3/60)
- **Moderate visual impairment**: Snellen chart reading (<6/12–6/60)
- **Low vision**: inability to perform everyday visual tasks, such as reading or recognizing faces, resulting from a visual impairment
- **Visual impairment**: Smelled chart reading (<6/12–6/60)
- **Refractive error**: an optical defect of the eye that prevents light from being brought to a sharp focus on the retina
- **Astigmatism**: an irregularity on the surface of cornea (optical lens defect)
- **Amblyopia**: failure of vision to develop properly often due to squinting (lazy eye)
- **Hyperopia**: refractive error, also known as far sightedness, where visual acuity is good at far and poor at near
- **Myopia**: refractive error, also known as nearsightedness, where visual acuity is good at near and poor at distance.

Chapter Two: Literature review

2.1 Introduction

The Addis Ababa polices of road authority indicate that the major cause of traffic crashes is road users' errors. This is true virtually in all countries. This indicates that safe pedestrian is a necessary for a user to behave. This study is the essential to solve the traffic problems and give free traffic flow in Addis Ababa by providing the pedestrian especially how are partially impaired, to have accesses to the major nodal areas especially in Addis Ababa city. So, this section of the literature introduces about general information about the pedestrian and pedestrian related information.

2.2 Definition of pedestrian nodes

Pedestrian nodes are points where pedestrian related amenities are grouped to increase the perception of an active, urban corridor and to encourage more walking, bicycling, and transit use. Amenities may include shade-oriented bus shelters, seating, drinking fountains, landscaping, public art, information displays, and bicycle rest stops. Not all locations require all amenities. Pedestrian nodes are important because it give emphasis on alternative mode use in the corridor, contribute to the —greening of the corridor, provide —true shade during the hottest months, and contribute to the overall vibrancy, safety, and desirability of the area. These nodes should occur where single uses or a combination of uses lead to higher levels of pedestrian activity (Mohammed, 2015).

Pedestrian nodes should be located where higher pedestrian densities exist or are forecasted. Such locations may include high-use bus stops or transfer points, schools, larger multi-use complexes, and active retail areas (Mohammed, 2015).

The road network of Addis Ababa is limited in extent and right of way. Its capacity is low, on-street parking is prevalent, and the pavement condition is deteriorating. Despite a large volume of pedestrians, there are no walkways over a large length (63%) of the roadway network. This is a major concern because it contributes to the increased pedestrian involvement in traffic accidents (10,189 accidents occurred in 2004)

Ethiopia is an African country that has made significant investment in improving its injury surveillance capacity. Initial work on injury surveillance started in 2000 with the support of WHO, followed by the government's efforts to strengthen the Traffic

Police Department's road traffic injury data management capacity and to expand data collection nationally (Tulu et.al, 2013).

2.3 The Historic Construction of pedestrian

In the 1970s, around 200 pedestrian-only spaces were installed in cities around the U.S. (Baker 2010). These areas were characterized by having fixed seating, and in general were barren, wide-open places that were not very inviting to the public (Baker 2010, Smith Simon2008). An example of this can be found in Saint Louis, MO. From 1977-2010, two blocks along North 14th Street were closed to vehicular traffic to create a pedestrian mall. Local residents felt that the mall had been a failure long before it was converted back to accommodate a mixture of pedestrians and car traffic in 2010(Gohringer, 2017).

2.4 Pedestrian design and safety

In planning and design of roundabouts special thought should be given to the movement of pedestrians. Roundabout is at least as safe for pedestrian because pedestrians are able to cross one direction of traffic at a time by staging on the splitter island. However, pedestrian must cross with care because unlike traffic signals roundabout do not give positive priority to pedestrian over through traffic movement. Particular group of pedestrians such as elderly or children find traffic signals a more secure form of control for crossing a road (Mohammed, 2015).

A pedestrian crossing is a point on a road where pedestrians traverses the road. Pedestrian crossings, sometimes referred to as crosswalks, may be found at intersections or along road stretches. Marked crossings are designated by markings on the road, commonly white stripes. Signalized crossings include automatic traffic signals that indicate to pedestrians when they should cross (Tulu et al., 2013).

Pedestrian mobility is a vital factor in urban centers of low-income countries. Research has shown that increased mobility of residents and workers are vital to the economic development of a location. Mobility improves trading, specialization of businesses, and enables social contacts and exchange. Therefore, transport infrastructure investments are often used as a catalyst, and are essential factors within the development of any country. In socio-economic environments where public transport is scarce or too expensive, where incomes are dependent both on one's ability to travel to changing job sites, and access to street level pedestrian

flows, the spatial configuration of urban transportation infrastructure becomes an essential feature. In many emerging economies, enhanced mobility is defined exclusively by increasing access to cars and high ways (Workshop, 2014).

Pedestrian safety requires that road design and land-use planning include safe, accessible and comprehensive facilities prioritizing the needs of pedestrians. This module examines the ways in which the design of roadways and the entire built environment can either prevent pedestrian traffic injuries or magnify pedestrian risk (Tulu et al., 2013).

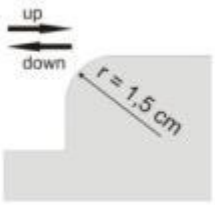
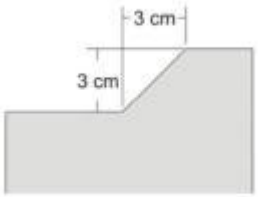
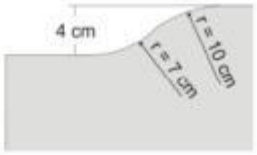
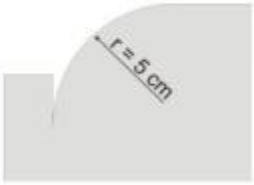
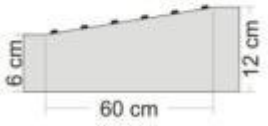
Visually impaired person's needs perceptible distinctions in the pedestrian walk in order to get more information about the street crossing. For the last decades at most street crossing facilities built in uniform kerbs but it must be uniform height installation level of 3 cm it also perceived by blind and visually impaired people using a white cane. As the usage of walkers in the street space increased, so did the feedback about problems in dealing with kerbs heights. As a result, some municipalities dropped kerbs to the level of carriageway for the walkers, sometimes even without considering (e. g. no ground surface indicators) blind and visually impaired people. However, this practice's in conflict with the requirements of blind and visually impaired persons. They express an unsafe feeling if no perceptible distinction exists in the ground surface in order to indicate where the sidewalk ends and the roadway begins.

An installation level of only 3 cm lies already at the lower limit of perceptibility for them. Since the design is only3 cm, there can be problems with the building tolerances and accumulation of dirt in the gutter.

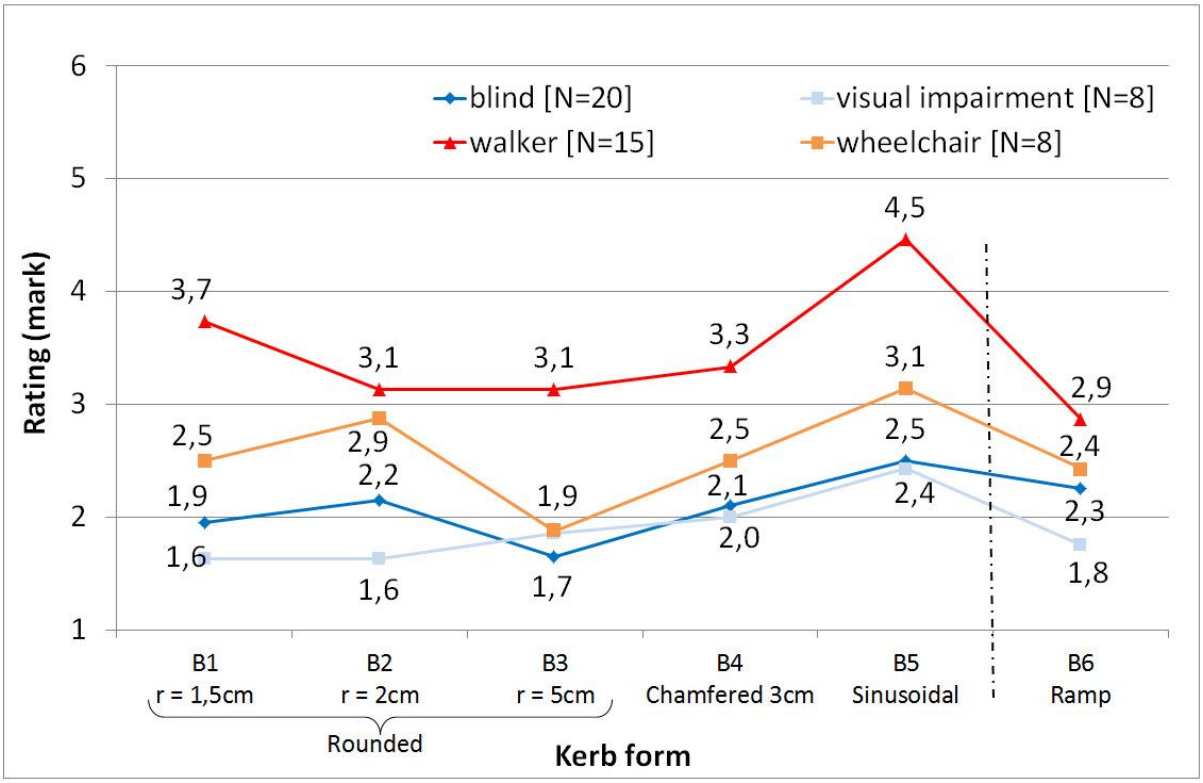
To solve the oppositional requirements of all users, it is possible to build crossings with adjacent crossing areas with different kerbs heights.

Figure 2.1. Street crossings with different heights (multi crossing) example

1. Plan layout of the pedestrian side walk

Kerb	Principle	Kerb	Principle
B1 Rounded kerb (r = 1,5 cm)		**B4** Chamfered kerb (3 cm/3 cm, 45 degrees)	
B2 Rounded kerb (r = 2,0 cm)		**B5** Sinusoidal kerb	
B3 Rounded kerb (r = 5,0 cm)		**B6** Ramp	

Apart from this analysis with the support of the German Association for the Blind and Visually Impaired (DBSV), a survey was conducted of 1,384 blind and the visually impaired people regarding their experiences with the mobility in street space in order to receive empirically substantiated statements of individual mobility and orientation of the blind and visually impaired in general as well as at crossings (dropped kerbs, tactile ground surface indicators) in particular.



2.5 Improving the visibility of pedestrians

A high percentage of pedestrian collisions and deaths occur when lighting conditions are low. There are a number of engineering and behavioral measures that make pedestrians more visible to motorists, especially during dusk, dawn, and at night (Tulu et al., 2013). These measures include (Tulu et al., 2013):

- Providing crossing enhancements such as raised crossing islands and traffic signals.
- Implementing lighting and/or crossing illumination measures. Increasing intensity of roadway lighting increases visibility of pedestrians at night, especially at pedestrian crossings. This intervention has been associated with significant reductions in night-time pedestrian crashes. For example, a study conducted in Australia reported a 59% reduction in pedestrian crashes following improvement in roadway lighting.
- Removing or repositioning physical objects that affect visibility, such as trees and billboards that make it difficult for drivers to see pedestrians.
- Installing signals to alert motorists that pedestrians might be crossing. Pedestrian activated signals may be appropriate at locations with sporadic pedestrian traffic.
- Improving conspicuity of pedestrians. Pedestrians need to be aware that drivers may not see them in low light or dark conditions, especially when they are wearing dark clothing. Selecting light-colored clothing as well as adding reflective materials to backpacks, shoes and clothing is basic measures to increase visibility of pedestrians.
- Raising awareness among pedestrians and drivers, through public service announcements and other media, about the importance of pedestrian visibility, especially at night.

2.6 In international and national case study

2.6.1 A common urban intersection in the Netherlands

Can urban intersections be designed in such a way that motor traffic, cycling and walking flow smoothly and that the potential conflicts of these very different types of traffic crossing each other's paths are made less complicated and less dangerous? In my opinion the answer is "yes." Intersections are most important in

making cycling safer and more attractive. They can be the weakest link in the chain that is your journey and one nasty junction can put people off cycling. I would like to show you a common intersection between a distributor road with protected cycle ways and a smaller neighborhood access street. How does the Dutch design an intersection between two streets like that and how does everything work?

Figure 2.2 How do the Dutch design an intersection between two streets

Google recently published 3D images from ’s-Hertogenbosch. This is great to study the cycling infrastructure. In this post I focus on the crossing with the side street in the foreground.

Figure: 2.63 there are no protected cycle ways in the side street.

This particular intersection -Hertogenbosch, between the recently rebuilt Bahrenburg, that I wrote about earlier, and the Graff_sewage, a main street with service streets that I also wrote about before. This distributor road has a speed

limit of 50km/h, a surface of black asphalt and dedicated cycle infrastructure. Cycling takes place shared with cars on the service street and also on completely separated cycle ways connecting the service street parts. The neighborhood access street has a surface of bricks and a speed limit of 30km/h. The traffic volume here is low, since only residents will use this street. That makes mixing traffic possible and therefore there are no protected cycle ways in the side street.

Figure: 2.64 A clear indication of the priority, also in the road surface

A clear indication of the priority also in the road surface. The shark's teeth indicate you must yield. The so-called piano teeth markings indicate a speed bump. Note the continuous surface of red asphalt of the cycle way, interrupting the roadway.

If you were to turn into the side street on a bicycle you would have to let pedestrians crossing that side street go first. I would also do that if I were to cycle from that side street onto the cycle way of the main road. Even though pedestrians do not officially have that priority here. When you want to turn left, onto the cycle way alongside the main road, you need to cross that main road first. In that case you can also do that in two stages, exactly like the motor traffic drivers do. First you deal with traffic coming from the left. Once that lane is clear you can go to the central waiting area and once there are no vehicles coming from the right you can cross that lane as well and turn into the cycle way. Crossing a main road is convenient with this design. The crossing is cut up in four easy parts. This man is crossing the 3.3-meter traffic lane very quickly in 5 small steps.

Figure: 2.65 crossing a main road is convenient with this design

2. Pedestrians

It could already be clear from the above paragraphs what the rights of pedestrians are. But I'd like to repeat everything from the view of a pedestrian nevertheless. When you walk straight-on on the main road you will have to cross the side street. For traffic turning into that side street from the main road, whether motor vehicles or people on bicycles, it is certain that you must get the right of way from those road users. The ground rule is namely, that turning traffic must give way to traffic going straight-on on the same road. And in this case pedestrians are conceded traffic. It is a bit different for traffic from the side street, which is obviously not on the same road. And as explained previously, the tricky part is the fact that the intersection is raised, but that at the same time the footway is not continuous. Often when road users experience a level change in their path, they must give priority, when they exit a driveway for instance. But that also goes for intersections that have a continuous and raised footway. I'm pretty sure many in the Netherlands would not be 100% certain about the priority here, or they think it is different from what it really is. To prevent problems due to such misunderstandings it is best to look the other road user in the eyes, read what they are going to do and act accordingly.

Figure 2.6-: the crossing is flush. There are no kerbs

The crossing is flush. There are no kerbs. This makes it also easy to cross in a wheel chair or pushing a stroller. For people with impaired vision there are tactile markings in the surface, indicating the outer edge of the road.

When it comes to crossing the main road, everything is plain and simple again. As a pedestrian that crossing is divided into four parts. First you cross the cycle way. You must wait for the cycle way to be clear, because you have no priority. That would be different if there were zebra stripes, in that case you would have priority. The cycle way is 2.3 meters wide. That means you can get to the other side in 3 to 4 steps, so you need only a little gap in the stream of people cycling.

There is a waiting space between the cycle way and the first lane of the roadway. There you can wait for a gap in motor traffic, because, here too, you have no priority due to the absence of a zebra crossing. The motor traffic lane is 3.3 meters wide here, a pretty standard width. That means most people will be able to cross this lane in 4 to 5 steps. This means you also only need a small gap in the motor traffic flow. That is one reason why you see so much movement in the video. Nobody really needs to stop for longer times. Once you have also walked the 5 meters of the central traffic island, you can deal with traffic coming from the opposite direction. First one lane of motor traffic and then the cycle way. The crossing is completely level. This makes crossing the road easy for people in wheel chairs or mobility scooters and for parents with a stroller.

This type of intersection is perfectly clear for all road users. Mainly because all the moments and locations, where you have to negotiate the right of way with different

types of other road users, are separated. You can make one decision at the time and then quickly move to the next point. This makes that traffic can flow smoothly in a safe way.

Seeing, which can be sub-divided into blind and partially sighted people? It is estimated by the Department for Work and Pensions (DWP) that there are almost two million people in Great Britain with a significant sight loss.

Someone who does not use a walking aid can manage to walk along a passage way less than **700mm** wide, but just using a walking stick requires greater width than this; a minimum of **750mm**. A person who uses two sticks or crutches, or a walking frame needs a minimum of **900mm**, a blind person using a long cane or with assistance dog needs **1100mm**. A visually impaired person who is being guided needs a width of **1200mm**.

Walking distances were researched in some detail in the late 1980s and, based on the findings from these studies, the following are recommended (refer table 2.1):

Table 0-1: the impaired person's recommended road standards

Visually impaired	1.5m

Source, Street Crossings for Travelers who are visually impaired by Linda Myers, COMS, *and Wendy Schaffer's, COMS*

2.6.2 Disability and Mobility in Developing Countries

Almost everyone will face temporary or permanent disability at some point in life; there are also people with limited mobility caused by a number of factors, such as disease or accidents. Others who live to old age will likely experience increasing difficulties in functioning and many can experience disability.

The first World Report on Disability (2011) produced jointly by the WHO and the World Bank suggests that more than a billion people in the world today has some form of disability.

Improved access and mobility are important factors in reducing poverty and can facilitate the participation of people with disabilities in economic, social, and political processes. Physical accessibility will also benefit people who are not disabled but have limited mobility, including elderly, children, and pregnant women.

Exclusion increases the costs associated with disability and people who are denied access to essential transport services tend to face greater challenges to stay out of the poverty cycle.

Too often inclusive transport is not fully considered in transport planning, design, construction, and implementation in developing countries. Mobility and access requirements of people with disabilities should be considered by planning and designing barrier- free transport systems. This implies an understanding and identification of the circumstances that create barriers for people with disabilities (Meriläinen and Helaakoski, 2001).

“Enabling transport” for persons with reduced mobility should take place across all components of the travel chain—the pedestrian environment, building and public transport.

An accessible environment, while particularly relevant for people with disabilities also has benefits for a broader range of people. For example, curb cuts (ramps) assist parents pushing baby strollers; information in plain language helps those with hearing impairment or non-native speakers of a language; and announcements of each stop on public transit may aid travelers unfamiliar with the route as well as those with visual impairments.

Governments often perceive accessibility to be a luxury that they cannot afford, and consider universal access unaffordable in the face of pressure to meet other priorities. This is regrettable; as we will illustrate below significant gains can be made even by just ensuring that good design principles that offer inclusion are properly observed when any infrastructure investments are being made. In most cases, following inclusive design principles requires attention and good design, not extra cost. Guidelines regarding outdoor environments often include measures for space and width for wheelchair users, appropriate non slippery firm surfaces, maximum gradients on ramps and curb stones, design of handrails, and visual and tactile markings for persons with impaired vision. In some country’s appropriate designs for pedestrian crossings, including light poles and guiding technology for visually impaired persons, are included in standard street and road design documents.

Figure 2.67 designing for persons with disabilities is not institutionalized.

Often, the principles of UD may not be applied because designing for persons with disabilities is not institutionalized. Other factors that hinder implementation can include:

- Lack of knowledge amongst professional staff about the existence of standards and their applicability;
- Lack of input from the community and from consultation with persons with disabilities on barriers to transport and priorities for access features;
- Where standards exist, they are not implemented or enforced consistently; and
- Lack of awareness on the importance of the issue and coordination among government agencies that may be responsible for different parts of UD elements for a fully accessible trip chain. It is often the case that officials at government agencies are not aware of how much impact a little attention to detail in implementation of public infrastructure can make in terms of the impact on the lives of people with limited mobility.

It is critical to adopt UD depending on the level of existing development and local circumstances. Likewise, interventions will also vary depending on the mode of transportation targeted. There could be an emphasis on developing UD of non-motorized mode of transport when such transport provides the greatest share of trips made. In other circumstances, UD features for buses should be emphasized due to their key role in providing the majority of trips too many passengers (World Bank 2008).

2.6.3 Accessibility in Design Standards

There are common themes across all standards and in the absence of any existing national standards, the use of a standard from another country is recommended.

Accessibility in design standards is manifested in a number of different ways, many of which are imperceptible to the general public. For example, in public transportation:

+ **Pedestrian environment:** Curb cuts, Braille markers, traffic signals with sounds for the blind;

+ **Designated Areas:** On buses and metros designated areas for wheelchair users, special seats for elderly and people with disabilities;

+ **Improved Sizing:** Increased width and heights, improved signs and information, etc.; and,

+ **Audible and Tactile Features:** Tactile guide paths at metro stations, audible guides at entrances and escalator, Braille at ticketing machines.

Table 0-2: Accessibility in design standards

Sidewalk: • 50-cm wide sidewalk is too narrow and is sometimes blocked by vehicles, debris or other obstacles	• Consider widening the textured lane where the width of the sidewalk permits; • Install different shaped tactile points to alert users of turns, • Make the path as direct and obstacle free as possible
Pedestrian street crossing: ➢ Pedestrian signals don't have audio features to alert the visually impaired of the signal phase and time remains for crossing	Consider installing audio features and adjusting the phase
Damaged sidewalk and pavement: ➢ Some damaged sidewalk and pavement are not repaired in timely manner, and thus become obstacle for pedestrians	Better coordination and expedite repairs

Source: Wang (2012)

There are valuable insights into road safety in developed countries, as a considerable amount of research has been undertaken since the 1970s. Currently, road traffic crashes in developed countries show a declining trend due to ongoing

investment in safety programs and countermeasures. However, the literature on pedestrian crash risk in developing countries (DC's) is at an early stage as the implementation of road safety interventions has only begun recently and rapid motorization is taking place. Moreover, the focus of road safety interventions has generally been restricted to improving the safety of motorists rather than pedestrians. A considerable effort is required to understand the unique features of pedestrian crash risk in DCs. Figure 1 show the comparatives of pedestrian and car driver sharing in dc (Tulu et al., 2013).

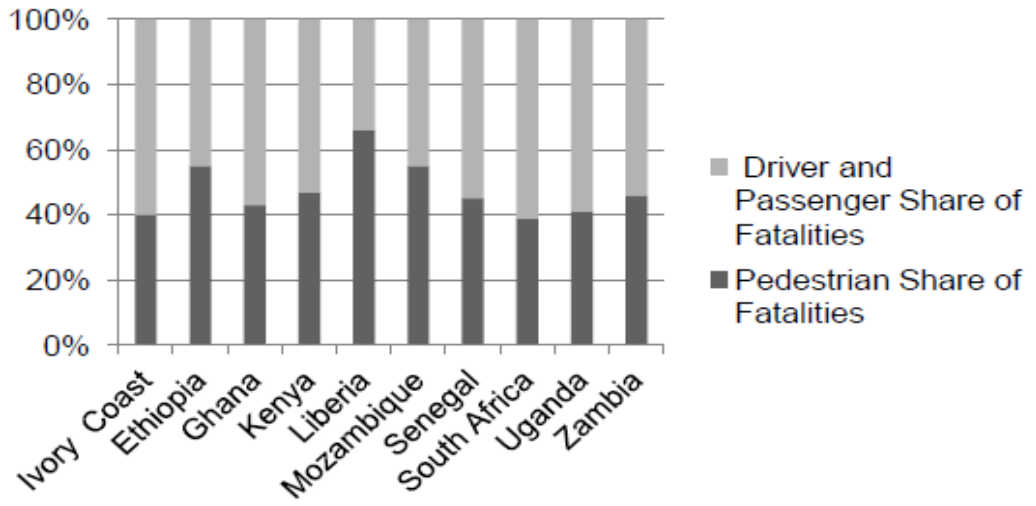


Figure 2.6-1: Proportion of Pedestrian Fatalities in African Countries (Tulu et al., 2013)

Table 0-3: Addis Ababa City Administration Road Network

Road Hierarchy	**Unit**	**Length**	**Number of Bridge Constructed**	**Condition of Road**
Arterial	Km	1291	116	Good
Sub –Arterial	Km	267	55	Good
Collector	Km	114	66	Good
Local	Km	135	40	Good
Sum		**1807**	**277**	Fair
Cobble stone	Km	147		
Gravel	Km	1777		
Total Road Length	**Km**	**3731**		

Source: Addis Ababa city Roads Authority, January 2012 (ASRAT, 2015)

2.1. Organization of the paper

This research is organized in five Chapters. The first part of this chapter is **introduction:** this part tries to give a general review of the project, statement of the problem, objective of the study, relevance of the study and formulate research question. **Chapter II** Describes the pedestrian nodes, Historic pedestrian construction of walks design and safety, Improving the visibility of pedestrian, Case study's, clearly shows the pedestrian footway, the accessibility of the standards in design and it explains various ideas which are related to the topic from different literatures like books, magazines, and thesis papers. **Chapter III** give researched data on contextualized level. It also analyzes different case studies, data type and data source from abroad and in Addis Ababa. **Chapter VI** in this part all the researched data will be summarized to recommend on them**.** **Chapter V** discusses the results of the absorbed problems and gives Conclusion and Recommendation.

Chapter Three: Research Design, Methodology, and Process

3.1 Study areas

The city of Addis Ababa was one of the fast expanding cities in the country and presently covers an area of about 540km^2 of which 18.2 km^2 are rural (AACC, 2016). Addis Ababa was established as the capital city of Ethiopia in 1886 and has grown to become the largest urban and commercial center in the country, hosting a population of 3,384,569 according to the 2007 population census with annual growth rate of 3.8%. It was located in the central part of the country surrounded by mountains such as Mt. Enteto in the north (3199m above sea level), Mt. Wochacha in the west (3385m above sea level), Mt. fur (2839m above sea level in the southwest and Mt. Yarer (3100 above sea level in the southeast (UNEP, 2003); at the edge of the Ethiopian Rift with its rivers flowing from north to south. Addis Ababa is the seat of the African Union and other many international organizations.

The selected study area was located at the center of Addis Ababa which was at the center of roundabout of Megenagna. The place can serve thousands of peoples per a day and it was the intersection of bole, Aratkillo, Hayahulet, Kotebe and Ayat and other sub roads (refer figure 3.1).

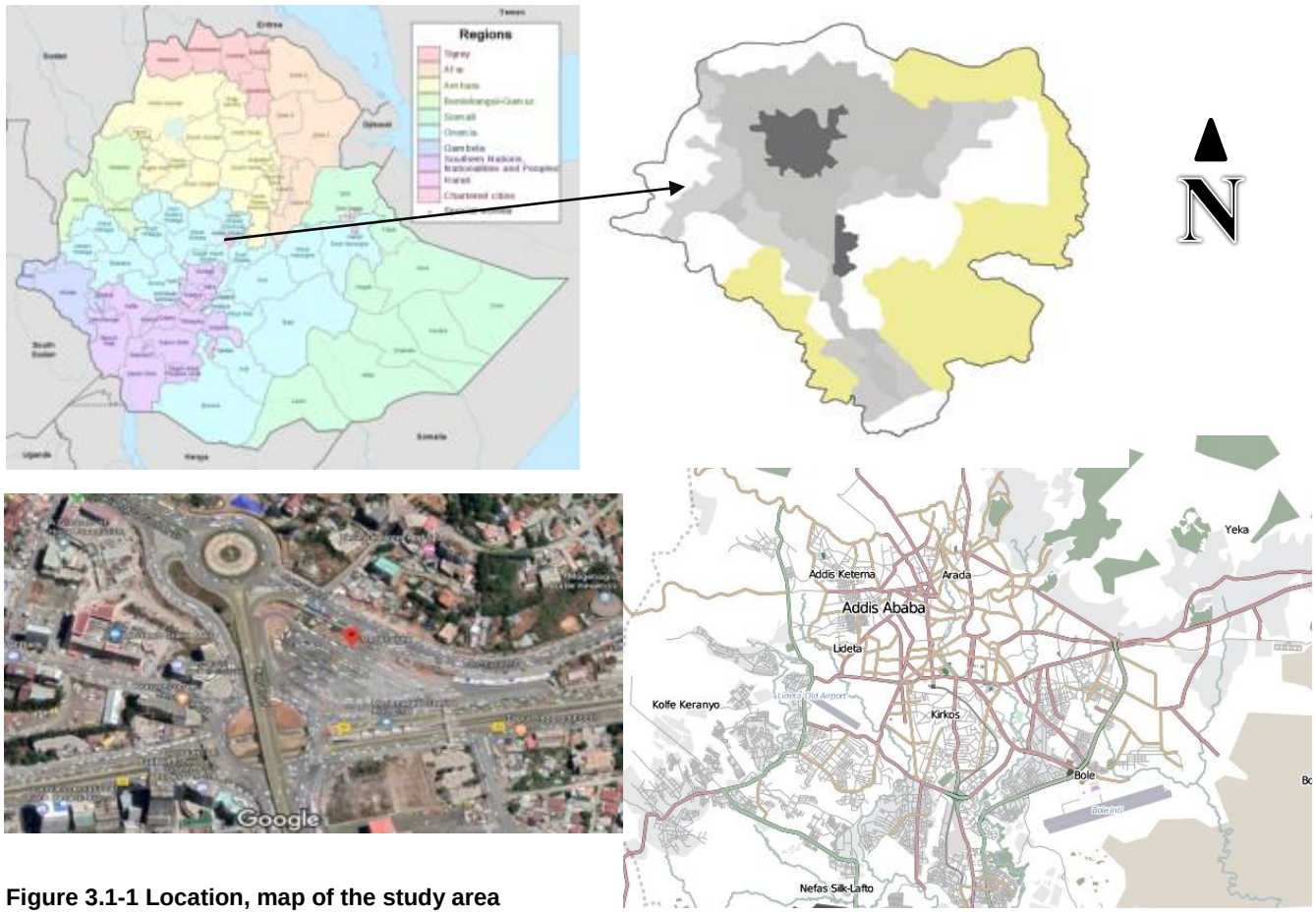


Figure 3.1-1 Location, map of the study area

3.2 Data types

This study employed a mix of quantitative and qualitative data types. The qualitative data included those data which was collected from visually impaired persons, traffic management office, Addis Ababa City Urban Planning institute and Addis Ababa transport authority. The quantitative data refers those data which can be measured in terms of numerical values such as the size and volume of street crossings in the study area.

The Qualitative research approach related to quality or kind including attitudes, behavior, and experiences. Quantitative research was based on the measurement of quantity or amount that generates statistics. In the case of this research, the study used the two approaches, simultaneously because of the availability of data. Thus, in this study both qualitative and quantitative was known as triangulations were implemented by the study to strengthen the research in different perspectives.

3.3 Data sources

The present study was dependent on both primary and secondary data. The primary data was collected from visually impaired persons, traffic management office, and Addis Ababa transport authority. Conversely, the secondary data would be collected from documents, reports and published materials (e.g. articles, books).

3.4 Data collection methods

3.4.1 Primary data source and collection method

The primary data was collected from site survey responded by sample pedestrians and directly be collected by interview, direct observation, to understand the perception of pedestrian on the street from different perspective. Applications of measurement were used by meter. All the methods used to collect data, identify the problems, and generate finding. These include direct observation, Photograph, Interview: formal, informal, Questioner: residents, administrative body, and friendly approach informal discussions.

Figure: 3.34-1: Image taken around Autobustera pedestrian walk way and zebra

Figure: 3.34-2: Interviewing voluntary full and half blind persons

3.4.2 Secondary Data Sources and collection method

The secondary data was collected from magazines, journals, reports, official documents, plans published and un-published sources from different institution including AACRA, A.A. city administration planning office, and Addis Ababa transport authority also carried out in this study. These might include Books, related researches and different related to the target group issues. Demographically the population densities of Addis Ababa/Ethiopia were about 4,794,000 out of 114,963,588 and from the total population of Ethiopia1.6% of them were visually impaired.

3.5 Sampling techniques

In this research case study method was used because of the presence of many roundabouts and people dominated Megenagna, Mexico, Piazza, Merkato and perception of pedestrian toward the pedestrian. it was very difficult to make a depth analysis on all pedestrians a case study was an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between object of study and context were not clearly evident it relies on multiple sources of evidence. So, this methodology was appropriate to investigate the recently happening problems in our daily life with support of large evidences, it makes it fit with case of study.

- Google maps and satellite maps
- Existing base maps, structural maps,
- Arial photos of different periods including current situation and sketches

To undertake this study appropriate technique used to improve accuracy of research findings. In order to do that simple random sampling from probability sampling were used.

The techniques applied to collect the data were only the interview. So that, data must be collected from Ethiopian visually impaired association (EVIA) and other related institutions including school a total population of 71 VIS the study has selected 12 samples of which 6 are males and the reset females. Additional 12 non-visually population samples will represent for the study.

3.6 Data Analysis and Interpretation

The primary and secondary data were organized, analyzed, and interpreted into their representative categories so as to come up with logical results. In dealing

with the qualitative analysis based on the evidence collected from the different sources made to be carefully understandable and interpreted in order to use it together with the quantitative data. In general, the data collected would be analyzed using different parameters developed by researchers from perspective of basic need of pedestrian. Then those parameters applied by integrating with computer software including GIS, MS-Excel, and AutoCAD.

3.7 **Data Presentation**

The analyzed data were presented using statistical tools including tables, graphs, charts, and percentages.

3.8 Research Design Diagram

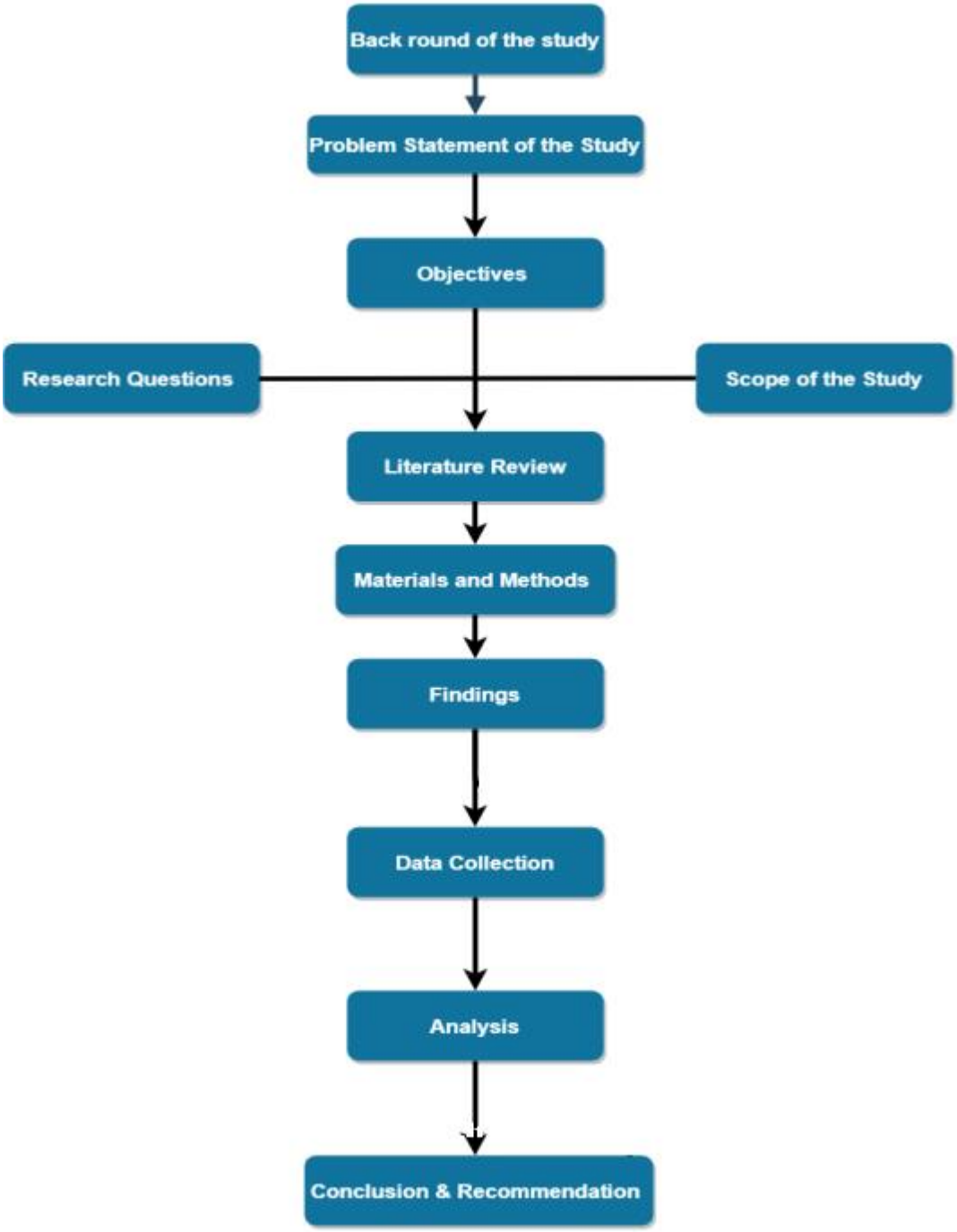


Figure 3.8-1: Research Diagram

Chapter Four: Data Analysis, Findings and Discussion

4. Introduction

The major problematic areas for the impaired persons were mainly around their working areas, school, and population dense areas, and the problems in these areas are mainly caused when they were crossing the streets. In the case of Addis Ababa, the major problematic areas where around sadist kilo, Megenagna, Aratkillo, paisa, Mexico and Afincho Ber and these areas were the major sites to get education, office, and other necessary things for their life. In these areas the major cause for the problem was a high traffic conjunction of people and cars.

The problems of Poor Street crossing areas persons have endless problems on the visually impaired persons and it need detail analysis on the street crossing areas to minimize these problems and give good solution for these parts of society.

No of persons	**Age group**	**Work Status**	**Blindness**
7	25 - 30	5 students, 2 job seekers	Fully impaired
8	31-35	4 worker, 4 job seekers	Fully impaired
5	36-40	4 worker, 4 job seekers	Fully impaired
3	41-45	4 worker, 4 job seekers	Fully impaired
1	45-50	V. Manager	Fully impaired

I. Interview for Visually Impaired Person

- How was your ability in using the streets?

Answers: -

- While crossing the street they use a Wight cane, after 2 or 3 years the road authority builds the pedestrian walk so, we use the side stones to senses
- It is difficult for the persons to use this white cane unless they took a course about the use of white cane

- What are the barriers you faced on street crossing in relation with your visual blindness?

- We just use common sense if there are no peoples around, we left the cane and above 1.5 meter this time the cars movement stops for us to cross the roads because we took course about how to use the white cane.
- In some pedestrian walking way, there are special stones (tiles) I can't say they are enough to walk but they are help full.
- Even if there are special walking way built by the road authority the other Governmental or non-governmental body's dig the pedestrian walking, because of this we are unable to use the walk way and it is not safe for use, I have a friend who lost his right leg by this cause.

- Are the pedestrian walk ways and streets crossing points convenient for you?

  a. If yes, where / which place, area

  b. If no, is it from lack of quality of design or construction road infrastructure problem?

- No, there are no signs and sounds that left for us at all it is impossible to go to the market like Merkato by our self. in some country they have trained dogs, GPS, white canes which have sensor,
- No, because they always left the holes uncovered
- They left construction materials like sand, stone, and selected material on the pedestrian walking way.

- In the moment you are going to cross the road, is there any street element that helps you to give you a direction on street crossing points?

  a. If yes, where/which place, area

  b. If no, what should be present / installed?

  - Yes, there are for example in 4 kilos around CBE it was good to walk for us but now a day there are street marketing, trees and dust been we collapse every day and jump into the road holes which was dig for utilities

  - In general, there is no lesson about how blind persons cross the street for the drivers

- What are the fundamental problems on pedestrian walk ways and street crossing?

- There is no sign

- There are no sounds
- The pedestrian walking way not sensible by lower foot
- Pols of electric city
- Holes of the Ethiopian water association
- Pols of ETHIO-telecom
- Peoples park on the tactile paving way
- There are .5 m concert pols

- How do you know the street is free from accident / barriers before you going to cross the road?
  - We can not to be sure about the rode safe to cross.
  - If there are persons around, I ask them and cross
  - Listening for the Right Moment and Staying the Course
  - Orientation and Mobility training
- What type of street crossing point is comfortable you recommend?
  - First, we should train or lecture the peoples
  - Trained dogs
  - Smart cane (it has a sensor on it)
  - There trees are not planted in a street line
  - Sensible white stripes of crosswalks should be built for us.
  - Tactile clue in every white stripes of crosswalks

4.1 The barriers of visually impaired persons during crossing the streets

Our country Ethiopia have high amount of visually impaired persons due to natural and man-made factors. The visually impaired persons face barriers during crossing of streets and the barriers they face were due to un leveled street, the absence of street sign, street marketing, car parking on the pedestrian walk way, difficulty of sensing white stripes, pedestrian material, overpopulation, and car crowd. The problems of crossing of street for visually impaired persons needs architectural and traffic result to give long term and futuristic solution. Based on the data collected through observation some of the major barriers for visually impaired persons while they are crossing the streets in the study are presented in sections below:

Figure 4.1-1 the challenges visually impaired person face on pedestrian walk way

4.1.1. Street levels and ramping

The streets in the city of Addis Ababa have very poor leveling to use by every person due to high contour, poor construction and weak design before construction. The selected areas for the study were highly populated and have high traffic conjunction of cars. As shown in Figure 4.1, the case sites paisa, Aratkillo / Sidistkilo, Autobus tera, Megenagna and Mexico were the densest by people and car with unleveled street that create uncomfortable space for the users.

Figure 4.1-2 pedestrian walk way leveling problem and Street marketing impact

Figure 4.1-3: The street leveling problems impact

The street unleveled and absence of ramps cause the visually impaired persons to face physical and psychological problems and making the streets comfortable for walkway in a well designed for all people make our town beauty, comfortable and sustainable for living.

4.1.2. Street sign and furniture

The unprofessional design of streets makes the streets to use in a bad way. Using of the street walkways and sign together was the cause the street to high traffic conjunction and physical damages. Most of the street signals were used together and this make the visual and visually impaired persons to the unexpected physical problems (refer table 4.2).

Figure 4.1.2-1: the street signal physical and psychological impacts in Piassa and around 6kilo

The street sign needs great design consideration to serve all the society and well locating the street signals at appropriate location that protect the visual and visual impaired persons from the damages. According to studies the Street designs must need professional analysis before construction and locating of street sign and furniture. Designing the street signal at the very corner of the street has advantage of aesthetical and functional output for the city and people.

4.1.3. Pedestrian material, design and construction

The most common pedestrian construction materials were concrete, ceramics tiles, and cobblestones. Each of the construction materials has their own advantage and disadvantage during the construction and use. The selections of appropriate construction material for pedestrian were the basic thing for the professionals who participate in the street construction industry. Locating the

street signals and furniture at appropriate place is the basic in designing pedestrians for the users. In our country Ethiopia the design and construction couldn't match to each other due to labor, material availability, and corruption/managements but if the design and construction is done collaboratively the problems of these street problems were solved in small amount. As shown in figure 4.3 the weak construction material, design and construction cause the streets to the problems of cracked streets, poor location of street sign and furniture, nonfunctional streets, and traffic problems.

Figure 4.1.3-1: The problems due to weak design and construction of street

From this analysis and literatures, the major problems for durability and functionality of pedestrians were weak managements during construction and professionalism to select appropriate materials. To solve the problems of street pedestrian using appropriate materials according to the designs were the outstanding solution. Beside this the designers didn't consider the disables during designing stage.

4.1.4. Population density

The population densities of many cities in Ethiopia were increasing incredible way due to high availability of infrastructure in towns. In Addis Ababa the population density is more than million and the pedestrians design for this population is very low to serve them due to weak design. To serve this dense population widening the street, design the signals at appropriate location, rejecting unnecessary street furniture and considering the visually impaired persons were the basic criteria. Majority of the streets in Ethiopia didn't consider the high population density and

visually impaired person mostly at the high populated areas of the city the peoples are walking on the tactile paving way which is especially made for the physically impaired persons at a time they collide with the persons, they encountered difficulties while crossing the streets, most pedestrians push the physically impaired persons unintentionally while rushing to cross the streets (refer figure 4.4).

Figure 4.1.4-1: High population density cause the visually impaired person for problems

4.1.5. Street side barriers

Streets that were used by visually impaired persons were surrounded by many factors such as fences, street signals, automobiles, street boundaries, electric lines, ditches, and street furniture. These environments have impacts on the activity that the users perform while using the paths. The wrong way of design and use of these street side environments causes the visual and visual impaired persons for great physical and physiological problems that directly affect their life and productivity. As shown in figure 4.5, the pedestrians were not comfortable for the visually impaired persons due to the surrounding environments.

Figure 4.1.5-1: Street side enviroments impacts on the users

From the literature and site observation of the reality, the pedestrians were used for street market, parking, street signal and fenced greenery. Due to the shared pedestrians for different purpose the users especially the visually impaired persons were in high risk to perform their daily activity.

4.2 The major problem at street crossing

4.2.1. The analysis of most populated areas of the town

4.2.1.1. Merkato

Merkato is the old and trading center of Addis Ababa city with the highly populated areas in the city. In this area majority of the population comes from different parts of the country and towns of Addis Ababa that directed to different direction of the town. Merkato were highly dense areas that make the pedestrians more than its capacity.

Figure 4.2-1: Merkato partial site map where major marketing activities are done

4.2.1.2. Piazza

Piazza is the highly populated commercial and recreational center in Addis Ababa city that serve multipurpose that act as the center of the city.

Figure 4.2-2: The paisa around St. George church areas top view

4.2.1.3. Aratkillo and Sidistkilo

Aratkillo and Sidistkilo were the major place for educational, administration and other multiple functions. In the area between Aratkillo and Sidistkilo there was the visually impaired person's school. The students use the shared streets with the visual persons and cars that affect their life greatly. In the area there is also traffic access to paisa, Shiromeda, Ferensay, Megenagna and palace. These over dose traffic conjunction and high amount of student from AAU, colleges and other primary and secondary schools make the area between Aratkillo and Sidistkilo difficult for the traffic.

Figure 4.2-3: Ethiopian National Association of Blind around sadist kilo near to Yekatit 12 Hospital

4.2.1.4. Megenagna

Megenagna is the also one of the populated districts of Addis Ababa city that found at the northeast and give access to Aratkillo, Mexico, Kotebe, Ayat, and saris/bole. It is high connection to many areas of the town that have complex street crossing. In this area there is city tax/bus station that cover large area and difficult to access.

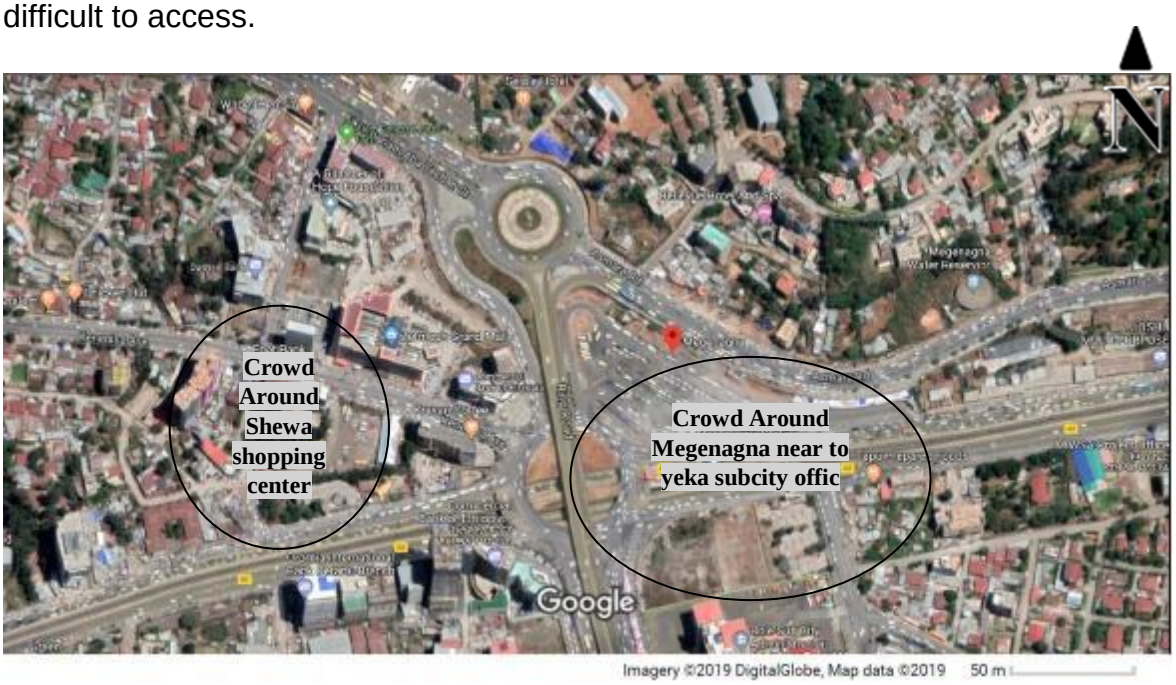


Figure 4.2-4: Megenagna area nodes where complex crossing points are existing

4.2.1.5. Mexico

Mexico is one of the central parts of Addis Ababa city that have high population density with access for many parts of the town such as leg hare, Kera, Lideta, Jemo, Meskel square and Merkato. Like other areas in Mexico the access is high due to its access to many areas and it need design to solve the problems of high traffic problems.

Figure 4.2-5: Mexico area where many pedestrian activities are existing

4.3.1. Causes of problems for visually impaired person during street crossing

1) Overpopulation

The population of Addis Ababa is very high compared to many cities in Ethiopia and the street designs to control dangers related to all people during crossing the road is not matched to the population density. From the extremely populated areas of Addis Ababa city, Megenagna can serve too much peoples per day as it is the center to access many parts of the town.

The square of Megenagna is crossed by many thousands of people and cars that make the area more complex to use or cross the streets. In this area the pedestrians were not comfortable to serve these large people due to the pedestrian is very narrow, broken, no over/under cross ways, high traffic, and street markets. In addition to the above the streets were not designed for the visually impaired person that the visual and visual impaired person can use the same pedestrian by sharing with the automobiles.

In any cities in the world, if cities were not design according the dense population, the visually impaired persons were easily affected. As shown in figure **4.5**, the population density of Megenagna was high that leads all the people face problems.

Figure 4.2-6: high population density of Megenagna areas

2) Cars/vehicles

The number of cars crossing the square of Megenagna is very high as it shared the streets with peoples. In presence of tax and town bus station is the major case

for the traffic conjunction of the area that makes it more difficult for the users. In addition to the town bus and taxes, at the place is the center for many parts of the city, there is extreme amount of private and government cars that use/ cross Megenagna.

To make a clear and comfortable street crossing for both visual and visual impaired person the street needs a design that solves or minimizes the traffic problems. As the area was in a high traffic area it needs underground tunnels or over path bridges after great analysis on the position of the areas. As shown on figure 44, the cars around Megenagna were very high and compete with the peoples to cross the roads that take long time to cross the squares.

Figure 4.2-7 the Fatigue of people with car while crossing the streets

3) Street material

The roads in Megenagna square and surrounding area were constructing from material such as concrete, tiles, asphalt, and cobblestone. The area needs well designed street to solve this traffic problem of the site. The street materials should be strong enough to resist the loads without any crack and provide the comfort for the users. The type of street construction material has impacts on the users and the material type for example in Ethiopia the tactile paving (yellow tile) helps the visually impaired persons to identify in small amount they were in the right way even though it is researched for particular users there are on site construction problems that the visually impaired persons while walking faces such as un covered man holes, miss placed electric pols, miss placed dry disposal bins and plants putted on the pedestrian walk way.(**refer figure 4.8**). In order not to face those obstacles they choose to use a car way / asphalt even to walk not only in the moment they want to cross the street.

Figure 4.2-8: The street materials that most commonly used for the impaired persons

4) Street side sign, furniture and vegetation

The streets have complex elements that were not arranged or designed to solve the problems. These street environments can cause physical problems on the visually impaired persons. Even if the street sign, furniture, and vegetation are the basic element for any towns the miss design of this element can disturb the towns aesthetically and functionally (refer figure 4.9).

Figure 4.2-9: The views of street side furniture, sign, and vegetation

5) Street venders

Addis Ababa is well known by the illegal street markets especially at the place known by their high population density. Street based market can cover very large amount of marketing on the path used for footing. Due to such high amount of street-based market many problems were happened on the user. The street-based marketing can disturb both the visual and visually impaired person by displaying their objects on the pathway, high sound of calling for buying, and people's attention on the vender. As shown on figure 4.10, the majority of Addis Ababa streets around the main populated areas were hold by the street marketing and it was difficult for the users to perform their daily life activity.

Figure 4.2-10: The street-based marketing around the squares of Piassa

4.3. Protection of visual impaired persons from dangers

Visually impaired persons face endless problems of physical, psychological, economic, and social due to the miss design and use of streets. In Ethiopia and most parts of the world streets were not designed by the consideration of visual impaired persons. The absence of considering the visual impaired person causes endless loss of human life and materials per year. The major problems were occurred during the crossing of streets especially around the squares or transition of roads.

In the design and construction of pedestrians for visually impaired person, rejecting any extra and unnecessary elements was the basic thing that any professional and government body consider to solve the problems come on them. As discussed above, all the basic elements around the streets were designed and constructed by culture rather than based on the science and the need the street provide.

According to this study and literatures, the best solution to protect the problems of the visual impaired and visual persons redesign of street side environment and design of street crossing underground tunnel or over ground bridge have endless advantage. But the construction of such street crossing structure could need great analysis of adaptability, functionality, economy, and aesthetical value. If the streets crossing structures are well design besides serving the users it was used as the tourism center.

4.4. Problems linked with poor street crossings for the visually impaired persons

4.4.1. Major problems during street crossing and its consequence

I. Physical damage

Visually impaired person's needs special support to perform their daily activity to protect from physical damage face them. Almost all the visually impaired persons have additional physical damage due to the uncomfortable living and working environments.

Due to uncomfortable and unfair design of street pedestrians and crossing at least all of the visually impaired persons face the physical damages. The major causes of the physical problem for the visually impaired persons were street furniture, vegetation, street sign, overpopulation, cars, and uncomfortable roads. In addition to the above the rule and regulation on the use and design of streets to serve the visually impaired person were not respected and done well.

The physical problems that the visually impaired persons face was mainly from the car accident and street sign during they perform their daily activity but if the designs were done on the street and street crossing this problem should be minimized to the extreme. As shown in figure 4.16 the visually impaired person faces endless physical problem that need further analysis.

Figure 4.4-1: the physical damages of visually impaired person

II. Psychological problem

The uncomfortable living and working environment make the visually impaired persons to face the endless psychological problem that they were always between living and not living. In crossing of streets, the visually impaired person 100%

gives their live for death due to the uncomfortable and no design on crossing of street. The lives of visually impaired person were not guaranteed and superiority in crossing and using of the street were not designed according to the needs of these people.

Almost all the visually impaired persons were in a psychological problem and minimizing this psychological problem was the mandatory of all people due to uncomfortable living and working spaces. Minimizing the uncomfortable space helps the visually impaired to be more productive as it adds full confidence for them to perform their daily activity.

III. Economic problems

Many causes such as physical and psychological problem, visually impaired, uncomfortable living, and working environment and unacceptability in society were the major cause for economic problems and they haven't access to any economic activity to support their self and the society.

In the reality the visually and physically impaired person were not able to cover their daily food and yearly cloths. The main causes for the economic weakness of the impaired persons were mainly the uncomfortable working and living environment.

Minimizing the impacts and preparing appropriate living and working environment helps the visually impaired person to perform their life activity. In Addis Ababa Majority of the visually impaired persons face great physical problems while crossing streets as the streets were not done in a comfortable and accessible by considering those impaired persons.

IV. Social problems

The problems of the visually impaired person were also the problems of all the society. All the impaired persons were not from single group or society but they were from all the society of the country and when the visually impaired persons were affected the whole society of the country were also affected. Minimizing and supporting the visually impaired person was also helping the whole society.

In Ethiopia the impaired persons were separated and give inferiority from society and they consider the impaired person to be the productive. The impaired was not inability and developing the acceptance of the impaired person was increased by

providing a comfortable working and living space. If the working and living space for the visually impaired person were done well, they can perform every activity and the society and government should prepare the appropriate space and should consider the impaired person as the parts of the society. As shown on Figure 4.19. The society rejects the visually and physically impaired person and considers them as the incomplete person.

Figure 4.4-2: the isolation of the visually impaired person from the society

The social interaction greatly increased when all the living and working environment for the visually impaired person is well designed. Designing of the street and street crossing in a comfortable way helps the society to create good relationship.

4.4.1.1. Current practice of street crossing for visually impaired person

Currently, the number of populations in Addis Ababa is extremely high and these increase in the population leads to high traffic conjunction. The increment in population density of Addis Ababa leads to high problems on the movements of these visually impaired people in multidimensional and the other is that the visual persons were get into a mandatory to share the paths with the impaired persons.

The street-based venders were also increased with endless amount in a large number and these vender shares the impaired person's path. When the paths for impaired person was used for other purpose the visually impaired person miss their way and face problems. In some areas of highway streets in Addis Ababa the

street crossing were design but it didn't consider the visually and physically impaired persons and had weak design in considering space (refer figure 4.18).

Figure 4.4-3: the highways street crossing in Addis Ababa

Beside the population density and street vender, the amount of automobile was very high and it was increasing extremely in the future that cause for the uncomfortable movements for both visual and visually impaired persons. The increase in the number of cars couldn't stop and it need best solution to minimize the problems come on the impaired person. The major problems related to car movement was that the roads were not well designed and functioned due to weak design, corruption, material usage, and driver's problem.

In concluding the above according to the literature and this study, the amount of the population, street vender and cars would be increased in endless way but giving solutions for these problems is the responsibility of government. Designing the best place areas for the street vender, placing the street elements at street side and using appropriate construction material bring good movement ways for the society. In the other way the squares were highly populated and designing the best street crossing bridges or underground tunnels will help both the visual and visually impaired persons.

4.4.1.2. Visually impaired person Challenge during street crossing

In Addis Ababa city all the pedestrian users face challenges during go on the pedestrian and crossing the streets. The major causes of the challenges were the overpopulation street crossing at short time and mostly they share the road with cars. Most of the time the society share the pedestrian paths the visually impaired person and they lost their freedom to go and face dangers physical problem.

In Ethiopia the government consideration for the impaired person was very weak. As the amount of the visually impaired person was high and they have human right to be served and use their environment without any restriction. In their use of common public space they have rare interface due to uncomfortable service areas. Designing the spaces for the visually and physically impaired person was the mandatory of the government unless they face endless challenges (refer figure 4.19).

In the street crossing of visually impaired person the streets were designed by using different street crossing philosophy mainly using underground tunnel and over crossing bridges. The designing of street crossing using bridge and tunnel help the sites not only as the street crossing but also used as the tourism center and recreational purpose that add the aesthetical value of the area.

4.4.1.3. Creating of dangers free streets crossing

Most streets in Addis Ababa was in dangers for visually impaired persons. The societies share the street with cars during crossing and they face great impact. In creating of dangers free street, all the solution was done by professional designer in collaboration with the science and impaired person. The best ways to minimize dangers during street crossing were mainly using tunnel and bridges.

Majority of developed country, the street for car, bicycle, walkway and others were separated and did not interfere with each other that help them to control the problems that affect the visually impaired persons. Our countries Ethiopia should take references from the developed countries and gives appropriate solution for the problems that visually impaired persons face on street.

5. Chapter Five: Conclusion and Recommendation

5.1 Conclusion

The visually impaired persons face many problems due to the fact that they lost their visual capacity as the environment they work and live were not designed according to the impaired persons. The infrastructural barriers that cause problems on the impaired person rise from the street signs, street side furniture, vegetation, and the design consideration for impaired person. Locating the street and street side elements at appropriate place minimize the problems that the impaired persons face. Even if the problems on street and street side exist the problem of impaired person was high during street crossing and the majority of the problems of the impaired person were during street crossing and the need of designing the street crossing bridges and tunnels could maximize the functionality and recreational tourism of the area. Thus if the streets crossing infrastructure were designed and constructed in the way that it consider the impaired persons accessibility the traffic problem were minimized extremely.

The majority of roundabouts or squares in Addis Ababa city are highly populated to use and the users face endless problems related to these dense traffic areas of the city. Almost in all the squares of Addis Ababa, the community and the automobiles can share the streets and this sharing on the street for both car and people cause to endless problems. On the major squares of Ethiopia, the problems that the visually impaired persons face were very high due to the high population density, cars, street furniture, street signals, vegetation, and the design and construction materials used. To minimize the problems on the visual and visually impaired person the well corporation of the street furniture and designing the street crossing tunnel and bridge were needed by taking the design philosophy from the well designed and developed city of the world as the case study.

The problems of under designed streets and street crossing in Ethiopia especially in the selected area results in the problems of physical, psychological, economic and social problems. Designing the appropriate street and street crossing bridge and tunnels would minimize extremely the problems all human being and the well-designed street and street crossing helps the visually impaired persons from damages. Currently the population density of Addis Ababa were increasing extremely and the problems related to the street crossing would be need solutions

related to designing street crossing tunnel and bridges that minimize the problems by taking the design from other cities of the other country as majority of the problems were during street crossing especially in the areas of highly populated and traffic squares of Addis Ababa. Thus, designing the street and street crossing for main nodes can minimize the problems of the visually impaired person and it is used as the base to design the street crossing bridges/tunnel for other street and squares of Addis Ababa and other cities of Ethiopia.

5.2 Recommendations

Based on the finding, and conclusion of street and street crossing of the visually impaired person, the following recommendations were drawn for the following concerned bodies.

In this world the designers play great role in the functioning of the spaces for the users. The concerned persons in designer part were architects, urban planner, landscape designer, infrastructure designer, and structural engineers. If all these bodies were participating in cooperation the design and construction of the street and street crossing bridge could be successfully functioned for the visually and physically impaired persons. Following the science and technology of the street crossing and design in a futuristic way was the mandatory of all professionals.

Government was the most influential body in directing, serving, and managing of the society. As the visually impaired person covers extremely maximum number in the city and need special treatments compared to the visual person providing appropriate solution for them by standing with the concerned body minimize the problems that the impaired person face and make them more productive.

Contractors were the most influential company in the construction industry. Most of the time majorities of the designs were done in the best way but in the reality they design and constructed element/structure was not the same. In the design and construction of such a street crossing infrastructure for the visually impaired person were the common benefits of all the society in the city. The contractors participating in such construction of infrastructure for the impaired people were the best and endless advantage for the society and economy of the country.

The nongovernmental organization especially those work on the human right and safety must participating and budgeting on the plan, design, and construction of

infrastructure for the visually impaired person. As making safe life for the visually impaired person was the advantage of all the society in political, social, and economic views, the non-governmental organization plays endless roles to serve the society in this way. In our country Ethiopia the interferences of the nongovernmental organizations in to the street and street crossing infrastructure design and construction for the impaired person were very low and it need great initiation for the success of such projects.

The societies of the country were the key player in solving the problems of 1.6% of the visually impaired person of the country people. The community that the visually impaired people live in were the best solution giver for the problems that the visually impaired person face due to the fact that the community perform their daily activity with the impaired person.

The capitalist in Ethiopia and world had full responsibility in serving the visually impaired persons by participating in providing the solutions in the design and construction of infrastructure during crossing and using of streets. The capitals were needed to provide the best solution for the society in budgeting capitals for the construction of the infrastructures by standing with the governmental and nongovernmental organization.

Separating the street of car and person helps to minimize the problems occurred on the society and economy of the country. These separation roads of car and people can be done by providing the necessary bridging and tunneling strategy that consider the visually impaired persons. The cost for the construction of the tunnel and bridge were high the solution it provides in serving the society life was endless product.

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Appendix 1: Publishable Manuscript

This research is submitted to EiABC, AAU in fulfillment of Masters of Science in Architectural Engineering entitled:

Street Crossing Infrastructure for the Disabled Persons in Addis Ababa: The Case of Visually Impaired Persons

Hana Bulto Dida, Ethiopian institute of Architecture, Building Construction and City development, Addis Ababa University Dec 2021 G.C.

Abstract

Street crossing infrastructure is the most common issue worldwide for disability as it is the basic space and needs treatment to fully function particularly for visually impaired people. In the case of developing countries, the street crossing barriers are numerous; that the disable person needs the special consideration in every design and construction of engineering structure. The research aims to give a resource for the researcher's as primary information for further investigation about the problem. This research would attempt to answer the following questions: What were the existing and anticipated problems of visually impaired peoples on street crossing? What were Crosswalk problems for visually impaired persons? And Where does delivering the pedestrian routes are necessary? How could reduce the existing street crossing problem for the target group? This study investigated in survey, historical analysis, case studies and uses the research case study for the qualitative approach as a strategy for these proposals. The findings of the study reveal on the major squares of Addis Ababa (A.A) the problems that the visually impaired persons face was very high due to the high population density, cars, street furniture, street signals, vegetation, and the design and construction materials used. Therefore to minimize the problems on the visual and visually impaired person the well corporation of the street furniture and designing the street crossing tunnel and bridge were needed by taking the design philosophy from the well designed and developed city of the world.

Keywords: *visually impaired, street crossing*

Introduction

The major and clear problems seen in the selected sites are; overcrowding along narrow footpaths and difficulties in crossing the road at ground level, Poor signage, and barriers to pedestrian movement. An unwelcoming environment for the physically disabled, Safety problems in relation to traffic and in areas those are poorly lit or badly maintained and Lack of free and walk able pedestrian paths especially for disable part of the society, Lack of proper finishing of road construction quality and urban elements such as Open Manhole, sewage lines, ditches and related. The quality of pedestrian walk way fails to make up for the poverty and unappealing atmosphere.

The number of disable people in Addis Ababa city as per the CSA 2010 report estimated at 32,630 (CSA, 2010). Most of the pedestrian routes in Addis Ababa city lack a proper infrastructure for people with disability, for example, the major challenge is at white stripes crossings where the roads have a continuous median, which is a serious problem for disable especially for visually impaired persons.

To date, there has been little agreement on presence of unfinished pedestrian walkways in the city is becoming a dangerous for disabled people mobility due to the presence of uncovered manholes, unpaved surface and poor linkage between roads of different hierarchy, damped soils and stones and at the street crossing points there are related problems faces them because of the lack of proper street infrastructure i.e. misplaced plants, dry disposal bins, TELE and ELPHA poles.

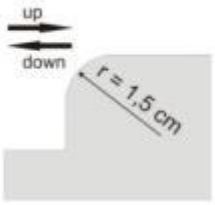
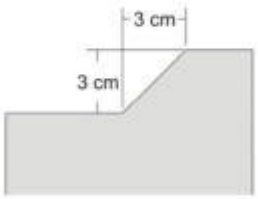
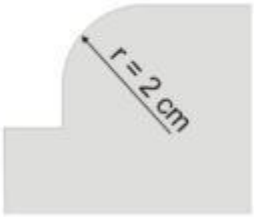
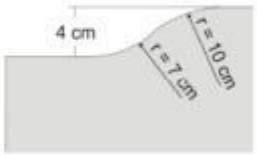
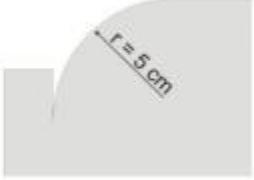
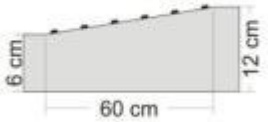
The general objective of this study was to investigate the existing and anticipated street crossing infrastructure problems and design improved street crossings for visually impaired persons in Addis Ababa. This study focused only on street crossings problem encountered by the visually impaired persons. The other groups of disables were not considered in this study. The issue of visually impaired persons has recently grown in importance. Moreover, spatially this study was conducted in Addis Ababa with a special emphasis on Merkato, Piassa, Megenagna, Aratkillo and Sidistkilo localities which might be representative to the other parts of Addis Ababa.

Literature Review

Numerous studies have argued that design of roundabouts special thought should be given to the movement of pedestrians. Roundabout is at least as safe for pedestrian because pedestrians are able to cross one direction of traffic at a time by staging on the splitter island. However, pedestrian must cross with care because unlike traffic signals roundabout do not give positive priority to pedestrian over through traffic movement. Pedestrian crossings, sometimes referred to as crosswalks, may be found at intersections or along road stretches. Marked crossings are designated by markings on the road, commonly white stripes.

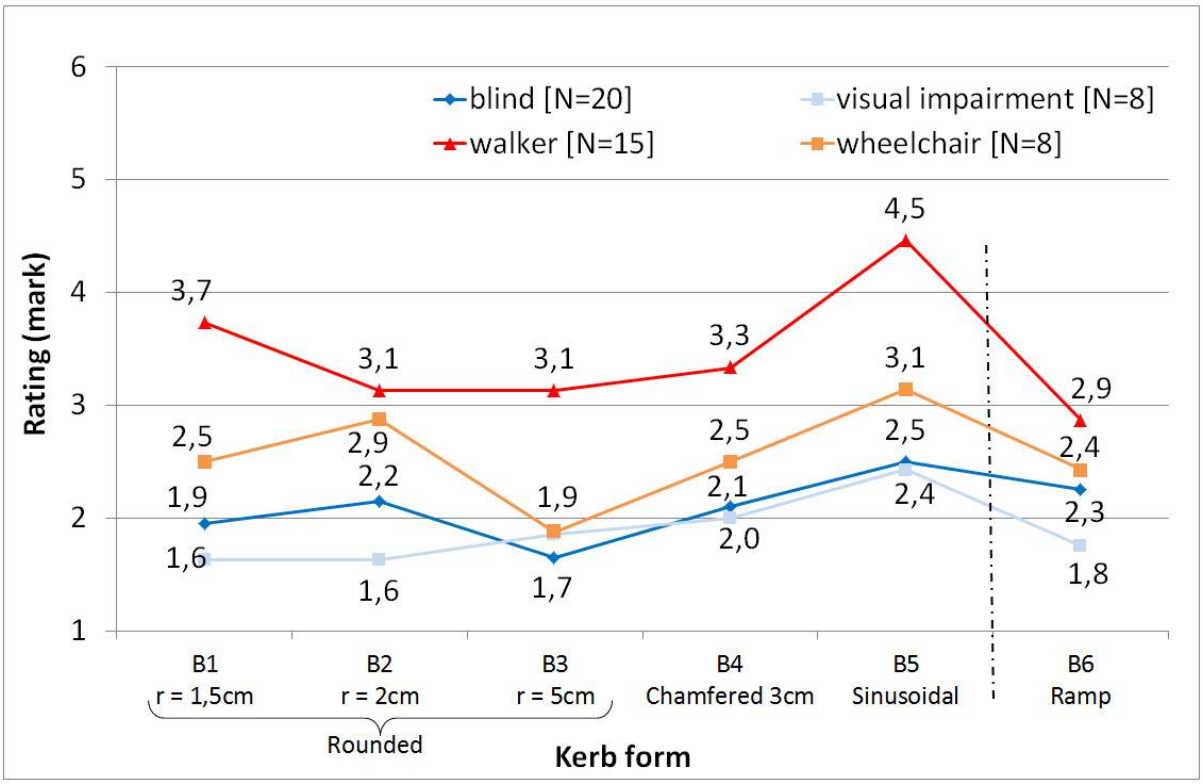
The research to date has tended to focus on high percentage of pedestrian collisions and deaths occur when lighting conditions are low. There are a number of engineering and behavioral measures that make pedestrians more visible to motorists, especially during dusk, dawn, and at night (Tulu et al., 2013).

Data from several studies have identified the oppositional requirements of all users; it is possible to build crossings with adjacent crossing areas with different kerbs heights.

Kerb	Principle	Kerb	Principle
B1 Rounded kerb (r = 1,5 cm)		**B4** Chamfered kerb (3 cm/3 cm, 45 degrees)	
B2 Rounded kerb (r = 2,0 cm)		**B5** Sinusoidal kerb	
B3 Rounded kerb (r = 5,0 cm)		**B6** Ramp	

Apart from this analysis with the support of the German Association for the Blind and Visually Impaired (DBSV), a survey was conducted of 1,384 blind and the

visually impaired people regarding their experiences with the mobility in street space in order to receive empirically substantiated statements of individual mobility and orientation of the blind and visually impaired in general as well as at crossings (dropped kerbs, tactile ground surface indicators) in particular.



Most studies of visually impaired persons have only been carried out on road safety in developed countries, as a considerable amount of research has been undertaken since the 1970s. Currently, road traffic crashes in developed countries show a declining trend due to ongoing investment in safety programs and countermeasures.

Methods

This study employed a mix of quantitative and qualitative data types. The qualitative data included those data which was collected from visually impaired persons, traffic management office, Addis Ababa City Urban Planning institute and Addis Ababa transport authority. This methodology has a number of advantages, such as data measured in terms of numerical values such as the size and volume of street crossings in the study area.

The primary data was collected from site survey responded by sample pedestrians and directly collected by interview, observation, to understand the perception of pedestrian on the street from different perspective the design of the questionnaire was informed by.

To increase the reliability of measures, all the methods used to collect data, identify the problems, and generate finding. These include direct observation, Photograph, Interview: formal, informal, questioner: residents, administrative body, social organization, and friendly approach informal discussions.

The secondary data was collected from official documents, plans published and un-published sources from different institution and Addis Ababa transport authority also carried out in this study. These might include Books, related researches and different related to the target group issues. Demographically the population densities of Addis Ababa/Ethiopia were about 4,794,000 out of 114,963,588 and from the total population of Ethiopia1.6% of them were visually impaired. In this study, the initial sample consisted of the presence of sample roundabout and people dominated in Megenagna, Mexico, Piazza, Merkato and perception of pedestrian toward the pedestrian.

The analysis was prepared according to the procedure outlined by an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between object of study and context were not clearly evident it relies on multiple sources of evidence. So, this methodology was appropriate to investigate the recently happening problems in our daily life with support of large evidences, it makes it fit with case of study. To undertake this study appropriate technique used to improve accuracy of research findings. In order to do that simple random sampling from probability sampling were used.

Results:

The major problematic areas for the impaired persons were mainly around their working areas, school, and population dense areas, and the problems in these areas are mainly caused when they were crossing the streets. In the case of Addis Ababa, the major problematic areas where around sadist kilo, Megenagna, Aratkillo, paisa, Mexico and Afincho Ber and these areas were the major sites to get education, office, and other necessary things for their life. In these areas the major cause for the problem was a high traffic conjunction of people and cars. The problems of Poor Street crossing areas on the visually impaired persons and it need detail analysis on the street crossing areas to minimize these problems and give good solution for these parts of society.

The barriers of visually impaired persons during crossing the streets in our country Ethiopia have high amount of visually impaired persons due to natural and man-made factors. The visually impaired persons face barriers during crossing of streets and the barriers they face were due to unleveled street, the absence of street sign, street marketing, car parking on the pedestrian walk way, difficulty of sensing white stripes, pedestrian material, overpopulation, and car crowd. The problems of crossing of street for visually impaired persons needs architectural and traffic result to give long term and futuristic solution. Based on the data collected through observation some of the major barriers for visually impaired persons while they are crossing the streets in the study are presented in sections below. Street levels and ramping in the city of Addis Ababa have very poor leveling to use by every person due to high contour, poor construction and weak design before construction. The selected areas for the study were highly populated and have high traffic conjunction of cars. The unprofessional design of streets makes the streets to use in a bad way. Using of the street walkways and sign together was the cause the street to high traffic conjunction and physical damages. Most of the street signals were used together and this make the visual and visually impaired persons to the unexpected physical problems.

(a) Pedestrian material, design and construction the most common pedestrian construction materials were concrete, ceramics tiles, and cobblestones. Each of the construction materials has their own advantage and disadvantage during the construction and use. The selections of appropriate construction material for pedestrian were the basic thing for the professionals who participate in the street construction industry. Locating the street signals and furniture at appropriate place is the basic in designing pedestrians for the users. In our country Ethiopia the design and construction couldn't match to each other due to labor, material availability, and corruption/managements but if the design and construction is done collaboratively the problems of these street problems were solved in small amount.

(b) Population densities of many cities in Ethiopia were increasing incredible way due to high availability of infrastructure in towns. In Addis Ababa the population density is more than million and the pedestrians design for this population is very low to serve them due to weak design. To serve this dense population widening the street, design the signals at appropriate location, rejecting unnecessary street furniture and considering the visually impaired persons were the basic criteria. Majority of the streets in Ethiopia didn't consider the high population density and visually impaired person mostly at the high populated areas of the city the peoples are walking on the tactile paving way which is especially made for the physically impaired persons at a time they collide with the persons, they encountered difficulties while crossing the streets, most pedestrians push the physically impaired persons unintentionally while rushing to cross the streets

(c) Street side barriers that were used by visually impaired persons were surrounded by many factors such as fences, street signals, automobiles, street boundaries, electric lines, ditches, and street furniture. These environments have impacts on the activity that the users perform while using the paths. The wrong way of design and use of these street side environments causes the visual and visual impaired persons for great physical and physiological problems that directly affect their life and productivity. Problems linked with poor street crossings for the visually impaired persons.

(d) A small number of those interviewed indicated that Currently, the number of populations in Addis Ababa is extremely high and these increase in the population leads to high traffic conjunction. The increment in population density of Addis Ababa leads to high problems on the movements of these visually impaired people in multidimensional and the other is that the visual persons were get into a mandatory to share the paths with the impaired persons. The street-based venders were also increased with endless amount in a large number and these vender shares the impaired person's path. When the paths for impaired person was used for other purpose the visually impaired person miss their way and face problems. In some areas of highway streets in Addis Ababa the street crossing were design but it didn't consider the visually and physically impaired persons and had weak design in considering space.

Beside the population density and street vender, the amount of automobile was very high and it was increasing extremely in the future that cause for the uncomfortable movements for both visual and visually impaired persons. The increase in the number of cars couldn't stop and it need best solution to minimize the problems come on the impaired person. The major problems related to car movement was that the roads were not well designed and functioned due to weak design, corruption, material usage, and driver's problem.

In concluding the above according to the literature and this study, the amount of the population, street vender and cars would be increased in endless way but giving solutions for these problems is the responsibility of government. Designing the best place areas for the street vender, placing the street elements at street side and using appropriate construction material bring good movement ways for the society. In the other way the squares were highly populated and designing the best street crossing bridges or underground tunnels will help both the visual and visually impaired persons.

Visually impaired person Challenge during street crossing in Addis Ababa city all the pedestrian users faces challenges during walk on the pedestrian and crossing the streets. The major causes of the challenges were the overpopulation street crossing at short time and mostly they share the road with cars. Most of the time the society share the pedestrian paths constructed in special consideration for visually impaired person which cause them to face dangers or physical problem.

(i) Creating of dangers free streets crossing in creating of dangers free street, all the solution was done by professional designer in collaboration with the science and impaired person. The best ways to minimize dangers during street free crossing were mainly using tunnel and bridges that can be used as recreational purpose. In majority of developed country, the street for car, bicycle, walkway and others were separated and did not interfere with each other that help them control the problems that affect the visually impaired persons. Our countries Ethiopia takes references from the developed countries and gives appropriate solution for the problems that visually impaired persons face.

Analysis and Discussion:

(ii) Major problems during street crossing and its consequence

1) Physical damage

Visually impaired person's needs special support to perform their daily activity to protect from physical damage face them. Almost all the visually impaired persons have additional physical damage due to the uncomfortable living and working environments.

Due to uncomfortable and unfair design of street pedestrians and crossing at least all of the visually impaired persons face the physical damages. The major causes of the physical problem for the visually impaired persons were street furniture, vegetation, street sign, overpopulation, cars, and uncomfortable roads. In addition to the above the rule and regulation on the use and design of streets to serve the visually impaired person were not respected and done well.

The physical problems that the visually impaired persons face was an important issue emerging from these findings is mainly from the car accident, and street sign during they perform their daily activity but if the designs were done on the street and street crossing this problem should be minimized to the extreme.

2) Psychological problem

The uncomfortable living and working environment make the visually impaired persons to face the endless psychological problem that they were always between living and not living. In crossing of streets, the visually impaired person 100%

gives their live for death due to the uncomfortable and no design on crossing of street. The lives of visually impaired person were not guaranteed and superiority in crossing and using of the street were not designed according to the needs of these people.

Almost all the visually impaired persons were in a psychological problem and minimizing this psychological problem was the mandatory of all people due to uncomfortable living and working spaces. Minimizing the uncomfortable space helps the visually impaired to be more productive as it adds full confidence for them to perform their daily activity.

3) Economic problems

Many causes such as physical and psychological problem, visually impaired, uncomfortable living, and working environment and unacceptability in society were the major cause for economic problems and they haven't access to any economic activity to support their self and the society.

In the reality the visually and physically impaired person were not able to cover their daily food and yearly cloths. The main causes for the economic weakness of the impaired persons were mainly the uncomfortable working and living environment.

Minimizing the impacts and preparing appropriate living and working environment helps the visually impaired person to perform their life activity. In Addis Ababa Majority of the visually impaired persons face great physical problems while crossing streets as the streets were not done in a comfortable and accessible by considering those impaired persons.

4) Social problems

The problems of the visually impaired person were also the problems of all the society. All the impaired persons were not from single group or society but they were from all the society of the country and when the visually impaired persons were affected the whole society of the country were also affected. Minimizing and supporting the visually impaired person was also helping the whole society.

In Ethiopia the impaired persons were separated and give inferiority from society and they consider the impaired person to be the productive. The impaired was not inability and developing the acceptance of the impaired person was increased by

providing a comfortable working and living space. If the working and living space for the visually impaired person were done well, they can perform every activity and the society and government should prepare the appropriate space and should consider the impaired person as the parts of the society. Designing of the street and street crossing in a comfortable way helps the society to create good relationship.

Conclusion and Recommendation:

(e) **Conclusion**

The visually impaired persons face many problems due to the fact that they lost their visual capacity as the environment they work and live were not designed according to the impaired persons. The infrastructural barriers that cause problems on the impaired person rise from the street signs, street side furniture, vegetation, and the design consideration for impaired person. Locating the street and street side elements at appropriate place minimize the problems that the impaired persons face. Even if the problems on street and street side exist the problem of impaired person was high during street crossing and the majority of the problems of the impaired person were during street crossing and the need of designing the street crossing bridges and tunnels could maximize the functionality and recreational tourism of the area. Thus if the streets crossing infrastructure were designed and constructed in the way that it consider the impaired persons accessibility the traffic problem were minimized extremely.

The majority of roundabouts or squares in Addis Ababa city are highly populated to use and the users face endless problems related to these dense traffic areas of the city. Almost in all the squares of Addis Ababa, the community and the automobiles can share the streets and this sharing on the street for both car and people cause to endless problems. On the major squares of Ethiopia, the problems that the visually impaired persons face were very high due to the high population density, cars, street furniture, street signals, vegetation, and the design and construction materials used. To minimize the problems on the visual and visually impaired person the well corporation of the street furniture and designing the street crossing tunnel and bridge were needed by taking the design philosophy from the well designed and developed city of the world as the case study.

The problems of under designed streets and street crossing in Ethiopia especially in the selected area results in the problems of physical, psychological, economic and social problems. Designing the appropriate street and street crossing bridge and tunnels would minimize extremely the problems all human being and the well-designed street and street crossing helps the visually impaired persons from damages. Currently the population density of Addis Ababa were increasing extremely and the problems related to the street crossing would be need solutions related to designing street crossing tunnel and bridges that minimize the problems by taking the design from other cities of the other country as majority of the problems were during street crossing especially in the areas of highly populated and traffic squares of Addis Ababa. Thus, designing the street and street crossing for Megenagna square can minimize the problems of the visually impaired person and it is used as the base to design the street crossing bridges/tunnel for other street and squares of Addis Ababa and other cities of Ethiopia.

(f) **Recommendations**

Based on the finding, and conclusion of street and street crossing of the visually impaired person, the following recommendations were drawn for the following concerned bodies.

In this world the designers play great role in the functioning of the spaces for the users. The concerned persons in designer part were architects, urban planner, landscape designer, infrastructure designer, and structural engineers. If all these bodies were participating in cooperation the design and construction of the street and street crossing bridge could be successfully functioned for the visually and physically impaired persons. Following the science and technology of the street crossing and design in a futuristic way was the mandatory of all professionals.

Government was the most influential body in directing, serving, and managing of the society. As the visually impaired person covers extremely maximum number in the city and need special treatments compared to the visual person providing appropriate solution for them by standing with the concerned body minimize the problems that the impaired person face and make them more productive.

Contractors were the most influential company in the construction industry. Most of the time majorities of the designs were done in the best way but in the reality they design and constructed element/structure was not the same. In the design

and construction of such a street crossing infrastructure for the visually impaired person were the common benefits of all the society in the city. The contractors participating in such construction of infrastructure for the impaired people were the best and endless advantage for the society and economy of the country.

The nongovernmental organization especially those work on the human right and safety must participating and budgeting on the plan, design, and construction of infrastructure for the visually impaired person. As making safe life for the visually impaired person was the advantage of all the society in political, social, and economic views, the non-governmental organization plays endless roles to serve the society in this way. In our country Ethiopia the interferences of the nongovernmental organizations in to the street and street crossing infrastructure design and construction for the impaired person were very low and it need great initiation for the success of such projects.

The societies of the country were the key player in solving the problems of 1.6% of the visually impaired person of the country people. The community that the visually impaired people live in were the best solution giver for the problems that the visually impaired person face due to the fact that the community perform their daily activity with the impaired person.

The capitalist in Ethiopia and world had full responsibility in serving the visually impaired persons by participating in providing the solutions in the design and construction of infrastructure during crossing and using of streets. The capitals were needed to provide the best solution for the society in budgeting capitals for the construction of the infrastructures by standing with the governmental and nongovernmental organization.

Separating the street of car and person helps to minimize the problems occurred on the society and economy of the country. These separation roads of car and people can be done by providing the necessary bridging and tunneling strategy that consider the visually impaired persons. The cost for the construction of the tunnel and bridge were high the solution it provides in serving the society life was endless product.

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Appendix 2: Interview Questions

Ethiopian Visually impaired persons Association

1. How can I get the statistical data or number of visually impaired persons from your office?
2. Where did the visually impaired persons mostly exist?
   - At Recreation
   - School
   - Work places
   - Market areas
   - Health center
   - Public libraries

Interview for Visually Impaired Person

- How was your ability in using the streets?
- What are the barriers you faced on street crossing in relation with your visual blindness?
- Is the pedestrian walk ways and streets crossing points convenient for you?
  a. If yes, where / which place, area
  b. If no, is it from lack of quality of design or construction road infrastructure problem?
- In the moment you are going to cross the road, is there any street element that helps you to give you a direction on street crossing points?
  a. If yes, where/which place, area
  b. If no, what should be present / installed?
- What are the fundamental problems on pedestrian walk ways and street crossing?
- How do you know the street is free from accident / barriers before you going to cross the road?
- What type of street crossing point is comfortable you recommend?

Questions for visually impaired schools' managements

1. What are negative and positive impact that you think the students could face when crossing?
2. What is your attitude towards integration of the street crossing infrastructures and school gates?
3. What are the main barriers that visually impaired students faced when on the way of school?