

**A STUDY ON THE SOCIO-ECONOMICAL IMPACT OF ROAD
TRAFFIC ACCIDENTS IN
BAHIR DAR TOWN**



By

TADIE KELEMU MELAKU

DEPARTEMENT OF SOCIAL WORK

AT

**IGNOU UNIVERSITY WITH THE COLLABORATION OF St. Mary's
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**A STUDY ON THE SOCIO-ECONOMICAL IMPACT OF ROAD
TRAFFIC ACCIDENTS IN
BAHIR DAR TOWN**

**A THESIS
PRESENTED TO
THE SCHOOL OF GRADUATE STUDIES
IGNOU UNIVERSITY**

**In Partial Fulfillment of the Requirements for the Degree of the
Master of Arts in SOCIAL WORK (MSW)**

By:

TADIE KELEMU MELAKU

ID 1051136

Tel: 0918766311/0920251218

**April 2012,
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Name

Signature

Advisor

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Abbreviations and Acronyms

- **ANRS:** Amhara National Regional State
- **ANRSPC:** Amhara National Regional State Police Commission
- **BCATPO:** Bahir Dar City Administration Traffic police Office
- **BTAC:** Bureau of Transport and Communication
- **BWUD :** Bureau of Works and Urban Developments
- **CSA:** Central Statistical Authority
- **ECA :** Economic Commission for Africa
- **ECE :**Economic Commission for Europe
- **EMA :** Ethiopian Mapping Authority
- **ERA :** Ethiopian Roads Authority
- **ERTA :** Ethiopian Road Transport Authority
- **ETA :**Ethiopian Telecommunication Agency
- **GDP :** Gross National Product
- **GIS :**Geographic Information System
- **GPS :** Global Positioning System
- **DALYS :** Disability Adjusted Life Year
- **EMA :** Ethiopian Mapping Agency
- **GNP :** Gross National Product
- **GIS :** Geographic Information System
- **GRSP :** Global Road Safety Partner
- **NGO's :** Non-Government Organizations
- **NUPI :** National Urban Planning Institute
- **OAU :** Organization of African Unity
- **OECD :**Organization of For Economic Cooperation and Development
- **PIA :** Personal Injury Accident
- **RTA :** Road Transport Authority
- **RA :** Road Accident
- **SPSS :** Statistical Information System
- **TRL :** Transport Research Laboratory
- **UN :** United Nations
- **UNCHS :** United Nation Center for Human settlement
- **UNDP :** United Nation Development Program
- **UNTACDA :**United Nation Transport and Communication Development for Africa
- **WHO :** World Health Organization

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Abstract

A study was conducted to examine the Socio economical Impact of road traffic accidents in Bahir Dar town and arrive at some possible suggestions to alleviate the problem. Based on the understanding and appreciation of the problems, the study has come up with suggestions some remedial measures.

The research was conducted based on the archive of traffic police data between 1999 and 2003. A questionnaire survey and field observations were also carried out to collect the required data to be preformed as complement to accident analyses in this research. In this study, five structured attitudinal type of questionnaires were designed. The first was completed by the traffic policemen, the second by the pedestrians, the third by school children, the fourth by drivers and the fifth by cyclists. Results indicate that road traffic accident is a serious problem in the town of Bahir Dar.

The study considered a number of factors grouped into driver, vehicle, pedestrian, and environmental factors. Also problems associated with the number and facilities of the traffic police department as well as the traffic regulation itself were assessed. The study indicated that the concentration of economic activities and services, negligence of drivers and working for longer hours, older vehicle fleet, and inadequacy of traffic control facilities are among the main causes of traffic accidents. Also the low level knowledge of pedestrians about the traffic rules, the small number of traffic police working for long hours without incentives, inadequate facilities and the lack of enforcing capacity of the traffic regulation itself have also been identified as the main contributing factors to the incidence and magnitude of traffic accident in Bahir Dar.

In the study, pedestrians are the road users most affected by road accidents. On the average 52 percent of traffic casualties are pedestrians. Passengers, drivers and two-wheeled vehicles riders are also frequently involved in traffic accidents. All safety measures introduced to protect the road users are disregarded by the large proportion of drivers, pedestrians, school children and cyclists; and that the majority of them have a tendency in complete ignorance of the dangers encountered by traffic accidents.

On the basis of the findings of the study, it has been recommended that the expansion and improvement of road facility programmes should be supported with prompt remedial measures such as the decentralization of functions, traffic education for children, strict driver training and licensing and public education for pedestrians. Also it recommends the proper management of the available road facilities, and revising of the existing traffic regulation to enhance its enforcing capacity on the offenders

Annex- I

IGNOU University

Faculty of Social Work

Department Of Social Work

Post Graduate Program

Questionnaire to be responded by Traffic policemen, Pedestrians, students and drivers in Bahir Dar

This questionnaire is designed in order to study the cause, extent and economical impact of road traffic accident in Bahir Dar town. The objective of the study is to identify the major causes contributing to road accidents in Bahir Dar town, to determine the socio-economic costs that incurred due to road traffic accidents and to depict some possible solutions to reduce the problems of road accidents in Bahir Dar town. Therefore, the information that you will provide have its own impact in understanding the whole situation of road traffic accident in Bahir Dar town. Your opinion, suggestions and recommendation may be of great input in the future in this sector. Therefore, I, the researcher, would like to thank you in advance for the collaboration in giving valuable time to respond this questionnaire.

***General instruction:**

- There is no need to write name.
- For multiple choice items, circle a letter/s.
- For short answer items, write the answer briefly and clearly on the space provided.

A. Questionnaire to be responded by traffic policemen in Bahir Dar

I .Working Area information

1. When do you usually work/ working time -----

2. Name of working kebele/site -----

II. Respondent's background

1. Sex:

A. Male

B. Female

2. Service as a traffic police:

A. Less than 5 years

B. 5-10 years

C. 10-15 years

D. Greater than 15 years

3. Marital status

A. Single

B. Married

C. Divorced

D. Widow

4. Educational status

A. 1-4 grade

B. 5-8 grade

C. 9-12 grade

D. Above grade 12

E. Diploma/ Degree

F. Others

5. Do you have driving license?

A. Yes

B. No

6. Religion

A. Orthodox

B. Islam

C. Protestant

D. Catholic

E. Others

III. General questions

7. Do you have ever seen a traffic accident?

A. Yes

B. No

8. Whom do you accuse for that accident?

A. Driver

B. Pedestrians

C. Problem in the Car

D. road problem

E. Specify if any other _____

9 What is your immediate reaction for a traffic accident? (Multiple answers is possible)

A. Accelerate traffic flow

B. report the accident

C. helping people if injured

D. calculate human/ economic losses

E. Specify if any other _____

10. What type of cars result traffic accident mostly? (Multiple answers is possible)

A. Big trucks

B. Medium trucks

C. Government cars

D. Private cars

E. specify if any other _____

11. How is the traffic accident going on during the last seven years?

A. Increasing

B. Decreasing

C. No change

12. If your answer for question no 11 is 'increasing' write the reason briefly?

13. Do drivers give priorities to pedestrians as required by law?

A. Always

B. Some times

C. Never

14. What are the major factors for traffic accident in Bahir Dar? State all of them.

A _____

B _____

C _____

D _____

E _____

15. What could be the possible solution to minimize road traffic accident?

A. Improving driving license award

B. Improving road quality

C. Continued quality checking of cars

D. Specify if any other _____

16. Elaborate what type of weather condition led to road traffic accidents in Bahirdar town _____

B. Questionnaire to be responded by selected pedestrians in Bahir Dar

1. Address (Kebele) -----

2. Sex-----

3. Age -----

4. Educational level

A. Illiterate-----

B. Read and write/informal-----

C. Primary education (1-8) -----

D. Secondary education (9-12) -----

E. Above secondary-----

5. Occupation

A. Private Worker -----

B. Unemployed-----

C. Student-----

D. Office worker-----

E. Other (specify) -----

6. How long have you been in Bahir Dar?

- A. < 1 year-----
 - B. 1-2 years -----
 - C. 3-5 years -----
 - D. 6-and above -----
7. Which type of trip purpose constitutes most of your time?
- A. Work Trip -----
 - B. Educational Trip -----
 - C. Shopping -----
 - D. Recreational -----
 - E. Walking -----
8. How do you perceive the level of road traffic accident problems in Bahir Dar?
- A. A big problem -----
 - B. A moderate problem -----
 - C. Not a problem -----
9. Have you faced / observed traffic accidents in your journey?
- A. Yes -----
 - B. No-----
- 10.If your answer is "yes " in question No 9, how many times?
- A. One time -----
 - B. Two times -----
 - C. Three times -----
 - D. Four times-----
11. If your answer "yes" in question no 9 have the accidents been reported or registered with trafficpolice?
- A. Yes-----
 - B. No-----
12. Which types of collision or road accidents were highly prevailing in the town?
- A. Motor vehicle with motor vehicle -----
 - B. Motor vehicle with bicycle -----
 - C. Motor vehicle with pedestrians -----
 - D. Motor vehicle with static object -----
 - E. Bicycle with bicycle -----
 - F. Bicycle with pedestrians -----
 - G. Bicycle with horse drawn carts -----
 - H. Horse drawn cart with pedestrians -----
 - I. Others (specify) -----
13. How frequent do you have to leave sidewalks and walk along roads?
- A. Always-----
 - B. Some times-----
 - C. Rarely-----
 - D. Never do this-----

14. While walking along roads, do you walk with your
 - A. Face to the oncoming vehicles-----
 - B. Back to the oncoming vehicles -----
15. Do you understand traffic signs, signals and road marks while you are moving along streets?
 - A. Yes-----
 - B. No-----
16. Have you give way / priorities to vehicles as required by law
 - A. Always-----
 - B. Sometimes-----
 - C. Never-----
17. Where do you usually cross the main roads?
 - A. At traffic light-----
 - B. At junction-----
 - C. At mid-block pedestrian crossing away from junction----
 - D. At any point-----
18. Crossing the main roads in the town is:
 - A. Difficult-----
 - B. Easy-----
19. How do you rate drivers give priorities to pedestrians as required by law.
 - A. V. good-----
 - B. Good-----
 - C. Poor-----
 - D. V. Poor-----
20. Rank the following problems in their order of priority in terms of endangering your safety, Which creates by driver's error.
 - A. High speed of vehicles-----
 - B. Not give priorities, to pedestrians-----
 - C. Lack of enforcements-----
 - D. Limited number of properly designed pedestrian crossing -----
 - E. Others (specify) -----
21. Are drivers failing to maintain traffic rules and regulations in the presence of traffic police would be penalized for their law effective?
 - A. Always-----
 - B. Sometimes-----
 - C. Never-----
22. How do you rate the traffic police commitment to their duties?
 - A. V. good-----
 - B. Good-----
 - C. Poor-----
23. Have you ever got education about road safety rules by concerned officials?
 - A. Yes-----
 - B. Not yet-----

24. Who is your source of knowledge and experience about road safety rules?
- A. My self -----
 - B. Parents-----
 - C. Schools-----
 - D. Traffic police-----
 - E. Media-----
25. Suggest some possible solutions to prevent and reduce road traffic accidents in Bahir Dar?

C. Questionnaire for School Children Traffic Safety

Please choose an answer and mark it for the following questions.

1. Address (Kebele)
2. Sex
 - A. Male-----
 - B. Female-----
3. Age -----
4. Are you afraid of traffic accidents in your way to school?
 - A. Yes-----
 - B. No-----
5. Crossing the road is
 - A. *Difficult*-----
 - B. *Easy*-----
6. What type of wheeled vehicle does you often afraid on your way to school?
 - A. Motor vehicles -----
 - B. Bicycles-----
 - C. Horse drawn carts -----
7. Do you recognize the safer way of walking along the streets relative to on coming vehicles?
 - A. Yes -----
 - B. No-----
8. Have you got any road safety education by concerned bodies?
 - A. Yes-----
 - B. No-----
9. Who is the source of your knowledge about road traffic safety rules?
 - A. Schools-----
 - B. Traffic police -----
 - C. Television-----

D. Questionnaire to be filled by Drivers

1. Address (Kebele)
2. Sex
3. Age

4. Educational level
 - A. Illiterate-----
 - B. Read and write / informal -----
 - C. Primary education (1-8) -----
 - D. Secondary education (9-12) -----
 - E. Above secondary-----
5. Level of License
 - A. None -----
 - B. First level-----
 - C. Second level-----
 - D. Third level-----
 - E. Fourth level-----
 - F. Fifth level-----
6. How long have you been driving in Bahir Dar?
 - A. Less than one year -----
 - B. 1-2 years -----
 - C. 2-5 years -----
 - D. 5-10 years -----
 - E. >10 years-----
7. Which type of vehicle do you normally drive?
 - A. Private car-----
 - B. Commercial car drivers-----
 - C. Governmental-----
8. How many years is the vehicle give service in Bahir Dar which you drive?
 - A. < 2 years-----
 - B. 2-5 years-----
 - C. 5-10 years-----
 - D. >10 years -----
9. Where do you often parking your motorcar?
 - A. On street-----
 - B. Park area -----
 - C. In front of commercial / office area-----
10. When you drive, what is your normal speed (approximate) in the town?
 - A. < 20 km/ hr-----
 - B. 20-30 km/hr-----
 - C. 30-40 km/hr-----
 - D. 40-50 km/hr- -----
11. When you drive, have you give way priorities to pedestrians as required by / law?
 - A. Always-----
 - B. Some-----
 - C. Never-----
12. How do you rate pedestrians respect ion for vehicles in giving priorities where necessary?

- A. Good-----
 - B. Moderate-----
 - C. Poor-----
13. How do you perceived the level of road accidents problems in your town?
- A. A big problem -----
 - B. A moderate problem-----
 - C. Not a problem-----
14. Are you faced/ observed accidents while driving in the town roads?
- A. Yes-----
 - B. No-----
15. If you are involved in accidents how many times?
- A. One-----
 - B. Two-----
 - C. Three-----
 - D. Four-----
16. If you are involved in accidents have it reported or registered with traffic police?
- A. Yes-----
 - B. No-----
17. How many times you convicted by traffic police for your traffic law-offensives?
- A. One-----
 - B. Two-----
 - C. Three-----
 - D. Four-----
18. How do you rate the traffic police commitment to their duties?
- A. V. Good-----
 - B. Good -----
 - C. Poor-----
 - D. V. Poor-----
19. Do you have a trust on the current driving testing and training procedures?
- A. Yes-----
 - B. No-----
20. Have you got additional education or training about road safety by concerned bodies?
- A. Yes-----
 - B. Not yet-----
21. Suggest some possible solutions to prevent and reduce road traffic accidents in Bahir Dar?

D. Questionnaire to be filled by cyclists

1. Address (Kebele)-----
2. Sex-----
3. Age -----
4. Educational level-----
5. Occupation -----
6. How much experience do you have, in total, of riding a bicycle?
< 1 year-----
1- 2years -----
2- 5 years -----
5- 10 years-----
> 10 years-----
7. Which type of trip propos constitutes most of your cycling time?
 - A. Work trip -----
 - B. Recreational-----
 - C. Educational -----
 - D. Shopping-----
 - E. All purpose-----
8. Had you faced accidents on your journey by riding bicycle?
 - A. Yes-----
 - B. No-----
9. If you had faced road accidents how many times?
 - A. One-----
 - B. Two-----
 - C. Three-----
 - D. Four-----
10. Was the accidents you faced reported/ recorder by traffic?
 - A. Yes-----
 - B. No-----
11. In which time of a day bicycle accidents are highest?
 - A. Daytime-----
 - B. Nighttime-----
12. In which roads/ locations of the town roads bicycle accidents are the highest?
 - A. On the main roads-----
 - B. On the residential roads-----
13. Rank the following bicycle accidents in their order of priority, which prevail in the town roads?
 - A. Collision with motor vehicles-----
 - B. Collision with bicycles-----
 - C. Collision with pedestrians-----
 - D. Collision with a static object-----
 - E. Collision with horse drawn carts-----

- F. Falling while driving-----
14. Rank the following major causes of s bicycle accidents in their order of priorities.
- A. Negligence of pedestrians for cyclists-----
 - B. No priorities given to cyclists by motor car drivers-----
 - C. Absence of segregated lane for bicycles-----
 - D. Poor road conditions-----
 - E. Speedy riding-----
 - F. Poor condition of bicycle on the roads-----
 - G. Lack of en for cement -----
15. Where you thought riding bicycle is more dangerous on the town roads?
- A. On cross roads-----
 - B. At traffic light -----
 - C. At junction roads-----
 - D. On the stretched drive way-----
16. Do you correctly perceive traffic sign, signals and road marks when you riding bicycle along the town streets?
- A. Yes-----
 - B. No-----
17. Have you gained education about road safety by concerned officials?
- A. Yes-----
 - B. Not yet-----
18. Suggest some possible solutions to prevent and reduce road traffic accidents in Bahir Dar?
- A. -----
 - B. -----

Annex- II
IGNOU University
Faculty of Social Work
Department Of Social Work
Post Graduate Program

Interview questions to be responded by traffic police managers, Finance and Economic Experts

This interview is designed in order to study the socio economic impact of road traffic accident in Bahir Dar town .Therefore, the information that you provide has its own impact in understanding the entire situation of road traffic accident in Bahir Dar town.

General information of the interviewee

1. Sex A. Male B. Female
2. Age
 - A. 20 -30 years
 - B. 30-40years
 - C. 40-50years
 - D. Greater than 50
3. Services
 - A. Less than five years
 - B. 5-10 years
 - C. 10-15 years
 - D. 15-20years
 - E. Greater than 20 years

4. Positions hold -----

II .General questions

- A. What are the major causes of traffic accident in Bahir Dar?
- B. What are the consequences of road traffic accident in Bahirdar town?
- C. Can you suggest some solutions to prevent traffic accident in Bahir Dar?
- D. What are the roles of each stockholder to prevent traffic accident?
- E. Is traffic accident increasing or decreasing?
- F. What are the social and economic impacts of road traffic accident in Bahirdar town?

DECLARATION

I hereby declare that the dissertation entitled **A STUDY ON THE SOCIO-ECONOMICAL IMPACT OF ROAD TRAFFIC ACCIDENTS IN BAHIR DAR TOWN** submitted by me for the partial fulfillment of the MSW to Indira Gandhi National Open University, (IGNOU) New Delhi is my own original work and has not been submitted earlier, either to IGNOU or to any other institutions for the fulfillment of the requirement for any other programme of study. I also declare that no chapter of this manuscript in whole or in part is lifted and incorporated in this report from any earlier work done by me or others.

Place: Addis Abeba

Date: April, 2012

Signature:.....

Enrollment No.....**ID 1051136**

Name:.....Tadie Kelemu Melaku

Address:

Bahir Dar

P.O.Box:49

Ethiopia

CERTIFICATE

This is to certify that Mr. Tadie Kelemu Melaku student of MSW from Indira Ganhi National Open University ,New Delhi was working under my supervision and guidance for his project work for the course **MSWP-001**. His project work entitled **A STUDY ON THE SOCIO-ECONOMICAL IMPACT OF ROAD TRAFFIC ACCIDENTS IN BAHIR DAR TOWN** which he is submitting, is his genuine and original work.

Place: Addis Abeba
Date: June, 2012

Signature:.....

Name:..... Messele Mengsteab

Address of the supervisor:

- **Addis Abeba University**
- **Phone No: 0911445870**
- **Addis Abeba,**
- **Ethiopia**

CHAPTER ONE

Introduction

1.1 Background of the study

Road transport plays a key role in the national traffic flow of developing countries and accounts for more than 95 percent of inter-urban transport of goods and passengers in different African countries including Ethiopia (UNTACDA, 2000). Clearly road transport has an important role in economic, social and cultural functioning of cities. But in many cities today it is also generating significant social and economic costs (Shefer, 1997). These costs arise from the external effects of traffic system, particularly accidents, congestion, consumption of public space, air pollution, noise, and disruption of social and economic interaction (Alshuler, 1965; Reynolds, 1966; Creighton, 1970; Wough, 1990; Rienstra, 1996; Piet, 1997; WHO, 2000). These externalities of traffic are especially pertinent in urban areas because here spatial densities are high and the infrastructure networks are most intensively used. For example Barrett (1989) indicated that about 70-80 percent of road accidents of every nation occur in urban areas.

According to TRL (2000) estimates, the number of people killed in road accidents in 1999/2000 was between 750,000 and 880,000 and 23-24 million were injured, about 85 percent of these deaths occurred in the developing countries of Africa, Asia and Latin America. World Health Organization (2000) statistics reveal that in developing countries road accident is the major factor that brings about death next to those caused by natural factors; one death per annum is recorded for every 50 to 500 motor vehicles, whereas the corresponding range in developed countries is 2000 to 5000 motor vehicles. The total economic costs are also the highest when measured in terms of the productivity loss and expenses incurred because of road traffic accidents. TRL (2000) estimated that the social cost of road accident in 1999/2000 was in excess of 500 billion US dollars and the cost in the developing world was estimated to be about 65 million US dollars. Ethiopia, as one of the developing countries which has one of the world's worst road accident.

Records as measured by fatality rate of 170 fatalities per 10,000 motor vehicles are common. Ethiopia currently loses almost 1700 lives each year; another 7500 are injured, and a further 7783 face property damage only due to accidents (RTA, 2001; FTP, 2002). According to Transport Research Laboratory (TRA 2000), the average annual cost of road accidents in Ethiopia was about 400 million birr per annum, which accounted for about 0.8-0.9 percent of the GNP. Clearly, these are sums of money that the country cannot afford to lose every year.

This study is mainly concerned with road traffic safety in Bahir Dar. Emphasis is given to Studying the socio - economical impact of road traffic accidents in Bahir Dar town. In addition, problems related to the road environment, condition of vehicles and Police enforcement would be identified.

1. 2 Statement of the Problem

In our country there are a few large cities and many small urban centers but because of the concentration of administration, economic activities, population and vehicles in these areas, the proportion of accident occurring in them is very significant. For example, in 1997/98 Addis Ababa accounted for 22 percent of all fatal accidents, 28 percent of serious and 68 percent of slight injuries of the country's total (FTP, 2002). Being the capital town of the Amhara National Regional State and its role as a cross-flight junction point to Gondar, Lalibela and Axum, have all contributed a lot to Bahir Dar's rapid urbanization. Its location along the main roads, the tourist sites of monasteries within the islands of Lake Tana and Tis Issat Fall of Blue Nile can be considered as additional factors for the growth of the town. In connection with the above facts road traffic accidents in Bahir Dar have increased over the years in a disturbing rate in terms of both the direct economic loses and the social lives. This observation is supported by Bahir city administration Traffic Police (2002/03) accident statistics which shows that 347 accidents occurred in the years between 1995/6 and 2001/02 (gives an average of 49.57RTA/Year), which cost Birr 1,145,065 for property damage accidents only. The number of victims treated in hospital, health center and clinics also show upward trend.

Most importantly, there is a general trend among drivers and pedestrians of non-compliance with traffic rules and regulations. The situation is further aggravated by deficiency in traffic rules and regulations and a lack of serious enforcement. According to 2003 fourth quarter report the Amhara National Regional Police Commission, in the city of Bahir Dar, most politicians, government bodies and societies at large know little about the magnitude of road accidents and associated factors. Reduction in accident rates comes as a result of actions on many fronts, including more disciplining of the drivers and pedestrians, safer vehicles, and safer roads through education, engineering, and enforcement. Safety can also be enhanced by institutional measures, such as improvement in coordination and integration of safety activities, and safety research and developments. In addressing road safety problems all these measures need to be examined and assessed comprehensively.

Finally, this study provides comprehensive findings on cause, extent and economical impact of road traffic accidents in Bahir Dar town.

1.3 Objectives

1.3.1 General Objective: The general objective of the study is to examine the socio-economical impact of road traffic accidents in Bahir Dar town and arrive at some possible suggestions to alleviate the problem.

1.3.2 Specific objectives:

- To identify the major causes of road traffic accidents in Bahirdar town.
- To determine economic costs incurred due to road traffic accidents in Bahirdar town.
- To depict the magnitude of traffic accidents such as death, injuries and property damage in the town.

1.4 Research Questions

- What are the major causes of road traffic accidents in Bahirdar town?
- How much economic costs are incurred due to road traffic accidents in Bahirdar town?
- What are the magnitude of traffic accidents such as death, injuries and property damage in the town?

1.5 Significance of the study: Even though the study is carried out for academic purposes and is confined to a single town, it could be helpful to have a deeper knowledge about the Complex problem of urban road transport in general and road traffic accidents in particular. It also helps as a source of information for those institutions concerned with road safety management and helps to improve the quality of decision-making in urban road transport safety planning. Finally, it also helps to carry out further research to refine the conceptual and methodology of the present study.

1.6 Delimitation of the Study: The research would be conducted through the entire of Bahirdar town.

1.7 Limitations of the Study: The absence of information related to primary data in terms of traffic accident type, distribution, consequences, traffic flow and other related factors, made this study difficult. The study has to rely on data from the archives of the traffic police, which are bulky and uneconomical in terms of time and resources. Therefore, shortage of time, absence of recent information and lack of adequate budgets were the main problems that the researcher had to face.

1.8 Organization of the Study

The thesis is organized in to five main chapters. The first chapter consists of the introductory parts including background of the study, statement of the problem, objectives, research questions, significance of the study. The second chapter provides literature review highlights the literature of worldwide and Ethiopian perspective. The third chapter deals with the general background of the study area, methodology with approaches incorporating research design. Chapter four deals with analysis, description, interpretation and explanation of the result and the last chapter consists of conclusions and recommendations.

1.9 Definitions of important terms

- **Accident Rate:** is a measure of the rate of occurrence of accidents in relation to any one of a number of exposure factors, such as per million vehicles entering or per million km on a study area
- **Accident Density** - It is the accident size over a black spot or an area.
- **Black Spots** - These are spots where road accidents do cluster together
- **Casualty** - This refers to road crash victims that include injuries and fatalities.
- **Fatal Accident:** is one where at least one person is killed with death occurring within 30 days of the accident.
- **Fatality Index** - This is the proportion of the number of persons killed to that of the total of injured persons
- **Fatality Rate** - This is the number of deaths per licensed vehicle.
- **Hit and Run Accidents** - This refers to the situation when drivers of motor vehicle fail to stop and report to a police station after they cause road accidents
- **Non-Injury Accidents** - This indicates no injury to persons but only damage to vehicles
- **Property Damage:** physical damages of vehicles or properties but not to a person.
- **Road Traffic Accident** : is defined as a rare, random and multiple factor events always preceded by a situation in which one or more road users have failed to cope with the road and its environment.
- **Serious Injury** - This is an accident where there is serious injury or there is a possibility for the injured persons to die.
- **Severity Index** - It is the proportion of the number of fatal accidents to the total number of injury accidents
- **Slight Injury** - It is an accident where there are slight injuries to the persons involved like a cut, sprain or bruise.
- **Traffic** - movement of people and vehicles along roads and streets.
- **Traffic Accident-** It is an accident that occurs owing to the presence of a motor vehicle on a road, where by injury or damage is caused to any person, vehicle, etc.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Historical Perspective of Urban Growth

Urbanization is defined as the process "whereby an increasing proportion of a nation's or region's population live in urban areas" Waugh, (1990). Even though there is no any global agreement as to what constitutes an "urban area", most nations uses population size and percentage of the population engaged in non-agricultural activities according to (UN, 1991). For instance Argentina, Malaysia and Nigeria define urban areas as having 2000, 10000 and 20000 inhabitants respectively Terence, (1998). The ratio of population growth in urban areas of the developing countries is dramatic as Compared to the urban population growth in industrialized nations. From 1950 to 2050, the urban population in the developing nations will increase almost 16 times from under 200million to 3.15 billion people. That means cities in developing countries are expected to grow by 140,000 people a day in the future (Perlman, 1993). In 1970, about 1.4 billion of the 3.7billion people in the world lived in urban areas. They were nearly equally divided between the developed and developing nations. UN, (1992).

According to the United Nations 2001, by 1990 the world's population was about 5.3 Billion of which 4.1 billion lived in the developing nations and 1.2 billion in the developed 21nations. Approximately 45% (2.4 billion) of the total population of the world lived in urban places of which 1.5 billion lived in developing and 0.9 billion in developed nations. Also the level of urbanization in developed and developing nations was 73% and 37% respectively in1990. As shown by the United Nations Department of Economics and Social Affairs (1999) estimates, the world's urban population was about 2.8 billion, out of which 1.9 billion were found in the urban areas of developing nations. As a whole, the urban population is growing faster than the world population where the growth rate is 1.2% and 2% per year for the world's total population and world's urban population respectively (UN, 2001). But there is a pronounced variation in the rate of increase for the developing regions. The highest rate of urban growth is found in Africa (3.7% per year) followed by Asia with 2.5% per year. Eastern African region cities are expected to grow by 5% a year between 2000 and 2005 (UN, 2001).

As it is indicated in the urbanization Prospects of 1999 Revision, world level of urbanization will reach 60% by 2030 from 46.6% in 1999. Accordingly the level of urbanization in developing nations will shift from 39.4% in 1999 to 56.2% by 2030, whereas the corresponding change for the developed nations will be from 75.8 to 83.5%.

Table 2.1 Percentage of World Populations Living in Urban Areas (1950-2030).

	1950	1960	1970	1980	1990	2000	2010	2020	2025	2030
World total	29.3	34.2	36.6	39.4	43.1	47.5	52.7	58.3	61.1	60.3
Developed Nations	54.7	61.3	67.5	71.3	73.6	76.3	79.3	82.5	84.0	83.5
Developing nations	17.3	22.5	25.1	29.2	34.7	40.7	47.2	53.8	57.0	56.2
Africa										
Ethiopia	4.6	6.4	8.6	10.5	12.3	14.9	19.5	26.2	29.9	35.3

Africa is the least urbanized region with 32% of its population living in urban areas in 22 1990 (Obudho, 1998). Urbanization estimates indicate that the urban population of Africa is growing 4 times faster than that of the remaining developing regions. In 1990, 15% of the developing nation’s urban population lived in Africa. And among the regions of Africa, Eastern Africa has the lowest level of urbanization despite the fact that it is one of the most populated regions in Africa (Obudho, 1998).

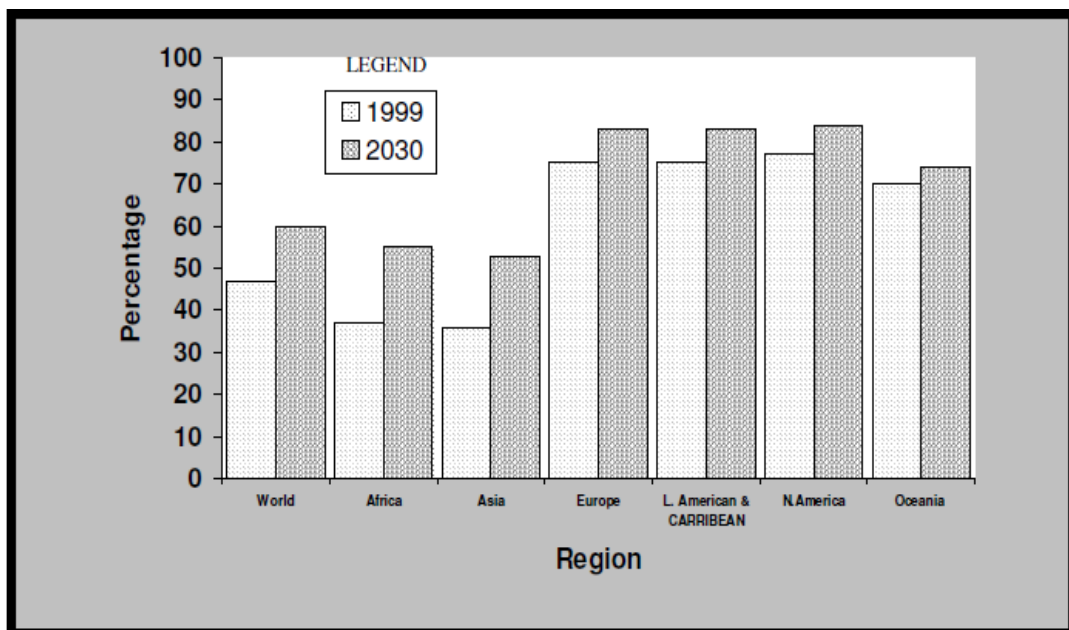


Fig. 2.1 Percentage of World Population Living in Urban Areas, 1999 and 2030

As indicated in Table 4, the process of urbanization continues at a faster rate in the developing nations of the world than in the developed ones. Accordingly, the urban population of Ethiopia accounts for about 15% currently and it is expected to reach 29.9% and 35.3% in the years 2025 and 2030 respectively.

2.2. World Vehicle Population

Today there are 737 million cars worldwide. Among these 70% of them are found in North America, Western Europe and Japan. Approximately 162 million cars (22%) are found in Latin America, Asia and Eastern Europe. The remaining is spread out in the rest of the world. (Deutschland, 2002). In 1950, there were about 53 million cars on the world's roads, and in 1990, the global fleet size rose to 456 million. On the average, the fleet has grown by about 9.5 million automobiles per year over this period. (World Bank, 1995).

The latest estimates of the UN (2001) shows that the share of the world population is 124 vehicles per 1000, but a very wide gap exists among the developed and developing nations in this respect. It is 473 vehicles per 1000 in the developed nations whereas 30 vehicles are available for every 1000 people in the developing nations. Regionally, Northern America, Oceania and Europe rank from first to third with 746, 498 and 341 vehicles per 1000 people respectively.

Table 2.2 Distribution of World Vehicle Fleet by Region (2001)

Region	Population in 000	Motor vehicle per 1000 people
World Total	6,134,135	124
Developed nations	1,193,861	473
Developing nations	4,940,274	30
Asia	3,720,705	41
Europe	726,312	343
L. America	526,533	92
N. America	317,068	746
Oceania	30,915	498
Africa	812,603	26
Eastern Africa	256,673	7
Ethiopia	64,459	2

Source: UN (2001) Department of Economic and Social Affairs

Motor vehicles are mainly concentrated in the major urban centers, mainly in big cities, where a variety of activities flourish. This condition imposes a serious problem in the ease of varmint. According to Bamford and Robinson (1978), the complex changes in the economic, social and technological sectors in the urban centers are responsible for urban transport problems. The problem originates from:

1. The absolute growth and changing distribution of population and the consequent increased travel demand. As urban population continues to increase the need for travel also increases because the distance between home and place of work becomes greater.
2. The growth in the number of private cars and freight vehicles leads to tremendous increase in the number of vehicles using the road.
3. The shift of passengers from public transport to the private car which leads to the decline in the use of public transport where public transport has a central role in any efficient urban transport system.

2.3. Road Traffic In Urban Areas

2.3.1. What is Traffic or Road Traffic?

As defined in Webster's Seventh New Collegiate Dictionary "Traffic is pedestrians, animals (whether ridden, driven, herded or led), vehicles and other conveyances, either singly or together while using any road for purpose of travel or locomotion". And as the Encyclopedia Britannica puts it, "traffic means movement of vehicles, pedestrians and animals on the road or street" (Vol.18), where the main components of traffic are the road, vehicles, pedestrians and animals. Furthermore, "Traffic" is defined in broad sense as "the movement resulting from transport of people along roads, railways, sea lanes, navigable inland water ways and air routes" (Goodall, 1987). And road traffic is a continuous interaction between the three elements related to traffic itself, and the interaction within the three groups. Namely: man or the human factor, the vehicle and the road or simply the environmental factor (Cantilli, 1987).

Growth in urban areas and in the number of vehicles in many developing countries has led to increased traffic congestion in urban areas and an increase in traffic accident on the road networks, which were never designed for the volumes and types of traffic, which they are now required to carry. In addition, unplanned urban growth has led to incompatible land uses with high levels of pedestrian vehicle conflicts (TRL, 1991). Hence, providing transport in urban areas is more complex. The main reasons include a high population density, inefficient traffic and pedestrians on one hand and a greater concern for personal safety on the other. According to Thompson (1998), the poor can rarely afford public transport and are more likely to walk or cycle on inadequate and insecure footpaths and tracks. This non-motorized traffic accounts for 80% of journeys in urban areas.

2.3.2. Road Network Characteristics

The structure of the road network in urban areas is usually determined by the existing patterns of layout and density of housing and building characteristics. In high-density urban areas the block building results in a large number of intersections with short distances between them. In urban areas nearly half of the fatal accidents occur at the intersections (Matson, 1955). In such areas different kinds of traffic management systems are installed. The numbers of signal-controlled crossings are normally high. But the road network in rural areas is wide, meshed and has lower density of intersections and less traffic controls (OECD, 1978).

Streets in urban areas are usually edged with sidewalks on both sides of the roadway. Buildings, fences and other vertical objects border the streets in urban areas while in rural areas fields or ditches often flank the roads. As opposed to rural roads urban streets are usually lighted. (OECD, 1978).

2.3.3. Road Traffic Factors

The prominent factors which affect the frequency and severity of road traffic accidents are mainly traffic volume, traffic speed and traffic composition. As the volume of traffic grows the increase of opposing vehicles increases, intervals for passing vehicles are less available, the accidents due to improper passing become frequent, and the frequency of accidents grows approximately in direct proportion to the average volume of traffic volume according to Babkov (1975) cited in Girma (2000). Here again as the volume of traffic increases, the speed of vehicles drops and the main kind of accident becomes a nose-tail collision.

According to Ross Silcock partnership (1991) and Ogden (1996) cited in Girma (2000), greater hazard occurs at higher speeds for the fact that vehicles become less stable and the driver and other road users have less time to react. Hence, as the speed of the vehicle increases the severity of accident increases. The survival rate also decreases as the collision speed of the vehicle increases. And the death risk of pedestrians is much higher than for a vehicle user according to Gunnarsson (1999). Gunnarsson cited results of studies that indicate that 90% of pedestrians survive at a collision speed of 30km/h, and 40% at 50km/h. Another study made in Norway as summarized by Sakshaug (1989) showed that when the speed limit was lowered from 60 to 50, 70 to 60, and 80 to 60 km/h, serious accidents were reduced by 40-50%. On the other hand, the number of serious accidents increased by about 50% where the speed limit was raised from 80 to 90 km/h.

Another factor, which affects the frequency and severity of road traffic accidents, is composition of traffic. There are different types of vehicles in a traffic stream. And different

types of vehicles have different physical, geometric, and performance characteristics. Speed and acceleration can vary greatly from one vehicle type to another. High differential speeds in traffic streams result in more overtaking maneuvers and more probable danger of accidents. In support of this view, Ogden (1996) showed that the speed differential between heavy and other vehicles is often the basic argument for higher involvement of trucks in accidents. Therefore, speed, volume and composition of traffic are most important factors in accident prevention (safety), which needs more attention.

2.4. Nature and Cause of Road Traffic Accidents: Generally speaking, for an effective reduction of road traffic accident rates, a full realization of the problem is required, before effective measures are taken to alleviate the problem. This will be discussed later. First we should define "accident" and "road traffic accident".

2.4.1. What is Road Traffic Accident?

An "accident is generally an event or happening which is unexpected, undersigned with an element or chance or probability or unfortunate result" and sometimes an "accident" is defined as "the occurrence which usually produces injury, death or property damage" (Encyclopedia Britannica Vol. 18). And the definition of road traffic accident is more related with the road traffic, in that road traffic is considered as a system in which the human, the vehicle, and the road interact with each other where the efficiency and safety of road traffic depends on the performance and interaction of these components. The definition by Economic Commission for Europe (ECE), which is widely accepted in most countries of the world, is as follows. Road traffic accidents are those which occur or originate on a way or street open to traffic, which resulted in one or more persons being killed or injured and in which at least one moving vehicle was involved. These accidents, therefore, include collisions between vehicles, between vehicles and pedestrians, and between vehicles and animals or fixed obstacles (UN, 1997 Vol. XLII). A road accident is defined in Ogden (1996) shortly as A rare, random, multiple factor event, always preceded by a situation in which one or more road users have failed to cope with the road and its environment. It is a random event from time and location (space) aspects. It is not possible to predict accurately where and when the next road accident will occur. Moreover, there is rarely an accident situation where there is one sole cause of accident. Every accident is a unique event preceded by a chain of unique multiple factors. However, the contribution in each set of circumstances generally falls into the three components of the road traffic system: road, environment deficiencies, vehicle defects, and road user errors.

2.4.2. Types and Classification of Road Traffic Accidents

2.4.2.1. Types of Traffic Accidents: The major traffic accidents that occur on the main highway and streets can be grouped into motor and non-motor vehicle accidents

- 🌐 **Motor Vehicle Accident:** - which is any motor vehicle accident occurring on the highways and streets involving only one car, more than one car, car-pedestrian and car-bicycle accidents.
- 🌐 **Non-Motor Vehicle Accidents:** - are accidents that involve collision between a pedestrian and a bicycle on a sidewalk (Legault, 1960; TRL, 1995).

2.4.2.2. Road Traffic Accident Classification

There is no definite and consistent classification method of road traffic accidents worldwide. Some countries keep only simple records classifying accident into total serious (heavy) injuries, and minor (light) injuries or as total injury and property damage only. Also as indicated by Hobbs (1979), the comparison of accident statistics between countries is made difficult because common definitions are not used. For example, death is defined differently in different countries. Death within 30 days in Britain, at the scene in Portugal, within 24 hours in Spain, within 6 days in France, 7 days in Italy and within a year in the USA. Among these, the definition within 30 days is mainly accepted and the case is true in Ethiopia. Therefore, accidents are classified according to the severity of the accident emphasizing whether a person is killed or injured into fatal, serious, and slight and damage only accidents.

2.4.3. Causes of Road Traffic Accidents

Every accident is not usually attributable to a single cause but to a chain of unique multiple factors or failures associated with the road and environment deficiencies, vehicle defects, and road user errors. In most cases the traffic police associate traffic accident with a single most important cause on the spot of accident and do not list the multiple factors. Among the main causes of road traffic accidents, the most important ones as indicated by Hobbs (1979), Adler (1987), ECA (1989) and Tsumokawo and Hoban (1997) are:

- 🌐 Driving under the influence of alcohol or/and drug
- 🌐 Driving recklessly, dangerously or without due regard for other road users and lack of experience.
- 🌐 Driving above the speed limit- (too fast) and children playing on streets
- 🌐 Failing to observe traffic signs, misperception and panic reactions from the inexperienced driver
- 🌐 Negligent pedestrians crossing or walking on the wrong side of the road and rushing into the roadway

- 🚗 Roads unsuitable for motor vehicles such as narrow road, low quality shoulder surfaces, lack of non-motorized lanes/ paths, undefined crossing sites, dangerous curves, intersections, etc
- 🚗 Inadequate street illumination, poor visibility, lack of sidewalks, etc
- 🚗 Lack of proper signs, signals, markings, intersection layout and control
- 🚗 Mechanical defects of vehicles such as brakes, lights, etc. and congestion.

Most scholars classify these causes into three major classes of error as road user's error, vehicle defects and road condition or environment. Among the most prominent factors, is the human factor of which drivers' errors takes the majority of the blames. Drivers' errors that are hazardous include driving too fast, failing to give way, improper over taking and following too close. All of which could result from aggressive or irresponsible behavior, deficient actions, perceptual errors or impairments. (TRL, 1995)

Vehicle defects, which lead significantly to accidents, are mainly those related to the lack of regular maintenance, of which defective tires and brakes feature most frequently. According to the police, 69-94%, 1-17% and 0-20% of traffic accidents were caused by errors of road users, vehicle defects and road or environmental deficiencies respectively. Generally, it is known that driver errors, often accompanied by violation of law, are in the chain of events leading to more than 90% of road accidents (Hobbs, 1979). This fact is also true even in the developed nations. For example, the study by Evans (1991), on two on-the-spot investigations, one in USA and the other one in the UK, in the early 1970s show that road users, vehicles and roads are identified as the sole factor in 57,3, and 2 percent of accidents in the USA. The corresponding values for the UK study are 65,2 and 2 percent. Generally, these studies found that road user errors are responsible for 93-94%, roads and their environments for 28-34%, and vehicles for 8-12% of traffic accidents.

2.5. Major factors contributing to Road Traffic Accidents: This section focuses particularly on the identification of the contributory and determinant factors for the problem, among which the most important ones are road users (drivers and pedestrians), vehicles and environmental factors.

2.5.1. Road user Factors

Driving is a skill, which requires training, and experience, and a driver who is in charge of a vehicle should be physically and mentally capable. The basic task of the driver should be determining and maintaining speed and direction in relation to the road by reference to the perceived or expected road characteristics and also a driver should take into account traffic rules (such as observation of signs and signals) and the technical aspect. A driver should also determine and maintain speed and direction in relation to road users. Otherwise the risk of being involved in traffic accident will be much high (OECD, 1978).

According to the OECD (1978), studies about 80-90% of the road traffic accidents were attributed to the faults of the driver. The common driving errors are lack of observation or ineffectiveness, driving too fast, failure to look, misperception and panic reaction from the inexperienced. This will be severe if the driver is impaired due to alcohol, drugs, illness, fatigue and emotional stress. In the same study, young and inexperienced drivers were found to be more likely to cause traffic accidents than older and experienced drivers. In the USA, the age group 16-24 years contains 22% of the driver population and this group was involved in 35% of fatal and 39% of all injury accidents. And overall accident rates are lowest for those in the age groups 30-60 years (Hobbs, 1979).

In recent studies made by the American Automobile Association (1997), Larson (1997) as cited in Duckes (2001), the majority of aggressive drivers are men between the ages of 18 and 26. This study stressed age as the most important factor in aggressive driving incidents. Again as this study indicates, aggressive driving is increasing (Altman, 1997) resulting in an increase of 7% per year in traffic incidents. For instance, the Department of Transportation (USA) estimated that, in 1996, two-thirds of the 41,907 reported deaths resulting from automobile accidents are attributed to aggressive driving.

In another study as cited in Duckes (2001), a large percentage of cell phones are used while people are driving, and research shows that the use of the phones compromises safety. Redelmeier and Tibshirani (1997) found that the chance of a collision was four times higher when the driver was using the phone. Of particular concern are the consistent findings that drivers talking on the phone think they have more space in front of their car than they really have, and cell phone users have slower response times (Mcknight and Mcknight, 1997).

The problem of driving while chatting on a mobile phone (cell phone) is also a common problem for Spanish drivers, where the Spanish traffic authorities have decided to strictly enforce the new rules that says "Hang-up and drive" in the Spanish roads (The Economist February 9th 2002). According to this magazine, Spain had 314 deaths per one million vehicles and 151 deaths per one million people in 1998. Also considering the seriousness of the traffic accidents caused by the use of a cell phone which distracts drivers while driving, more than countries including Italy, Brazil, Denmark, Portugal, Israel, Japan, Spain and Kenya have issued laws that forbid the use of cell phone while driving (Addis, Vol. 2 No.1, 2002). In Addis Ababa though the traffic problem created as a result of the use of cell phones at present is not much serious, it will be a chronic problem in the near future as the number of people with cell phones is increasing rapidly. Today 32,000 people are in possession of cell phones and there are 40,000 on the waiting list (ETA, 2002).

Pedestrians are the next victims of most road traffic accidents particularly children below the age of 15. They are the most vulnerable to motor vehicle accidents. Because many children, most of the time especially in urban areas of developing countries where there is little availability of playgrounds in their neighborhood, play around streets or road crossings they

are easily exposed to traffic accidents. Cycling also is another cause of accident for children. In Great Britain in 1974 nearly 40% of the fatalities and 25% of those seriously injured were children under 14 and pedestrians aged over 60. Cycling accident is also acute danger to children, particularly in the under 15-age group. Nearly 25% of all cyclists' casualties, numbering over 20,000 per year, including those slightly injured are from this age group alone (Hobbs 1979).

2.5.2. Vehicle Factors

It is not only the improvement in the standards and design of vehicles that matters, but also adequate maintenance of the vehicle during its working life (Hobbs, 1979). Older vehicles with mechanical defects and poor maintenance cause higher fatal injuries and property damage. For instance, studies in Britain show that about 20-30 percent of personal injury accidents involve a vehicle having some deficiency (Hobbs, 1979). In most cases, defects associated with the break, tire, light and other mechanical defects are associated with accident. Size difference between colliding vehicles also affects the severity of injury, particularly in cases when heavy vehicles impact light vehicles. As indicated in many studies such as in Garner and Deen (1973), Evans (1991), and Downing et al. (1991), vehicle defects rank after driver and environmental deficiencies as a major cause of road traffic accidents.

2.5.3. Environmental Factors

There is an intimate relationship between defect of roads and road traffic accidents. The design, lighting, and surfacing of roads can affect injury rate and well-designed roads allow greater margins of safety. Many accidents needlessly occur because the facilities provided do not adequately allow for the range of individual requirements of separate groups of road users particularly the pedestrians. (Hobbs, 1979).

In many developing countries due to limited financial resources road construction and maintenance is poor. In addition, roads are not bordered by sidewalks for pedestrians. Both the vehicles and pedestrians are forced to share the available roads or streets, which contributes to high traffic accidents in those countries. The condition of road surface also contributes to the occurrence of traffic accidents. The theoretical basis is that damaged and uncomfortable road surface is most likely to increase the probability of incidence of traffic accidents. Road moisture condition is another contributory factor for the incidence of traffic accident. Road surfaces such as dry; wet and muddy have their own contributions to the traffic flow. The relationships of road width, curvature and straight distance all have particularly marked effects on the occurrence of accidents (Hobbs, 1979).

It is on straight and plain roads that traffic accidents occur mostly rather than on others. It is due to the low gradient of these roads that drivers want to drive fast on this section of the road. The occurrence of an accident is not usually attributable to a single cause but to the combined effects of a number of deficiencies or failures associated with the user, his vehicle and the road layout. Environmental conditions such as weather and time of day will be of

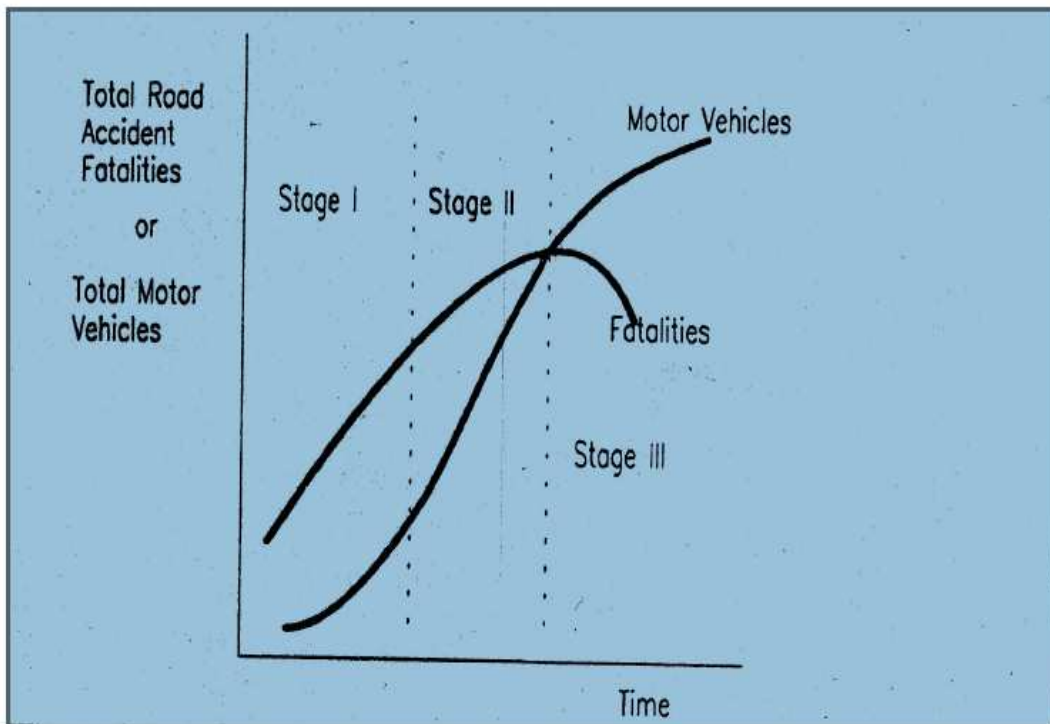
influence. Out of the total road accidents (as studies show) about 1%, 2% and 15% occur in a foggy, snowy and rainy weather respectively. Night-time accident rates for unlit streets, are about twice that of day time, and even under average street lighting conditions they are about 50% greater (Hobbs, 1979).

Generally, though traffic accidents are most of the time associated with one sole cause, most of them are attributable to multiple causes. In a study made by the Department of Transportation and Environmental Planning in UK out of 500 road accidents it was found that 77% were attributable to multiple causes and 3% to a single cause. Environmental/road user factors account for 48.8% followed by environmental/ vehicle road user factors (16.4%), road user factors (12.4%), vehicle/ road user factors (7.2%), environmental factors (5.6%) and environmental/vehicle factors (4.8%). And in a wider ranging on-the-spot study by TRL, human factors are the sole reason in 65% of the cases and a contributory cause in 95%. About 25% of the accidents studied displayed a deficiency in the road, environment linked to a driver error (Hobbs, 1979).

2.6. Road Accident Risk and Levels of Motorization

Road accident and the number of vehicles in most cases (other things being constant) have a direct relationship. When the volume of traffic increases the risk of traffic accident increases. On the basis of the number of vehicles per a given number of people the world nations are at different stages of motorization. As experienced in many developed countries, the development of motorization generally follows a typical trend of S-shaped curve. The overall trend has been characterized into three distinctive stages of development (Jorgensen, 1996),

These two curves in Figure show the general relationship between motorization and safety at a given development stage of a country. In the initial stage of motorization, the population has little knowledge about road safety and less aware of how to act safely in the motor traffic. During this stage, road accident fatalities rise with the increase in motorization and population. In the second phase, as the traffic hazard increases with high rate of motorization, awareness and concern develops. At this stage there is an increased understanding of the man-vehicle-road-regulation system. This is due to the fact that attention is given to the improvements of road and vehicle design as well as influencing human behavior by means such as education, legislation, and enforcement. This stage is characterized by the decrease in the rate of fatalities per vehicle.



Source: Girma, (2000:27)

Fig 2.2 Typical Trend for the development of Motorization and Traffic Fatalities

The third phase of development starts when road-traffic fatalities peaks and begins to decline. Here traffic accident fatalities continue declining with the implementation of proven safety improvements on black spot road sections, drinking and driving, speeding and vehicle safety. This is the historical achievement of a number of industrialized nations in the early 1970s (Girma, 2000).

2.7 Spatial and Temporal Variations in Road Traffic Accidents: A fundamental per-condition for safe traffic is that the road users have sufficient information about road conditions, traffic characteristics and traffic regulations. The road layout and design should be improved. If it is not the case, traffic accidents will tend to increase and most road accidents occur in urban areas than in rural.

2.7.1 Spatial Distribution of Road Traffic Accidents

Severe road traffic accidents are associated with those areas, where there is lack of information, overload of information and when the information is difficult to perceive as well as at intersections where traffic is not regulated and with complex geometry (design). Moreover, roads with heavy traffic volumes, with mix of local and through traffic, road users traveling at different speed levels and/or in different directions as well as in busy shopping streets where

the high complexity makes it difficult to select sufficient information about the road and the traffic. Most road traffic accidents take place at junctions, on curves, at gaps in dual carriageways, at pedestrian crossings, private driveways and bus stops. Also accidents more likely occur at junctions than elsewhere and in urban areas (Hobbs, 1979).

According to Ogden (1996), for example, in the USA, over 50% of urban and over 33% of rural total reported accidents occur at intersections. The corresponding figures in Australia are 43% and 11%, respectively. Again in the United Kingdom, 60% of all reported accidents are intersection accidents (Jacobs et al., 1986). Therefore, intersections and urban areas especially in the central places of cities are the areas of traffic accident and focus of road safety works. Intersections have different configurations such as the T, X and Y junctions which have different influence on the safety performance of intersections (Ogden, 1996).

2.7.2. Temporal Variation of Road Traffic Accidents

Occurrences of road traffic accidents obviously vary with time. This variation occurs between hours in a day, days in a week, and months in a year closely following the variation of Traffic volume. Even though nighttime driving is normally low, the rate and severity of the accident is higher during the nighttime. According to Hobbs (1979), nighttime accident rates are about 50% greater than daytime accidents.

2.8 SOCIO-ECONOMIC ASPECTS OF ROAD ACCIDENTS IN DEVELOPING COUNTRY

Apart from the humanitarian aspects of road safety, the injuries and fatalities which occur as a result of road accidents have serious implications for a country in both Social and economic terms. As a result of a wide variety of road safety activities and traffic management measures, in developing countries the situation is worsening with road accident deaths increasing. As the numbers of road accident fatalities in developing countries have grown, their relative importance as a cause of death has increase (owning and Sayers 1982). Transport Research Laboratory. According to An analysis of police and medical road accident data 1977-1981, Transport Research Laboratory, to ascertain whether this is still a characteristic of road accident deaths in LDCS, the age profiles of road accident victims in LDCS have been compared with those in ICS. The age-profile of accident victims can also have an impact on GNP (Gross National Product) and working years lost. Therefore, age related data have been important in calculating the economic costs of road accidents. Apart from the humanitarian aspects of road safety, the injuries and fatuities which occur as a result of road accidents have serious implications for a country in both social and economic terms. As a result of a wide variety of road safety activities and traffic management measures, road accident levels in most industrialized countries are falling, but in developing countries the situation is worsening, with road accident deaths increasing.

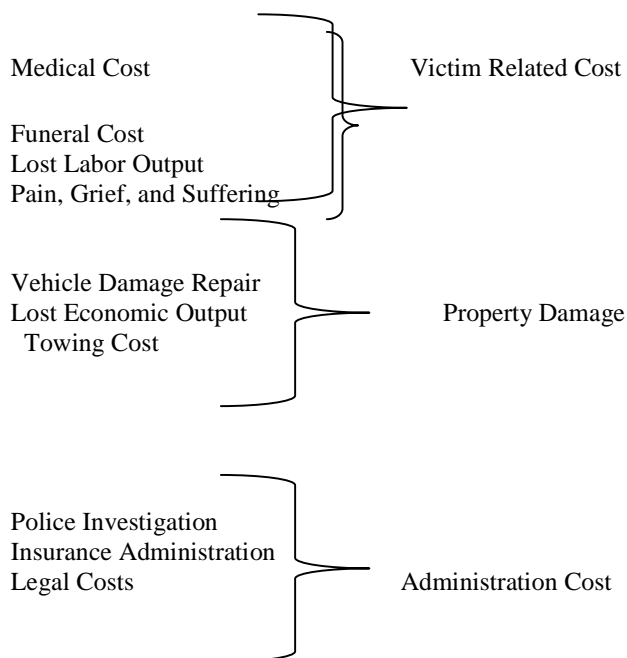
2.9 GLOBAL ECONOMIC COSTS OF ROAD ACCIDENTS

Research on road accident rates in developing countries calculated that for any country, the cost of road accidents is equivalent to approximately 1 percent of its gross national product (GNP). To gauge the economic cost of road accidents, GNP by region for 1990 has been calculated using statistics published in the World Bank Atlas, it was calculated that the global cost of road accidents may well be of the order of US\$ 230billion per year, with the cost to LDCs being around US\$ 36billion. Apart from the humanitarian aspect of reducing road accident fatalities, a strong case can be made for reducing road accident deaths on economic grounds alone, as they consume financial resources that LDCs can ill afford. Substantial returns are available from investment in roads safety (Four acre and Jacobs, 1976)

2.10 ESTIMATION OF SOCIO-ECONOMIC COST OF ROAD ACCIDENTS IN METRO MANILA

Accident Cost Components: According to Journal of the Eastern Asia Society for Transportation Studies, (2005); To be humane and considerate of the social impacts of accidents, a notional sum is also added to quantify the PGS of the victim's families. Property damage consists of vehicle repair, lost of economic productivity of public utility vehicles and cost of towing services. The first two components make the largest portion of property damage and are given due attention in this paper. The third and last component of accident cost consists of costs associated with police investigation, legal activities and insurance administration.

Classification of Accident Cost Components



2.11 Socioeconomic Impact of Sustainable Road Transport System

The expressway was designed in accordance with national road engineering standards, taking into account forecasted traffic speed of 120 km per hour (kHz). The completed project expressway is a controlled-access, toll expressway with dual four-lane asphalt concrete pavement. It is 141 km long with a sub grade width of 28 meters (m), width of 3.75 m for each driving lane, 6 large bridges measuring a combined 4,000 m, 6 interchanges, 4 roadside stations, 225 crossings and culverts, and 8 toll stations. During implementation, some variations to the nine awarded civil works contracts were made to (i) increase haulage volumes and distances of sub grade materials; (ii) carry out lime treatment and impact compaction of sub grade materials with high moisture content; (iii) increase the number of underpasses and culverts to meet community needs; (iv) build micro-pile foundations for 10 minor bridges in soft soil areas; (v) change base course design from lime soil to lime-fly-ash and cement to make it more environment friendly and stronger; (vi) add waterproof layer in bridge decks; and (vii) relocate one toll station (HASS, 2005). HPCD uses, on an experimental basis, several modified techniques developed jointly with the Ministry of Communications (MOC) to overcome possible traffic rutting effects and reduce bleeding of bitumen. The pavement surface was treated by spreading a special coat to resist operational and wet weather impacts. The overall riding quality of the expressway is good. Surface roughness, as measured by the pavement roughness index (PRI), is well within the allowable tolerance (1.9 m/km). The expressway interchanges and drainage systems also were built to a high standard. The landscaping and slope protection work was carried out satisfactorily. The Project was carried out according to plan. (HASS, 2005).

2.12 Road Maintenance and Asset Management

The maintenance equipment purchased under the loan comprised snow plow, lawnmower, concrete cutter, crane, pothole repair plant, road marking vehicle, and salt spreader. The HPCD has adopted an efficient practice to maintain and manage the physical conditions of the road, taking into account the need of road users as well as the costs and benefits. Three groups handle road maintenance: (i) an internal road maintenance section with six staff in charge of expressway maintenance planning, asset management, and expressway clearance in case of bad weather conditions and emergencies; (ii) three sets of contractors (20 people each) selected through competitive bidding, each with a 3-year contract, to provide routine maintenance for the expressway; and (iii) a qualified road maintenance firm, selected through competitive bidding to carry out major maintenance as required. The International Financial Institutions Loan Project Office (IFILPO) is responsible for the bidding of major maintenance work, and an appropriate budget was provided. The maintenance cost was CNY13.4 million in 2003 and CNY28 million in 2004. Over the next 20 years, the maintenance budget is estimated to be CNY20–40 million per year for routine maintenance and CNY2 billion for major replacement scheduled for every 7 years. (HASS 2003).

2.13 Road Traffic Accident Situation in Ethiopia

Ethiopia is one of the developing countries with a very low motorization level, 1.7 vehicles per 1000 people in 1996/7 (Girma, 2000), and the most recent data show 2 vehicles per 1000 people in 2001 (UN, 2001). Despite having a very low road network density and vehicle ownership level, Ethiopia has a relatively high accident record. Even though the fatality rate is decreasing, it is still very high compared to the rates of many countries in the world. According to RTA (1996) cited in Admasu (2001), the years between 1990 to 1995, exhibited a fatality rate of 197 per 10,000 vehicles on the average. It was 178 and 155 per 10,000 vehicles during 1996/7 and 1998/99 respectively.

According to Jacobs (2000) cited in Admasu (2001), the fatality rate is 150 for every 10,000 licensed vehicles in 2000. This could be due to the underreporting of accidents and the problem associated with the inspection of vehicles. The controlling of the not inspected vehicles is loose which leads to the decrease in the number of inspected vehicles (the denominator). Ethiopia's road traffic accident problem has been indicated as the worst example in different papers in comparison with other countries. Jacobs and Sayer (1983), Ross Silcok Partnership (1991), Downing et al. (1991), Jorgensen (1997), TRL and Ross Silcock (2000), Jacobs (2000) and World Bank (2000) and Admasu (2001). Ethiopia is on the extremely high side of the international road unsafely scene as shown in Table 7 that shows fatalities per vehicle versus vehicle ownership for selected African and European countries. Accordingly Ethiopia ranks the top in terms of fatalities per 10,000 licensed vehicles but it is at the bottom in terms of fatalities per 100,000 populations as well as vehicle ownership compared even with the nations of Africa found at similar levels of development. In 1989 the fatality rate was 236 but it decreased to 198 fatalities per 10,000 vehicles in 1994.

Table 2.3 Fatality Rates and Vehicle Ownership Levels of Some African and Developed Countries

Country	Year	Fatalities per 10,000 vehicles	Fatalities per 100,000 population	Vehicles per 10,000 population
Ethiopia	1989	236	3	12
	1994	198	3	16
Uganda	1989	189	5	27
	1994	198	7	36
Kenya	1989	73	9	118
	1994	64	9	120
Botswana	1989	41	19	536
	1993	38	26	722
S. Africa	1989	21	36	1700
	1994	18	25	1336
Norway	1989	1.9	9	3810
	1993	1.4	7	3780
Sweden	1989	2.0	9	4200
	1993	1.6	7	4100
Great Britain	1989	2.3	9	3450
	1992	1.8	8	3620
USA	1989	2.4	18	5758
	1992	2.1	15	5654

Source: Girma (2000:24)

It could be even greater than this figure because there is a problem of under reporting. The problem of under reporting has been indicated in many studies like Tadele (1989) and Girma (2000). For instance, according to a study made by Tadele (1989), about 30% of hospital treated motor vehicle injuries in Addis Ababa, had no police records, while nearly all police recorded injuries had a hospital record

2.13.1 Casualties by Road Users in Ethiopia

The knowledge of the causalities by road users helps in how and where to start to solve the problem of personal injuries (Casualties). In the study made by Girma (2000) approximately 56% of the reported traffic accident fatalities are pedestrians (average from 1987/8 to 1996/7) and 45% of non-fatal injuries were pedestrians. In the same study drivers account on the average for 7% of fatal, and 6% of non-fatal road accident injuries.

Table 2.4 Comparison of Road Accident Fatalities by Class of Road Users in Selected African Countries

Country	Year	Road Accident Fatalities (%)		
		Drivers	Passengers	Pedestrians
Ethiopia	1993/4	6	42	52
Botswana	1994	20	58	23
Kenya	1994	20	37	43
Malawi	1994	10	53	37
S. Africa	1994	27	32	41
Zambia	1994	14	41	46
Zimbabwe	1994	37	22	41

Source: Girma (2000:25)

There are higher pedestrian fatalities and very low driver fatalities in Ethiopia compared to the above-mentioned countries.

2.13.2 Accident Reporting in Ethiopia

The existing system of accident reporting classifies accidents into four accident severity classes in Ethiopia, namely: fatal, serious injury, slight injury and property damage. But the distinction between serious and slight is not well established where it mainly depends on the personal judgment of the traffic police on the spot. But the traffic accident casualty pattern in urban areas of Ethiopia is very high even compared with that of other countries. For example, in Addis Ababa, the pedestrian casualties account for 88% and 83% of the fatal and non-fatal injuries

(average from 1987/8 to 1996/7) Girma, (2000). But comparing with other studies like in Bombay (Sayer and Palmer, 1997), and Kampala (Oliver, 1995) pedestrian fatalities account for 70% and 61% respectively. Whereas passenger and driver casualties according to Girma, (2000), in Addis Ababa were four and two times less than the national average respectively. Many countries use the definition of road accident fatality as one in which death occurs within a 30-day period as a result of sustained accident injury (Ogden, 1996) and (Ross Silcock, 2000).

In Ethiopia, however, road accident fatality is not clearly and uniformly defined. Accident deaths shown in the accident statistics are mainly on-the-spot deaths. The inclusion of victims who died in hospitals within a short period of time during police investigation is probable. It is quite dependent on the follow up of the investigating policemen. If the victim dies after the preparation of the monthly summary of the accident report, the severity class will most likely remain unchanged. But comparing the reliability of the accident statistics, the fatal accident statistics are more complete and reliable than the non-fatal accident data (Tadele, 1989) due to fatal accident information is needed to enforce the law and carryout prosecutions.

CHAPTER THREE

METHODOLOGY OF THE STUDY

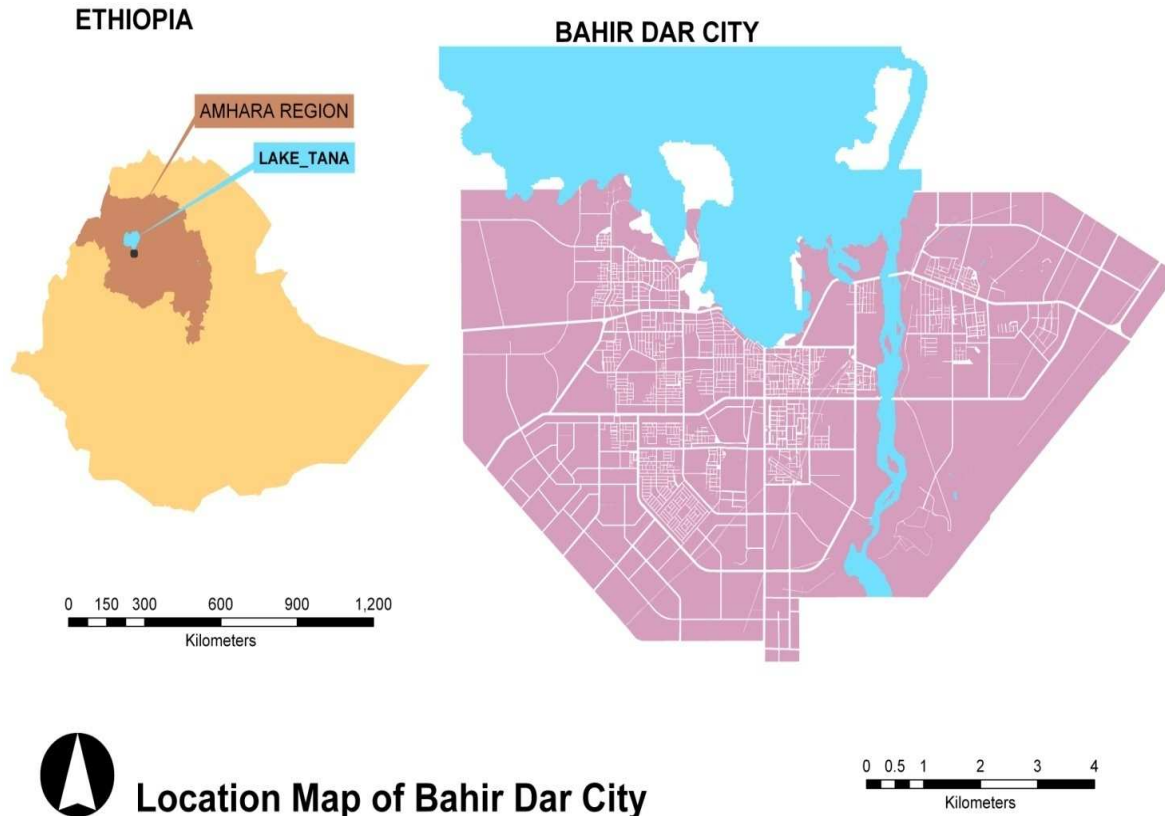
3.1 Introduction: In order to achieve the objectives set and get the plan implemented, one needs mechanisms and strategies put clearly. This chapter lists and describes the general background of the study, methods, techniques and strategies used in the study.

3.2 GENERAL BACKGROUND OF BAHIR DAR

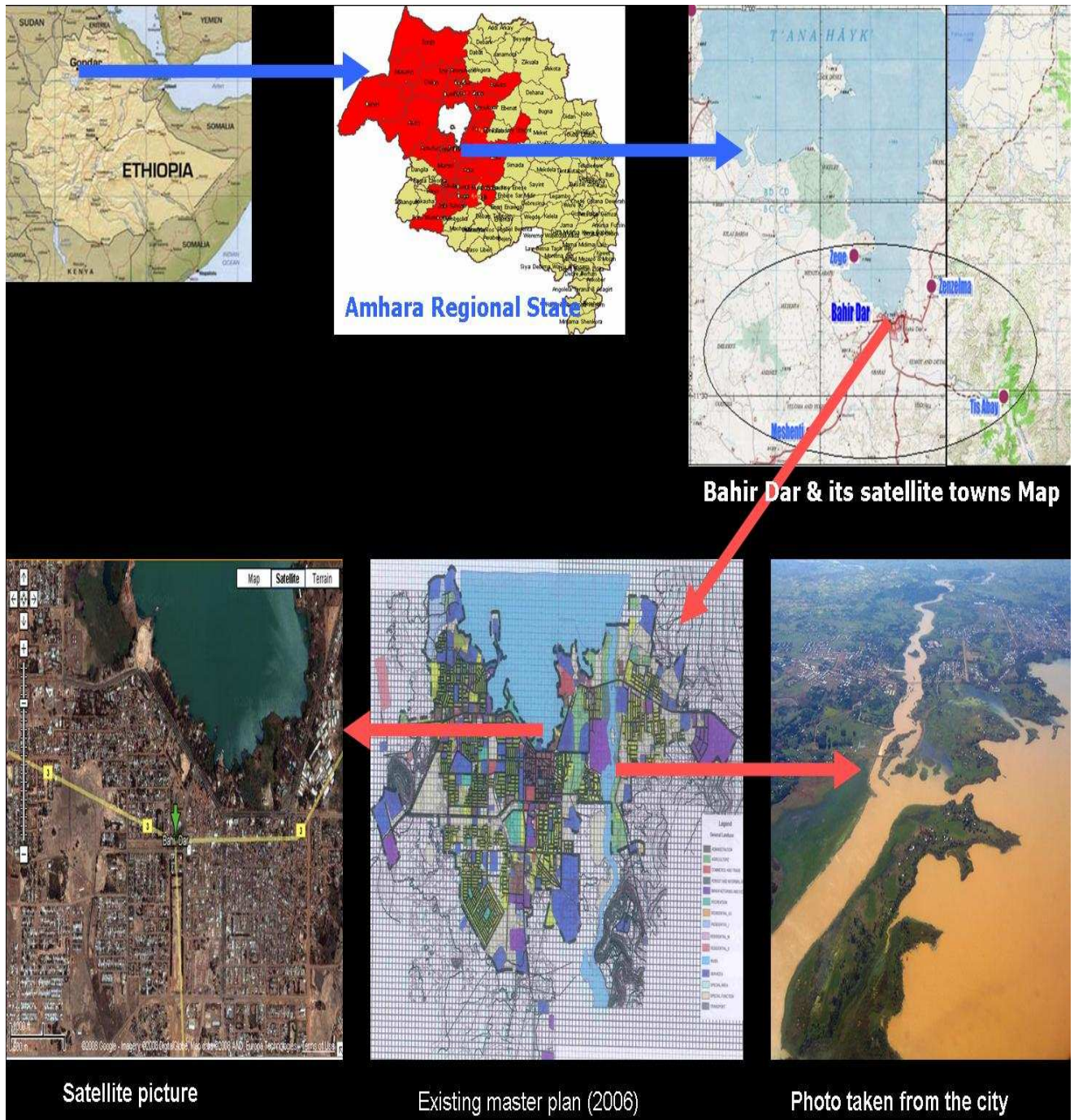
3.2.1 Location

Bahir Dar is the capital city of Amhara National Regional State (ANRS) and is the regional government headquarters. The Bahir Dar City Administration is accountable to the Amhara National Regional State. With the restructuring made in 2004, it incorporates 3 satellite towns (Zegie, Tis abay and Meshenti), 9 urban and 4 rural Kebeles, which have their own executive and judiciary organs. The core city has an estimated area of 16,000 hectares. The town of Bahir Dar is located in the North Western part of Ethiopia at a physical distance of 565 kilometer from Addis Ababa, the capital of Ethiopia. Astronomically, Bahir Dar is located at 11° 36' north latitude and 37° 25' east longitudes (EMA, 1988). The foundation of Bahir Dar dates back to the 14th century associated with the establishment of Kidane Mehret church near Lake Tana (Seltene, 1988). But the construction of Bahir Dar as a modern town started in 1936 during the Italian occupation (NUPI, 2000). The city is encompassed with flat landscape in-between 1,780 - 1,886 m.a.s.l (BDIDP, 2006). The city has got a metropolitan administration status with state and municipal level functions. In this regard, the nearby small urban localities named Tis Abay, Zegie and Meshenti are integrated with the city proper. For administrative purposes the core city area is divided into nine urban Kebeles and nine rural Kebeles

Map 3.1 Location Map of Bahir Dar City



Bahir Dar has a flat land topography situated on the South Eastern shore of Lake Tana. The slope varies from 0 to 20 % with swampy areas, especially during the rainy season (NUPI, 1996). The city, in general, experiences a moderately warm humid climate with annual rainfall of 1,224mm and an approximately daily temperature of 18.5°C. The flat topography with high concentration of rains in short periods and lack of drainage net- works has affected the city with flood and water logging problems. Notwithstanding, the city is favoured with multifaceted opportunities, in terms of good water resource it benefits from Lake Tana, Blue Nile River and intermittent watercourses.



Map 3.2: Location Map of Bahir Dar and Blue Nile River

Bahir Dar has a total population of 234,720. The city's population is growing and it is expanding horizontally at a fast rate in the rural hinterland. This manifests the existing spatial and infrastructure service delivery problems. The unavailability of proper drainage systems,

dilapidated city centre and poor solid waste collections as well as deficient management is among the critical social, economic and environmental issues that have been encountered in the city. Bahir Dar plays a role as manufacturing, storage and distribution centre in the west of the Region. It has a growing tourism and recreational performance due to its location close to historical sites in and around Lake Tana and the Abay River. Significant is its development with respect to transport and communication due to its location along the main highway and its Regional, Zonal, Woreda and Metropolitan administrative status.

The rapidly growing population is in a need of working opportunities. The development of micro and small scale enterprises and commercial activities are expected to help overcome this problem. In addition, the favourable investment climate in the tourism and service sectors would create employment opportunities as well as enhance the growth and development process of the city. In terms of education and health service delivery the city's performance is quite promising. Besides, the city has to deal with various economic problems, including urban poverty, unemployment, and food insufficiency, poor urban-urban and rural-urban integration.

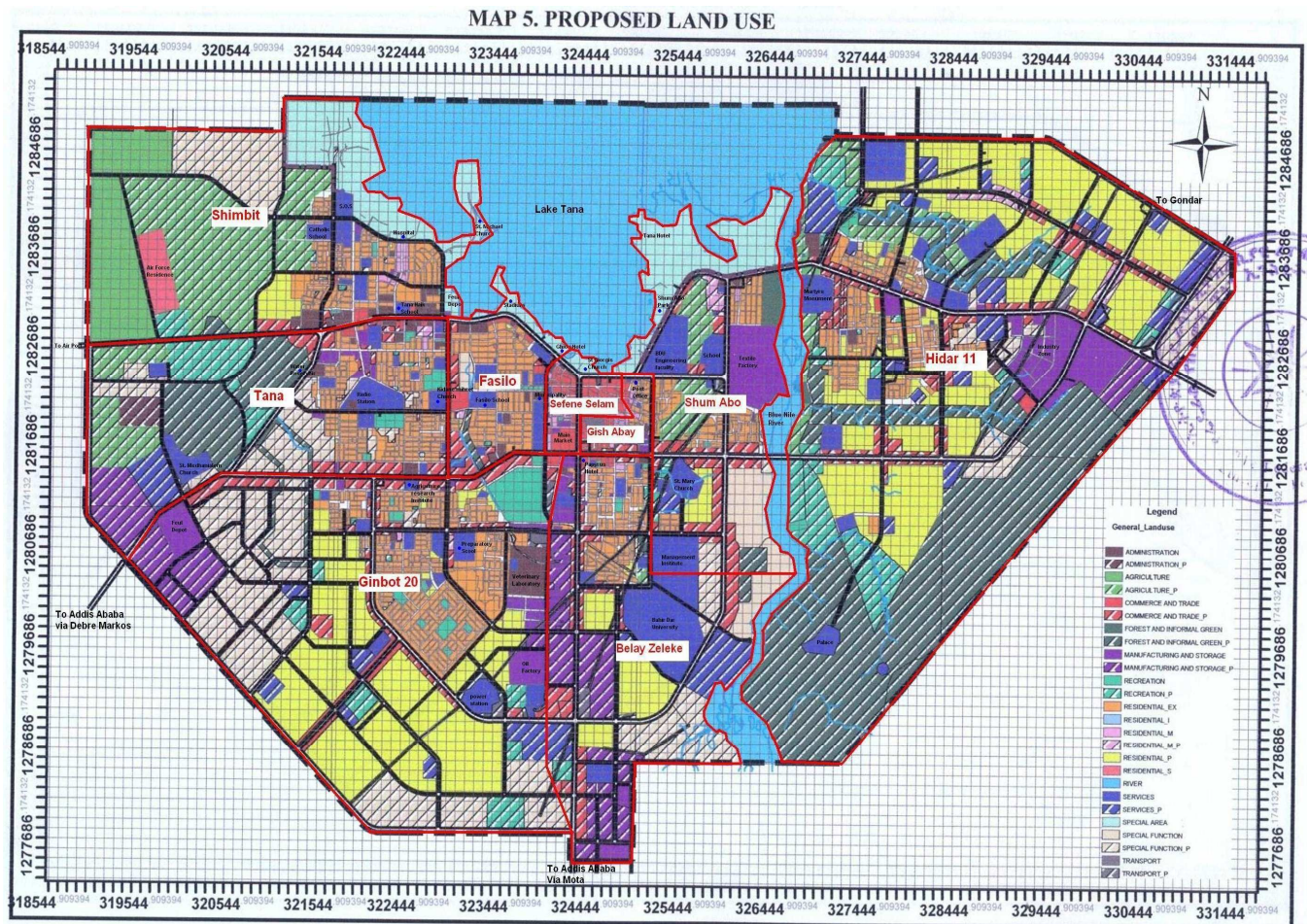
3.2.2 Area and Structure

Bahir Dar covers a total area of 4520 hectares having a built up area of 2632(BSZ, 2002/03) hectares, which is divided into two Woredas and seventeen Kebeles for the purpose of administration. Out of the total surface area, 17.2 percent is covered by water. The area that is covered by Lake Tana, Abay basin, and River Chambel is 6.3, 3.8 and 1.2 percent respectively. In the town nearly 17 hectares of ponds and 198 hectares of swamps cover the large areas of different localities (DEVECON, 1999). Bahir Dar lies on flat topography at the Lake Tana sub-basin. The most geographical structure of the area is Lake Tana depression formed from circular fault which creates a large subsidence. The topography of the town is predominantly flat area with an altitude ranging from 1786 to 1870 meters above sea level. The slope varies from near zero to some 20% in few hillsides, but for the most parts of the town the slope is below 2 percent (DEVECON, 1999).

3.2.3 Land Use Patterns and Master Plan

Pre-twentieth century Bahir Dar was characterized by its function as a caravan stop, administrative center and place of Christian learning and worship. These factors already led to the emergence of a relatively bigger settlement. Christians and Muslims inhabited the town and

Woitos, landlords and hand crafts partitioned the land of the town among themselves (Seltene, 1988).



Map 3.3 The existing Land use plan of Bahir Dar

Following the advent of the Italians, a marked urbanization and growth of Bahir Dar was achieved. With the Italian invention of 1935, the town started to serve as military camp. As a result the land holding system was changed forcefully and different land use system were implemented, introducing residential and commercial places. The town got municipal status in 1944. In 1950 the town got an *Awraja* status in the Imperial Government administrative structure. A new and better plan was prepared at this time by giving emphasis to opening new roads, constructing offices, and identifying residential and commercial places (NUPI, 1998). Observing its historic place as a center of the region, the town master plan was prepared in a modern way in 1958, by German consultants and this plan was meant to serve a total of fifty years.

Except for a few alterations, most urban functions and infrastructure, either economic or social projects, had been established according to this master plan. To mention some, the Textile Factory, the Felege Hiwot Hospital, the Bezawit Palace, the main Lake Port, the Hydro Eclectic power generation project on Tiss Abay, the bridge on the Blue Nile River, opening of commercial Bank and others took place in between 1958 and 1963 (NUPI, 1998). In 1962 the Ministry of Housing and Urban Development made an improvement on the existing master plan, which was functional until 1995. This detailed plan showed the total area and the land use pattern for different services like residential, industrial, commercial, recreational, office use and other areas (BWUD, 1998). In 1994 the total actual land use for the above mentioned purposes reached 1108 hectares.

Table 3.1: Land Use Type and the Percentage Share in the 1962 Master Plan and Detailed Plan of Bahir Dar in 1996

Land use Type	Master Plan Area of 1962		Detail Plan Area of 1996	
	Hectare	%	Hectare	%
Residential	1112	72.6	1782	67.7
Industry	370	2.4	301	11.4
Commercial	154	1.0	35	1.4
Office	264	1.7	189	7.2
Recreation	137	0.9	82	3.1
Transportation & Road	282	1.8	203	7.7
Others	2639	17.2	41	1.5
Total	4958	100	2632	100

Source: Socio-Economic Profile Study of Bahir Dar (1998)

Table 3.2: Land Use Profile of Bahir Dar in the Revised Master Plan of 1996 by Activities

No	Land use classification	Proposed Future Land use (Hectares)	% share of Built up area
1	Residential	897.3	23.2
2	Administration	174.6	4.5
3	Commercial/Trade	218.4	5.7
4	Social Services	448.4	11.7
5	Manufacturing	262.6	6.8
6	Transportation and Road	472.8	12.8
7	Recreation	201.9	5.2
8	Agriculture	367.1	9.5
9	Forest	472.7	12.2
10	Special Function	326.7	8.4

Source: Socio Economy Profile Study Of Bahir Dar (1998)

The town of Bahir Dar has been restructured in accordance with the proclamation No 43/2000, a proclamation issued to provide for the establishment, reorganization, and definition of power and duties of the municipalities of the Amhara National Regional state. The objective of the reform capacities is to transform the municipality from administrative units into autonomous service delivery units. Therefore, the municipality of Bahir Dar is now an autonomous entity which carries out its functions with principal organs of a municipal council, a standing committee, a mayor, a town manager and deputy manager.

3.2.4 Economical Situation

According to the 2007 Population and Housing Census, Bahir Dar has a total population of 220,344, of which 107,578 (48.8 %) are males and 112,766 (51.2%) females. As to distribution of population across rural-urban settings, the rural residents constitute a very low proportion (18 %) (CSA,2008). The population of the city is growing alarmingly despite the recent decline. Like other Regions of the country, poverty is a severe problem in Amhara National Regional State and hence in Bahir Dar. To this effect, about 42 % of the population is living under the poverty line (ANRS, BoFED, 2007/08). One of pervasive problem of urban centers in general, and Bahir Dar in particular, is the existence of very high unemployment rate. About 25 % of the employable residents of Bahr Dar are unemployed. The Office of Micro and Small Scale Enterprises of Bahir Dar indicates that the numbers of unemployed male and female were 6,323 and 14,975 respectively. The monthly household income of the population of Bahir Dar city shows that about 44% of them earn less than 250 Birr/month, while 31% and 15% of the population are earning a monthly income of 250 to 600 Birr/ month and greater than or equal to 600 Birr/month respectively. The situation justifies that poverty is still a chronic problem in the city. The urban economy of the city shows that 42% of the population is engaged in wholesale and trade, 39.1% of them engaged in Administration, Recreation, and Social activities, 19.9% of them in manufacturing sector and about 4 % of them are engaged in urban agriculture (Bar Dar IDP, 2006). For detail information, please refer to the *Bahir Dar LED Strategy*, annexed herewith.

The Bureau of Planning and Economic Development (1999) indicated that 48.8 percent of the households earn less than Birr 4000 per annum and 18.2 percent earned even less than 2000 per annum. According to the Bureau the annual income of Bahir Dar was estimated to be about birr 4000 the majority of the residents are low income earners engaged either in small scale business or in daily labor to meet their basic economic needs. Based on CSA 1994 survey, some 40 percent of the household heads (of those who are employed) are engaged in government services; around 33 percent are in private businesses and 27 percent are self-employed. The major economic activities of Bahir Dar include tourism and recreational services, trade,

manufacturing activities and informal sector engagements. Due to the proximity of the town to Lake Tana with its internal historic churches and monasteries and scenic beauties, international and external tourism have developed, which, in turn, has accelerated the growth of the town. For instance 20,100 and 26,440 tourists visited Bahir Dar in 1995 and 1996, respectively (BSZ, 2000). Such development in tourism industry has a forward linkage to stimulate local transport activities. A total of 1967 private commercial organizations with a total capital of 12, 182, 029 Birr were registered by the end of 1996 in whole sale, retail and service giving sectors. By the year 2000, those small-scale industries in the town have reached 535 with a total expected capital of 46,011,284 Birr and employees of 4252 workers (BSZ, 2000).

3.3 Research Design

Research methodology adopted by the researcher is a key instrument to solve the problem identified to carry out research. For this study a descriptive survey type of study was used. This type of research helped the researcher to describe the characteristics of the variables in the study. Therefore, the type of research is both qualitative and quantitative. Because, to measure, quantify, and describe the respondent's response and the number of accidents, damaged cost etc, the hybrid method [qualitative and quantitative] research design is selected for this research. In this research structured interviews, open ended and close ended questionnaires and documentary analysis was used to meet the research objectives and research questions stated above in their part.

3.4 Source of Data and Instruments

In order to make closer investigation and to get reliable data and information related to cause, extent and economical impact of road traffic accidents, both primary and secondary data were used in the study. The main type of data used in the thesis includes both primary and secondary sources. Several techniques were employed to collect primary data. Some of these include: attitudinal surveys involving structured questionnaires, field observations of vehicle flows and real road situations. In this study, five structured attitudinal type of questionnaires were designed. The first was completed by the traffic policemen, the second by the pedestrians, the third by school children, the fourth by drivers and the fifth by cyclists. The questionnaires were designed to allow the researcher to identify the most profound difficulties and traffic safety problems that road users face while moving along and crossing the roads of the town. It is also designed to serve the researcher to identify the level of adherence and understanding of traffic regulations of the individual person being interviewed. In addition, the questionnaires were designed to allow the researcher to provide measures of the traffic experience, perception, attitude as well as stated driving and road crossing behavior of drivers, children, pedestrians and cyclists. Furthermore, to get a general picture of road traffic problems, informal

interviews were conducted with Bahir Dar City Administration Finance and Economic Experts and Traffic Police Officers. Their opinions have been given great attention in the study

Secondary data for road accidents were obtained from the police accident files of Bahir Dar city administration Traffic Police office (**BCATPO**), Amhara National Regional State Police Commission (**ANRSPC**), reports of health centers and hospital were also collected.

3.5 Population and Sampling size: Bahir Dar city administration has 28 traffic policemen's those are directly involved through traffic flow of the city so that the researcher has taken all 28 populations as a target of study. Besides to that the researcher identified three main locations or streets in Bahir Dar town that are characterized by a dense vehicle and pedestrian movement. Pedestrians, school children, drivers and cyclists were randomly selected and interviewed in these areas. In order to select these sample streets and sample populations the researcher first assessed the recorded traffic police accident data and refer a pilot study made by Bahir Dar City administration Traffic Police Office (BCATPO, 2010). According to this survey, about 90 % of the accidents occurred on these three main roads of the town, namely:

- St. George church to Felegehiwot hospital road
- St. George church to Gamby square
- St. George church to Poly road

These roads usually make up 10 percent of the total road length in the town areas. Comparing the figures on road length and accidents, it turned out that these main roads have 15 times more accidents per kilometer than residential area streets. (BCATPO, 2010)

The personal observation of the researcher also identified a complex traffic flow (motor vehicles, cyclists, pedestrians, horse drawn cars and animals) on these streets. These concentrations of traffic in these roads are directly related to the concentration of administrative offices, social services, schools and commercial centers. These high concentrations of activities along the main roads results in a large number of accidents. Therefore, accidents on the main roads are critical issues of concern in this study. Thus, pedestrians, drivers, cyclists, and school children were randomly selected and interviewed in these areas.

According to the a pilot study made by Bahir Dar City administration Traffic Police Office (BCATPO, 2010) 450 pedestrians, 125 motor vehicles, 304 cyclists, 550 school children moving and crossing along these line of streets at the identified peak hour of between 5 p.m. and 6 p.m. From the total population lists above, the researcher believed that if 20 % of the

pedestrians and school children, 80% of the drivers, and 33% of the cyclists were taken as a sample from these different sites, it could give us a clear picture of traffic accident problems in the town. Therefore, in this study a total of 400 respondents were chosen randomly, that is, from pedestrians (90), school children (110), cyclists (100) and motorcar drivers (100) from the three sites and they were interviewed at different time. However, after verification of the completed forms and coding in preliminary analysis of the data, 10 forms of the questionnaire for cyclists and 10 forms of the questionnaire for drivers were rejected for incompleteness or misinformation. Thus, the achieved final sample is 90 pedestrians, 90 cyclists, 90 drivers and 110 school children, a total of 380 respondents were involved in the study.

3.6 Data Analysis


Before the actual analysis, the collected data were edited, coded, and tabulated. After both primary and secondary data has collected, it was analyzed and presented using statistical tools like tables, bar graphs, line charts, pie charts and percentage. Raw data collected through questionnaires, interviews, observations was carefully tallied, tabulated and organized. Both quantitative and qualitative approaches of data analysis were used. The qualitative method was used to describe the findings qualitatively like attitudes and perceptions while the quantitative data was analyzed by using excel and statistical presentation system software package like SPSS. Tables, Charts, Graphs, Percentages, Ratios, Figures and Photos were used to interpret and summarize the findings where necessary.

3.7 Variables of the study;

3.7.1 Dependent variables

Road Traffic Accidents: are those which occur or originate on a way or street open to traffic, which resulted in one or more persons being killed or injured and in which at least one moving vehicle was involved. These accidents, therefore, include collisions between vehicles, between vehicles and pedestrians, and between vehicles and animals or fixed obstacles

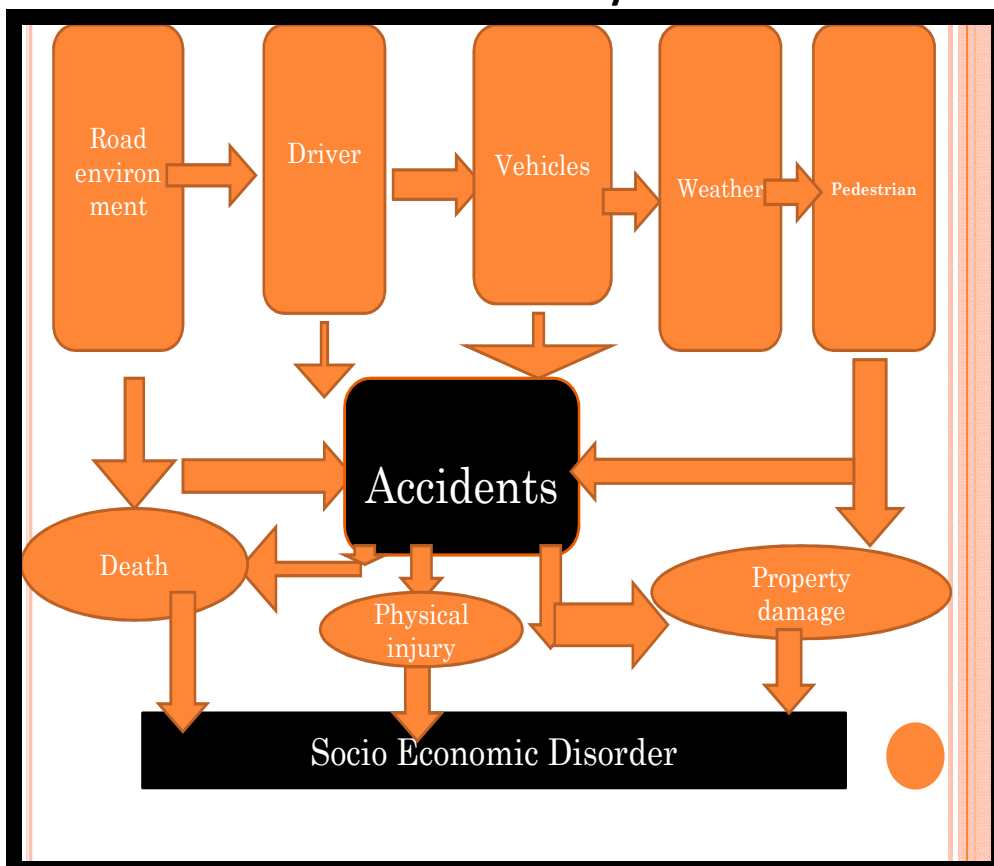
3.7.2 Independent variables: Road environment, Weather condition, Driver behavior, Vichels, pedestrians is independent variables for this study.

 **Road Environment:** There is a close relationship between defects of roads and road traffic accidents. The design, lighting and surfacing of roads can also affect injury rate.

Well-designed roads allow greater margins of safety and help minimize the rate of accidents.

- **Weather condition:** It is directly related to the elements of bright, rainy, cloudy, and fog conditions of the day and have a direct relation with road traffic accident.
- **Driver behavior:** The common driving errors are lack of observation or ineffectiveness, driving too fast, failure to look, misperception and panic reaction from the inexperienced. This will be severe if the driver is impaired due to alcohol, drugs, illness, fatigue and emotional stress. The negligence, sex, license etc of drivers character have also a direct relation to road traffic accidents
- **Pedestrian:** Movements of pedestrians on roads also contribute to the incidence of traffic accidents, which is magnified at road crossings.
- **Vichels Factors:** It is not only the improvement in the standards and design of vehicles that matters, but also adequate maintenance of the vehicle during its working life is an important factor to traffic road accidents. Older vehicles with mechanical defects and poor maintenance cause higher fatal injuries and property damage

3.8 The General Frame Work of the Study



CHAPTER FOUR

Discussion, Analyses and Presentation

4.1 Introduction

The foregoing chapter presents the research findings and discussions covering the cause, extent and economic impact of road traffic accidents in Bahir Dar town, so that different data's have been collected and cross tabulated through literature reviews from different sources. As it has been shown in the methodology part of the paper, questionnaires were distributed to all traffic policemen, selected pedestrian, divers and school children's based here in Bahir Dar and different related documents were collected from Amhara National Regional State Police commission/ANRSPC/ and Bahir Dar city Administration Traffic police office/BCATPO. In this chapter all collected information has interpreted, tabulated and discussed in relation to the objectives of the study.

4.2. Demographic Characteristics of the respondents

4.2.1 Demographic Characteristics of Sample Households (Pedestrians, Children, Cyclists)

Socio-demographic data of the sample respondents is displayed in Table 4.1 below. The table shows that the respondents are mainly males falling within the age group of 20 to 40 years. The level of education for most of the pedestrians is above grade nine, and most of the cyclists and drivers are a high school graduates or above. The majority of the respondents were government employees. From the total questionnaire forms completed by children, 57 (52 percent) were boys and 53 (48 percent) were girls who were mostly below 17 years of age.

Table 4.1 Demographic Data of the Surveyed Pedestrians, Children, Cyclists and Drivers in Bahir Dar, 2003 E.c

Socio-Demographic	Response							
	Pedestrian		Cyclist		Drivers		School children	
	No	%	No	%	No	%	No	%
Gender								
• Male	61	77	72	80	86		57	52
• Female	29	23	18	20	4		53	48
Age group								
<17years	8	9	12	13	-	-	101	92
17-22	30	34	25	28	12	13	9	8
23-28	21	23	36	40	46	51	-	-
29-34	17	19	7	8	16	18	-	-
35-40	9	10	5	6	8	9	-	-
41-45	1	1	2	2	4	4	-	-
46+above	4	4	3	3	1	1	-	-
Level of Education								
• Illiterate	2	2	1	1	-	-	-	-
• Reading and witting	1	1	3	3	1	1	-	-
• 1-4 Grade	1	1	6	7	1	1	68	61
• 5-8 Grade	6	7	9	10	21	23	42	38
• 9-12 Grade	39	43	50	56	47	53	-	-
• 12and above	41	45	21	23	20	22	-	-
Employment								
• Government	47	52	16	18	23	26	-	-
• Private sector	21	24	38	42	56	62	-	-
• Unemployed	8	9	18	20	-	-	-	-
• Students	10	11	18	20	3	3	110	100
• Others	4	4	-	-	8	9	-	-

4.2.2 Demographic Characteristics of Traffic Policemen's

As we shown from the table 4.2 below, about 69% of the respondents were male and the rest 31% were female. Besides to that, about 50% of the respondents have an experience of a traffic police for less than five years and 36 % of them have an experience of between 10 and 15 years.

Table 4.2 Traffic Policemen Age, Sex and Number of service served as a traffic police

Number service years	Gender of respondent		Total
	Male	Female	
Less than five years	14	0	14
Between 5 and 10 years	5	5	10
Between 10 and 15 years	0	2	2
Above 15 years	0	2	2
	19	9	28

Table 4.3 Educational status and Driving license of Traffic policemen

Educational level	Do you have a driving license?		Total
	Yes	No	
9-12 Grade	8	0	8
Above 12th Grade	14	0	14
Diploma/Bachelor's	1	5	6
	23	5	28

As you have seen from the above table 4.3, about 50% of the traffic policemen of Bahir Dar are graduated from grade 12 and almost all of them have driving license. 21% of them are educationally above diploma level but about 80% of them have no driving license.

4.3 Results and Findings

4.3.1 Major factors contributing to road traffic accidents in Bahir Dar: This section focuses on the identification and analysis of the major factors contributing to road traffic accident of which the most important ones considered are the driver, vehicle, pedestrian, and the environmental factors.

4.3.1.1 Driver Factor: Accidents commonly have multiple of causes, in that they stem from a number of adverse circumstances. From analyzing the accidents records of 1997-2003 E.c. it was found that of all accidents, 72.3 percent were caused by drivers error, 8.4 percent were caused as a result of pedestrians' error, 4.9 percent were caused as a result of vehicle defects and the rest 14.4 percent were caused as a result of others and unknown factors.

Table 4.4 Cause of accident as reported by traffic police in Bahir Dar 1997-2003 E.c

Accident cause	Total Accidents	
	Number	%
Driver's error	251	72.3
Pedestrian error	29	8.4
Vehicle defect	17	4.9
Road defect	-	-
Other/unknown	50	14.0
Total	347	100.0

Source: (BCATPO, 2003 E.c)

As indicated in Table 4.4, more than 80 percent of the total traffic accidents were caused by human error (drivers and pedestrians) and appear to be serious problem as reported by the police. The contribution of vehicle defects to road traffic accidents as identified by the police is only 4.9 percent, which is lower than as one could expect from vehicles accidents. To cross fertilize the above fact the researcher was presented an interview for traffic policemen’s about their observation for cause of road traffic accident. 43 percent of them were rated as a cause of driver’s error, 29 percent were caused as a result of pedestrians’ error and 28 percent were caused as a result of vehicle and road.

Table 4.5 Police men’s view on causes of road traffic accident

Causes	Number	Percent
Drivers’ error	12	43%
Pedestrians’ error	8	29%
Road defect	4	14%
Vehicle defect	4	14%
Total	28	100%

Source: Traffic police questioner by the author

Analysis of the Amhara Regional Traffic police statistics show that the main causes for all accidents that are related to driver’s error include refusing priority to pedestrians, failure to give way for vehicles, driving to close. They were considered to be the major error which caused the majority (65%) of the accidents in the town. Excessive speeding were also the other error, which caused 11 percent of the accidents, and about 6 percent of the accidents were due to Driving on the wrong side/ wrong passing .

Table 4.6 Detailed Causes for Road Accidents by Type of Drivers Error in Bahir Dar, 1997-2003 E.C

Detail Causes	1999	2000	2001	2002	2003	Total	%
failure to give way for vehicles	22	34	11	78	52	197	16
Refusing priority to pedestrians	92	124	44	82	74	416	34
driving too close	43	43	32	9	49	176	15
Inaccurate by pass	6	3	0	22	8	39	3
Excessive speeding	25	26	36	6	45	138	11
Driving on the wrong side/ wrong passing	7	7	19	12	32	77	6
wrong light	6	9	4	3	6	28	2
tire defect suddenly	3	2	0	0	2	7	0.5
Problem of Break	5	3	0	2	7	17	2
unknown	40	42	13	16	14	125	10
Total	249	293	159	230	289	1220	100

Source: ANRSPC

As calculated using the traffic accident data from Amhara National Regional State Police Commission (1999-2003 E.C) Refusing priority to pedestrians (34%) and to other vehicles (16%), driving too close (15%) and inaccurate by pass (3%) respectively which account for about 68% of all cases are the prominent problems.

The police traffic accident statistics in Bahir Dar indicated that drivers' errors are the main causes of the great majority of road accidents in the town. Higher accident occurrences correlated to the drivers can be explained by many factors, including lack of experience, age, and ignorance with inadequate understanding of the value and use of traffic regulations. These are being believed to be the major causes of the higher accident rates by drivers in Bahir Dar. To achieve the objectives of the study, a questionnaire survey was conducted. The questionnaires were designed to allow the writer to identify the level of adherence and understanding of traffic regulations of the drivers being interviewed, including a series of direct and indirect questions related to traffic regulations and their importance. In addition to this, questions related to age, level of license, number of years of driving educational level, etc. were

also included. Reduced data reveal drivers composition in Table 4.7. From this table the following characteristics can be observed.

Table 4.7 Driver's Composition by Vehicles Registration Categories

Classification	Private car drivers	Commercial car drivers	Governmental car drivers	Total	%
Sex					
· Male	13	48	25	86	95
· Female	4	-	-	4	5
Age group					
· 18-22	2	4	3	9	10
· 23-28	5	23	10	38	42
· 29-34	3	9	5	17	19
· 35-39	3	6	2	11	12
· 40-45	2	3	2	7	8
· 45+over	2	3	3	8	9
Educational level					
· Illiterate	0	0	0	0	0
· Writing & reading	1	0	0	1	1
· 1-4 grade	0	2	0	1	1
· 5-8 grade	4	12	5	21	23
· 9-12 grade	6	31	10	47	53
· 12+ above	6	4	10	20	22
Level of license					
· 2 nd	6	2	0	8	9
· 3 rd	8	27	18	53	59
· 4 th	2	14	5	21	23
· 5 th	1	5	2	8	9
Driving Experience					
· 1 year	3	9	3	15	17
· 1-2 years	4	12	7	23	26
· 3-5 years	8	17	11	36	40
· 5-10	1	7	4	12	13
· 10+ above	1	3	-	4	4

Source: Computed by the writer, (2003 Ec).

As it indicates in Table 4.7, the majority of the drivers are male which accounted for 86 (95 percent) of all the observations in the study area. Thus, most of the drivers (79 percent) are less than 35 years of age. As far as educational status of the respondents is concerned (78 percent) of the drivers are less than 12 grades. It has also been found that most drivers have less than 5 years of driving experiences.

The writer has therefore, attempted to describe speed behavior of the drivers by asking Questions such as "what is your normal speed when you drive in the town". A set of choices were given which include: 20km/hr, 20-30 km/hr, 30-40km/hr, 40-50km/hr and above 50 km/hr. For this questions majority of drivers interviewed, 56 (63 percent) declared that they currently drive more than 40 km/hr, which is above the urban speed limits of 30 km/hr stated by the Ethiopian traffic regulation of Negarit Gazeta, 1963. From this, it is possible to conclude that current speeds are high in Bahir Dar which generating high accident risks. This again tells us that strict speed control system needs to be enforced in the town. But during the field observations by the writer, yet no adequate speed limit signs are installed and posted on the town roads of the drivers' errors indicated in the year 1999-2003 E.c accident statistics, failure

to give the right of way to other road users, are placed in the second places. The Ethiopian traffic regulation (Negarit Gazeta, 1963) clearly directs a driver of a vehicle where and how he/she should give priority to other road users. For example, a driver of a vehicle approaching a pedestrian zebra crossing is instructed by the law to slow down, and if pedestrians are crossing, to stop his/her vehicle and permit them to cross the road safely.

In attempt to deduce the perceptions of drivers towards pedestrian’s safety two interrelated questions were introduced to the drivers as follows.

Table 4.8 Perceptions of drivers towards pedestrian’s safety

Questions	Alternative responses					
	Always		Sometimes		Never	
	No	%	No	%	No	%
1. When you drive, have you give way/priorities to pedestrians as required by law?	63	70	25	28.0	2	3.0
2. How do you rate pedestrians respecting for vehicles in giving priorities where necessary?	Good		Moderate		Poor	
	No	%	No	%	No	%
	3	3	12	13	75	84

As shown on the above box, the majority of drivers interviewed, 63(70 percent) of the total responded that they always give priorities to pedestrians, 25(28 percent) sometimes give priority to pedestrians, and the rest 3 percent never give priorities. For the second question the majority of the surveyed drivers (84 percent) confirms with poor ranking. Thus, the drivers highly criticized pedestrian’s behavior in applying the laws and rules of traffic. To compare the idea discussed above the writer has prepared other questions to study the behavior of drivers by taking sample pedestrians as presented below.

Table 4.9 Drivers Versus pedestrian’s behavior in applying the laws and rules of traffic

Questions	Alternative responses					
	Always		Sometimes		Never	
	No	%	No	%	No	%
1. Are drivers slow down/stop in pedestrian cross-walks when you are crossing?	10	11	32	35	48	54
2. Crossing roads in Bahir Dar is?	Easy		Difficult			
	No	%	No	%		
	10	11	50	89		

For the first question, 48 (54 percent) of them said “never” and 32 (35 percent) responded as “some times. This shows that few drivers were prepared to stop or even slow down for pedestrians while crossing roads.

In attempt to deduce the perception of pedestrians towards traffic safety in Bahir Dar, question was asked as to whether crossing the road is easy or difficult. For this question the majority of the surveyed pedestrians, 80(89 percent) indicated that they perceived crossing the roads in Bahir Dar to be difficult. It is generally observed that driver’s behavior towards pedestrians is rather poor; especially they do not respect pedestrians on road crossing i.e. drivers are less likely to stop for them. Therefore, it can be concluded that pedestrians who totally depend on their traffic rights at crossing points can be at great risk.

In addition, there is a lack of appropriate discipline among drivers in the traffic system when overtaking, changing lane, crossing or entering a road. It is common to see a driver almost widely turning the vehicle without giving priority and signs to other road users in the traffic system of the town. Therefore, the respect for traffic regulations in the town is very much dependent on the physical presence of traffic police.

Girma (2000) points out that much of the dangerous behavior by drivers could be attributed to lack of knowledge or their general attitude towards road safety. The basic issue of lack of knowledge lies on inadequate driver training and poor evaluation techniques. The existing system for training and examination of new drivers leaves much more to be desired. Drivers were asked questions on what they trust the current driving testing and training procedures

Table 4.10 Attitudes of current driving testing and training procedures

Questions	Alternative responses			
	Yes		No	
	No	%	No	%
1. Do you have trust on the current driving testing and procedures?	43	47	47	53
2. Have you got additional education or training about road safety by concerned officials?	Yes		Not yet	
	No	%	No	%
	21	23	69	77

For the first question in the above box, 47 (53 percent) of respondents replied that they do not have trusts on the current driving testing and training procedure. Through the expression of the drivers interviewed thus appears a negative image of the existing system for training and examination of drivers. For the second question in the same box, the majority of the surveyed

drivers, 69 (77 percent) of the sample drivers replied "not yet". This indicates that large numbers of drivers did not gain additional training and education by concerned bodies after getting their driving license.

In attempt to deduce the perceptions of traffic policemen's towards drivers level of responsibility to give priority to pedestrians as required by law and presented the following questions were presented to interviewers

Table: 4.11 Do drivers give priority to pedestrians as required by law?

Response	Number of respondents	Percent
Yes,	7	25%
No	21	75%
Total	28	100.0

As you have seen from the table 4.11, about 75% of traffic police officers have perceived that drivers have not give priority for pedestrians as required by law

Finally looking at the accidental situation from the angle of the driver's age, the result obtained is also quite different. From the police statistics and survey results, young and inexperienced drivers are highly prone to accidents. In Bahir Dar young and non experienced drivers were more than 2 times more dangerous than experienced adult drivers. Due to this facts, the majority of drivers interviewed (83 percent) faced accidents more than one time in their journey on the town roads and 71(79 percent) of all respondents indicated that they convicted by traffic police more than two times as the result of their traffic law violations.

5.3.1.2 Vehicle Factor: Although traffic police officers as the cause of traffic accidents rarely identifies vehicle defects, the contribution could be quite considerable due to the fact that the condition of vehicles is generally very poor. Most of the vehicles in the fleet are very old without proper maintenance. Besides many un roadworthy vehicles are on the roads because of the socio- economic situation and lack of enforcement. From the reported driver offences in Bahir Dar in 1997- 2003 one fourth were due to driving unlicensed vehicles, because of that vehicle owners normally don't afford to take their vehicle for over all maintenance.

Table 4.12 Share of Traffic Offences in Driving Unlicensed Motor Vehicles in Bahir Dar, 1997-2003 E.c

Year	Total offences	Unlicensed Vehicles	% Share
1997	1744	619	35.4
1998	3017	1014	33.6
1999	3244	621	19.1
2000	2064	549	26.5
2001	1822	618	39.9
2002	1496	510	34.0
2003	2084	413	19.8
Total	15471	4344	28.0

Source: (BCATPO, 2003 E. c)

As can be seen from the table 4.12, on the average of 28 percent reported offences of Bahir Dar in 1997- 2003 were due to driving unlicensed vehicles. The regulation of the country states that vehicles should be inspected yearly. It can, therefore, be predicted that the regular testing of vehicle will reduce the number and severity of accidents in which vehicles are involved. However, poor maintenance cannot be blamed for all defects. The traffic police data of Bahir Dar reported in 1997 -2003, states that 90.5 percent of accidents contributed by good vehicles.

Table 4.13 Accident Involving in Defective and Non- Defective Vehicles, in 1997 - 2003

Vehicle Condition	Accidents	
	Number	%
Vehicles with defects	33	9.5
Vehicles with no defects	314	90.5
Total	347	100.0

Source: (BCATPO, 2003 E. c)

From the Table 4.13, more than 90 percent of road accidents in Bahir Dar have been involved vehicles in good condition. In fact, in Bahir Dar a high proportion of the vehicles were found to be defective in some degree but it would be unfair to conclude that defects springing from bad maintenance were responsible for more accidents. In Bahir Dar, both governmental vehicles and private cars are usually over loaded above their capacity, especially taxi drivers are observing transporting larger number of passenger or overloading above their capacities through out the day. Road traffic accidents vary by type of vehicles with their corresponding compositional structured in the vehicle fleet. In Bahir Dar, this factor is quite relevant. The mixture effects mean that different types of vehicles use the same roads. This leads to high potential risk, especially for non-motorized road users.

Table 4.14 Accidents by Vehicle Types, 1997-2003

Type of vehicle	1997	1998	1999	2000	2001	2002	2003	Total	%
Pedal cycles	-	2	4	5	2	5		18	5.2
Horse drawn carts	-	-	3	1	2	-	1	7	2.0
Motor cycles	-	-	2	-	-	-	-	2	0.6
Cars	15	25	34	26	31	21	13	165	47.6
Taxi/Minibuses	3	9	13	9	11	7	4	56	16.1
Buses	4	2	7	6	2	5	2	28	8.1
Trucks	4	8	13	8	5	13	11	62	17.7
Undefined	1	1	1	-	3	2	1	9	2.7
Total	27	47	77	55	56	53	32	347	100.0

Source: (BCATPO, 2003 E.c)

As indicated in Table 4.14, 47.6 percent of all accidents are inflicted by private and governmental cars (automobiles, station wagons and pickups). This is followed by trucks, which contribute 17.7 percent of accidents. Ranking third are taxis and minibuses that inflict 16.1 of the accidents. Adequate maintenance of vehicle during its service (working) years is of paramount importance for safe driving. Older vehicles, with mechanical defects and poor maintenance are frequently exposed to accident. The majority of traffic accidents in general are associated with defects related to brakes, tires, lights and other mechanical defects

Table: 4.15 number of Vehicle defects Vs accident per year (1999-2003Ec)

Vehicle Defect type	No. Of Accident/Year					Total
	1999	2000	2001	2002	2003	
Problem of brake	2	0	0	7	22	31
Problem of steering wheel/"Meri"	0	0	0	2	3	5
Problem of tire	0	0	0	1	7	8
Light Problem	11	1	0	3	3	18
Other Mechanical Problem	3	1	0	9	11	24
No defect at all	220	240	129	106	177	872
Unknown	13	51	30	48	65	207
Total	249	293	159	176	288	1165

Source: ANRSPC

As you have seen from the above table the largest portion of accidents (87 %) through five years is associated with no defect at all on vehicles and problem of brake and other mechanical problem has ranked 2nd and 3rd for traffic accidents. Besides to that the increment of wheeled vehicle from time to time is also another factor which contributes as a case for traffic accident.

Table 4.16 Type of cars is prone to traffic accident

Response category	Number of respondents	Percent
Big truck	2	7.1
Medium Truck	8	28.6
Government cars	8	28.6
Private cars	10	35.7
Total	28	100.0

Source: Information gathered from Traffic police by the author

As the information which is obtained from traffic police officers, private cars take the first blame to be followed by Medium track and government cars for 35.7 and 28.6 percent of the traffic accidents respectively. Then big tracks (7.1%) are the last factor of all.

4.3.1.3 Pedestrian Factors

Movements of pedestrians on roads also contribute to the incidence of traffic accidents, which is magnified at road crossings. The accident statistics of police in Bahir Dar showed that pedestrians are the most vulnerable category of road user in traffic. The high accident risk of pedestrians stems largely from lack of giving priorities to pedestrians by the drivers and the cyclists

Table 4.17 Share of Pedestrian Casualty, 1997-2003 E.c

Year	Total Casualty	Share of pedestrian	
		No	%
1997	29	9	31.0
1998	52	29	55.7
1999	71	41	57.7
2000	52	30	57.6
2001	45	19	42.2
2002	54	22	40.7
2003	28	23	82.1
Total	331	173	52.2

Source: (BCATPO, 2003 E.c)

From the Table 4.17, one can see that the percentage of pedestrian casualty as the highest in each year that persons walking are the principal sufferer in road accidents, which accounts for 52 percent of road victims. As stated pedestrians accidents largely occur due to failure of drivers to give way to pedestrians at road crossing. But a number of accidents can be blamed on the ignorance and lack of attention of some pedestrians. Unlike drivers a considerable section of pedestrians in the town never learn the basic rules of the road safety except through observation. Thus, the following sub sections represent a discussion of the results with 90 pedestrian's traffic behavior study under taken in Bahir Dar.

An attempt is made to produce some indicators of the traffic experience of the pedestrians in the town. Traffic experience is considered to be a function of age as well as of traffic exposure. In this study most of the surveyed pedestrians (86 percent) fall with the age group of 20- 40 years, and more than 75 percent of the respondents lived in the town for more than 3 years. One can look at traffic exposure of pedestrians in terms of the trips they made. To understand the main type of journey purposes perform by the surveyed pedestrian the following questions have been presented.

Table 4.18 main type of journey purposes perform by the surveyed pedestrian

<u>Question</u> <i>Which type of trip propose frequently constitute most of your time?</i>	Alternative responses									
	<i>Work trip</i>		<i>Educational</i>		<i>Shopping</i>		<i>Recreational</i>		<i>Walking</i>	
	<u>No</u>	<u>%</u>	<u>No</u>	<u>%</u>	<u>No</u>	<u>%</u>	<u>No</u>	<u>%</u>	<u>No</u>	<u>%</u>
	52	58	25	27	43	48	28	31	15	17

As can be shown from the above box, work trip purpose would be perceived as constituting the main part of pedestrian journey, 52 (57 Percent), business/ shopping trip selected (47 percent), and recreational trip accounts (31 percent), while walking for health services constitute small parts of the journey which selected at the fifth level.

In an attempt to deduce the perception of pedestrians towards traffic safety problems in Bahir Dar, a question was asked to the respondents "How do you perceive the level of road traffic accidents in Bahir Dar". The majority of pedestrians (51percent) interviewed agree that the current accident problems are high in Bahir Dar. This shows that the level of perception of the problems experienced by pedestrians in the town is very high. In the same box in column 3, the majority of pedestrians interviewed (61 percent) replied that they faced or observed road traffic accidents more than one times in their trip of the town.

Table 4.19 Does Pedestrians walk along the roads with their backs to the direction of traffic

<u>Questions</u>	Alternative responds							
	Big problem		Moderate problem		Not a problem			
<i>1.How you perceived the level of road traffic accidents in your community?</i>	<u>No</u>	<u>%</u>	<u>No</u>	<u>%</u>	<u>No</u>	<u>%</u>	<u>No</u>	<u>%</u>
		46	51	43	48	1		1
<i>2.Have you faced/observed traffic accidents in your Journey?</i>	Yes		No					
	<u>No</u>	<u>%</u>	<u>No</u>	<u>%</u>				
	69	77	21	23				
<i>3.If you faced/observed accidents, how may times?</i>	One		Two		Three		Four	
	<u>No</u>	<u>%</u>	<u>No</u>	<u>%</u>	<u>No</u>	<u>%</u>	<u>No</u>	<u>%</u>
	14	20	31	45	12	17	12	17

Further, pedestrians were asked whether they walk along the roads with their backs to the direction of traffic. Contrary to what has been expected, the majority of the surveyed pedestrians, 72 (80 percent) indicated that they walk with their face to traffic. On the other hand 18(20 percent) indicated that they walk with their back to traffic. However, still, a relatively high number seemed to indicate that they walk along roads with back to traffic which further aggravates the potential risk of being exposed to an accident. The tendency of walking

with their back to the traffic, however, is certainly related to a lack of knowledge. Pedestrians were also asked how much they perceive traffic signs, signals, and road marks when they walk and cross the roads. For this question only 32 (36 percent) of all pedestrians indicated, as they perfectly understood. But the majority of pedestrians, 58 (64 percent) were not clearly aware of the traffic signs and road marks. Road crossing facilities in the urban area can be categorized into four main types. These are space segregated crossing facilities, time segregated crossing facilities (traffic signals), priority segregated crossing facilities (zebra crossing) and uncontrolled crossing. Pedestrians were asked questions as to where they would usually cross main roads. Alternatives given were: at traffic light, at junctions, at any point, at mid-block pedestrian crossing away from junctions. For this question the majority of the surveyed pedestrians, 43 (48 percent) have indicated that they would cross roads at any point, 31 (34 percent) at mid block pedestrian crossing away from junctions, 7 (8 percent) at junctions and 9 (10 percent) at traffic light. This shows that about 59 (66 percent) of the pedestrians would tend to cross roads at any of the other unsafe points. This represents a dangerous crossing attitude that might lead to the occurrence of accidents

Table 4.20 Accident Severity towards Pedestrians Road Crossing Activities in Bahir Dar, 1997-2003

Pedestrian Activities	Accident Severity				
	Fatal	Serious Injury	Slight Injury	Total	%
A. Pedestrian on crossing	8	41	23	72	41.3
B. Pedestrian not on crossing					
• <i>Walking in roads</i>	16	34	17	67	38.5
• <i>Playing in roads</i>	2	6	3	11	6.3
• <i>On the side walk</i>	4	6	5	15	8.6
C. Others	3	4	2	9	5.3
Total	33	91	50	174	100.0

Source: (BCATPO, 2003 E. c)

As expected, the severity of accidents occurring when pedestrians were crossing was higher. As it has been demonstrated earlier only few drivers are prepared to stop or even slow down for pedestrians while crossing roads. Thus, it could be true that pedestrians who totally depend on their traffic right at crossing points can be at great risk because of drivers being less likely to

stop for them. The rules and regulations recognize the right of pedestrians on the road and restrict drivers to stop upon seeing a pedestrian on the pedestrian crossing. The regulation further provides for penalty against offending motorists. But the respect for traffic regulations and penalties are very much dependent on the physical presence of traffic police along the roads.

The questionnaire result for this question revealed that pedestrians in Bahir Dar, 41 (46 percent) of all respondents perceived the high speed of vehicles as the most profound problem that endangers their safety when attempting to cross roads. The results also indicate that 25 (28 percent) of pedestrians perceive non-abidance of drivers to pedestrian's traffic rules as the second serious safety problem encountered while crossing the roads. Limited number of properly designed pedestrian crossing (15 percent), lack of enforcement (3 percent) and others are problems in their order of seriousness. The rules and regulations recognize the right of pedestrians on the road and restrict drivers to stop upon seeing a pedestrian on the pedestrian crossing. The regulation further provides for penalty against offending motorists. But the respect for traffic regulations and penalties are very much dependent on the physical presence of traffic police along the roads. To understand the perception of pedestrians towards traffic police efficiency on enforcement the writer interviewed the sample pedestrians as mentioned below:

4.21 The perception of pedestrians towards traffic police efficiency on enforcement

<i>1. Are drivers failing to maintain traffic rules and regulations in the presence of traffic police would be penalized for their law offensive?</i>	Always		Some times		Never	
	<u>No</u>	%	<u>No</u>	%	<u>No</u>	%
	10	11	37	41	43	48
<i>2 How do you rate the traffic police Commitment to their duties?</i>	N. Good		Good		Poor	
	<u>No</u>	%	<u>No</u>	%	<u>No</u>	%
	9	10	47	52	34	38

The response of the respondents for the first question, 47 (52 percents) indicated that the presence of penalties for drivers for their law offensive, while, 43 (48 percent) of interviewed pedestrians indicated that they did not see any penalties for law offensive drivers. Concerning the second question in the above box, large number of pedestrians interviewed criticize the current system of penalties taking by traffic police against offending drivers, 34 (38 percent) of all respondents were replied that the traffic police commitment to their duties are poor. Two

interrelated questions were introduced to the pedestrians whether they gained education or not about road safety

Table 4.22 Does pedestrians whether gained education or not about road safety?

1. Have you ever got education about road safety rules by concerned officials?	Yes		Not yet							
	No	%	No	%						
	45	50	45	50						
2. Who is your source of knowledge and experience about road safety rules?	My self		Parents		School		Traffic police		Media	
	No	%	No	%	No	%	No	%	No	%
	48	53	4	4	14	15	7	8	17	19

For the first question in the above box large proportion of pedestrians, 45 (50 percent) did not get education about road traffic rules by concerned officials. For the second question the majority of pedestrians, 48 (53 percent) have indicated that they have learned how to deal with traffic by themselves and 14 (15 percent) through school. Also 17 (19 percent) have indicated the involvements of media (radio and television), and 23 (26 percent) of pedestrians have also indicated the involvements of traffic police; and the parent involvements accounted only 4 percents. The above responses and result demonstrate the almost non-existence of any systematic official source for providing the necessary education, training and information related to traffic safety. Television and radio both have a wide coverage in town of Bahir Dar. Thus, essential mixed safety message can promote for influencing human behaviors and attitudes. However, their broadcasting of road safety education is still limited and not gained great attention.

4.3.1.4 School Children Traffic Behavior as Pedestrians: In the town of Bahir Dar children under the age of 15 years are highly vulnerable to road accidents. The following subsection represents a discussion of the result of the school children traffic behaviors study undertaken in Bahir Dar.

Table 4.23: Percentage Shares of School Children Accidents in Bahir Dar Dar, 1997- 2003 E.c

Vulnerable Road Users	Injury Type			Total	
	Fatal	Serious	Slight	Casualty	%
Students	8	33	16	67	38.7
Workers	4	12	11	27	15.6
Peasants	4	12	7	23	13.3
Unemployed	7	20	11	38	22.0
Unknown	5	9	5	19	10.9
Total	28	86	50	174	100.0

Source: BCATPO, 2003

The records in Table 4.23 show that accidents involving school children contribute a high percentage of the total accidents in Bahir Dar. Many factors could be raised to this accidents but the major one is inadequate education and training of children on how to use the road safely. The data obtained from the traffic police indicated that more than 80 percent of injured children were pedestrians and the rest 20 percent were most likely related to cyclists, and more than four-fifth (80 percent) of injured children were in the age groups of 5-14 years. The risk of school pupils being injured in a traffic accident was 50 percent higher during school time than during a similar period when it was not a school day. The traffic police data also indicated that, quite a high proportion of children (87 percent) accidents occurred at the main roads of the town on their ways to school, and 13 percent of children accidents were occurred around the roads of residential areas.

Further, more the traffic data also reveals that only 8 percent of child accident took place between 7a.m to 8 a.m. when most of children are going to school. On the other hand, most of the children accident (70 percent) took place between 12 noon to 1 p.m. and nearly 22 percent took place after 5 p.m. At these times, traffic is usually congested with adults coming from work at midday and in the evening. An attempt has been made to establish measures for traffic exposure of school children by preparing a set of inter-related questionnaire.

The first traffic related question was whether the children afraid of or not in afraid of on their way to schools. The result for this question shows that, out of the total 110 respondents, 96 (87 percent) of children stated that they are afraid of traffic on their way to school. The second question stated that "crossing the road is easy or difficult". For this question, 90 (81 percent) children have perceived that crossing the road was difficult and only 19 percent of them have indicated that crossing roads was easy. These responses of school children demonstrate the probable existence of potential problems in the locations of schools and the presence of traffic hazards nearby in front of the schools Children were also asked a question as" what type of

wheeled vehicle do you often afraid on your way to school". The alternative given were motor vehicles, bicycles, and horse drawn carts. The majority of the surveyed children, 60 (55 percent) have indicated that they afraid of motor vehicles, 30 (27 percent) bicycles, 8 (7 percent) that horse drawn carts, and the rest 12 (11 percent) were afraid of all. From this one can deduce that motor vehicles traveling at high speeds were mostly the causes to create fear of school children in Bahir Dar. It is not uncommon to see drivers driving at very high speeds, where there are signs of school children crossing the roads. Insufficient knowledge of safe ways of walking along the streets appears to be one of the contributory factors to road traffic accidents among children of school going age.

Thus, 73(65 percent) of interviewed school children did not know the safer way of walking along the streets relative to oncoming vehicles. The last question forwarded to school children was the identification of different parties towards the teaching of school children on how to deal with traffic sources. The alternatives are: parents, schools, traffic police, radio and television and none of them were allowed to mark more than one choice.

Accordingly, 26 (24 percent) of children were indicated the involvement of traffic, 54 (49 percent) through the involvements of their schools, 15 (14 percent) the involvement of with their parents, 8(7 percent) stated television and radio and the rest 17 (15 percent) of still not taught by any parties about road safety education. Other multiple replies include, 50 (45 percent) the involvement of their school traffic and parents, and 15 (14 percent) parents, schools and television.

From the discussion it can be concluded that traffic police, schools and parents together share the responsibility for educating the children on how to deal safely with traffic. However, schoolchildren face problems in terms of parents and school system not providing adequate knowledge on how to safely walk on and across the roads. from school are increasingly susceptible to road traffic accidents.

4.3.1.5 Traffic Behavior of cyclists

Similar to pedestrians and drivers, a questionnaire survey was conducted for cyclists and asked, as "which type of trip purpose is constitute most of your cycling time?" For this question 47(52 percent) of respondents replied for all-purpose trips, 26(29 percent) were for work trips, and 10(11 percent) for recreational purposes. Another question asked was whether they had had an accident on their journey of the town roads or not. For this question, 49(55) percent of interviewed cyclists were replied as " yes" answer which means more than half of the cyclists interviewed were faced road traffic related accidents in their journey, of which 75 percent of respondents were indicated that road accidents were not recorded by police. Cyclists were also asked to mark when and where bicycle accidents frequently happened in the town roads (see the box below)

Table 4.24: The perception of Cyclists when and where bicycle accidents frequently happened in the town roads

Question	Alternative responses			
	Day time		Night time	
1. In which time of a day bicycle accidents are highest?	No	%	NO	%
		70	78	20
2. In which roads/locations of the town roads bicycle accidents are the highest?	On main roads		Residential roads	
	No	%	No	%
		79	88	11

For the first question 70 (78 percent) of interviewed cyclists replied that large number of accidents happened during the day time, while, 20(22 percent) indicated at night time Cyclists were also asked to tick up in rank order as "which type of cycle accidents are most common for collision?" Amongst the cyclists interviewed, falling whilst riding represented most common causes of cycle accidents (34 %) followed by a collision with pedestrians (22 %), collision with bicycles (16 %), collision with motor vehicles (15 %) collision with an object (8 %) collision with horse drawn carts (5 %).

Table 4.25 The perception of Cyclists on the major problems or factors contributing to cycle accidents in the town

Rank	Responses	Number of times selected	%
1	<i>Absence of segregated lane for bicycles</i>	19	21.0
2	<i>Poor road conditions</i>	17	18.6
3	<i>Speedy riding</i>	15	16.6
4	<i>No priority given by motor car drivers</i>	13	14.4
5	<i>Negligence of pedestrians for cyclists</i>	12	13.3
6	<i>Lack of enforcements</i>	8	8.9
7	<i>Poor condition of bicycle on the road</i>	6	6.6

As it is shown in the box, out of 90 cyclists interviewed during the traffic survey period, 19(21 percent) of interviewee responded absence of segregated lane for cyclists and other road users, road conditions (18.6 percent), speed riding (16 percent), drivers not giving priorities for cyclists (14.4 percent), negligence of pedestrians (13.3 percent), lack of enforcement (8.9 percent), and poor maintenance of cycles (6.6 percent).

Detailed observation of cyclists by the writer during the study period identified that most bicyclists with pedestrian's accidents happened on off street paths and are caused by the error of bicyclists, because the bicyclists ride too fast and not giving priorities for pedestrians. In addition to this, bicyclists also ride on sidewalks in a business districts or heavily trafficked pedestrian areas, which highly aggravate the pedestrian / bicyclists accidents with bicycles.

Cyclists were asked to mark where they thought riding of bicycles is most dangerous. For this question the majority of respondents, 34(38 percent) indicted that large number of accidents frequently happened on crossroads, 32(35 percent) were on the drive way, 21 (23 percent) were at junction roads, the remaining accidents (6%) occurred on traffic light areas. From this, one can conclude that large number of bicycle accidents occur at junctions than straight sections.

Cyclists were asked how much they perceived traffic signs, signals and road marking when they ride along the town streets. For this question, 75(83 percent) cyclists indicated that they perfectly understood the components of road safety, while 15(17 percent) were not clearly aware of the stated road safety elements. The result obtained implies that knowledge of traffic safety elements generally does not have importance for the reduction of accidents among cyclist, because cyclists are notorious for breaking traffic rules in the town streets. In general, 46(51 percent) of the cyclists were not yet gained education about road traffic rules by responsible agencies and majority of the respondents learned how to deal with traffic rules by themselves.

4.3.1.6 Road Factor

Efficient and economic road transport is largely dependent on road layout. Efficiency cannot be achieved if the road user is frequently involved in road accidents, but fortunately those design provisions and frequent maintenance needs to improve traffic flow to reduce accidents. In Bahir Dar, due to lack of training and traffic engineering skills of the traffic police underestimated the contribution of road environments to traffic accidents. A number of factors can be attributed to these accidents relating to road environments as discussed below.

Condition of road: The existing roads conditions in Bahir Dar are in poor conditions. The basic problem lies in roads that are not planned to fulfill a certain function by following an appropriate standard procedure. Like many other town and cities of Ethiopia Bahir Dar has an urban transportation infrastructure that was initially designed for largely non- motorized travel. The flat nature of the land plus the poor drainage facilities on the roads during the rain season creates flood hazards to most of the town streets, which affect smooth mobility. Except very few arterial, which are asphalt pavements, the roads in Bahir Dar are dominantly unmade roads with little or no improvement at all. The poor conditions of the road networks are mainly due to inadequate maintenance such as, lack of funds to buy equipment and materials, inadequate numbers of trained manpower and lack of maintenance culture. Therefore, the poor nature of

the roads in the town can be explained by the amount of money invested for construction and maintenance purpose

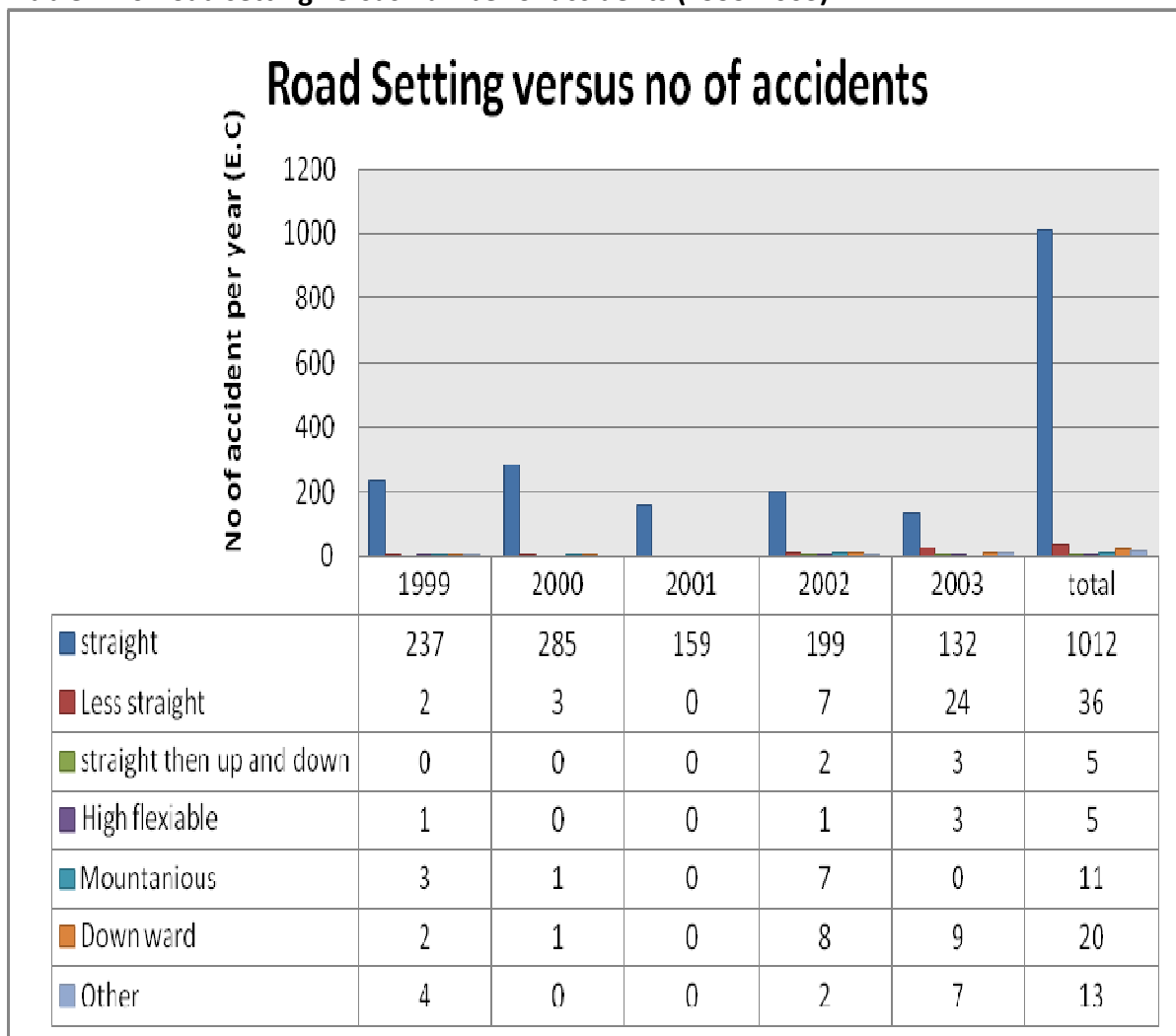
Traffic Segregation: A traffic engineering principle of overriding importance is the segregation of traffic categories by function and in space and time, for example the segregation of vehicle and pedestrian, of different classes of vehicles and different types and purposes of vehicles movement. Vehicles are usually parked on pedestrian lanes and pedestrians (including animals) walk in the center of motorways. Heavy trucks also use almost all routes without any restrictions or regulations, which lead into traffic conflicts between fast moving through traffic, slow moving local traffic and vulnerable pedestrians. The conflicts arising from these inadequacies of traffic segregation give rise to all sorts of traffic accidents

Facility on the road: Despite the heavy mix of traffic flow in Bahir Dar, there are no safe pedestrian and vehicular facilities on the road net works. Engineering measures to segregate vehicles and pedestrians or to facilitate safety on shared surfaces such as paved side walks, pedestrian crossings, fences, speed calming facilities, road signs and good street lighting are inadequate or totally absent on the road. The road environment lacks important road safety facilities, which have proper guidance to road users..

In Bahir Dar sight obstructions on the road observed due to the presence of tall vegetation along the main roadsides and intersections. Footways are obstructed by long trees, sign of advertising, illegal parking, hawkers and traders, encroachments of shop displays, and in some streets foot way dwellers). Under these conditions, footways are unusable and pedestrians are forced to walk in roadway with both safety and traffic congestion problems.

On road -parking: In Bahir Dar, drives and cyclists normally are forced to park on the road due to the absence of adequate parking lots. On road parking is very much reacted to the frontage land use. Traffic generation characteristics of adjacent land use and absence of access control on street parking is another important factor, which affects traffic safety and efficiency.

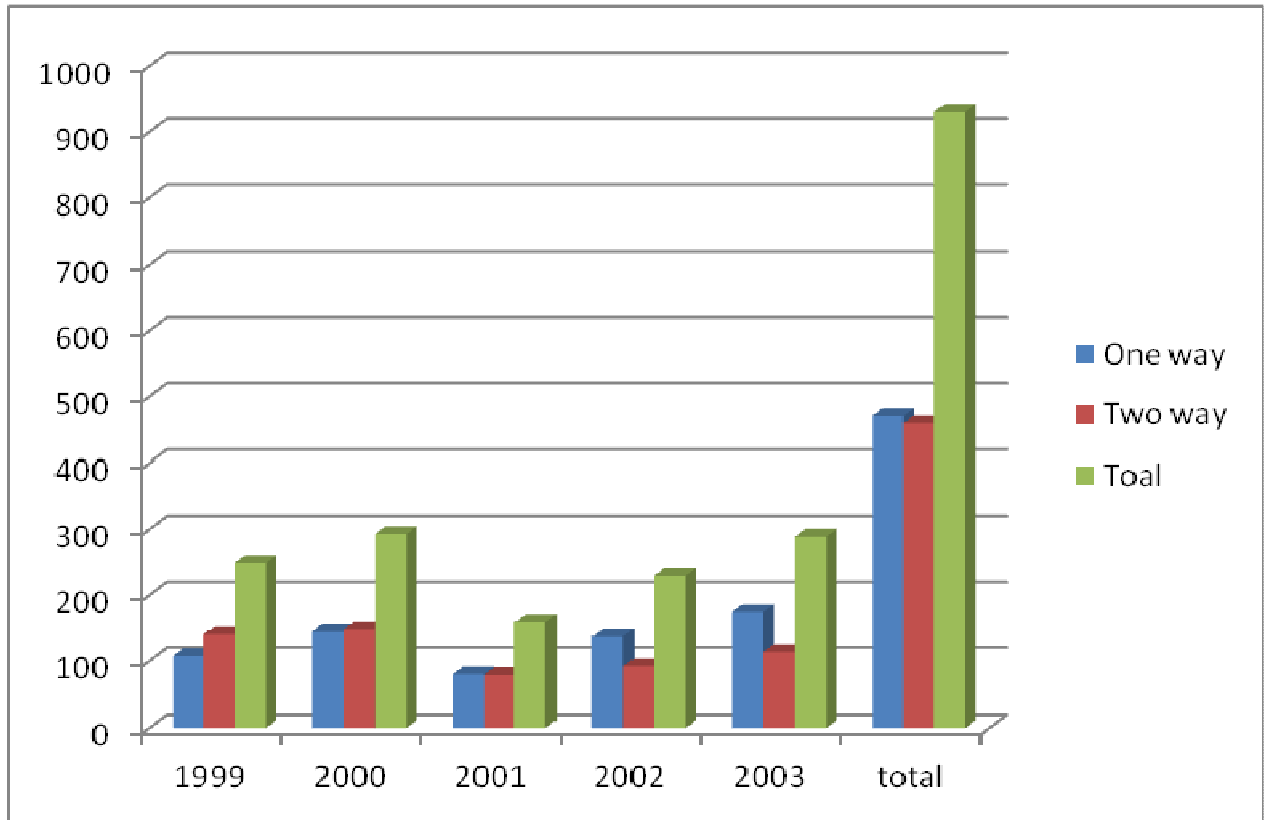
Table 4.26 Road setting versus number of accidents (1999-2003)



Source: ANRSPC

As you have seen from the above table 4.26, most accidents were occurred in straight roads and less accident was recorded on high flexiable roads which many of us have not expected.

Figure 4.1 Road directions versus number of accidents per year



Source: ANRSPC

From the above figure 5.2 one can infer that two way roads are more exposed to traffic accidents than one way.

Table 4.27 Weather Condition versus number of accidents per year

Road Condition	Total Damage/Number of accidents					
	1999	2000	2001	2002	2003	Total
Dry	243	289	153	102	168	955
Moisture	6	4	6	7	21	44
Muddy	0	0	0	1	0	1
other	0	0	0	2	0	2
Total	249	293	159	112	189	1002

Source: ANRSPC

Surprisingly, as you have seen from the above table which is collected from the Amhara regional police commission, high number of accidents has been recorded during dry season of the year than moisture and muddy weather condition. Besides to that, when we consider the light condition as a factor of road traffic accident, the largest portion of accident was occurred during day light followed by night time.

Table 4.28 Light Condition of the roads versus number of traffic accidents

Light Condition	Number of accidents					
	1999	2000	2001	2002	2003	Total
Day Light	222	283	159	193	159	1016
During Sun Set	2	0	0	6	6	14
Night Time but good Road Light	13	10	4	18	18	63
Night Time but less Road Light	4	0	0	3	0	7
Night Time and no Road Light	7	0	0	5	0	12
During Sun raise	2	0	0	5	6	13
Other	0	0	0	0	0	0
Total	250	293	163	230	189	1125

Source: ANRSPC

4.3.1.7 Weather Factor

Weather condition is one major factor for the occurrence of road traffic accident.

Table 4.29 Type of weather conditions leading to traffic accident

Weather type	No of respondents	Percent of responses
Rainy weather	15	53.6
Cloudy	10	35.7
Good weather condition	3	10.7
Total	28	100.0

Source: Questioner gathered by Researcher

The researcher was tried to cross fertilize the perception of traffic police officers (Table 4.28) and the actual records which gets from Amhara Police Commission (table 4.29). Most traffic

police officers assume that the accident is occurred in cloudy weather conditions, however the actual occurrence is made in a good weather condition.

Table 4.30 Weather condition versus number of traffic accidents

<i>Weather Condition/year</i>	<i>Number of accidents</i>					
	1999	2000	2001	2002	2003	total
Good weather	236	291	155	228	262	1172
Fog	0	0	0	0	4	4
Cloud	1	0	2	0	7	10
Light rain	0	1	0	0	4	5
Heavy Rain	0	1	0	1	2	4
Heavy wind	0	0	2	0	0	2
Dest	0	0	0	0	0	0
Hot	0	0	0	1	3	4
Cold	12	0	0	0	4	16
other	1	0	0	0	3	4
Total	250	293	159	230	289	1221

Source: ANRS *Police Commission*

4.3.2 The Extent and Trends of Accidents

As the a socio-economic status of Ethiopia's regions and towns change, road traffic accidents are bound to increase and assume greater importance as a cause of deaths, injuries and property damage. This observation is supported by Amhara Regional Traffic Police data, which shows that the number of road accidents increased from 446 in 1996 to 1040 in 2003, an increase of nearly 133 percent at a regional level and the number of accidents grew from 22 to 53, an increase of 140 percent in the town of Bahir Dar.

Table 4.31: The Extent and Trends of Road Accidents in Amhara Region and Bahir Dar Town, 1996-2003E.c

Year	Amhara Region		Bahir Dar Town	
	Number of accidents	Annual % increase	Number of accidents	Annual % increase
1996	446	-	22	-
1997	516	15.6	26	18.1
1998	748	44.9	27	19.2
1999	890	18.9	47	121.2
2000	918	3.1	77	-35.6
2001	919	0.1	55	63.8
2002	912	-0.8	56	-28.6
2003	1040	14.0	53	1.8
Total	6389	11.9	363	19.9

Source: (BCATPO, 2003 E. c)

Many reasons have been advanced to explain this increase of road traffic accidents in Bahir Dar. One is rapid urbanization with the resultant increase of motorized and non-motorized. Vehicles; this mixture of motorized and non motorized vehicles is inherently hazardous under any traffic condition, as shown in Table 4.32 below. The relatively higher speeds of motorized vehicles and the unprotected nature of the bicycle, horse- drawn carts and pedestrians highly aggravate the accident situation of the town.

Table 4.32: Trends of Wheeled Vehicle and Road Accidents in Bahir Dar, 1997-2003 E.c

Year	Registered Wheeled Vehicles					Accidents	
	Bicycle	Horse drawn carts	Motorized Vehicle	Total	Annual rate of increase (%)	No	Annual rate of increase (%)
1997	6270	328	867	7467	-	27	-
1998	7199	427	896	8522	14.1	47	74.0
1999	7996	602	968	9566	12.2	77	38.9
2000	8694	875	1135	9077	-5.1	55	-40.0
2001	9509	1002	1157	11668	9.0	56	1.7
2002	10976	1280	1275	13531	15.9	53	-5.6
2003	12971	1427	1246	15644	15.6	32	-65.6

Source: (BCATPO, 2003 E. c)

As shown in Table 4.32, the rate of increases in the number of accident greatly influences by the rate of increase in the number of vehicles. For example in between 1997 and 1998 the number of vehicles increases by 14 percent and the number of accidents by 74 percent. On the other hand, in between 1999 and 2000 the number of vehicles decreases by 5 percent and the number of accidents declined by 40 percent. A different relationship is observed in the year 2001 to 2003 when the number of vehicles increased by greater than 15 percent while the number of accidents decreased to 65 percent. This is mainly due to considerable under-reporting of the number of accidents. When one assesses the rate of accidents compared with the numbers of accidents per ten thousand entering motor vehicles in Bahir Dar as it is expressed by Garber and Hoel (1999), the number fluctuates between 250 and 800 per 10,000 inspected vehicles. This condition was approved by the questioners presented to traffic police officers, that they have predicted that the number of accidents have increasingly from time to time which have a great burden to the economy of the locality.

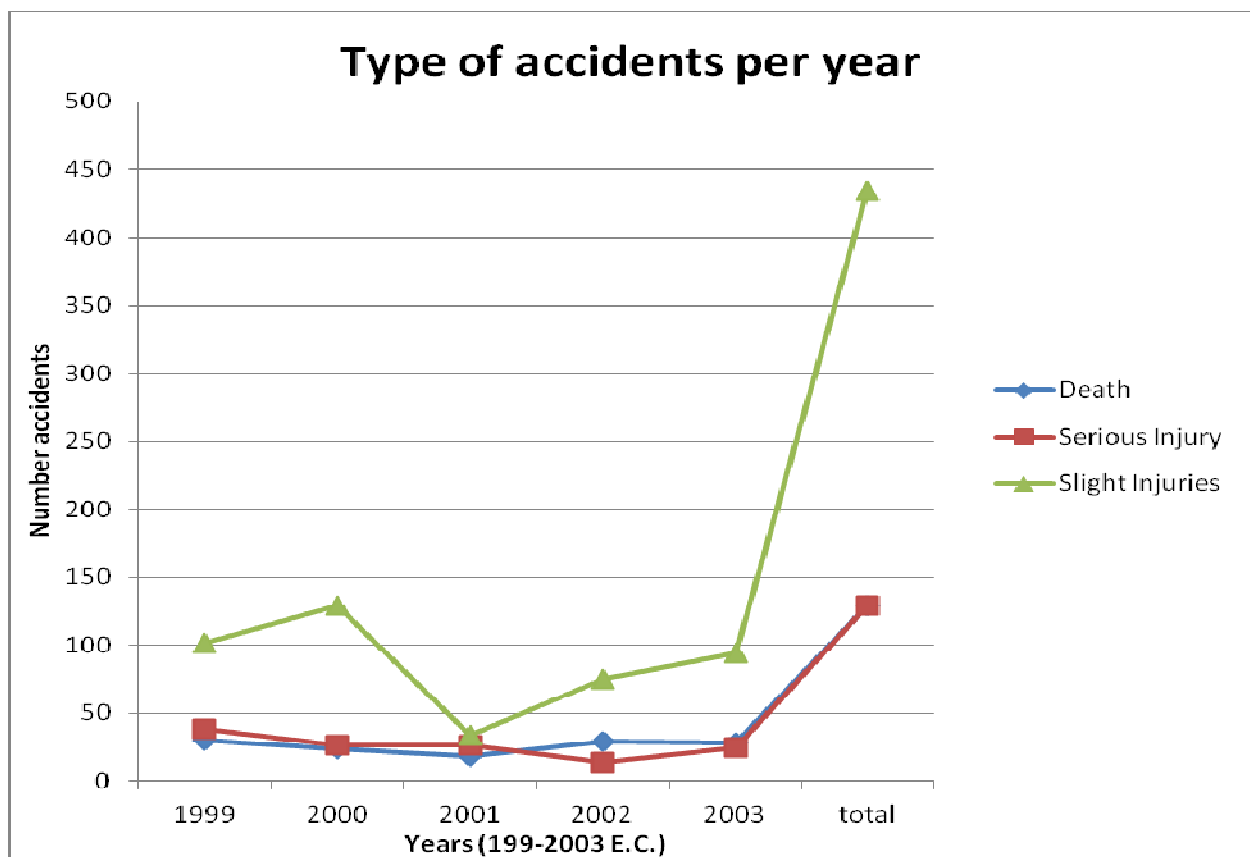
Table 4.33 Traffic accident situation in the last five years

	Number of responses	Percent of responses
Increasing	24	85.7
Decreasing	4	14.3
Total	28	100.0

Source: Researcher gathered through questioner

As you have seen from the above table 4.33, about 86% Traffic Polices of Bahir Dar have responded as the occurrence of road traffic accident from time to time is increased so that it needs a serious intervention on it.

Figure 4. 2 Types of accidents by year



Source: ANRS Police Commission

From the graph one can conclude that at the beginning of 2002 E.c slight and serious injuries with death was decreasing but after 2001Ec on wards the rate of death, serious injury and slight injuries have increasingly alarmingly.

Under-Reporting of Road Accidents: All road accidents, even property damage accidents, are required to be reported. Yet, the traffic police officials of Bahir Dar readily acknowledged during the discussion that not all accidents are reported to them and their statistics greatly underestimates the extent of the true accident situation. To support the idea of under reporting of accidents in the town, the writer designed the questions for pedestrians, drivers and cyclists as follows.

Table 4.34 under reporting of accidents in the town

Question	Pedestrians		Drivers		Cyclists	
	Yes	No	Yes	No	Yes	No
<i>1. Have you faced/ observed traffic accidents in your trip?</i>	77%	33%	83%	17%	54%	46%
<i>2. If your answer is "yes" have the accidents been reported or registered with traffic police?</i>	24%	76%	52%	48%	24%	76%

As shown in the above box, almost 77 percent of pedestrians, 83 percent of drivers and percent of cyclists replied that as they faced or observed accidents while moving in the town. Out of these, only 24 percent of pedestrians 52 percent of drivers and 24 percent of cyclists have reported immediately to the police. This implies that not all road accidents are perceived as crimes and many road users prefer to settle claims immediately and not involve the police. In addition, the current reporting procedures do not make it easy for road accidents to be reported to the police. Accident investigator traffic police are few in number and they have no mobile patrols. Accordingly, if a party wants to report an accident, they must go to the police station and request it to be reported.

4.3.3 Socio Economic Costs Incurred Due to Road Traffic Accidents

Road traffic accidents are causing various human sufferings and imposing financial burdens in many developing countries like Ethiopia. Hence, road traffic accidents are serious problems, which should not be under estimated. Although calculating road traffic accident costs is not a simple task, various studies on accident costs have identified six different methods. The gross output (or Human capital) approach was suggested and used in Ethiopia in relation to the prevailing conditions in the country. In the gross output method, the cost of a traffic accident involving death or injury is divided into a cost of a loss of current resources and costs due to a loss of future output. Cost of a loss of current resources includes loss of vehicle damage, medical treatment, police and administration costs. While loss of future output is an estimate of the cost to the nation of the person or person's lost out put when killed or seriously injured. All of these costs are considered as "resource" costs and sums to reflect pain, grief and

suffering (PGS) and are also considered to be non-resource costs. Nonrecourse costs are usually expressed as percentages of resource costs of accidents of varying severity (TRL and Ross Silcock, 2000).

As presented in the Ethiopian Road Safety Study by TRL and Ross Silcock (2000), it was suggested to use slightly higher values of PGS than those used in the UK to estimate road accidents in the mid 1980's. In 1984 it was 40,100 and 10 percent of resource costs used to reflect PGS in the UK for fatal, serious and slight injuries respectively.

Accordingly, in Ethiopia at present 50%, 120% and 15% of fatal, serious and slight injury resources costs are used to reflect PGS. In costing road accidents a great deal of information needs to be calculated on social and economic factors and also on the road accidents actually taking place. As explained by TRL and Ross Silcock (2000) if basic information on the cost of damage only accidents can be determined, then a broad estimate of cost of slight, serious and fatal accidents can be obtained by applying ratios derived from other studies.

Table 4.35 : Ratios of Accident Costs by Type in Different Nations

Accident Severity	UK 1987	Cyprus 1985	Jordan 1984	Ethiopia 1983	Tanzania 1994	Malawi 1997
Fatal	238	130	64	10	18	9
Serious	9	6.8	3.6	3	4	3.5
Slight	2.2	2.2	1.6	2	4	2
Damage only	1.0	1	1	1	1	1

Source: TRL with Ross Sikock (2000) Technical Appendix VII: 10

According to the study made in Ethiopia by British and American consultants in 1983 on behalf of the Road Transport Authority and the (then) National Road Transport Corporation compared with the recent studies in Malawi and Tanzania suggest that a ratio of about 10:1 (fatal to damage only) for Ethiopia can be taken as reasonable standard and was used for instance in 1998 cost estimation. Based on the information from the Ethiopian insurance corporation of 1990, the average claim for a road accident of about, Birr 8200 was restructured into Birr 10,000 for a serious accident; Birr 6,600 for a slight accident and Birr 3,300 for damage only accident using the ratios of 3:2:1 for serious, slight and damage only accidents respectively. Also these values set the cost of a fatal accident at Birr 33,000 a ratio of (10:1) and then applying costs for PGS.

Therefore, the model that is used today for estimating road accident costs based on insurance companies information and set ratios of accidents by severity is given as follows:

Table 4.36 Traffic Accident Costing Model

Cost in Birr	Fatal	Serious	Slight	Damage only
Resources cost	33,000	10,000	6,600	3300
Sum to reflect PGS	50%	120%	15%	-
Total cost per accident	49,500	22,000	7,600	3300
Number of accidents				
Total cost of accidents				
Grand total cost				

Source: TRL and Ross Silcock (2000) Technical Appendix VII:11

4.3.3.1 Damage and Costs of Life

Damage on life is one of the serious problems today resulted from traffic accidents. Not only people lost their life, but also many of them become crippled and their family's sufferings are becoming worse then after. Therefore, increasing number of road traffic accidents means increase of damage on life. As it was discussed, the types of damage on life caused by traffic accidents are grouped into fatal (death), serious and slight injures. The number of damage on life under each category from 1997 to 2003 is given in Table 5.24. The other ways of assessing the challenges and seriousness of road accident in the town, according to Girma (2000) , TRL (2001) is to compare the fatality rate (deaths Per 10,000 motor Vehicles) and Fatality risk (deaths per 100,000 Population)

Table 4.37 Fatality Rates and Fatality Risk of Road Accidents in Bahir Dar, 1997-2003 E.c

Year	<i>Fatality Rate (Death per 10,000 vehicles)</i>	<i>Fatality Risk (Death per 100,000 Population)</i>
1997	23	2.0
1998	78	6.2
1999	78	5.9
2000	72	5.6
2001	62	5.3
2002	79	7.2
2003	56	4.9

Source: (BCATPO, 2003 E. c)

Table 4.37 above shows the relative weighting of road accident as a traffic safety risk (fatality rate) and as a personal safety risk (fatality risk). The reported road accident fatalities throughout 1997-2003 fluctuates between 20 and 80 per 10,000 registered vehicles, which is the worst as far as safety is concerned. The fatality risk also ranges from 2 to 8 per 100,000 populations, which is the highest in the country.

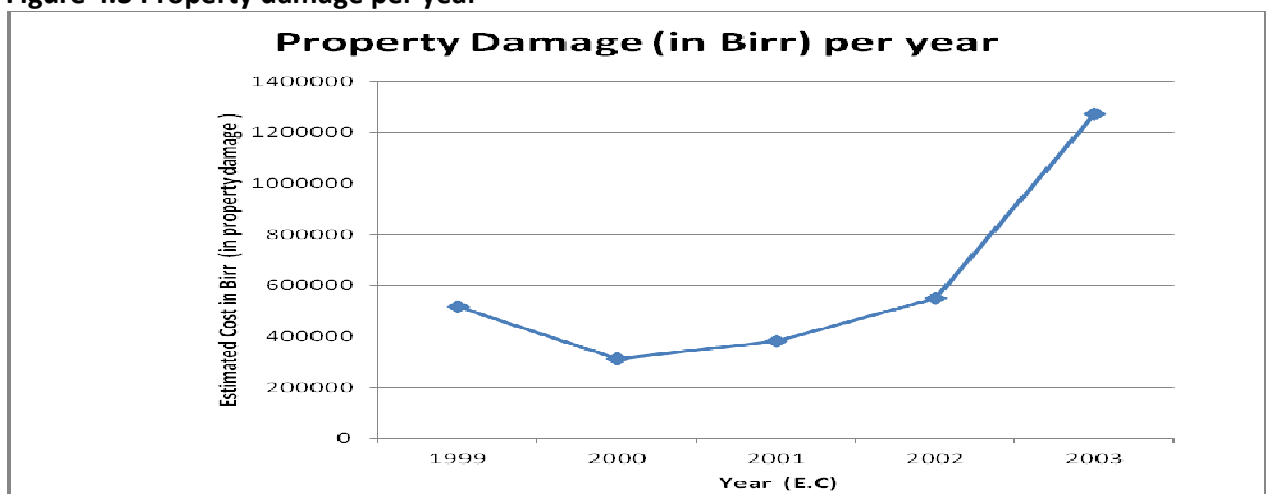
4.3.3.2 Property Damaged Accidents: The consequences of road traffic accidents have both social and economic impacts. One of the major economic impacts caused by road traffic accidents is damage on property. The main cost component in damage to property is the value represented by crashed vehicles. Property damage, however, also includes damage caused to objects inside the vehicles, such as cargo, and damage to objects outside the vehicles, such as, roadside furniture (sign posts, guardrails, etc.) and fixed property (fences, houses, etc.). The amount of damage on property usually depends on the number of accidents. The higher the number of road traffic accidents the larger the damage on property.

Table 4.38: Reported Damaged Property Accidents and Estimated Costs in Birr in Bahir Dar?

Year/money	1999	2000	2001	2002	2003	Total
Property damage (in Birr)	517,580	312,710	383,000	549,700	1,271,765	3,034,755
Annual Budget (in Birr)	81,761,157	167,577,403	232,490,060	308,232,634	300,968,607	1,091,029,861
% of Property damage Vs Annual Budget	0.633038987	0.186606305	0.164738226	0.178339325	0.42255736	0.278155082

Source: BDCA, 2003

Figure 4.3 Property damage per year



Source: BDCA, 2003

As can be seen from Table 5.25, the total damage on property accidents only estimated in birr in the years between 1999 and 2003 was greater than three million birr. Looking at the distribution of wasted property within a year for the last 5 years, one can understand that a picture of huge sum of money is lost each year. In order to assess the percentage share of annual budgeted loss as a result of road accidents in the town of Bahir Dar, the writer carried out TRLs Regression Equation Models and derived the result as follows.

Log Y = log A + log B _X, where

Y = accident cost as a percentage of annual budget allocates

X = amount of budget allocated for the town per annum

The result of this equation is found to be 0.98 percent. This indicates road accidents appeared to cost about 0.98 percent of the town's budget per annum. In other words about one percent of the town wealth was lost as a result of road accidents. This equation has been used to provide an estimate of the town's accident cost as a percentage of total budget allocation per annum. According to the statistics of the city administrations, the average annual budget allocated for the past five years was about 218 million birr per annum. Thus, the estimated costs of the annual property damage only of road accidents would be reached 0.98 percent (2,136,400 birr) per annum.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

- With the increase in the horizontal expansion of the city and lack of parallel alternative roads, lack of appropriate short cuts and/or absence of linkages between radiating or parallel roads; poor surfacing and narrow carriage ways; inadequate sidewalks and traffic control facilities; together with the existing narrow streets and junctions create traffic congestion and jams in the city. However, it is expected that the ring road, which its construction is underway, will not only divert traffic but also it will reduce time and the resource. It will be a shortcut to move from any corner of the city relative to the prevailing condition.
- The results obtained throughout the assessment of the traffic police and field survey data in chapters four indicated that road traffic accident is a serious problem in the town of Bahir Dar. The extent and numbers of road traffic accidents have been following an increasing trend throughout the study period, and the rate of increase has risen rapidly.
- Bahir Dar is characterized by poor traffic control systems and regulations, overcrowded residential patterns, lack of good engineering systems that reduce to the high traffic congestion, absence of road safety organization concerned with coordinating the different offices related with roads and road traffic, and absence of modern road transport regulations and other factors have resulted in a high number of traffic accidents in the city
- The analysis underlined that under-reporting of road traffic accidents assumed to be really bad in the town of Bahir Dar. Traffic police statistics greatly underestimated the true extent of nonfatal accident situations (only fatality accidents are relatively well- reported). In between 1999-2003 E.c, for example, 3188 road transport related injuries were registered by Bahir Dar City administration traffic police office. These people received medical treatment as inpatient and outpatient in the town hospital, health center and clinics. But in the same year the traffic police registered and reported only 76 road injury accidents. These are indications that more accidents go unreported, and that the statistics compiled are not always reliable.
- Among the driver factors, vehicle ownership, driving experience, level of education, and age of drivers have been found the major causes of traffic accidents in Bahir Dar. Those drivers who are young, employed, with less driving experience and less educational level

are mainly responsible for the many of traffic accidents in the city. Those drivers with experience as being assistants to other drivers, and those who are unmarried, working for longer hours without recess and weekly leave and with fixed terms of contract have a tendency of committing more traffic accidents than others. On the other hand, most of the vehicle fleet in the city are quite old and thus are responsible for the incidence of traffic accidents. Among the road factors, road arrangements, moisture, road surfaces and gradients have been identified as important contributing factors to the incidents of traffic accidents. Most road traffic accidents occur along two-way lanes and roundabouts; dry, straight and plain, good asphalt roads as well as roads without junctions.

- It is found that the annual accident rate in Bahir Dar for the last seven years fluctuated between 250 and 800, or remained nearly constant with an average of 467 accidents per 10,000 licensed vehicles. This rate is extremely high on the national road safety scenes which are attributable to high population number (increase in road users) and high traffic mixes (increase of wheeled vehicles of all kinds on the town roads). In this respect positive relationships between road accident fatalities and the number of vehicles and population were found. The relationships derived constantly indicate that the increase in vehicles and population will bring an increase in traffic accidents and a rise in fatalities.
- The study revealed that the economic costs incurred by road traffic accidents are very high in Bahir Dar. To measure the extent of economic costs incurred by only property damage accidents, a regression equation was computed. The result indicates that road accidents appeared to cost about 0.98 percent of the town's budget per annum. In other word about one percent of the town wealth (2,138,414 birr Birr) per annum was lost as a result of road accidents.
- In Bahir Dar, pedestrians are the road users most affected by road traffic accidents. Between 52 and 64 percent of all road accidents are pedestrians. Especially, school children under the age of 15 years are highly vulnerable to road accidents. Drivers, passengers and two-wheeled vehicles are also frequently involved in traffic crashes. Results also show that the risks are higher among males, particularly those who are economically active age group of 18-50 years
- Even though there is incidence of road traffic accidents in all weather conditions and throughout the day, the intensity and concentration of traffic accidents is higher during good weather conditions and day time hours.
- The small number of traffic police with inadequate supply of the necessary facilities, lack of incentives, and the lack enforcing capacity of the traffic regulations may lead to different forms of corruption. These corruptions seemed to have aggravated the occurrence of repeated violations of the traffic regulations by taxi drivers that resulted in more traffic accidents.

- The survey results indicate that, of all road traffic accidents of Bahir Dar, 82 percent were caused by motor vehicles (cars and taxis). The traffic flow is too mixed and no distinction of flow for different modes is observed. Cycles and motor vehicles are usually parked on pedestrian paths, and pedestrians including animals walk in the center of roadways. Moreover, heavy trucks use almost all routes without any restrictions or regulations.
- The study revealed that road traffic accidents in Bahir Dar were highest in areas where mixed traffic conditions are observed particularly on the main streets of schools, shopping centers, office areas and on older mixed residential roads with narrow right ways (hospital, Gamby and Poly roads). These roads constitute 10 percent of the total road length of the town and account for more than 80 percent of the road accidents. Road facilities such as, safety guard police, reflectors, street lighting, appropriated road marking, traffic and direction signs, which improve safety on the road are either insufficient or totally absent in these streets. Absence of adequate sight distance at intersections as a result of tall vegetation also intensifies accidents in the main streets of the town. Poor road maintenance and drainage have also been identified as a crucial problem facing the existing infrastructure to smooth mobility and safety.
- The peak hour accidents in Bahir Dar also took place between 5 p.m. and 6 p.m. This is observed as these are the hours when the schooling and working time in Bahir Dar ends and vehicle traffic and pedestrian volume are at their highest. According to the police reports and cases analyzed, 80 percent of the total accidents in Bahir Dar were caused by human errors. Of these accidents caused by human errors, drivers were indicated as being responsible causes in about 73 percent of the cases. Speeding and failure to give way for pedestrians and cyclists were the main reported and observed errors of drivers. Especially, motor vehicles are traveling at speeds usually around and over 50 km/h on roads where there are high traffic of pedestrians and cyclists. The behavior of pedestrians is also causing loss of lives and a lot of material damage. People in the town give little attention to traffic because of little experience of a comprehensive traffic regulation and lack of awareness how to act safety in the motor traffic system.
- In conclusion, the mixed traffic flow in narrow and heavily pedestrians movements, inadequate urban public transport provision, poor standard of vehicle, poor maintenance and development of roads, the negligence of drivers due to lack of adequately training and driver testing, poor traffic control and enforcement which combine increase risk of accidents on roads of Bahir Dar. Low institutional and public awareness of the extent of the destruction of traffic accidents aggravates the situation. So it is self evident from the discussion and analysis made so far that the problem of traffic accident needs to be resolved.

5.2. Recommendations


- 🌐 **Decentralization of Functions:** Due to the lack of a definite land use policy in the city the concentration of commercial activities and other services such as schools has encouraged more traffic accidents. Hence, decentralization of functions in the city should be given priority as well as controlling the improper expansion of the city. Therefore, minimizing the trips generated towards the existing concentrations means reducing congestion and traffic accidents.
- 🌐 **Understand the issue better (Develop reliable accident database):** The absence of reliable data on the magnitude and nature of the road traffic accidents is a serious handicap that needs to be overcome as a priority. Under-reporting is significant in Bahir Dar. Official police statistics, the common data sources used, greatly underestimate the true extents of road traffic accidents in the town. Errors in data collecting and coding are also very common. Therefore, to solve these problems traffic safety personnel should be made aware of the importance of accident data recording and reporting systems. Good data systems should be developed to identify successful and cost effective interventions in road safety works.
- 🌐 **Setting urban transport management bodies:** As in the other areas of public work, the urban transport management section is not well-organized in the town of Bahir Dar. Transport-related works are done in a fragmented way. Establishing a road safety unit to implement all programs pertaining to road safety is still not the concern of the municipal government. Only the traffic police department is involved in all activities. Therefore to implement all programs relating to urban transport in general and road safety in particular an urban transport management department should be organized at the town level. In addition to this the municipal road safety council should be put in place to support and ensure continuity of road traffic safety activities at the town level. Members could be drawn from different sectors such as municipal authorities, transport, education, schools, justice, public health, traffic police, mass media, private companies, road user groups and nongovernmental organizations. This council should have support at the highest level in government and should have a legal entity to work with the community. Cooperation between agencies and institutions is vital for future road safety work in the town.
- 🌐 **Formulating an urban transport policy:** To promote and enhance an efficient urban transport system, an appropriate policy and regulatory framework is needed. According to some concerned officials, the traffic law, high way code, legislation and enforcement are not comprehensive enough to encompass all aspects of the urban traffic issues and problems. These are outdated and not clear, and also fail to cover all the traffic issues related to road users and vehicles that exist today. Therefore national and regional governments should give a great emphasis to alleviating these problems by formulating a


safe transport and traffic management policy. The primary requirement for a sustainable reduction of the accident rate is that road safety should be made a political priority


Urban and transportation planning related measures: The solution to the problem of preventing traffic accidents lies mainly in the better planning of cities and the adequate provision of transport infrastructure and facilities. However, this is still difficult to attain in the town of Bahir Dar. As it is mentioned in the discussion, the highest traffic accidents in the past seven years have been registered on the main roads of the town . Common factors for this are incompatible and mixed allocation of land use types such as residential, schools, commercial, cultural, recreational and office areas. These integrated land uses contribute to the flow of different modes of transport which intensifies traffic conflicts as well as accidents. In addition, the locations of the main entrances of all these institutions are along the main streets which have high traffic loads. Thus, immediate measures should be taken to move the main gates to the back side of the institutions which have low traffic loads. In the long run, mixed allocation of land use types along the main streets should be redesigned and avoided. Activities that are expected to attract heavy traffic should be located on the main roads. On the other hand, activities expected to attract heavy pedestrian walking like schools, market centers and religious institutions should be located on minor roads. Pedestrians and cyclists need routes which are positive, safe, direct accessible and free from barriers. Therefore, main streets in the town should be designed for low traffic speeds with suitable calm restriction (ideally 20km/hour or less). Crossing police patrols should be located at busy crossing points to assist pedestrians and cyclists to cross these roads

Road and traffic related measures: The prevention and reduction of accidents in the town should be included in the development of new road schemes or improvement or maintenance of existing roads. In Bahir Dar most parts of the accident-prone streets are severely damaged. Even the newly constructed ring road has been totally damaged without giving any service. Therefore, systematic identification and treatment of hazardous locations can improve road safety substantially. Road safety inspection should be included during the design, construction and maintenance phase of road projects. It is also important to develop a traffic management strategy on the roads of the town by establishing functional hierarchy of roads and allocating road space to priority users, including bicycles and horse-drawn carts. In Bahir Dar, these factors are quite relevant because the mixture effects of different types of vehicle use on the same road leads to high potential risks especially for non-motorized road users. Thus, the segregation or separation of road user types, such as the construction of bicycle lanes, but also banning vehicles with hazardous freight from the main routes will substantially improve safety. The provision of off-road parking spaces or the establishment of some forms of parking control may reduce conflicts and increase road capacity and safety. In Bahir Dar foot ways are often obstructed by long trees, signs of advertising, illegal parking, hawkers and traders, encroachment of shop displays, and in some streets foot way dwellers . Under these conditions, footways are

un-usable and pedestrians are forced to walk in roadways with both safety and traffic congestion problems. There fore, town governments should take enforcement actions against illegal parking on the main roads hazardous and obstructive locations. Tall vegetations at the intersections and junctions should always be cut and equitable policies for relocation of street traders and footway dwellers should also be carried out

 **Road signs and marking measures:** Information for drivers, pedestrians, cyclists and school children is essential for good traffic management. However, in Bahir Dar, it was observed that the number and size of regulatory signs are often inadequate and poorly sited. Road marks are poorly visible at night and unclear even in day time. There are also institutional problems. For example, responsibility for putting marks and signs is not clearly designated to a legal entity in the town. There is no responsible institute or department for designing and supervising signs and marks. It is indisputable that good town-wide signing and ,road marking can assist development and maintenance of road user behavior and can support enforcement. Therefore, immediate actions should be taken by the town government in arranging effective traffic management agency and in supervising signing and marking measures. Near schools, warning signs for children are needed, and strict speed control systems are need to apply in the town roads.

 **Vehicle related measures:** Most of the vehicles in the fleet of Bahir Dar streets are very old with no proper maintenance and enforcement. Especially many un-roads worthy taxis and private cars are operating on the roads of the town because of lack of enforcement. Despite all these inadequacies, vehicles are over-loaded above their capacity. With bad road conditions of the town these circumstances lead to severe accidents which involve a number of people. Governmental vehicles are also highly involved in road accidents at the night hours due to lack of strict controls on drivers out of working time. Therefore, mandatory regular inspection of all types of vehicles in terms of age, condition and safety features should be carried out constantly. Moreover, strict control and checking of vehicle loads is needed both in the interests of road safety and prevent excessive axle load on pavements.

 **Bicycle related measures:** Bicycles are the predominant non-motorized transport mode in the town of Bahir Dar next to walking (accounting for 30 percent of trips), and offer low cost personal mobility assisting lower income groups. However, increasing motorization has increased safety problems for bicycles particularly in mixed traffic heavily used streets and intersections. In the town providing convenient and good quality facilities for cyclists is a low priority. There is a view in some government officials during the discussion that bicycles are considered to impede motor vehicles, and are categorized as the least transport hierarchy. The tendency is, therefore, towards elimination of cyclists rather than provision of good facilities for their use. But bicycles are an efficient mode, suitable for various urban journeys and available to at least most of the social groups of the community. Therefore, bicycles should be treated as an integral part of the traffic

management system and strategies should be designed to improve safety by protecting cyclists from conflict with motor vehicles and pedestrians.

- 🌍 **Driver Training and Licensing:** Driver errors are the causes of most taxi traffic accidents. The young, less experienced and with taxi driver assistant background; taxi drivers are responsible for most of the accidents. Therefore, drivers' training and testing should be standardized; a longer minimum time of driving experience should be imposed before a license is issued to a driver. In addition, there should be additional prerequisite criteria for taxi drivers with regard to their background and good behavior, age, driving experience, free from any addiction like chewing chat, alcoholic drinks, free from criminal acts as well as offending violation of traffic regulations. There should be a restriction for taxi drivers regarding the length of driving hours (working hours) because most taxi drivers are on the road for about 13 to 16 hours a day continuously, which leads to the use of chat as stimulant and that in turn makes them more aggressive drivers
- 🌍 **Education and training:** Discussions with pedestrians, drivers, cyclists and children about their level of knowledge of the rules and laws of road safety revealed that the majority of these road users did not have education and training. Therefore, road safety education should be given to all classes of the community. All dwellers should be trained to be good road users at all stages of their lives. The training and education system should also start at home from his/her parents. A strong commitment is needed towards road safety education in schools. Since almost all accidents have drivers error as one of the contributory factors there is potential benefit in improving the standards of driving. The driving training program of motor vehicles should be introduced in revised test and with a safety emphasis. Updated training and education is needed for beginners as well as licensed drivers. Media campaigns should concentrate on disseminating knowledge to the public regarding the safe use of the roads, as well as attempting to change unsafe traffic attitudes.
- 🌍 **Traffic Education for Children:** Road safety education should be provided in the schools as a short-term solution. But in the long run, this should be included in the school curricula. This is because most of the traffic accident victims are children
- 🌍 **Public Education for Pedestrians:** Road user education and awareness raising should be given the necessary attention. Pedestrian traffic education should be offered and encouraged through the radio, television, newspapers, magazines, books, films, leaflets and posters as well as giving traffic education around worship places and public gatherings, and the like.

- **Enforcement of traffic regulations:** Enforcement measures are fundamental in Bahir Dar town where the drivers and cyclists as well as pedestrians are always reluctant to obey the rules. So, strict and continuous enforcement is one of the key factors that can bring changes to negative traffic attitudes and hence improve the behavior of road users towards a more safe traffic behavior. But traffic growth rate in the town is high and the work load and working practices of traffic police need to keep pace with the changes. Often, working practices are not responsive to the new traffic conditions and fundamental attitudinal changes. The traffic police forces in Bahir Dar are under equipped and not well trained in traffic management. If enforcement of traffic regulations is generally the responsibility of the traffic police, therefore, they are to be well trained and equipped. Training should include how to deal with accident in terms of accident reporting, dealing with patterns, causes and remedial actions. Manpower allocation to traffic police should be sufficient to deal with traffic control as well as enforcement of traffic violations of pedestrians and cyclists.

- **Management of the Existing Facilities:** The misuse of the scarce sidewalks by service giving enterprises such as Garages, Wood and Metal works, Groceries, Restaurants, street peddlers or hawkers, should be controlled. Also parking cars on both or either sides of the road along narrow one-way or two-way streets especially in front of Hotels, Restaurants and supermarkets can be controlled by introducing paid parkings (Parking meters).The scarcity of traffic signals such as traffic lights and their frequent technical failure creates chaos around squares and junctions leading to the incidence of traffic accidents. Therefore, in addition to the maintenance of the existing ones, the expansion of traffic lights to other accident-prone squares and junctions should receive immediate response.

- **Research related measures:** Some parts of the road accident problems are unique to Bahir Dar, such as the heavy accident burden put on cyclists and child pedestrians. But the extent and the effects of road traffic accidents in the town area is usually not known. Therefore, these situations will require research. The research and evaluations should be consequently including studies on the problems of implementing road accident countermeasures. Finally, the measures which are suggested in this thesis should not necessary have to be treated separately. They should complement each other and work together in a supportive way so as to tackle the particular traffic safety problem in Bahir Dar town.

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