ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

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TRAFFIC INFORMATION SYSTEM: THE CASE OF ADDIS ABABA TRAFFIC POLICE DEPARTMENT

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF SCIENCE IN INFORMATION SCIENCE

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Name and Signature of Members of the Examining Board

Ato Getachew Birru, Chairman, Examining Board

Ato Tesfaye Biru, Advisor

Ato Solomon Yewondwossen, External Examiner

Dedication

To my wife, Haimanot Tolla, whose love and encouragement have given new significance to my every accomplishment.

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Abstract

This paper starts by presenting a brief background abouechnical inspection of vehicles, etc,) has its won use, and the measures applied yield some results towards greater safety. The paper tried to identify and review road safety measures in Addis Ababa in order to provide and Over view of how Addis Ababa is tackling its road safety problems.

The paper draws attention to the importance of road safety improvement measures in Addis Ababa. The cost of accidents to the economies of our country is significant. According to the study conducted in 1983 the cost rep tackling its road safety problems.

The paper draws attention to the importance of road safety improvement measures in Addis Ababa. The cost of accidents to the economies of our country is significant. According to the study conducted in 1983 the cost ro treat accident victims and reinstate vehicles reduces the availability of these important resources for more productive development projects. Anything that can be done to reduce the cost of accents would therefore have an economic as well as a social impact.

Finally by discussing a finding of an outstanding amount of birr 9, 833,010 due to lack of proper record and follow up a prototype database is created to show the importance of computerized traffic information system. It is possible to store, manipulate, and retrieve updated information from the systems that in turn facilitates the provision of timely information to support decision making.

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List of abbreviation used in the study

AAATCB	Addis Ababa City Administration Transport and Communication Bureau
AACRA	Addis Ababa City Roads Authority
AATPD	Addis Ababa Traffic Police Department
ADS	Accident Data System
CR	Criminals Record
DBMS	Database Management System
DBO	Design by Objective
FARS	Fatality Analysis Reporting System
GDP	Gross Domestic Product
GVW	Gross Vehicle Weight
IEM	Information Engineering Methodology
IHT	Institution of Highways and Transportation
JSD	Jackson Systems Development
MAAP	Micro Computer Accident Analysis Package
NCSA	National Center for Statistics and Analysis
NHTSA	National Highway Traffic Safety Administration
PAD	Problem Analysis Diagram
PC	Personal Computer
PSA	Problem Statement Analysis

PSL	Problem Statement Language
SADT	Structured Analysis and Design Technique
SQL	Sequential Query Language
SSA	Structured Systems Analysis
SSADM	Structured Analysis, Design and Implementation of Computer System
TOSS	Traffic Operations System Software
TRRL	Transport and Road Research Laboratory

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Chapter one

Introduction

1.1 Background

1.1.1 Traffic Defined

People use transport for a variety of reasons. They travel between home and place of work or school and they may travel during the course of their work. According to Faulks (1990), this is regarded as essential traffic. Then, there is the optional traffic which consists of those who are not travelling in connection with their work but are doing so for personal reasons such as shopping or visiting friends, pursuing leisure interests, visiting places of interest, or going to sporting events.

Traffic could be defined as movement of people and vehicles along roads and streets, or aircraft in the sky. It could also include the traffic of shoppers in a supermarket, the flow of papers in large offices, and the movement of components on an assembly line. For the purpose of this research, the term traffic, is used to refer to movements by the road users: people, vehicles, animals etc.

1.1.2 Emergence of Traffic Control in Ethiopia

According to Richard Pankhurst (1963) motor engine vehicles were first introduced to Ethiopia's roads during the era of Menilik II (1889-1913). But before the four wheeled vehicle entered Ethiopia, there was a need to construct a road for the cars. Therefore, a road roller entered Ethiopia through Djibouti In 1904. Since there were no other alternatives, the road roller was pulled by 3,000 army to travel from Djibouti to Addis Ababa. After it reached Addis Ababa, it stacked due to mechanical problem at a place now called *"Sebara Babur"* (non functioning train) before serving the purpose.

The first four-wheeled vehicle entered Ethiopia in 1912. Before vehicles emerged in Ethiopia, the means of transportation were horses, mules and carts. In Addis Ababa, these transportation meanses were controlled by a guard called "*Yarada Zebegna*" . A guard had the right to punish the riders if they violated rules set for this group of road users. The punishment could be money or imprisonment. This,it is felt, indicates the introduction of traffic controlling mechanism before cars were introduced to Ethiopia's roads.

Starting from 1912, there has been a drastic increase in the number of cars in the traffic system. According to the Addis Ababa City Administration Transport and Communication Bureau Statistics Department, the number of cars in Addis Ababa were not more than 200 in the year 1935 E.C., which increased to 2500 by the year 1940 E.C., and further increased to 86667 cars by the year 1974 E.C. This resulted in a high growth rate of car accident which brought the establishment of the Addis Ababa Traffic Police Department in 1942 E.C. The Addis Ababa Traffic Police Department (AATPD) is solely responsible for the enforcement of traffic rules and regulations and investigation of traffic accidents and other offences. As such it is one of the important wings of the city police.

1.1.3 Traffic Data

The basic enumeration principles of traffic data collection and analysis are not new. They can be traced back to the start of mathematics. The basic concept is one of measurement, and as soon as people began to count their animals and cut notches in a tree, data collection and analysis was born (Kline 1972). The procedures adopted for collecting data and carrying out calculations have, however, changed considerably over the past few decades. This change owed much to the ever increasing capabilities and availability of computers.

For example, according to the U.S. Department of Transportation Federal Highway Administration (1998) there are traffic camera views which provide traffic information along the roads. As stated the objectives of such systems are:

- To reduce the number and severity of vehicular accidents by providing early detection of incidents
- Improve the movement of people and goods by providing accurate traveler information.

In addition, according to the Transportation Research Board of USA (1999) there is what they call Fatality Analysis Reporting System (FARS). FARS contains data on all fatal traffic crashes within the 50 states, the District of Columbia, and Puerto Rico. The data system was conceived, designed, and developed by the National Center for Statistics and Analysis (NCSA) to assist the traffic safety community in identifying traffic safety problems, developing and implementing vehicle and driver countermeasures, and evaluating motor vehicle safety standards and highway safety initiatives.

NCSA responds to over 3,000 requests for information and sends out more than 50 computer tapes of FARS data each year. FARS data are used extensively within National

Highway Traffic Safety Administration (NHTSA) and requests are received from sources such as state and local governments, research organizations, private citizens, the auto and insurance industries, Congress, and the media.

FARS data can be used to answer many questions on the safety of vehicles, drivers, traffic situations, and roadways. FARS data can also be accessed at the state level by the FARS analyst to respond to state safety issues.

Much of the work in traffic data collection and analysis in some countries is contracted to private consultants, particularly (but not solely) by municipalities or private developers. According to Young (1988) in Australia, local governments in both urban and rural areas have taken on such responsibilities, or are required to do so. The resulting situation is a large number of bodies having interests in traffic data collection, analysis and interpretation.

1.2 Statement of the Problem and Justification of the Study

Addis Ababa Traffic Police Department consists of six sections. These sections are, statistics section, accident records section, violations records section, vechiles inspection section, information section, and archives.

According to the Statistics section of the Addis Ababa Traffic Police Department, road traffic accidents continues to be a growing problem in Addis Ababa. This is evidently revealed by the yearly increase in the number of road traffic accidents as shown below. Despite the good intentions and attempts in creating a necessary climate of reducing collisions, fatalities, injuries, and damage, in the form of campaigns, workshops, and seminars, the attempts have not yielded much, because, there is an upsurge of road accidents.

The following table summarizes selected data of traffic accidents during the past three years.

Table 1.1 summary of Traffic Accident data (1989-1991 E.C.)

Year (E.C)	1989	1990	1991
Estimate of loss due to damage to property (birr)	11,685,154	12,019,031	12,311,129
Death	264	280	283
Heavy injury	340	470	487

Source: The Addis Ababa Traffic Police Department yearly statistical reports (1989-1991E.C)

According to the Institution of Highways and Transportation (IHT) 1990 road traffic accidents can be attributed to numerous factors such as weather, light conditions, faulty design and /or in adequate maintenance of the road, infrastructure development, as well as some vehicles with mechanical defects and human error. Road traffic accident statistics of some developing countries have also demonstrated that the hazard to road users is related to increase in the vehicle ownership.

In addition to loss of human life and personal suffering, road accidents involve extensive damage to vehicles. In the case of countries such as Ethiopia, acquisition of spare parts for repair of such vehicles, and acquisition of new cars to substitute those damaged beyond repair, require large amounts of foreign exchange which often enough is in short supply. Considering all the

different negative effects, it is evident that road accidents consume a rapidly growing share of the available resources of the country, resources which are already severely limited.

Data collection and analysis is of major importance in the sense that it is the foundation stone on which all the activities of road safety rest on. The collection of data makes it possible to asses the impact and the nature of the accident problem as well as to identify some accident areas and or dangerous locations. The planning, design and management of road traffic systems depend greatly on the availability of reliable, relevant and recent traffic data, and the ability to analyze and interpret these data (IHT 1990).

Addis Ababa being a capital city of Ethiopia (a third world country) its modernization concerning road traffic technology is very low. Recent statistics show that, the car traffic accident in Addis Ababa is increasing. However, so far there are no many studies, which state the magnitude of car traffic accident, its sources and suggest solutions. In addition, based on the discussion I have had with the officials of the Addis Ababa Traffic Police department, I realized that manually maintained accident files of the department are often inadequate (in terms of the reliability of the statistics, easy of access to detailed accident investigation files, etc...). It is, therefore, essential that good system analysis be made which will serve as a foundation for the design of a reliable data base and system improvement.

This research work is to be conducted as a partial fulfillment to the M.Sc.I.S degree program in which I am enrolled and thus is mainly an academic exercise. In addition as traffic data collection and analysis form the basis for all studies on traffic systems management, those who are engaged in monitoring and diagnosis of existing traffic conditions, are expected to benefit from the results of this study. The research also tries to provoke further studies in this area, so that new findings and better solutions will be found.

1.3 Objectives of the Study

1.3.1 General objective:

The general objective of this research project is to examine the current status of traffic accident data management within the AATPD with a view of proposing an automated traffic control data management and reporting system.

1.3.2 Specific objectives

The specific objectives of the study are:

- To identify user categories of the existing system.
- To asses the information needs of the different user categories.
- To identify the various sources of information.
- To identify major problems in accessing information.
- To highlight experiences of other countries in organizing traffic information.
- Recommend improvements to the existing traffic control data management and reporting system.

1.4 Methodology

1.4.1 Data Sources and Materials

- Relevant reports, books and journal articles.
- The Traffic Police Department staff
- Drivers.
- The Internet.

1.4.2 Data Collection Techniques

This research work was based on survey methodology. To carry out the survey, the following instruments were employed:

- document review,
- interview, and
- participant observation

Copies of documents consulted, questions used as a guide for the interview and list of people interviewed are attached as annex to this report.

1.4.3 Systems analysis and design technique

From the variety of systems analysis and design methodologies available today the widely used ones are the structured design methods. Because these methods provide a formal and organized way of working through the stages of design to ensure consistency, documentation, change of control and above all recognize that the potential users of a system should have the ultimate voice in the design process. All structured methodologies have common features in that

" they use graphical models to document the outcome of each step, place heavy emphasis on user participation in the design process and involve repetition of the previous phase (s) and step(s)" (Daniels and Yeates 1983).

Rowley (1990), and Eardley et al (1991) have categorized the best known structured design tools into three major groups as: Functional Decomposition, Data-and-Process design, Prescriptive methodologies.

Functional decomposition Methodologies: These structured design methodologies emphasize on the breaking down of systems into smaller subsystems, so that the whole system can easily be understood. Some of the best known functional methodologies include the top-down approach, bottom-up approach, HIPO and step-wise refinement approach (Caroline and Mike 1990)

Data-and-Process Design Methodologies: These methodologies are broadly divided into two groups, namely data-oriented and process oriented. The data-oriented methodologies mainly emphasize on the characteristics of the data being processed by the system. Data flow-oriented (process) methodologies, on the other hand, are based on the decomposition of a system into modules by considering the types of data elements and their logical behavior within the system. Data-oriented Methodologies include Structure Analysis and Design Technique (SADT), Composite Design, Structured design, Structured System Analysis (SSA), Structured Systems Analysis and design Methodologies (SSADM), etc.(Caroline and Mike 1990).

Process-oriented methodologies: Include Jackson systems development (JSD), Structured Analysis, Design and Implementation of Computer Systems (STRADIS), Warnierorr methodology, Information Engineering Methodology (IEM), etc. (Caroline and Mike 1990).

Prescriptive methodologies: These are basically computerized design procedures commonly used by analysts to develop software. The most widely used prescriptive design

methodologies include Chapin's approach, design by objective (DBO), Problem Analysis Diagram (PAD), Problem Statement Language (PSL)/Problem statement Analysis (PSA) (Caroline and Mike 1990).

It is not always easy to select the 'best' one from the structured methodologies described above. However, the analysis and design methodology used for this study is a combination of useful elements of data and process-oriented methodologies.

1.5 Interview

The general approach taken in this work was one of trying to get a sense of what was being done in Addis Ababa in terms of road traffic. I did not attempt a complete census of all organizations potentially involved in road traffic. Nor did I attempt a statistically valid random sample of those same organizations. My approach was simply to try to contact at least one person at an organization level, which I discovered to be potentially important in handling road traffic and related issues. The purpose of this was to get sense, even if only on anecdotal level, as to who is doing what, and how, and why in terms of data collection.

Interviews were conducted with top management of the AATPD, traffic polices, drivers, and staff from other organizations. Intensive and repetitive interview and discussion were held with most employees that work in the AATPD to understand:

(a) Activities of the Addis Ababa Traffic Police Department

(b) The information need

(c) The sources of information and problems in accessing existing information

It should be noted that the greatest problem I had was in identifying organizations concerned with road traffic. I attempted this by first contacting the public relations officer of the

Addis Ababa Traffic Police Department, who in turn directed me to the appropriate organizations and staff person.

1.6 Literature review

The purpose of the literature review was to have a theoretical background on the basics of information systems in general and traffic information system in particular and also to see if other similar studies have been conducted in this areas; and to what extent.

However, little in the way of useful information was obtained by way of a conventional literature review. In addition to a standard library search, transportation related topics available on the INTERNET were examined in an attempt to find documentation describing the traffic data collection practices and programs of individual city or countries elsewhere. Browsing INTERNET was not very fruitful since many of the listed sources, primarily State Dot home pages, provided only general agency information, " real time" traffic reports, or lists of on going construction projects.

1.7 Scope and Limitation of the study

Even though the title of the study is traffic information system, due to time constraint the main emphasis of the study lies on the analysis part of the existing traffic information system.

1.8 Organization of the Thesis

This report comprises of six chapters. Chapter 1 gives the background information as well as the statement of the problem, justification, general and specific objectives of the study, scope and limitation of the study, and the methodology used to conduct the study.

Chapter 2 deals with an overview of basic information related terminology's which were surveyed form various literature. It has highlighted the terms like data and information, information system and types, decision making and information etc. Chapter 3 provides a background of the transport situation in Addis Ababa, fundamental reasons of accidents, and major regulation related to transpiration. In chapter 4 the processing of information at AATPD is discussed.

Chapter 5 presents the design of the prototype database. Finally chapter 6 provides conclusions and recommendations.

Chapter two

Traffic Information System: An overview

2.1 Introduction

To render our discussion meaningful, in what follows we will first introduce basic concepts and terminologies.

2.1.1. Data and Information

Data can be defined as a collection of unprocessed facts associated with particular activity; measurements or observations about people, events or objects (Clare et al, 1995). However, data in isolation has no real meaning and simply collecting it for its own sake is a pointless exercise (Burn et al 1987). In other words, if data is to have any value at all, it needs to be given some meaning and interpretation and this can be achieved only by some forms of processing applied to data (Clifton & Sutcliffe, 1994).

Generally the result of the processed data is known as information. According to Clare et al (1995) information is defined as relevant data that has been processed meaningfully.

In order for information to be meaningful and useful for the user it has to have certain characteristics, namely *accessibility*, *relevance*, *comprehensibility*, *timeliness* and *accuracy* (Eric et al, 1993 Jennings & Sener, 1995 Clifton & Sutcliffe, 1994).

To be useful, information must be accessible. For information to exist somewhere is not sufficient. Users must know that it exists in the first place and they must know how to obtain it as well.

The second fundamental requirement of information is that of relevance. Having large amount of information can burden the user with unnecessary administrative overloads. In order to avoid such burdens, the available information must be relevant to the purpose.

Comprehensibility of information is related to the format of its presentation and its match to the particular needs of decision makers.

A further requirement is that of timeliness. From the end user's point of view, this may be a preference to minimize or at least limit the time taken from information requests to receipt. That is, to minimize delays between request for and provision of information, that can be caused due to: procedures and structures of the system or weakness in the information received (incomplete, insufficiently accurate, irrelevant, etc.) which implies that the user should repeat the request (Eric et al, 1993). The qualities, attribute of accuracy and timeliness are clearly linked.

2.1.2 Information systems

Information system as defined by Laudon (1995) refers to a set of interrelated components working together to collect, retrieve, process, store and disseminate information for the purpose of facilitating the management functions (planning, control, co-ordination, analysis, and decision making in business and other organizations).

The general model of information system is highlighted by input, process, and output. The input aspect of the model refers to capture or collection of raw data resources from within an organization or from its external environment. By process, it is meant the conversion of raw input into more appropriate and useful form. Finally, the output aspect refers to the transfer of processed information to the people or activities that will use it. Of course, the storage of information is understood to exist in all parts of the model.

2.1.3. Information use in decision making

Information is primarily used in organizations for planning and operational management purposes, and essentially for making decisions associated with them.

Decision making (selecting the best alternative and committing resources) is mainly based on the availability of proper information. Decisions made based on wrong information are normally worse than making no decision because the outcome from such decisions could be destructive to the organization. As mentioned above decisions mean committing some resources of the organization and if any decision is made on the basis of wrong input (information), the result is undoubtedly improper utilization of the resources committed. And, that is why it is said making wrong decision is worse than not making decision.

2.2 Traffic information system

According to IHT(1990), traffic information system refers to a systematic process for the collection, analysis, summarizing and retention of road [1] and transit related and vehicular traffic data. The main inputs to such traffic information system are road traffic data and accident data. In the case of Addis Ababa Traffic Police Department the inputs to the traffic information system include Accident data and Violation data. More on this i.e. how the Accident data and Violation data are collected and processed by the AATPD is presented in chapter four.

According to Shelley Burke (1999) road traffic data means data used to develop estimates of the amount of person or vehicular travel, vehicle usage, or vehicle characteristics associated with a system of roads or with a particular location on a road. These types of data

1. For the purpose of this research the terms road and highway are used interchangeably

support the estimation of the number of vehicles traversing a section of road or system of road during a prescribed time period (traffic volume), the portion of such vehicles that may be of a particular type (vehicle classification), the weight of such vehicles including the weight of each axle and associated distances between axles on a vehicle (vehicle weight), or the average number of persons being transported in a vehicle (vehicle occupancy).

2.3 Traffic accident information and decision making

Accidents are due to a number of different causes, and accident prevention must therefore be based on a combination of various countermeasures. To find appropriate solutions to road accidents, the accident locations and victims patterns must be identified first (IHT 1990)

It is generally agreed that the purpose of any accident analysis system is to find the possible causes of accidents related to vehicles, roadways, drivers and pedestrians, and to plan measures to protect the motoring public by reducing the frequency and severity of accidents. These and other related objectives are not expected to be achieved or partially achieved without a proper data management and accident reporting system. Accurate accident reports and records are the foundation for analysis and prevention of traffic failures. They serve, not only in guiding engineering measures, but also in shaping traffic law enforcement and traffic education polices and procedures as well in legislation and administration of motor vehicle law.

2.3.1 Identification of accident locations and Victims patterns

According to IHT (1990), identification of accident locations and victims patterns, constitutes the first step in the accident analysis process. Getting a general overview of the accident prone locations (i.e. where do accidents usually happen?) as well as the type of victims involved in an accident (i.e. to whom do accidents usually happen to?) It is through such general overview of the scale and characteristics of accident data, that some preliminary actions might be taken in the form of low-cost engineering counter measures to relive the black spot areas from the road network. Most importantly, based on such general overview, decision would be taken as to the direction of the in-depth accident investigations: investigation of particular types of accidents or investigation of accidents occurring to vulnerable road users, etc.

2.3.2 Accident Reporting System

According to IHT(1990) accident reporting system activity constitutes the root of the whole accident investigation process. It is mainly concerned with collection of accident data. Accident data collection forms/booklets should be carefully designed so as to capture all the necessary information required to perform an overall as well as an in-depth accident data analysis. The accident reporting form should be designed so as to ensure the easy and speedy completion of reliable and sufficient information concerning the reported accident. In most cases, it is the police officers or traffic police officers who bear the responsibility of completing such forms. Accordingly, they should be fully aware of the significance and importance of the different data items included in the form. Such form should answer at the very list, questions pertaining to

- Where did an accident take place?

- When did an accident take place?
- Who was involved in an accident?
- What happened in terms of fatalities, injuries, damages?
- How did an accident take place?
- Why did an accident happen?

When it comes to the last question, it is always important to remember that an accident could happen as a result of any of the following elements or a combination of these elements:

- the road environment
- the vehicle
- the road user

Chapter three

Addis Ababa City Transport: the existing situation

The aim of this chapter is to give a background of the transport situation and to show the fundamental reasons for accidents in Addis Ababa. It also presents an outline of the solutions implemented so far and assesses the major regulations pertaining to transportation and development of the infrastructure. The processing of road traffic information by AATPD is discussed in chapter four.

3. 1 General data

Some of the data presented in this section are in the public domain while some are the result of this investigation.

Though the city of Addis Ababa was founded some 110 years ago, the pace of its development is relatively lagging behind and is facing quite serious problems.

The population of Addis Ababa, which was 300,000 in 1938 E. C. stands at more than 2.5 million after 50 years (Statistical Abstract 1998). And even if it is difficult to estimate the length of roads 50 years ago, it is now assumed that it exceeds no more than 1,000 km. The number of motor vehicles that was registered to be 22,700 in 1956 E. C. has now reached more than 175000. Currently Addis Ababa is divided in to six administrative zones.

While the average growth of people is 5 percent and that of motor vehicles is 12 percent, the development of infrastructure is generally lagging behind (Statistical Abstract 1998).
Obviously better transport benefits our city in different aspects:

- it activates labor

- it increases GDP
- it helps in the development of investment
- it helps in the creation of production services and specialization
- it bridges the gap between supply and demand of raw materials etc.

The term transport as used in here refers to infrastructures (roads, bridges, traffic control devices and other services), public transport: buses, taxis, private cars, trucks and services given in sector offices and organizations.

3.2 Duties & Responsibilities of the Addis Ababa Traffic Police Department

Responsibilities of the Addis Ababa traffic police Department, include, among others, the following (AATPD)

- Checking whether the region's proclamations and rules of transportation have been followed
- Controlling the road traffic to improve movement and safety
- Maintaining traffic accident & violation records
- Reporting accident statistics and others
- Other activities related with road traffic.

To accomplish its duties and responsibilities, the Addis Ababa traffic police department has a total of 350 staff (Traffic Police) in the 6 zones of Addis Ababa and about 55 staff (Administrative and investigation) at its head office.

The primary duty of the police is to protect life and property. From traffic point of view it is the prevention of accidents, investigations of accidents, enforcement of all traffic laws, provision of the free flow of traffic and promotion of road safety.

As in any other job, it is important that those employed in traffic control duties are properly trained. Adequate traffic control training is the real foundation to the aim of reducing accidents. Accordingly, the Addis Ababa Traffic Police Department provides the following courses.

a) Two months course for subordinate officers

b) Two months course and one month special traffic course for inspectors

There is a traffic faculty in the police college to cater for the above courses

3. 3 Major Regulations

In Addis Ababa, Road Traffic is governed by regulations and laws which make up what is commonly referred to as the transport code. It is Transport Act Number 361/1961 E. C., which contains most of the major regulations currently employed. What follows is a brief summary of major regulations that are felt, are related with road traffic accidents.

3.3.1 Vehicles Inspection

Vehicle inspection has been compulsory in Addis Ababa since 1956 E. C. for both new and old vehicles.

According to the Addis Ababa Administration transport and Communication Bureau AAATCB the inspection of new vehicles is carried out for the following purposes

- To ensure that the vehicle meets the construction and use regulations.
- To check the engine and chassis number so that the vehicle can be correctly identified
- To collect statistics on the vehicle for various purposes.

The annual roadworthiness inspection is carried out on all registered vehicles by the vehicles inspection section and the passing of the inspection is a precondition to the renewal of registration and the issue of the annual inspection sticker by the Vehicle Registration Renewal Section. The inspection has two main purposes:

- to verify the identity of the vehicle,
- to ensure its roadworthiness .

According to the vehicles inspection section of the Addis Ababa Administration transport and Communication Bureau, there is a very big difference between the total number of registered vehicles and the total number of vehicles which appear for the annual roadworthiness inspection. The following table shows number of vehicles inspected for their roadworthiness in the past five years.

Table 3.1 summary of vehicles inspected for their roadworthiness

	Years (E.C)				
Code	1986	1987	1988	1989	1990
01	4382	5442	5471	5272	9443
02	29642	32648	33363	35499	37686
03	13907	18377	20587	19364	20931
04	8373	8450	8208	7096	6456
International	4322	4578	4770	4080	4111
other	430	240	331	500	150
total	61056	69735	72730	71811	78777

Source: AAATCB vehicles inspection section

The above total numbers, which are in the range of 61,000 and 79,000, can be compared with the total number of registered vehicles, which is more than 175,000. Four main reasons have been forwarded, by the employees who work in the vehicle inspection section of AAATCB , as to the difference in number between the registered vehicles and those inspected.

- Some organizations have their own inspectors (e.g Anbessa City Bus)
- Vehicles change address to other regions
- Vehicles may be destroyed and out of use
- The owners of some vehicles do not bring the vehicles for the inspection and they use stolen or forged sticker.

Rules and regulations provide for vehicle testing every year. The vehicles are to be tested every year in order to determine whether they are roadworthy. However, it is a common sight to find on the roads some vehicles with weak structures and defective systems. This might suggest that standards of testing and vehicle inspection are not at present adequate and rigorous.

3.3.2 Speed limits

High speed has both positive and negative aspects. Positively, high speed can reduce journey times and can help reduce driver fatigue as less gear changes are required. However, higher road speeds, coupled with less than ideal roads, can have a detrimental effect on the overall safety of the vehicle and road users. To overcome this, the law sets speed restriction.

There are three types of speed limits in Addis Ababa.

- 60 km/h for private cars and motorcycles
- 40 km/h for commercial vehicles with a total laden weight of more than 3500 kg

- 30 km/h for city buses and vehicles towing a trailer with a total laden weight of which exceeds 3500 kg

Although the law is well intentioned, it is riddled with problems in formulation, implementation and enforcement. The laws, rules and regulations contain provisions for speed limit and speed limit signs installed and posted on the roads. There are no radar guns to enforce speed limit regulations.

3.3.3 Alcohol

There is a relationship between drink and safe driving. It is common knowledge and experience that many fatal accidents are alcohol - related, accordingly the council of Addis Ababa City Administration passed a bill aimed at preventing driving under the influence of alcohol. It states one who drove while drunk or having taken drug or 'chat' shall be punished birr 140 effective from July 8, 1998.

Speeding and drinking-and-driving are important safety problems in Addis Ababa. According to the statistics section of AATPD about 63% of the accidents occurred during the night in 1991 E. C. were attributed to these factors. Unfortunately, the Addis Ababa Traffic Police Department does not have the necessary technical means to undertake in-depth investigations of these problems. Moreover, the present lack of speed measuring systems and breathalyzers does not allow the traffic police forces to organize systematic or preventive checks, although there are provisions for them in the regulations.

As already indicated above, the law on drunk-driving prescribes penalties which includes an imposition of fine and a possibility of being banned from driving. For a law of this nature to

be applied, it must be simple to enforce. The law does not set any legal limit by medical standards on the level of alcohol which is permissible for safe driving.

Although the laws, rules and regulations are numerous and extensive, some are defective and need to be amended while others are difficult to enforce. There are no laws on wearing of seat belts.

3.4 The driving license system

3.4.1 Driver Licensing

The objective of the driver licensing procedure is to promote safety by ensuring that only drivers who have passed the driving test shall be allowed to drive and that bad drivers are prohibited from driving.

As is the case in all countries which participated in Vienna convention of 1968, there are six types of driving license in Addis Ababa. This is summarized in table 3.2 presented on the next page.

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Table 3.2 categories of driving license in Addis Ababa

Categories of driving license	
Class	**vehicles permitted**
I	Motorcycles and motorcycle combinations (minimum age 16 years)
II	Saloon cars, dual-purpose vehicles ,passenger vehicles of up to twelve seats other than taxis freight vehicles with a capacity up to ten quintals all three-wheel vehicles (minimum age 18 years)
III	Any vehicle in class II Any freight vehicle with GVW up to 7500 kg. Any passenger vehicle up to twelve seat capacity used as taxi (minimum age 21 years)
IV	Any vehicle in class II or class III Any sized freight vehicle (minimum age 21 years)
V	Any vehicle in classes II,III or IV Any truck trailer, tractor- trailer (minimum age 21 years)
VI	Any vehicle in class II or class III Any passenger vehicle (minimum age 21 years)

Source: AAATCB

Any of the above driving licenses can only be issued to applicants who satisfy the following requirements.

- Over minimum age
- Passed driving test
- Previously held licenses in other categories (for 12 months) where required.
- Not suspended or disqualified, and

- Have paid appropriate fees.

Passing the drivers test, which is a must to get hold of a license, requires that i.e. the objectives of driver testing are to ensure that:

- drivers are competent to control the class of vehicle to which the license applies
- drivers are aware of, and understand, the rules of the road and traffic laws, and
- drivers have a sufficiently developed road sense

There are four parts to the driving test:

- medical examination
- theory test
- maneuvering test, and
- road test

3.4.2 Instructor Licensing

To improve the standard of driver training, all instructors of driving are required to be licensed by AAATCB. Such license shall last for one year and shall only be renewed on evidence of a satisfactory record.

As part of the control on instructors, each month the driving test applicants' files are examined. From each file, the name of the driving instructor, who certifies that the applicant is ready for the test, shall be noted and the result " pass" or " fail" to each part of the test noted.

Using this, a record is built up for the driving instructor in his/her respective file regarding the failure rate of students certified.

Each year when an instructor applies for renewal of his/her license to instruct the following will be checked:

- driving license to ensure no endorsement
- driving license file to ensure no reports of driving offenses and
- instructor file to examine record of student

3.5 Transportation safety

Transportation, by its very nature, provides enhanced opportunities but also risks to those who travel, including pedestrians and bicyclists.

The scarcity of infrastructures, the growth of population and vehicles together with the low standing of drivers, vehicles and problems in executing traffic law has made our city to be registered 1st to 3rd places in world traffic accidents.

Comparing traffic crash statistics between one city and another is a tricky business. A lot depends on how crashes and fatality rates are defined, on driving conditions, and on whether the comparison is based on miles driven, population, or number of cars. No matter how the comparison is set up, Addis Ababa comes out at or near the top of the list.

For example according to World Capital Cities (1994) in Befekadu (1998) Addis Ababa is placed 1st in accident per 1,000 vehicle.

Table 3.3 Number of accidents by city

City	Year	No. of Vehicles	Average No.of yearly accident	Average daily accident	Accident per1000 vehicles
Addis Ababa	1988 E.C	136344	6202	16.2	45.5
Mexico City	1991	2392972	8922	24.4	4
Jakarta	1991	1796897	2142	5.9	1.2
Bangkok	1991	2010152	31309	86.9	15.8
London	1991	2357000	7878	21.6	3
Rome	1993	2187837	19677	54	9
Bones Ayres	1992	1397455	19865	54.4	14.2
Yaunde	1978	-	4202	-	40

Source: World Capital Cities (1994) in Befekadu (1998)

While road safety in most industrialized countries is improving, for many newly developed or developing nations, safety problems are worsening. For example, according to Britain's Transport and Road Research Laboratory (TRRL) between 1968 and 1985, the number or motor vehicle fatalities in some African countries rose by more than 300 percent and in Asian countries by over 170 percent. In that same period, the number of motor vehicle fatalities in industrialized countries decreased by 25 percent (TRRL 1991).

According to Britain's TRRL, growth in motorization and urbanization in emerging and developing nations has increased traffic on roads that were never designed to carry the volumes that they do today. Moreover, unplanned growth has led to incompatible land use in sprawling urban areas and created significant driving hazards. In many countries, poor road conditions, badly designed intersections, and inadequate protection have exacerbated these dangers for pedestrians.

TRRL identified at least four conditions contributing to road safety problems in developing countries:

- ***Inadequate design standards***. In many developing countries, highways design standards are either outdated (sometimes going back to colonial times) or inappropriate (usually because standard in industrialized countries are applied without considering local needs). Such standards may ignore pedestrians or other non motorized transportation or may be too costly for countries to afford.
- ***Limited resources***. Developing nations often lack the engineers and other professionals, as well as the financial resources, needed to modify design standards to accommodate local conditions or to properly maintain roads and other infrastructure.
- ***Operational and control deficiencies***. Operational practices have not kept pace with road building in the developing world. For example, roads are often poorly maintained, traffic signage may be inadequate, walkways for pedestrians are often nonexistent or in poor conditions, and control measures to channel vehicles are rarely available.
- ***Inadequate driver training***. Drivers in developing countries typically lack the experience of their counterparts in the industrialized world. Many such drivers have never been adequately tested or trained. Moreover, enforcement of traffic laws in developing countries is often ineffective and driver compliance poor.

Safety improvements implemented in the industrialized world have the potential to significantly reduce road hazards in less developed nations. According to TRRL, among the most successful strategies are more safety-conscious road planning and elimination of hazardous locations on roadways through traffic engineering.

According to the statistics of the Addis Ababa Traffic police Department, following are the most important causes of accidents :

- Driving under the influence of drinks or drugs
- Driving recklessly, dangerously or without due regard for other road users.
- Driving too fast
- failing to observe traffic signs
- playing in the street—especially children
- careless walking, such as walking in the wrong side of the road
- Roads unsuitable for motor traffic (too narrow, defective or with dangerous curves, intersections etc.)
- Mechanical defect of vehicles (Defective brakes, lighting, etc.)
- Incompetent drivers
- Obstruction of all kinds.

3.6 Road Infrastructure

Road safety is closely linked to the standard of the road network. At present the quality of roads varies very much among areas in Addis Ababa. From a safety point of view, however, it appears that the standard of roads generally is fairly low. Even the newer roads that are built to a high standard are often rapidly deteriorating due to insufficient maintenance. This leads inturn to excessive wear and tear of vehicles. A particular problem is the high percentage of pedestrians which use the same road as motorized traffic. Even where there is sufficient space, physical

segregation between the various road users is not commonly used, due to limited financial resources. This constitutes a very serious problem and causes (in combination with overloading, high speed and inadequate technical standard of vehicles) a high number of accidents.

A special problem connected to the road network is that the Addis Ababa City Roads Authority is not fully aware of where road traffic accidents occur. This is due to the deficiencies in accident reporting system which do not include transfer of such information to the roads authority. This constitutes a serious problem and impedes rapid improvement of the safety standard of roads.

3.7 Survey of drivers

This survey conducted as part of this research also aimed at further explaining accident causation by gathering information on drivers' habits and attitudes with regards to mobility and safety. The technique or instrument used was intensive, based on in-depth semidirective interviews (giving hints and explanations) performed on some 28 drivers selected on random availability basis. Interviews were articulated around three main themes:

- Mobility and speed behavior
- Safety problems perceived in traffic and representation of accident cause.
- Awareness of, and opinions on, current safety actions.

Such investigations were considered useful in providing bases for the design of road-user information policies, by showing what people know and do not know, and indicating road-users' positive or negative biases towards the problems they have to deal with.

3 7.1 Safety perception

From what was expressed by all of the drivers interviewed, it appears that, their explanation of how accidents occur, focus on two poles.

The first pole addresses fate, destiny, or bad luck, making the accident as a random event or the consequence of a superior will. The second pole takes into account the various components of the traffic system (driver, pedestrians, roads or the vehicle), attributing accident causes to any of these components.

From the discussions wit the drivers, fate and the "human factor" play the central part in the representation of accident causes.

Fate: For most of the drivers interviewed, fate seems to be the ultimate cause of accidents. If some factors of risk are mentioned, the malfunction, the accidents, is seen only as the effect of a random coincidence of such factors. In many cases, the accident itself, as a unique and brutal event, is attributed to some sort of bad luck or destiny, especially when it strikes a careful and competent driver. Fate is often expressed as an unlucky encounter with the " other driver" the consequences of whose fault or incompetence one has to bear. In other words, " fate" for the victim and " fault" for the road user, are described as responsible for the collision.

For some drivers, an accident appear as the consequence of a superior, divine will.

Human factor: When the persons interviewed review the causes related to the various components of the traffic system, it is the road user behavior that comes out as the main accident factor. For a large number of subjects (20 from the 28 interviewed), it is even the only risk factor mentioned. Secondary factor relate to the vehicle (about one third of interviews); while factors related to the road come only in third position (one fifth of interviews)

3.7.2 Drivers behavior and attitude towards speed

The majority of drivers (16 from the 28) interviewed, declared that they currently drive at more than 60km/h in Addis Ababa, where the regulation provides 60km/h to be the maximum. This shows that most drivers are not fully aware of legal maximum speeds.

All drivers interviewed agree that the current speeds practiced in Addis Ababa are generally high. They consider that speeding is the fact, either of all drivers, or of some particular categories of road users (taxis, powerful cars etc). Speeding is attributed to problems of time-management, generated by the pace of life and work activity centers spread over large distances and time constraints.

Some symbolic determinants of speed also appear among drivers: speed as a means to show competence, but also as a reflection of some sort of competition or opposition between road-users.

3.8 Development of preventive measures

In concern for road safety and in order to effectively and efficiently combat road accidents various measures have been taken. This section presents an overview of these measures.

3.8.1 studies

In 1983, the then Ethiopian Road Transport Authority commissioned an international consultant (Muskaug, Richard) to study the nature and extent of the hazards of traffic accidents in Addis Ababa, where fatality and causality rates were compared with other countries and analysis was made of all readily available data on the number and type of accidents occurring in Addis

Ababa. The study in road safety in Addis Ababa also included improvement requirements in driver training and testing, tests of vehicle, road worthiness, vehicle use regulations, the role of the police in enforcement procedures, the design, layout and condition of roads in the city and mass education and publicity in safety requirements.

The study affirmed that Addis Ababa has one of the highest fatality rates in the world, and this is also related to the relatively low level of medical facilities available.

Improvements were, therefore, recommended in ambulance service and equipment for highway patrols to reduce the high fatality rate. Recommendations were also made for co-ordination between the different government bodies concerned with road safety, in reducing road accidents.

On the basis of the study and in recognition of the commitment to traffic safety, it has been possible to secure dollars 1.6 millions loans from the World Bank. The loan was to be used to supplement local resources for the implementation of concrete safety programs including the procurement of driver education equipment, for safety education and for traffic regulation enforcement.

With regard to in house study, no published document is available for the researcher except the one conducted by Taddle Dessie in 1989. The title of the study was the occurrence and impact of motor vehicle injuries in Addis Ababa. The study documented the health impact of motor vehicle injuries and assessed its relative priority as a public health problem.

3.8.2 Student Traffic

In order to help the traffic police, selected students are given training in traffic control and regulation. Traffic control training aims at providing for the integration and control of the road

system to improve the flow of traffic, improve safety for vehicular and non motorized travelers, and minimize congestion while maximizing the movement of people and goods. Upon completion of the training, these students are put on traffic control duty. There is a good response to this program and at present 150 students are deployed in the city for traffic control. This includes women students also. Plan is underway to train 800 more students in the near future.

In addition, a more general road safety education, was also given by traffic policemen, to the school community in general at different times.

3.8.3 Traffic Control Devices

Traffic control devices include all signs, signals, markings and devices placed on, over, or adjacent to road, that communicate information that helps road users travel safely. A standardized system has evolved internationally to regulate, warn, and guide road users. The purpose of the devices is to optimize traffic performance, help improve safety by reducing the number and severity of traffic crashes. On the basis of the information they communicate, traffic signs are divided into categories as follows:

Table 3.4 Summary of Traffic signs.

a) Prohibitive	- Bordered with red circle (except certain 'no stopping' signs). - Informs the driver what he/she must or must not do.
b) Compulsory	- Blue circles or rectangles. - Informs the driver of the direction he/ she must follow
c) Warning	- Mostly bordered with a red triangle. - Informs the driver of a variety of traffic situations ahead.
d) Direction	- Mostly rectangular with blue, green or white backgrounds- - Blue = motorways - Green = Primary routes - White = non-primary routes - Indicates routes and road numbers and general directions.
e) Information	- All rectangular - Provides the driver with information about road and traffic situation.

Source: Addis Ababa City Roads Authority

The Addis Ababa City Roads Authority (AACRA) is responsible for selecting, installing, and maintaining these traffic control devices in the city. As indicated above, traffic control devices are to function in regulating, warning, guiding, and/ or channalizing traffic. To achieve these purposes, the traffic signs and road markings must be regularly maintained, renewed and replaced when this becomes necessary. Maintenance, renewal and replacement are dependent on the availability of finance. On many occasions the organization charged with the maintenance of these signs (The Addis Ababa City Roads Authority) operate very tight budgets. Many a time,

therefore, some of the roads are without traffic signs, and where some of the signs are defaced or where road markings have deteriorated through heavy concentrations of vehicles, they are left unattended until the next budgetary allocations. It is known that many accidents have occurred where there are no traffic control devices. According to the Addis Ababa Traffic Police Department, out of a total of 6048 recorded accidents that occurred in 1987 E.C, 2523 occurred where there were no traffic signs. These clearly indicate the inadequacy of traffic signs on the road.

3.8.4 Radio Program

Another worth mentioning preventive activity is the Radio program on Road Traffic Matters. Safety interest programs have been broadcast by the Public Relations Department of Road Transport Authority once in a week for ten (10) minutes in the regular program of Radio Ethiopia.

3.8.5 Traffic Safety Week

Road traffic accidents are a social phenomenon which touch all levels of society in a country irrespective of age or sex. Thus any prevention policy wishing to be thorough and effective must involve everyone in the society genuinely realizing the issues and their obligations. In order to change public opinion, people must be informed and made aware of the issues. In a word, one must communicate with them. This has been well grasped by the public relations section of the Addis Ababa Traffic Police Department, which produces, with assistance from local sponsors,

- educational films on road safety,

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- posters for display in a yearly traffic safety week campaign. (In this yearly traffic safety week, the week is selected based on projected public gathering, and during the week there will be no violation penalties)

3.8.6 Prosecution

Most accidents are directly attributed to the improper conduct of some individual, which it is the direct responsibility of the police to prevent. Here are some accident preventive measures, in addition to those mentioned above, currently taken by the Addis Ababa Traffic Police Department.

- Prosecution of drivers who are primarily responsible for road accidents
- Prosecution of drivers who drive vehicles whilst under the influence of alcohol drinks to such an extent as to be incapable of having proper control of the vehicles
- Prosecution of drivers who violate the transport rules and regulations.

Chapter four

Traffic Information Processing at the AATPD

4.1 Needs Survey

A traffic information system should be responsive to the needs of data users. To identify these needs, in our case, staffs from the Addis Ababa traffic police and some external data users were interviewed. Additional information, taken from the literature, has also been used to determine needs.

The goal of the needs survey was to determine:

- The types of data required by the users to carry out their functions,
- the relative importance of each types of data,
- the frequency with which each type of data is required (e.g. annually, seasonally, or on a specialized needs basis),
- the user's general satisfaction with the existing traffic information system.

Needs surveys in other countries (Briggs 1986) have found that many data users do not have a clear understanding of what their data requirements really are? Their priorities are subjective. And their needs can change rapidly over time. It was also reported that, some data, which the users considered essential, was not provided by the existing system, and that some information provided by the system was not being used.

The remainder of this section summarizes the finding as the result of this survey is presented.

4.1.1 Types of Users and Information Requested

The needs survey found that users of the AATPD traffic information system are:

- Insurance companies (private and governmental),
- Transport organizations (mainly Anbessa City Bus Services);
- The Addis Ababa Administration Transport and Communication Bureau,
- Courts and,
- The Addis Ababa Administration Police Commission.

The police commission requires the Addis Ababa Traffic Police to transmit a weekly, monthly, semi-annual and an annual report on accident and violation statistics. There is no standard form for these reports. The reports summarize accidents during the period by identifying the main causes of accidents and accident prone areas of the period. The reports also summarize rule violations committed during the period of the report. This is the most frequently requested information. This system stakeholder utilize this information in its effort to improve road safety. For example, this information is used to enable the policy makers to judge the importance of the road accident problems and the need for funds, to enable them set an adequate general policy and legislation in connection with roads and vehicles, and select the right strategy for improving road safety, to propose the right countermeasures.

Detailed information about an accident is the second most frequently requested information. There is a standard form for this report and the contents of this form is summarized in table 4.1. For the most part, this information is required to support specific court cases or decisions. The detailed information about an accident is for use in court by the Attorney in order to sentence or fine persons involved in the accidents. Such information is also collected in order to clear out the question of guilt. These users (Insurance companies and Anbessa City Bus

Services) indicated a need for improved quality of data by the use of improved data capture tools which results in reduced errors in collection.

Table 4.1 summary of content of detailed accident report

User category	Type of information requested
Insurance Companies, Transport Organizations, and courts	-Date of accident -Time of accident -Place of accident -Type of accident -Plate number/s of the vehicle/s involved in the accident -Name/s of victims of the accident -The person responsible for the accident -Result of the accident: death, injury, amount of property damage -Name of the investigating officer -The current status of the case

4.2 Accident Data Collection

According to IHT (1990) there are six main data items that should be included in an accident reporting. These are:

- basic accident description,

- road types,
- environmental features,
- driver features,
- casualty details, and
- traffic characteristics- related to time and location.

In the case of Addis Ababa Traffic Police Department, these and other items are collected. Upon receiving a notification about occurrence of an accident, an investigator will be assigned from AATPD and he will appear at the place of accident as soon as possible. Normally the accidents are reported to the police because the law requires the drivers or others involved to do so, or the parties involved have interest in it or the insurance companies demand it. Nevertheless, some drivers will always try to cover up reckless driving followed by accidents by failure to report to the police. These hit-and-run accidents are treated as normal accidents.

4.2.1 Accident investigation

As indicated above, when an accident occurs, the traffic police will be sent to inquire into the circumstances, with complete authority. A detailed investigations is carried out for the purpose of:

a) obtaining detailed and accurate information as to its cause;
b) determining whether or not there has been any violation of the law, and to participate in the gathering of such evidence as may be necessary to support a prosecution, etc. should such be thought desirable; and
c) preventing the re-occurrence of further accidents.

4.2.2 Action by traffic police when an accident report is made

In particular, according to the AATPD, the following actions are normally taken when an accident report is made.

a) Record the full name and address of the person reporting the accident. Here no standard form is used.

b) Find out from the reporter (if applicable), the type of accident he/she is reporting.

i) Is it fatal, serious, slight, non-injury, or hit and run?

ii) When and where did the accident take place?

iii) Approximately how many people have been injured?

iv) What type of vehicles, are involved (buses, cars, etc.)?

v) Is there any obstruction?

c) The scene of accidents will, as far as possible, be guarded off in some way, so as not to allow such evidence as skid marks to be obliterated by other motor traffic

d) Obtain particulars of witness with the least possible delay. When possible, the traffic police record statements from witnesses at the scene with a view to checking their veracity with skid marks, damage, etc.

e) He thoroughly examines the physical condition of the vehicles, making a note of any damage or marks. Care will be taken that nobody tampers with a vehicle, until it can be examined by a vehicle inspector.

f) Measurements will be taken and a sketch plan prepared

g) The nearest relative of any person killed or taken to hospital will be informed at the earliest opportunity.

On returning to the office

a) the accident will be registered in correct Criminal Record (CR)

b) an accidents file will be compiled and proper investigations carried out

Each vehicle incident that results in personal injury and property damage regardless of the amount of damage (i.e. there is no level of threshold to report an accident), requires the investigating officer to identify characteristics about the crash, the vehicles in the crash and the people involved as well as diagramming the scene and completing a narrative description of the accident events in a form prepared for the purpose, (Sketch witness report form). The form is completed by the investigating officer at the traffic accident scene. It contains information describing characteristics of the crash, the vehicles, and people involved. The report also includes the results of the officer's investigation about the accident itself. Questions such as, " What paths were followed by the involved vehicles and pedestrians prior to impact?" "What occurred during the impact?", and " What factors may have contributed to the crash?" may be answered by the officer using evidence found at the scene, and by interviewing participants and witnesses. A detailed report from the vehicle inspection unit is also necessary for the prosecution. The accident report form asks for information such as the time and location of the accident, the number of vehicles involved, the vehicle type, drivers' license status, injury severity, data on each person involved in the crash, including age, gender, role in the crash (driver, passenger, pedestrian etc.). Normally such information is easily available except the accident location. Because maps are often inadequate and special road identification systems are lacking, the position of the accident spot has to be given in distance say several meters from a known area (e.g. around 'Arat Killo'). These kinds of references will very often be rather inaccurate and may prove to be a serious problem if traffic safety experts later try to determine the most accident prone spots.

At the office, each report undergoes a review for consistency and correctness. Reports with minor errors are corrected by the supervisor of the investigating officer. Other more serious errors and/or omissions are returned to the provider for correction. Once acceptably completed and approved by the supervisor, the reports will be sent to the accident records section. In some cases, information from the hospitals will change the data filled in on the spot (for instance, when seriously injured victims die in the hospital).

A traffic crash related fatality is defined by the Vienna Convention as an individual who dies at the scene of the crash or within 30 days following the crash (pozuelo and Izarzugaza 1996). Accordingly, the practice in the case of Addis Ababa Traffic Police is that a traffic crash-related fatality is recorded if the individual dies at the scene of the crash or within the month in which the crash has occurred. In addition to completing the accident report form, the investigator is required to copy all the information in the report to the daily criminal records book customarily called "CR".

4.2.3 Road Accident Sketching

According to the Addis Ababa Traffic Police Department, a sketch plan is a valuable adjunct to any accident report, both as an aid to memory and as a permanent record. It presents a clear picture of the scene of accident. It is often difficult to follow the sequence of events from a long and complicated description, involving such details as description of vehicles, positions, damage, measurements etc. A well drawn plan clarifies the evidence. A sketch plan should be drawn whether the scene has been disturbed or not whenever,

a) a person is injured however slight,

b) a government vehicle is involved,

c) there is a likelihood or possibility of prosecuting one or more drivers in the accident whether there is injury or not; or

d) vehicles involved are extensively damaged.

4.2.4 Problem of the Traffic Police at the Scene of Accident

From the discussion with traffic police officers, the traffic police to arrive at the scene of accident often finds himself in the difficulty of deciding whether he should first attend to the injured persons. And he will not find it easy always to make up his mind whether the injures are sufficiently serious to do so first, or not, or to occupy himself initially in taking names and addresses, and statements from anybody who witnessed the accident. If the officer does not attend promptly to certain kinds of injuries, the result of his neglecting to do so might be fraught with serious consequences for the injured person. If, on the other hand, he does not, at least, take the names and addresses of possible witnesses, with as little delay as possible, important evidence of the accident might be lost.

Whatever he decides the situation demands that he should do first, he carries out his investigations and other duties in connection with the accident systematically so as to miss as little as possible of what he should do. To this end, upon arrival at a scene of accident,

- He ascertains if anyone is injured, and, if so, he administers first aid himself, or if he thinks the injury requires more expert attention, he transports the person to where such remedial attention may be administered.
- He arranges a safe way round the scene of accident for other traffic. The vehicles involved in the accident should not be moved from the point where they came to rest (until everything has been finalized) unless they seriously affect safe traffic maneuver.

4.3 Accident Data Processing and Reporting

The Addis Ababa Traffic Police Department establish count of victims of accidents, with a distinction between fatalities, serious injuries and light injuries. However, there are no precise rules to define these categories. According to my observation, it seems that fatalities are counted if death has occurred on the spot or with in the month in which the accident occurred, while classification between serious and light injuries is based on the judgement of a physician or some times on the investigating traffic police.

Back at the office, there are two employees who work at the accident records section. Up on receiving the accident report, these employees do the following.

They check whether the driver has a prior record, from a manualy maintained record book. The record is maintained sequentially by using the first letters of Amharic alphabets used in name. According to my observation, because the record is maintained manually and its size, it is almost impossible to have an updated index. Therefore, with approximately 8500 accidents being reported each year, the process of identifying a prior record is not only time consuming but also omission is likely. The record is consists of two column only: serial number column and name column.

If the driver has a prior record, a card opened in his name will be searched from file cabinet based on the number given on the record book. The cards are sorted by first letter of the drivers name and ordered by the identifying serial numbers. The card contains a place for photograph, columns for recording type of accident penalty details of the driver etc. copy of the card is attached as annex to this report.

If no prior record is found, the driver's name will be recorded in the record book according to the first letter of his/her name and the number next to the last serial number in the list will be assigned as his/her identifying number. A card will be opened and assigned the identifying number. The details of the drivers characteristics: name, address, etc. will be recorded. The result of the accident (property damage, injury or death) is recorded in the appropriate column prepared for the purpose.

In addition to maintaining the above mentioned frequency records these two employees now and then classify the daily accident reports according to the reporting requirements and prepare themselves for the weekly, monthly, semi-annual and yearly statistical reports described earlier.

In particular, in reports of a day, first they classify the reports according to sex and take the statistics. Then, these two groups of reports are further classified into the following four age groups: below 18 years

- 18-30 years
- 31-50 years
- 51 and above

Not only this, the reports are classified according to the driver's driving license level (level 1 – level 6), time of the accident (24 time groups), educational level of the driver (7 groups),

- Illiterate
- Basic Education
- Elementary school
- Junior secondary school

- High school
- Above high school
- Unknown

Experience of the driver (7 groups)

- No driving license
- Below one year
- 1-2 years
- 2-5 years
- 5-10 years
- Above 10 years
- Unknown

Service year of the vehicle (6 groups)

- Below 1 year
- 1-2 years
- 2-5 years
- 5-10 years
- Above 10 years
- Unknown

Types of vehicles (19 groups)

- Bicycle
- Motor Bicycle
- Automobile

- Station wagon
- Pick up-capacity 10 quintals
- Track capacity 11-40 quintals
- Truck capacity 41-100 quintals
- Truck with trailer
- Trailer
- Taxi
- Public Transport with 12 seats
- Public Transport with 13-45 seats
- Military vehicle
- Military vehicle with trailer
- Train
- Carts
- Others
- Unknown

Along with result of the accident (four groups): death, heave injury, minor injury and property damage; as well as according to place of accident, road type and condition, light condition etc.

The employees of this section, in addition to completing the above activities, also respond to requests about existence of a record against a driver which is usually required for court cases and often very frequent. On the average, they respond to 20-25 such requests on a daily basis

Finally these employees, prepare reports on a weekly, monthly, semi annual and yearly basis which will be aggregated by the section head.

4.4 Violation Records

The council of Addis Ababa City Administration, considering the fact that the level of casualties daily caused by road traffic accident to human life, damage to property and the economy of the city has reached a serious degree, and new types of traffic offences that are not sanctioned by the already existing traffic regulations have emerged as a result of which it is found necessary to frame and issue regulations in line with present conditions has issued road traffic regulations which have been effective since July 8,1998. The regulations lists 86 types of offences which are classified in to six categories. Table 4.2 presents sample of these offences and the related penalties.

Table 4.2 Sample of offence types

Category	Rule code	Offence type	Penalty amount (in birr)
1	101	Improperly halving a vehicle.	40
	102	Driving an animal on a road.	40
	103	Driving vehicle without normal load supporters.	40
	105	Improperly honking a siren.	40
	106	Not putting marks upon extra load.	40

2	206	One who wrongly reversed a vehicle	60
	208	One who parked a vehicle at a forbidden place	60
	209	One who parked a vehicle on a traffic island	60
	210	One who parked a vehicle on a bridge	60
	211	One who parked a vehicle near a traffic sign	60
	212	One who parked a vehicle near a traffic light	60
3	302	One who violated a forbidding sign	80
	303	One who violated a binding sign	80
	304	One who crossed a traffic island by the left side	80
	305	One who stopped on a narrow road	80
	306	One who stopped on a turning point of a road	80

2	206	One who wrongly reversed a vehicle	60
	208	One who parked a vehicle at a forbidden place	60
	209	One who parked a vehicle on a traffic island	60
	210	One who parked a vehicle on a bridge	60
	211	One who parked a vehicle near a traffic sign	60
	212	One who parked a vehicle near a traffic light	60
3	302	One who violated a forbidding sign	80
	303	One who violated a binding sign	80
	304	One who crossed a traffic island by the left side	80
	305	One who stopped on a narrow road	80
	306	One who stopped on a turning point of a road	80

4	402	One who parked on a point of entrance or exit of a vehicle	100
	404	One who drove a vehicle with a conspicuous defect	100
	405	One who drove a vehicle with incomplete beam	100
	406	One who stopped a vehicle along side another vehicle	100
	408	One who drove a vehicle on a traffic island	100
5	502	One who didn't cede priority to another on a crossroad	120
	503	One who didn't cede priority while he/she should do so	120
	505	One who improperly overtook a vehicle	120
	506	One who drove a vehicle while the door is open	120
	509	One who used the road or pedestrians for different service	120
6	602	On who drove while drunk or	140

		having taken drug or *chat*	
	604	One who didn't cede priority to a pedestrian	140
	605	One who violated red traffic light	140
	610	One who stopped on a pedestrian road	140
	611	One who stopped on a pedestrian crossing	140
	612	One who drove without having any light	140

Any driver, in addition to the fines stated in each category shall be punished on the basis of the frequency and gravity of his offence by: making him/her retake traffic rules examination, suspending the driving license for a definite period of time or for life. Table 4.3 presents a summary of penalty on those who committed traffic regulation offences more than three times.

Table 4.3: summary of penalty for offences more than 3 times

Ser. No	Record of offence	Extent of penalty
1	For the forth record of offence	Be suspended for six months form driving a vehicle
2	For the fifth record of offence	Be suspended for one year from driving a vehicle
3	For the sixth record of offence	Be suspended for two years from driving a vehicle
4	For the seventh record of offence	Be subject to the revocation of his/her driving license. He/ She may, however, attain a new driving license after five years
5	For the eight record of offence	Be subject to the revocation of his/her driving license.

Now it is clear that a record of drivers who have committed an offence must be maintained to enforce the punishments. To this end, whenever a traffic police identifies a driver who has committed an offence, he shall sign and serve a penalty form declaring the offence(s) to a driver who commits one or more offence.

The penalty form identifies the driver, the vehicles type, plate number, offence type, category of offence, amount of penalty etc. The form is completed in four copies. The original copy will be given to the driver. The second copy will be given to the Addis Ababa

Administration Transport and Communication Bureau, which has the authority to enforce the punishment. The third copy is given to the Addis Ababa Traffic Police Department and the forth copy is retained in the pad. The penalty forms are sent to the above two organizations the next working day, an offence have been committed.

A driver who received a penalty form from the traffic police for the offence he/she committed is required to pay the fine immediately to the Addis Ababa Administration Transport and Communication Bureau.

The driver who has the appropriate driving license and served a penalty for offence he/she committed, and fails to produce within 30 days evidence of the payment of the fine imposed to the Bureau shall be punished by increased amount as follows:

A) by 50% for the first month

B) by 100% for the second month

C) by 100 % of the fine stated above in 'b' and his driving license shall be taken away.

Because it is the Addis Ababa Administration Transport and Communication Bureau which has the Authority to enforce the punishment according to the regulations, it would have been logical if the necessary records were maintained there. However, it is the Addis Ababa Traffic Police Department which is maintaining the violation records starting from July 1998. The paradox lies here. Currently, because of this, no body seems to make use of these frequency of violation records.

The Addis Ababa Transport and Communication Bureau records an offence against a driver if and only if that driver presents himself/herself to effect the payment of the penalty. Until that time, copies of the penalty forms are kept in a box file classified by date and zone where there exists a probability of being lost.

Comparing, the amount recorded by the Addis Ababa Traffic Police Department to be collected from penalty in the year 1990 E. C., which is birr 10,995,400 with that of birr 1,162,390 actually collected and recorded by the Addis Ababa Administration Transport and Communication Bureau from penalty of the same year, reveals an outstanding amount of birr 9,833,010. A huge amount! One of the main reasons seems to be lack of record to follow up and enforce payment.

Regarding the way the violation records are Processed at Addis Ababa Traffic Police Department, it is almost the same with that of the way accident data are processed, recorded and reported.

However, with an average of more than 133000 penalty forms received each year, which have filled a room in less than two years, classifying the penalty forms, preparing statistical reports, and maintaining frequency records by only six staff who work in the violations record section of AATPD is tiresome.

It has to be noted that it is not the statistical report that is not used; rather it is the record which is maintained against a driver who has committed an offence that has never been used; the record which should have been maintained at the Addis Ababa Administration Transport and Communication Bureau.

The violation statistical report prepared by the Addis Ababa traffic police lists only 53 offence types where as the effective regulation lists 86 offence types. The reasons for this is that the statistical report form is prepared based on the previously existing regulations i. e it is not updated (or redesigned) in accordance with the current regulations.

As a way to better understand the existing system and to document the data that must be captured and stored by the system, independently of showing how that data is or will be used-that

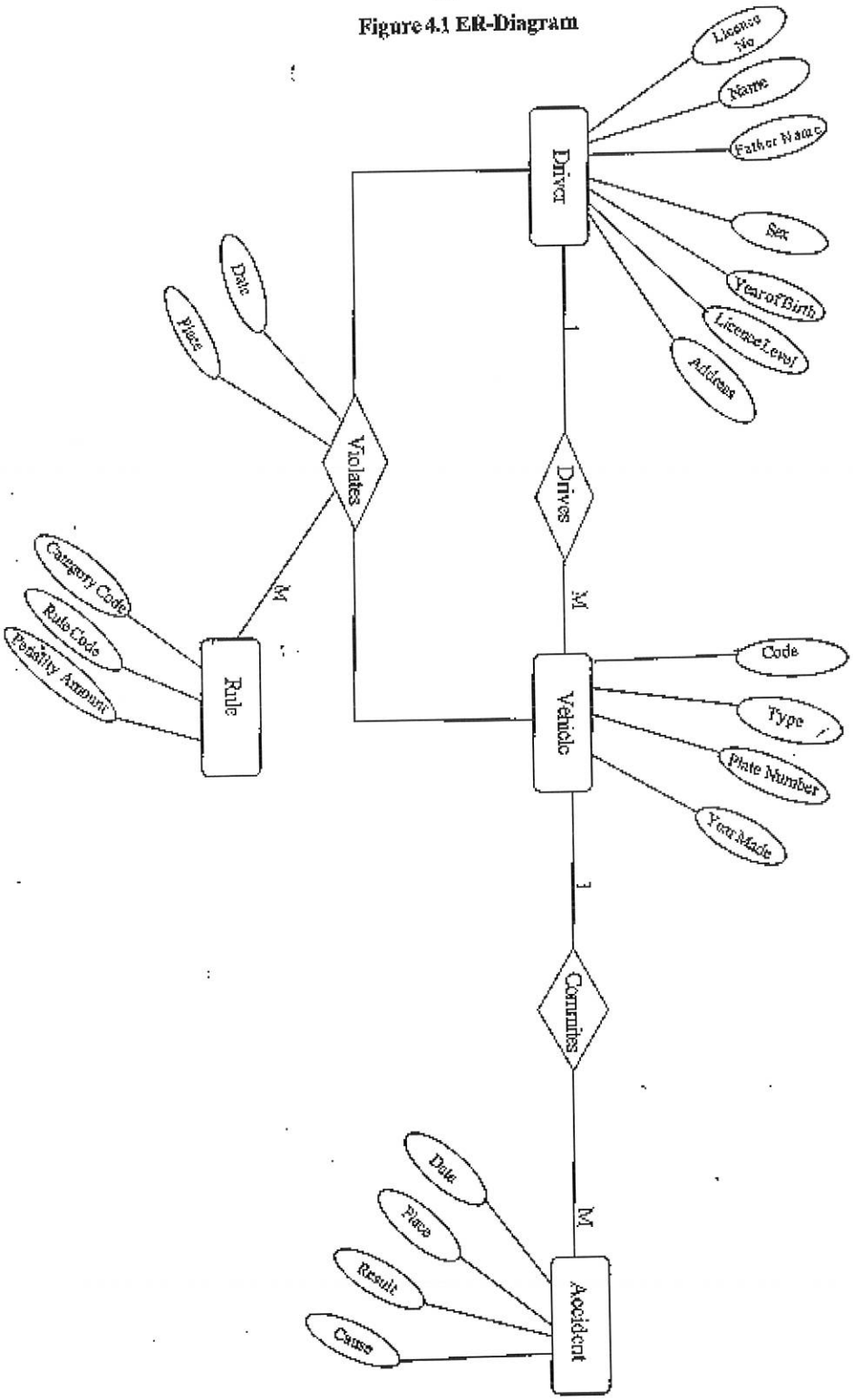
is, independently of specific inputs, outputs, and processing the following entity relationship Diagram (ERD) is constructed.

There are several notations for ERDs. Most are named after their inventor (e.g., Chen, Martin, Bachman, Merise). These data modeling" languages" generally support the same fundamental concepts and constructs. I have adopted the Chen convention as follows:

- Rectangles are used to represent entities
- Diamonds are used to represent the relationship(s) between the entities
- The number 1 is used to represent the "1" side of the relationship.
- The letter M is used to represent the "many" side of the relationship.
- If a " many to many" relationship is to be indicated, the letters M and N are used.
- Each oval contains the name of the attribute it represents.

oo

Figure 4.1 ER-Diagram



Chapter five

A prototype database design

5.1 Introduction

In chapter 4, through analysis of the processing, we have seen how the current system works as well as what it does. We have also seen the problems being experienced by the users. This chapter starts of by summarizing the problems in the existing system, and then goes on to give general description of the proposed system. An attempt is also made to evaluate different design alternatives to meet the requirements of the proposed system. This is followed by a general description of the system in terms of its input, processing, output, control and security requirements at a general level. A simple prototype database is also presented at the end.

5.2 Summary of Problems of the Existing System

All the activities of the AATPD described in preceding chapters are done manually. The colossal amount of data related to drivers, accidents, and rule violations are exclusively inspected, processed and stored through the use of human labour and paper alone. Records of accidents and rule violations are stored in paper files and cards.

The manual and paper- based system, apart from being slow, inefficient, and prone to many errors, has now made it difficult for the AATPD to deal with the increasing number of various reports already described. Closer observation and examination of the existing system revealed the following major problems.

Redundancy and Higher Storage Cost: Record of one driver is created and maintained by two different sections at two different places. The creation of such multiple copies of the same

record, has resulted in redundant files which in turn led to higher storage cost and the maintenance of inconsistent data.

Retrieval problem: Owing to the large volume of records, and the problem associated with paper-based files, the records created by the different sections cannot be easily accessed and retrieved. According to users, this is not only time consuming but also at times frustrating for it involves going through the large volume of files serially to locate the record of a driver.

Update problem: As indicated earlier, the records maintained by the AATPD require updating. For instance the record of a driver should be updated whenever he/she commits an accident, or rule violations. The information required for this purpose is obtained from the traffic police officer reports. Within the existing system, it is very difficult and requires extensive clerical effort to update the records on the cards.

Problems of producing statistical reports: Since the AATPD maintains huge paper files, it is difficult to collect data from these files to generate different statistical reports. For example, it requires considerable clerical effort and time to prepare summary reports on accidents and rule violation for a particular reporting period. To prepare such reports the workers have to tally all the required data on a paper sheet daily.

5.3 Requirements of the recommended system

This section describes output and input requirements of the proposed computer-based system at a general level.

5.3.1 Output requirements

An information system is judged by the quality of its output (Rowley 1990), and production of some output is the fundamental reason why an information system should exist.

There is no point in designing and implementing an information system unless it is capable of providing some results.

From the problems and requirements of the users, gathered during interview and participant observation, the following output requirements are defined for the proposed computer-assisted system.

5.3.1.1. Information required on drivers

The proposed computer-assisted system is required to produce the following outputs from the accident record

- Online checking of a driver's name, father's name, and grand father's name and other attributes in the drivers file;
- Online display of list of all persons in the drivers file, about whom an inquire is made, using the name, father's name or grand father's name
- Online display and hard copy list of all persons in the drivers file, with pending restriction;
- Online display and hard copy list of all persons in the driver file whose restriction period has ended;
- Online display and hard copy list of all persons in the driver file sorted by the name of the court which filed the restriction
- Hard copy list of all individuals in the driver file sorted in alphabetical order; and
- Other ad-hoc queries by users

5.3.1.2 Information required on accidents

The proposed computer assisted system is required to produce the following outputs with regard to accidents from the different files:

- Online checking of a driver's name, father's name, grand father's name and other attributes of a driver who has committed an accident;
- Online display of accident committed sorted by type, place, time, date, various age and sex group of drivers, types of vehicles involved, cause of accident, education level of drivers, experience of drivers, service year of vehicles, driver licenses level, amount of property damage;
- Demand-based hard copy list on all of the above
- Other ad-hoc queries.

5.3.1.3. Information required on rule violations

The proposed computer-assisted system is required to produce the following rule violation information from the different files.

- Online display of full name, and other attributes of a driver who has committed a rule violation
- Online display of different types of rule violations committed during a particular period
- Online display of the amount of penalty recorded during a particular period
- Online display of full name, and other attributes of a driver who have not paid their penalties
- Online display of rule violations committed sorted by type.
- Demand-based hard copy list on all of the above

- Other ad-hoc queries.

5.3.2 Input Requirements

Input requirements of the recommended computer-assisted traffic information system are the data items required to produce, the various outputs mentioned above. This includes the data items being used by the existing system and some additional data elements identified during the analysis.

To design a computer-based information system for any organization, it is necessary to know exactly what information should be held by the computer, and to specify how the information should be organized. In order to do this, it is essential to (a) identify entities of the system about which information must be held, (b) examine precisely what data items are required about each of these entities, and (c) how these data items are to be kept in the computer database.

In an information systems environment, an entity is defined as a thing, person or place of particular significance to the system about which information is held (Modell 1988). Generally, for an item to be called an entity, the following criteria must be satisfied (Ashworth and Goodland 1990)

- an entity should have more than one attribute,
- an occurrence of one entity must be associated with a least one occurrence of another candidate entity,
- an entity must have multiple occurrences; and
- each occurrence of an entity must be uniquely identified.

Based on these criteria, entities which are of particular significant to, and about which information is maintained by, the AATPD are the following

(a) Drivers (people who have a driving license)

(b) Transportation Rules

(c) Accidents

(d) Rule violations

(e) Penalties

(f)Payment

5.3.3 Processing Requirements

Based on the output requirements defined in section 5.5.1, the basic application level processing requirements of the recommended system are as outlined below.

- The system should search the record of a driver in the driver file, and if it finds a match it should retrieve and display the record for updating. If it doesn't find a match, it should allow the data entry clerks to create record about the new driver.
- As workstation operators enter data on a driver, the system should access the accident file and the violation file and display a message if the person about whom an enquiry is made has been found to be a person against whom a remark is made.
- The system should allow online access to the workstation operators at the accident records sections and the violations records section to update and/or create records on drivers, accidents, violations etc.
- The system should allow the AAATCB to have online access to the database only for retrieval purpose.
- The system should be capable of producing different statistical records about accidents, rule violations classified according to the need of users.

- The system should respond to different queries of users.

5.3.4 Security and Control Requirements

Nowadays, considerable efforts are made and money is spent towards the development of computer systems and databases. Therefore, it is important that the computer hardware, software and database remain secure. It is also necessary to keep the data accurate and the files complete and to avoid unauthorized access and use.

Since the AATPD maintains records against drivers, protection against any kind of infringement must start right from the data entry point. Therefore, through analysis of the rules and procedures of the existing system and by consulting users, the following initial considerations of security and control requirements of the new system are outlined.

- Not every user of the system should be able to access all the files maintained in the databases. Records in the various files should be created, updated, and accessed by authorized personnel only.
- It is difficult and perhaps unnecessary for the system to hold the record of all persons who have taken a driving license throughout the life time of the system, for this requires unlimited storage capacity. Therefore, records which remain inactive over certain years should be transferred into history file (number and years after which a particular record should be declared inactive will be decided by the management).
- In processing daily accident and violation transactions, the system should keep backup automatically to protect possible data losses in the event of system failure.

5.4 General Description of the Proposed System

As indicated both in the analysis of the current operations, and section 5.2 above, the major cause for most of the problems within the existing system is the creation and maintenance of multiple copies of the same record by different sections, at different places, and by different persons. Since there is a substantially large volume of records maintained by each sections, users find it difficult to locate and retrieve record of a particular driver to process accident and rule violation reports.

The proposed system should, therefore, at least avoid duplication of effort by providing central data depository to which all potential users involved in processing accidents, rule violations, and other reports are permitted access.

Since the AATPD handles and processes a lot of accidents and rule violation records, at least two workstations will be required to handle and process the large volume of reports pouring to the department. The AAATCB should also have a workstation that should be connected through a communication line to retrieve records about a driver.

For the reasons discussed in the following sections, it is not advisable, both economically and operationally, to keep records about details of a driver in separate files at different places. Therefore, the record of people in Addis Ababa to whom driving licenses have been issued should be maintained in one database centrally. This central database should allow multiple access from the different workstations at the accident records section, violations records section and the AAATCB. In addition to maintain records pertaining to transportation rules, another separate database, **rules database,** will be required which will contain data/information on transportation rules. This rules database should be linked to the central database to enable automatic search in the databases by data entry operators from different workstations.

5.5 General considerations and design alternatives for the Proposed System

5.5.1 General

To solve the problems and to meet the requirements of users, different ways of organizing the new system should be explored. The best starting point to suggest different design alternatives is the problems within the existing system and the requirements that the proposed computer-based traffic information system must meet.

Basically, there are three major objectives that the proposed computer based system must achieve. These are:

- to facilitate creation and maintenance of records of (a) Drivers,(b) Rules, and (c) Accidents;
- to enhance access and retrieval of records maintained in the (a) Drivers, (b) Rules and (c) Accidents files whenever an inquiry is made about a particular driver, accident etc.;
- improve the system of management of records related to drivers, rules, and accidents.

5.5.2 Architecture

To meet these requirements many design options could be developed, each varying slightly from the other. However, the three general design alternatives, which would have a major implication on the future structure of the AATPD, are discussed below.

Decentralized System

Decentralized design option is a situation where the AATPD will use separate computer facilities to serve the needs of each section. Under this option, the accident records section and the violations records section would create and maintain records pertaining to their activities. These essentially mean automating the existing system.

The following advantages may be obtained from this design option.

- Since the databases mentioned above would be located within the relevant sections, the respective users can easily be served and obtain more rapid response to their needs.
- The databases would be less complex.
- The risk of complete loss of data in the event of sudden system failure or environmental catastrophe can be minimized, and it may be possible for the remaining parts of the system to continue the operation.
- The databases can be built up phase by phase on the basis of priority accorded to each, there by offering flexibility in terms of finance and development.

The major disadvantage with the decentralized design option is duplication of effort in terms of hardware, software, personnel and data. If such a decentralized design option is chosen, it would require to maintain at least name of a person to whom a driving license has been issued in the two databases, which eventually leads to data redundancy. Therefore, apart from wasting resources, there is no point in maintaining records of the same driver in separate databases. As a matter of fact, this is one of the major problems with the existing system.

Centralized system

Centralized system is a situation where the system is located centrally at one site and all the computerized organizational functions are executed by this single system. This means that the record of all drivers in Addis Ababa, record of accidents and violations would be maintained in an AATPD central database and the respective functions are performed centrally.

The following advantages may be obtained from the centralized design option.

- It greatly may reduce duplication of efforts in the management of records related to accidents and violations. It may avoid the problem of data duplication, particularly that of drivers.
- It offers security in that data can be kept under tight control and it would be much easier to exercise supervision over a single facility as compared to the decentralized system.
- Cost of the hardware may be less as compared to the decentralized system because here a single high capacity computer is required.

The centralized design option may have the following disadvantages.

- Since the centralized system will contain large volume of data, the system may be too complex.
- There is risk of complete loss of data as a result of sudden system failure or environmental catastrophe.

Distributed System-the recommended option

A distributed system is a combination of decentralized and centralized system, which tries to capture the advantages of both while minimizing their weakness (Hutchinson and Sawyer

1992). Under this option, user sections will have their own computer facilities connected to a central and larger computer facility, which may consist, a microcomputer or a few microcomputers.

From the problem/ requirement of the system and from the assessment of user needs, structure of the new system tends to favor the distributed system.

The requirement that must be met by any proposed system clearly suggests that the records of drivers in Addis Ababa, who have committed accidents and/or violated rules, should not be maintained in separate databases. Because, records which belong to one driver, will be replicated in two databases. Therefore, aside form wasting resources and duplicating data, the processing efficiency and fast response time that ought to be gained from keeping accident and violation records with the decentralized option is minimal.

5.5.3 Network

A Network can generally be defined as a system that allows computer users to connect their system and share resources, files and programs (Sheldon 1990). There are different levels of networks, ranging from those that exist within a single office, known as Local Area Network, to those that span cities and countries, known as Wide Area Network.

With regard to the technical aspect of the network system under consideration, analysis of, not only the network hardware, but also methods and procedures required to establish a network system have to be done. This includes, among other things, specifications such as the type of server(s) hardware required, interface card to be used, the cabling system, type and the number of workstations, the architecture of a network that defines the length of the cabling

system and workstations attached to it, as well as the rules and protocols to transfer signals from one workstation to another.

As indicated in the scope of this study, data on these and similar aspect of the LAN environment under consideration could not collected mainly due to shortage of time and some of the technicalities involved in the process.

Therefore, after evaluation of the department's networking needs and formulating the proposed LAN, due consideration should be given to the following main components of LAN in relation to the application requirements of the department and in line with the government policy with regard to the acquisition of hardware and software.

At the heart of any network system is the server(s) which facilitate access to shared resources. The central server(s) entrusted with storing the drivers database and the rules database must have good performance rate, high level of reliability, back up and security. It must be powerful enough to run the network system and offer file storage, user management, security, common network commands, etc.

5.5.4 Operating software

Like any other computer system, a network needs software to run all the functions it is designed for. In a network environment three types of software are employed. These are the systems software, the network software, and the application software.

The networkable system software, like any other systems software operated in a stand alone machine, permits users to interact with hardware and manages other software to operate using the host hardware.

The network software, on the other hand, allow the interconnections between applications and performs the complex task of managing the requirements of a number of users to access simultaneously data or devices on the network. There are several network systems software in the market. The Novell netware, available in several versions, which can be installed on almost any network hardware is recommended.

5.5.5 Application software

The third component of network software is the application software. Application software covers the networkable versions of program or programs designed to carry out specific task of users in the network environment. The main focus for the network application software by the department should be the networkable versions of database management systems which will be accessible to multi-users from different workstations located at both AATPD and AAATCB. Here the department has two options: purchase or in house development. By considering the following factors the purchase option is recommended.

-the degree to which the available packages meet the users' requirements

-the support from the package vendor

-the flexibility and maintainability of the package

-the price of the package and the cost of in-house development

-the availability of in-house resources to do the development

-the different time scales within which the package or in-house development can be implemented

From the available software packages in the market, MAAP, which has been tested in other countries, is recommended.

5.6 A Simple Prototype Database Design

To generate relevant information efficiently, quick access to the data (raw facts) from which the required information is produced is needed. Data management, which focuses on data collection, storage, and retrieval, thus constitutes a core activity for any organization.

According to Date et al (1994), efficient data management requires the use of a computer database. A database is a collection of information related to a particular subject or purpose. Peter Rob (1997) defines a database as a shared, integrated computer structure that houses a collection of:

- end user data (that is raw facts of interest to the end user),and
- metadata or " data about data" through which the data are integrated.

The metadata provide a description of the data characteristics and the set of relationships that link the data found within the database.

In the system under study, it may be possible to record and analyze accident data and violation data manually. And, in fact, they have been recorded and analyzed manually at Addis Ababa Traffic Police Department, although there are problems mentioned in chapter four. However, with the rapid progress in computer hardware and software it became now relatively easy and cheap to acquire micro-computers with an easy to use (user friendly) accident investigation package installed to perform all the necessary analysis. One of the most popular accident analysis and investigation systems for developing countries is MAAP a microcomputer based accident analysis package developed by the British Transport Research Laboratory.

According to TRRL (1999), MAAP (Microcomputer Accident Analysis Package) is rapidly becoming one of the most useful and increasingly widespread pieces of Software

developed by TRL, with satisfied customers throughout the UK as well as places such as Zimbabwe, Egypt, Kenya, Colombia and the Caribbean.

MAAP provides the accident investigator with the latest techniques in accident data storage and analysis and is complex enough, yet simple to use to allow its tools to identify and analyze problems with accidents and for isolating common features in accidents.

MAAP's extensive facilities include accident, casualty and vehicle cross tabulations with graphical presentation and stick diagram analysis. Accidents can also be displayed and analyzed by location by use of scanned or vector maps of the area concerned using MAAP's Geographical Information System. Data handling within MAAP is based on the ACCESS (or SQL Server) Database engine and affords the user numerous benefits which include amongst others:

- Intrinsic multi-user capability.
- Data storage on a PC for single user or small network, or to any industry standard network using a SQL server database.
- Users can, if required, interrogate the MAAP for Windows database using simple or complex queries developed in may other software packages giving total flexibility in data analysis.
- A simple user-friendly data entry interface with full data validation.
- Flexible and powerful data security.

The interface within the Windows environment allows standard features like Cut and Paste, which can be placed in programs such as Word and Excel. MAAP also supports all Windows printers for both text and graphical output.

MAAP for Windows is a user configurable product. It has been designed for use by Police Forces, Overseas Governments and Highway Network Authorities. It is used as a tool for the storage and analysis of road traffic accident data. Each copy of MAAP for Windows is

configured for the individual needs of each customer, in particular, adapting the program to the customer's accident report form, maps and databases. For this reason, the total cost is made up of a basic fee for the use of the program (the license fee), plus professional fees for preparing each package individually, installing it and training users in data entry and analysis.

MAAP can be provided in a local language, currently they have Arabic, English, Spanish, French and Turkish versions.

MAAP is not the only software available. There are others among which Traffic Operations System Software (TOSS) is the one. TOSS is developed by McTrans Center at the University of Florida. TOSS is considered to be a total solution for Traffic Operations Management by its developers. According to the developers, TOSS consists of eleven modules which can be run separately without having to purchase additional software:

- Sign Inventory System
- Road Marking Inventory System
- Traffic Count Information System
- Accident Information System
- Collision Diagram
- Traffic Signal Maintenance System
- Traffic Signal Inventory System
- Street Light Maintenance System
- Street Light Inventory System
- Street Furniture Inventory System
- Complaint Logging System

To demonstrate that the Addis Ababa Traffic Police Department can better maintain their records using computer based database, the worker has designed a simple prototype database.

In the design of the database, the relational database model has been employed because it is the current database standard. The relational database is perceived by the user to be a collection of tables in which data are stored.

The prototype database is designed to store data about drivers, types of rules specified in the regulation, data about occurrence of each violation. And the database can also be used to find and retrieve data that meets conditions the user specifies, specifically to retrieve names of drivers who have committed an offence for more than two times and also those drivers who have not paid the penalty for the offence they have committed.

5.7 Tables used in the database

To accomplish the above objective the data will be stored in three tables:

- Drivers table- used to store data about each driver in Addis Ababa.
- Rules table- used to store data bout each type of rule listed in the regulation
- Event table- used to store data about each occurrence of violation.

Each table contains information about the same subject, and each field in a table contains individual facts about the table's subject. The worker has tried to include all the information that is needed and to store the information in its smallest logical parts (for example Name and Father Name, rather than Name), as shown in table 5.1 on next page.

and licenses number, rule code and event id fields are primary key for drivers, rules and events table respectively.

To have a way to tell Microsoft Access how to bring related information back together again in meaningful ways the worker defined relationships between tables. Whereas drivers and rules table is not related each of these tables has a one to many relationship with that of the events table.

5.8 The data dictionary

The data dictionary is used to provide a detailed accounting of all tables found within the user/designer created database. Thus the data dictionary contains (at least) all the attribute names and characteristics for each table in the system. In short, the data dictionary contains metadata. According to Peter Rob (1997) the data dictionary is sometimes described as "The database designer's database". The data dictionary for the prototype database is shown in table 5.2 on the next page.

Table 5.2 Data Dictionary

Table Name	Field Name	Type	Length	Required	**Default**	PK or FK	Foreign key Referenced Table
Drivers	License Number	Number	10	Yes		PK	
	Name	Text	20	Yes			
	Father name	Text	20	Yes			
	Sex	Text	2	Yes			
	Date of Birth	Date	10	Yes			
	License level	Text	2	Yes	Addis Ababa		
	Address	Text	10	Yes			
	Woreda	Text	2	Yes			
	Kebele	Text	2	Yes			
	House Number	Text	5	Yes			
	Tel. Number	Text	10	No			
Rules	Rule code	Number	4	Yes			
	Rule category	Text	30	Yes			
	Rule type	Text	10	Yes			
	Penalty amount	Currency	10	Yes			
Events	Event id	Auto number	10	Yes		PK	
	Event date	Date	10	Yes			
	Plate number	Text	10	Yes			
	License number	Number	10	Yes			Drivers
	Rule code	Number	10	Yes			Rules
	Paid	Yes/no	10	Yes			
						PK	
						FK	
						FK	

PK= Primary key

FK= Foreign Key

was clearly understood that it is not the presence of the data that make the record system successful one, but rather it is the presence of a systematic approach to record, save, retrieve, analyze and generate, reports. It was felt that with out the use of computers, this objective could not be achieved.

Chapter six

Conclusion and recommendations

It is appreciated that transportation is an integral part of the functioning of society, irrespective of its level of development. It exhibits a very close relationship to the style of life, the range and location of productive and leisure activities, and the goods and services which will be available for consumption. It is therefore essential that transportation service of adequate quality and capacity be provided. However the provision of transportation, like the provision of almost any other material good or service, carries with it many side effects. Some of the most disturbing by-products of transportation are pain, damage to property, injuries and loss of life brought about by unsafe acts and unsafe events in the transportation system.

Historically, the accident problem started with the invention of the automobile. In spite of the radical improvements in the vehicle and roadway, the accident problem continued and became even more severe. This serious problem was, however, recognized and scientifically dealt with by the developed countries during the last four decades.

These industrialized countries, as a direct result, have been able to arrest and reverse the increasing rate of road traffic accidents; and , by constantly improving highway design standard, increasing public awareness of traffic hazards, establishing and practicing road safety programs, enacting stringent legislation against drinking and driving, and enforcing the use of occupant protection measures, industrial nations have achieved a commendable and enviable measure of success in terms of lives saved and economic benefits addrued. By sustained research and application, industrialized nations are still finding new methods to reduce further the number of road accidents and their severity.

Addis Ababa, like the capital cities of many developing countries, is experiencing more than its share of road accidents.

As has been done elsewhere, the trend of the increasing rate of traffic accidents can be checked and reversed in Addis Ababa, provided ofcourse, the government and institutions are prepared to make firm commitments to initiate and implement concrete road safety program.

Although the high technology and the various techniques employed in industrialized countries may be too sophisticated to adapt in Addis Ababa at the moment, the knowledge and experience is still valuable and applicable in stages, or at " appropriate technology" level. For example, where proper equipment is not readily available to detect excess alcohol in the blood of a driver simple observation of general behavior, appearance, odor of breath, clarity of speech and general attitude could be usefully employed to identify and restrain problem drivers.

6.1 Education and Training

Traffic accidents occur through interaction between the road user, the environment and the vehicle. Human factors are crucial in accident causation and countermeasures must take these factors into account. Traffic education and training are therefore important elements in the combat against road accidents. It should include education of children, training of specific groups of road users and safety campaigns aimed at all road users.

The traffic education connected with the acquisition of a driving license in many cases may be the only time during the license holder's life that he receives any form of training on road safety and traffic. For that reason, license requirements and particularly the initial training are highly significant.

It seems that in Addis Ababa there are serious short-comings in driver licensing which need attention. There are many drivers who behave as if they had a license to kill. They drive too fast, drive drunk, and endanger themselves and others. These short-comings are not difficult nor expensive to abolish by appropriate policy legislation and enforcement.

This could be by preparing and requiring those parties which give training to follow a uniform syllabus and by taking appropriate measures to prevent corruption in licensing.

6.2 Technology Infusion

It is now increasingly recognized that improvements of infrastructure as well as adaptations of technologies effectively used oversees can substantially reduce accident risks at low cost and relatively high efficiency. Thus, as in other parts of the world, technology investments in Addis Ababa for traffic and traffic safety purposes offer substantial accident prevention potential.

6.3 Financing

All possible internal and external sources must be motivated. Experience from overseas countries may help. As a general, all-embracing financing source, it is common that a part or all of vehicle taxes goes to road infrastructure investments, including traffic safety components, so vital to the economics of any country.

It is clear that traffic safety needs will have to compete with priorities in other sectors. It is up to the policy makers to agree on an authoritative position in this regard.

6.4 Accident Data System (ADS)

It seems that there is an opportunity for Addis Ababa traffic Police Department which have not yet equipped in reliable accident data systems, to use experience form other countries (e.g. Egypt, Kenya) and computer packages already tested, in order to start its own accident base. Most of the systems now available are run on Micro-computers. It is clear that in order to get proper system some funding is necessary, although not considerable. The Addis Ababa Traffic Police Department which has not yet been able to get the system have been treating accident data manually, which is time and manpower consuming, somewhat unreliable, and reduces diagnostic possibilities for safety action.

An efficient ADS is based on objective and precisely defined information. Moreover, a procedure of accident location is essential, so that data can be used to identify black spots and accident accumulation areas and treat them accordingly. Existing computer packages meet these requirements, and some even include automatic cartography of accidents.

6.5 Road Safety Research

Road safety research is necessary to define specifically the road safety problem in Addis Ababa. Research is further needed to provide the necessary framework of knowledge within which policy can be made.

The Ethiopian government cannot and should not rely mainly and solely on external researchers to carry out road safety research in Addis Ababa. Indigenous professionals should be given the necessary material, moral and political support inorder to adequately cope with the challenges posed by road accidents in their city or country.

6.6 Utilizing Existing Records

It is already indicated that when a driver violates a rule the record against that driver is maintained at Addis Ababa Traffic Police Department. And due to lack of proper utilization of this record and may be some other factors there is an outstanding amount of birr 9,833,010 from the penalty of a single year (year 1990 E.C). Therefor, it is recommended that the AAATCB should seek a means of utilizing this record.

By virtue of their functions, insurance companies possess data on road traffic accidents involving insured victims. One would expect insurance companies to provide accident data that could help for example to assess the cost of repairs in the industry. In Addis Ababa, insurance companies do not act as a source of accident data.

6.7 Report to AACRA

The AACRA is responsible for selecting, installing, and maintain traffic control devices and for construction of roads in the city. It is clear that actions taken by the authority to improve road safety in the city would be more effective if they are based on accident data, among other factors. Therefore it is recommended that a detailed accident report be submitted to the authority.

Finally, although the study cannot be described as comprehensive, it provides an essential starting point for future investigations into the characteristics of road traffic in any city in Ethiopia.

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Appendix I

Interview guide for the staff of Addis Ababa Traffic Police Department

1 What are the responsibilities of the department?

2 What duties do you perform on daily basis?

3 How do you perform your duties?

4 Are there any difficulties that you encounter in your activities

5 Which organization people etc request information from you? What type of information and how often?

6 What do you think about the road safety condition in Addis Ababa?

7 What are the main causes of accidents?

8 What measures are being taken to reduce road accidents?

9 Which types of organizations perform what type of activity with regard to road safety?

10 Are there any comments you would like to bring to my attention regarding transportation infrastructure, road safety, traffic regulations and related matters.

Interview guide for drivers

1 What do you think about the road safety condition in Addis Ababa?

2 What is your opinion about the traffic control and violation enforcement activities in Addis Ababa? Is it weak or strong? What do you think the reasons will be for this?

3 What do you think the causes for accidents in Addis Ababa?

4 Do you drive fast? On the average How many km per hour?

5 What about other drivers? Do you think about the reasons for their speed?

6 Are there any comments you would like to bring to my attention regarding transportation infrastructure, road safety, traffic regulations and related matters?

Interview guide for the staff of users of the traffic information system

1 For which type of your functions do you need traffic information?

2 What type of traffic information do you need?

3 How often do you need these information?

4 What is your level of satisfaction or opinion about the information you receive?

5 Are there any comments you would like to bring to my attention?

Appendix II

People Interviewed

Major Befekadu Tolera,	Head the Addis Ababa Traffic Police Department
Ato Masresha Lema	Public Relations Office AATPD
Ato Asrat Tadesse	Record Officer, AATPD
Woy Tsehay Germa	Record Officer, AATPD
Ato Lema Bekele	Investigating Officer AATPD
Ato Dessalegn Benalfew	Record Officer AATPD
Ato Zewdu Telahune	Insurance Form Filler AATPD
Ato Afworki Yelma	Archive Section Head AATPD
Ato Solomon Ayele	Traffic Police Officer AATPD
Major Yared Brehanu	Addis Ababa Administration Police Commission
Woy Adanech Mulunehe	Ethiopian Insurance Corporation
Ato Haile Ashenafi	Nice Insurance Corporation
Ato Solomon Hailu	African Insurance
Ato Mengistu Melaku	Anbessa City Bus services
Ato Tadele Kebede	Addis Ababa City Roads Authority
Ato Tenadam Belete	Public Relations, AAATCA
Ato Zinabe Seid	Taxi Driver
Ato Berhany Germa	Taxi Driver
Ato Samson Taye	Taxi Driver
Ato Fasil Ayalew	Taxi driver
Ato Dereje Tesefaye	Taxi Driver

Appendix III

Documents reviewed and annexed

1. Insurance report form
2. Accident record card
3. Rules violations record care
4. Sketch witness report form
5. Accident frequency report form
6. Violations statistics form
7. Traffic statistics form

ተራ ቁጥር	ክስ የቀ'ረበበት ቀን	የተከሰ ሰበት ቀን	የጥፋቱ ዓይነት	የፖሊስ መዝ ቁጥር	የፍርድ ቤት መ ቁጥር	የቅጣቱ ውሳኔ		የተቀጣበት ቀን
						ብር	ግ	

ቀን_____

የፕላን ምስክርነት

እኔ _____

ዕድሜ _____

ሥራዬ _____

አድራሻ አ/አ ወረዳ _____ ቀበሌ _____ የቤት ቁጥር _____

የሆነ ዛሬ በ / /199 ዓ.ም ከ_____ ሰዓት ሲሆን ከዚህ

እንደሚከተለው የፕላን ምስክርነት ቃሌን በፅሁፍ አሰጣለሁ ።

ከሱ የቀረበው በመኪና _____

አደጋ ማድረስ የቀረበ ክስ ሲሆን አቶ ወ/ሮ_____

የተባለው ቁስላሽ በ / /199_ ዓ.ም ከ _____ ሰዓት ሲሆን

ንብረትነቱ _____ የሆነ የሠሌዳ _____

መኪና ይዞ ከ_____ ወደ _____

_____ እያሽከረከረ ሲጓዝ ወረዳ _____ ቀበሌ _____ ልዩ

ቦታው _____ ከተባለ ቦታ ሲደርስ የጉዞ አቅጣጫው ከ

_____ወደ _____ ይጓዝ የነበረዉን

አግረኛ/ተሽከርካሪ/ የሠሌዳ_____ ግጭቱ የሞት /የአካል/

የንብረት ላይ/ ጉዳት ያደረሰ በመሆኑ የቀረበ ክስ ነዉ።

ስለዚህ በተነሳው ፕላን መሰረት የአደጋ ቦታ ፕላን በእስኬል ተሰርቶ

ገ/ርዝር የፕላን መግለጫ ወጥቶለት ከም/መገገቡ ተያይዟል። ይመልከቱ

በዚሁ መሰረት ይህን ምርመራ ያጣራሁ ሲሆን ቁስላሽ የሆነበት ምክንያት

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ፈርማ

ማሳሰቢያ፡- በርርግቱ ላይ የተሰረዘዉ አይሰራም።

ሐ. የትራፊክ አደጋ ስታትስቲክስ

1 በዕለት የደረሱ አደጋዎች

ተ.ቁ	ዕለት	ብዛት
1	ሰኞ	
2	ማክሰኞ	
3	ረቡዕ	
4	ሐሙስ	
5	ዐርብ	
6	ቅዳሜ	
7	እሑድ	
	ድምር	

2 በሰዓት የደረሱ አደጋዎች

ተ.ቁ	ሰዓት	ብዛት	ተ.ቁ	ሰዓት	ብዛት	ተ.ቁ	ሰዓት	ብዛት
1	0100 — 0200		9	0900 — 1000		17	1700 — 1800	
2	0200 — 0300		10	1000 — 1100		18	1800 — 1900	
3	0300 — 0400		11	1100 — 1200		19	1900 — 2000	
4	0400 — 0500		12	1200 — 1300		20	2000 — 2100	
5	0500 — 0600		13	1300 — 1400		21	2100 — 2200	
6	0600 — 0700		14	1400 — 1500		22	2200 — 2300	
7	0700 — 0800		15	1500 — 1600		23	2300 — 2400	
8	0800 — 0900		16	1600 — 1700		24	2400 — 0100	
							ጠ/ድምር	

3 አደጋ የፈጸሙ አሽከርካሪዎች ዕድሜ

ተ.ቁ	ዕድሜ	አደጋው ያስከተለው ጉዳት				ድምር
		ሞት	ከባድ የአካል ጉዳት	ቀላል የአካል ጉዳት	የንብረት ጉዳት	
1	ከ18 ዓመት በታች					
2	ከ18—30 ዓመት					
3	ከ31—50 ዓመት					
4	ከ51 ዓመት በላይ					
5	ያልታወቀ					
	ድምር					

4 የአሽከርካሪዎች ፆታ

ቁ.ተ	ፆታ	አደጋው ያስከተለው ጉዳት				ድምር
		ሞት	ከባድ የአካል ጉዳት	ቀላል የአካል ጉዳት	የንብረት ጉዳት	
1	ወንድ					
2	ሴት					
3	ያልታወቀ					
	ድምር					

5 አደጋ የፈጸሙ አሽከርካሪዎች የትምህርት ደረጃ

ተ.ቁ	የትምህርት ደረጃ	አደጋው ያስከተለው ጉዳት				ድምር
		ሞት	ከባድ የአካል ጉዳት	ቀላል የአካል ጉዳት	የንብረት ጉዳት	
1	ማይም					
2	መሠረተ ትምህርት					
3	1ኛ፡ ሙ ደ፡ ት/ቤት					
4	ሙ 2ኛ፡ ደ፡ ት/ቤት					
5	ከፍ 2ኛ፡ ደ፡ ት/ቤት					
6	ከከፍ 2ኛ ደ፡ ት፡ በላይ					
7	ያልታወቀ					
	ድምር					

6 የአሽከርካሪና የተሽከርካሪ ግንኙነት

ቁ.ተ	ግንኙነት	አደጋው ያስከተለው ጉዳት				ድምር
		ሞት	ከባድ የአካል ጉዳት	ቀላል የአካል ጉዳት	የንብረት ጉዳት	
1	የተሽከ/ባለቤት					
2	ተቀጣሪ					
3	ሌላ					
4	ያልታወቀ					
	ድምር					

7.1 አደጋ የፈጸሙ አሽከርካሪዎች የመንጃ ፈቃድ ደረጃ

	የመንጃ ፈቃድ ደረጃ							
	1ኛ	2ኛ	3ኛ	4ኛ	5ኛ	ልዩ ተንቀሳቃሽ	ፈቃድ የለለው	ያል ወቀ
ብዛት								

የአሽከርካሪው የማሽከርከር ልምድ

ተ.ቁ	የማሽከርከር ልምድ	አደጋው ያስከተለው ጉዳት				ድምር
		ሞት	ከባድ የአካል ጉዳት	ቀላል የአካል ጉዳት	የንብረት ጉዳት	
1	መንጃ ፈቃድ የለለው					
2	ከ1 ዓመት በታች					
3	ከ1—2 ዓመት					
4	ከ2—5 ዓመት					
5	ከ5—10 ዓመት					
6	ከ10 ዓመት በላይ					
7	ያልታወቀ					
	ድምር					

8 የተሽከርካሪው የአገልግሎት ዘመን

ተ.ቁ	የአገልግሎት ዘመን	አደጋው ያስከተለው ጉዳት				ድምር
		ሞት	ከባድ የአካል ጉዳት	ቀላል የአካል ጉዳት	የንብረት ጉዳት	
1	እስከ 1 ዓመት					
2	ከ1—2 ዓመት					
3	ከ2—5 ዓመት					
4	ከ5—10 ዓመት					
5	ከ10 ዓመት በላይ					
6	ያልታወቀ					
	ድምር					

“ሀ”የትራፊክ ጀንበር መተላለፍ ስታትስቲክስ

1	2	3
የጥፋት አርከንና ኮድ ቁጥር	የጥፋት ዓይነት	የክስ ብዛት
301	በ15 ሜትር ርቀት ምልክት ሳያሳይ በተሽከርካሪዉ አቅጣጫ የቀየረ	
302	የሚከለክል ምልክት የጣሰ	
303	የሚያስገድድ ምልክት የጣሰ	
304	ደሴት በግራ ያቋረጠ	
305	በጠበበ መንገድ ላይ ያቆመ	
306	መታጠፊያ መንገድ ላይ ያቆመ	
307	የመንገድ አካፋይ ደሴት /መስመር/ ያቋረጠ	
308	የጭንቅላት መካላከያ /ሔልሜንት/ ሳያደርግ ሞተር ሳይክል የነዳ	
309	የተበላሸ ተሽከርካሪን መንገድ ላይ የጠገነ	
310	ከተወሰነለትመቀመጫ ወይም የጭነት ልክ በላይ የጫነ	
311	በተሽከርካሪዉ ላይ የተጫነዉን ጭነት በሚገባ ያላስረ ወይም ያላሰበሰ	
312	ዕይታን የሚከለክሉ መጋረጃዎችና ተለጣፊ ላስቲክ የለጠፈ	
313	አፈር አሸዋ ድንጋይና የመሳሰሉትን ባልተፈቀደ ቦታ ላይ ያራገፈ ወይም እንዲራገፍ ያደረገ	
314	ሌሎች የትራፊክ ፍሰትን የሚያሰናክሉ ድርጊቶችን የፈፀመ	
315	በተሽከርካሪ ላይ ተገቢ ያልሆነ አካል የጨመረ	
316	ተለጣፊ ምልክት /ቦሎ/ ያልለጠፈ	
401	ተሽከርካሪ በእንቅስቃሴ ላይ እያለ ተሳፋሪ የጫነ ወይም ያወረደ	
402	በተሽከርካሪ መግቢያ /መዉጫ/ በር ላይ ያቆመ	
403	ዓመታዊ የተሽከርካሪ ደህንነት ምርመራ ያላደረገ	
404	ጉድለት ያለዉ ተሽከርካሪ የነዳ	
405	ባልተሟላ መብራት ያሽከረከረ	
406	ተሽከርካሪ ደርቦ ያቆመ	
407	የሚታጠፍበትን አቅጣጫ ሳይዝ ያሽከረከረ	
408	በትራፊክ ደሴት ላይ ያሽከረከረ	
409	ከተማ ዉስጥ ከባድ መብራት /ባዉዛ/ የተጠቀመ	
410	ያለማንፀባረቂያ ምልክት የተበላሸን ተሽከርካሪ በመንገድ ላይ ያቆመ	
411	ከ2 ሰዓት በላይ ከባድ ተሽከርካሪ በመንገድ ላይ ያቆመ	
412	በሰንሰለት የሚሽከረከርና በሰዓት ከ10ኪ.ሜ. በታች የሚጓዝ ልዩ ተሽከርካሪ በመንገድ ላይ የነዳ	
413	በአዉቶብስ ማቆሚያ ስፍራ ላይ ሌላ ተሽከርካሪ ያቆመ	

DECLARATION

The thesis is my original work, has not been presented for a degree in any other university and that all sources of material used for the thesis have been duly acknowledged.

Mekitew Molla
June, 2000

The thesis has been submitted for examination with my approval as a university advisor.

Ato Tesfaye Birru
June, 2000