A STUDY ON LOW COST SAFETY IMPROVEMENTS OF SELECTED ARTERIAL ROADS IN METROPOLITAN DHAKA CITY

MD.ZILLUR RAHMAN CHOWDHURY

90102
2-9-96
লাইব্রেরী, ঢাকা
#90102#

DEPARTMENT OF CIVIL ENGINEERING
BUET. DHAKA

A STUDY ON LOW COST SAFETY IMPROVEMENTS OF SELECTED ARTERIAL ROADS IN METROPOLITAN DHAKA CITY

Submitted by

MD. ZILLUR RAHMAN CHOWDHURY
ROLL NO. TS911204F

In partial fulfillment of the requirements for the Degree of Master of Engineering in Civil Engineering (Transportation)

DEPARTMENT OF CIVIL ENGINEERING
BANGLADESH UNIVERSITY OF ENGINEERING & TECHNOLOGY
DHAKA

June 1996

A STUDY ON LOW COST SAFETY IMPROVEMENTS OF SELECTED ARTERIAL ROADS IN METROPOLITAN DHAKA CITY

A PROJECT THESIS
BY
MD. ZILLUR RAHMAN CHOWDHURY

Approved as to the style and content by

Md. Mazharul Hoque

Dr. Md. Mazharul Hoque :Chairman
Professor (Supervisor)
Department of Civil Engineering
BUET, Dhaka-1000

Syed Ahmed

Mr. Syed Noor-Ud-Deen Ahmed : Member
Associate Professor
Department of Civil Engineering
BUET, Dhaka-1000

Dr. Md. Shamsul Hoque : Member
Assistant Professor
Department of Civil Engineering
BUET, Dhaka-1000

23 June, 1996

DECLARATION

I hereby declare that the research work reported in this theis was performed by me as a research project in partial fulfillment of the requirements for the degree of Master of Engineering in Civil Engineering from Bangladesh University of Engineering and Technology (BUET).

This thesis contains no material which has been accepted for the award of any other degree or diploma from any other institution. Further, to the best of my knowledge and belief, the project contains no material previously published or written by any other persons, except when due reference is made in the text of the project.

June, 1996

(Md. Zillur Rahman Chowdhury)

ACKNOWLEDGMENTS

(All Praises to Almighty Allah)

I wish to express my deepest gratitude to my supervisor Dr. Md. Mazharul Hoque, Professor, Department of Civil Engineering, BUET, Dhaka for his constant guidance, continued encouragement, generous help and unfailing enthusiasm at all stages of the research work. His active interest in this topic and valuable advice were the source of my inspiration.

Sincere appreciation and gratitude are also expressed to Dr. Jamilur Reza Chowdhury, Professor and Dr. M. Azadur Rahman, Professor & Head, Department of Civil Engineering, BUET for their encouragement and co-operation.

I am grateful to Mr. Syed Noor-Ud-Deen Ahmed, Associate Professor, Dr. Md. Shamsul Hoque, Assistant Professor, Dr. Hasib M. Ahsan, Assistant Professor and Mrs. Saniya Sharmeen, Lecturer, Department of Civil Engineering, BUET, for their kind support during the present study. I am also grateful to the persons referred here including my maternal grand father, father, mother, sisters, brother-in-law and other relatives & friends without whose inspiration and help such work could not be possible.

I offer special thanks to all staff member of "Demra Police Station" for providing accident data and other useful information.

ABSTRACT

This thesis presents the findings of a study concerned with low cost safety improvements of the selected arterial roads under Demra Metropolitan Police Station in Metropolitan Dhaka. The selected road locations included sections of Dhaka-Chittagong highway and Dhaka-Narayanganj road and are composed of five intersections and eleven links. It examines the trends and characteristics of the accident problems for identifying the dominant accident types which need to be tackled in future initiatives. A total of 517 accidents occurred on these roadway sections over the three & a half years period, January 1992 to June 1995. Of the total 517 reported accidents, 22.5% took place at intersections and the remaining 77.5% at links of road (mid-blocks). These accidents were distributed as 33.8% fatal, 48.6 % injury and the 17.6% property damage only accidents. The Pedestrian accident problem emerged as the most serious problem . Rear end and overtaking accidents were also featured as the dominant problems. In the study area accidents peaked between 8 am and 2 p.m. Most of the major accidents occurred due to reckless and appropriate driving of the truck and bus drivers. Trucks were mostly involved in accidents (27.3%). These were followed by buses (22.0%) and minibuses (11.8%). The maximum operating speeds of cars, buses and trucks were 85 km per hour, 76 km per hour and 75 km per hour respectively with average vehicular speed of 64 km per hour. Detailed investigation of hazardous intersections and road links (mid-blocks) were made using available accident data, field investigations and taking photographs of most hazardous sites. Collision diagrams were drawn for the most hazardous intersections and links to determine the types of accidents and vehicles involved in the locations which gave clues as to the remedies required. Narrow roads, increasing road traffic, lack of pedestrian facilities and lack of road use sense among the road users were considered to be the main causes of road accidents on these roadway sections. Some of the low cost traffic engineering countermeasures have been recommended which can be implemented to help reduce road accidents. Similar countermeasures may be given increased priority in any future initiatives for the safety improvements of other arterial roads.

CONTENTS

	Page No.
TITLE PAGE	iii
DECLARATION	iv
ACKNOWLEDGMENT	v
ABSTRACT	vi
CONTENTS	vii
LIST OF TABLES	ix
LIST OF FIGURES	xii
Chapter - 1 INTRODUCTION	1
1.1 BACKGROUND	1
1.2 THE STUDY AREA	2
1.3 OBJECTIVES OF THE STUDY	5
1.4 STRUCTURE OF THE THESIS	5
Chapter - 2 LITERATURE REVIEW	7
2.1 INTRODUCTION	7
2.2 FACTORS INVOLVED IN ROAD ACCIDENTS	7
2.3 ACCIDENT CLASSIFICATIONS	8
2.4 HAZARDOUS ROAD LOCATIONS PROGRAMS	11
2.5 LOW COST REMEDIES FOR ACCIDENT PREVENTION	14
Chapter - 3 METHODOLOGY AND STUDY DESIGN	16
3.1 INTRODUCTION	16
3.2 ACCIDENT RESEARCH METHODOLOGY	16
3.2.1 Methodological Considerations	16
3.2.2 Accident Type / Location Technique	17
3.2.3 Framework of Accident Analysis	17
3.3 METHODOLOGY USED IN THE STUDY	18
3.3.1 Preliminary Works	18
3.3.2 Police Accident Records	18
3.3.3 Accident Data Collection	18
3.3.4 Coding, Editing and Validation of Data	21
3.4 LIMITATIONS OF THE STUDY	22
Chapter - 4 DATA ANALYSIS AND FINDINGS OF THE STUDY	23
4.1 ROAD INVENTORY	23
4.2 ACCIDENT STATISTICS	23
4.3 DISTRIBUTION OF ACCIDENTS BY LOCATION	25
4.4 ACCIDENTS BY TYPES	33

		Page No.
4.5	DISTRIBUTION OF ACCIDENT BY TIME, DAY AND MONTH OF THE YEAR	35
	4.5.1 Distribution of Accidents by Time of Day	35
	4.5.2 Distribution of Accidents by Day of Week	36
	4.5.3 Distribution of Accidents by Month of the Year	37
4.6	VEHICLES INVOLVED IN ACCIDENTS	39
4.7	PEDESTRIAN INVOLVED IN ACCIDENTS	41
4.8	INVESTIGATIONS OF HAZARDOUS LOCATIONS	41
	4.8.1 Hazardous Intersections	41
	4.8.2 Hazardous Mid-Block Locations	43
	4.8.3 Distribution of Accidents by Types	44
4.9	AGE DISTRIBUTION OF ACCIDENTS VICTIMS	47
4.10	ACCIDENT COSTS	47
4.11	TRAFFIC STUDIES OF THE SELECTED ARTERIAL ROADS	47
4.12	PHOTOGRAPHS	50
4.13	FIELD OBSERVATION IN THE STUDY AREA	63
4.14	FINDINGS OF THE STUDY	66
Chapter - 5	**CONCLUSIONS & RECOMMENDATIONS**	69
5.1	INTRODUCTION	69
5.2	CONCLUSIONS	69
	5.2.1 Intersection Accident Hazards	69
	5.2.2 Mid-Block Accident Hazards	70
5.3	RECOMMENDATIONS	72
	5.3.1 Recommendations to Minimize Accidents at Intersections	72
	5.3.2 Recommendations to Minimize Accidents at Mid-Blocks	73
5.4	RECOMMENDATION FOR FUTURE STUDY	74
REFERENCES		76
APPENDIX - A	**SAMPLE DATA SHEETS**	79
APPENDIX-B	**ACCIDENT RELATED DEFINITION**	83

LIST OF TABLES

Tables		Page No.
Table 1.1	Road Accident in Metropolitan Dhaka (1983-1992)	2
Table 2.1	Nine Boxes for Possible Focus of Attack on Elements of the Road Trauma Problem	7
Table 2.2	Low Cost Remedies for Specific Accident Hazard in Urban Area	15
Table 3.1	Common Core Data Items	19
Table 4.1	Number of Accidents by Severity in the Study Area	23
Table 4.2	Listing of Frequent Road Accidents in Different Section of Selected Arterial Roads in Metropolitan Dhaka City from January 92 to June 95	25
Table 4.3	Different Types of Road Accidents in Different Section of Selected Arterial Roads During the year 1992	30
Table 4.4	Different Types of Road Accidents in Different Section of Selected Arterial Roads During the Year 1993	30
Table 4.5	Different Types of Road Accidents in Different Section of Selected Arterial Roads During the Year 1994	31
Table 4.6	Different Types of Road Accidents in Different Section of Selected Arterial Roads During the Year 1995 (up to June)	31

Page No.

Table 4.7	Distribution of DCA codes with Number of Accidents in Decreasing Frequency (Accident Type)	34
Table 4.8	Hourly Distribution of Road Accidents from January 92 to June 95 (3.5 years)	36
Table 4.9	Day Wise Distribution of Road Accidents from January 92 to June 95 (3.5 years)	37
Table 4.10	Monthly Distribution of Road Accidents from January 92 to December 94 (3.0 years)	38
Table 4.11	Types of Vehicle Involved in Road Accidents from January 92 to June 95 (3.5 years)	40
Table 4.12	Types of Vehicle Involved in Different Categories of Road Accidents from January 92 to June 95 (3.5 years)	40
Table 4.13	Different Types of Road Accidents According to DCA codes at Most Hazardous Intersection (Jatarabari intersection)	42
Table 4.14	Different Types of Road Accidents According to DCA codes at Most Hazardous Location (section 1-2)	45
Table 4.15	Different Types of Road Accidents According to DCA codes at Hazardous Location (section 8-9)	45
Table 4.16	Different Types of Road Accidents According to DCA codes at Hazardous Location (section 2-6)	46

Page No.

Table 4.17	Different Types of Road Accidents According to DCA codes at Hazardous Location (section 2-8)	46
Table 4.18	Age Distribution of Accident Victims	47
Table 4.19	Hourly Motorized Traffic Volume and Speed of Vehicle in the Saidabad Road and Number of Accident involved by Vehicles	48
Table 4.20	Hourly Motorized Traffic Volume and Speed of Vehicle in the Dhaka Narayanganj Road and number of Accident involved by Vehicles	49
Table 4.21	Hourly Motorized Traffic Volume and Speed of Vehicles in the Dhaka Chittagong Road and Number of Accident involved by Vehicles	49
Table 4.22	Hourly Motorized Traffic Volume and Speed of Vehicles in the Dhaka-Demra Road and Number of Accident Involved by Vehicles	49
Table 4.23	Road and Traffic Characteristics on Different Section of Selected Arterial Roads	65

LIST OF FIGURES

Figures		Page No.
Figure 1. 1	Location of the Study Area	3
Figure 1.2	Study Area, Showing Section of Selected Roads In Metropolitan Dhaka City	4
Figure 2.1	Definition for Coding Acidents	10
Figure 2.2	Typical Collision Diagram	12
Figure 2.3	Hazardous Road Location Program Elements	13
Figure 4.1	Number of Road Accidents for Demra Area From January 92 to December 94.	24
Figure 4.2	Percentage of Road Accidents by Severity from January 92 to June 95	24
Figure 4.3	Collision Diagram for **Jatrabari Intersection**	26
Figure 4.4	Collision Diagram for Location **1-2**	27
Figure 4.5	Collision Diagram for Location **8-9**	28
Figure 4.6	Collision Diagram for Location **2-6**	29
Figure 4.7	Total Number of Road Accidents in Different Link of Roads for Derma Area from January 92 to June 95	32
Figure 4.8	Percentage of Road Accidents in Different Section of Roads for Demra Area form January 92 to June 95	32
Figure 4.9	Number of Road Accidents for Demra Area from January 92 to June 95	33
Figure 4.10	Distribution of DCA Codes with Percentage of Accidents for Demra Area from January 92 To June 95	34

Page No.

Figure 4.11	Hourly Distribution of Road Accidents for Demra Area from January 92 to June 95	35
Figure 4.12	Day Wise Distribution of Road Accidents for the Demra Area from January 92 to June 95	37
Figure 4.13	Monthly Distribution of Road Accidents for Demra Area from January 92 to June 95	38
Figure 4.14	Type of Vehicles involved in Road Accidents for Demra Area from January 92 to June 95	39
Figure 4.15	Number of Road Accidents by DCA codes at Most Hazardous Intersection (Jatrabari) from January 92 to June 95	42
Figure 4.16	Road Accidents by Severity at Most Hazardous Intersection (Jatrabari) from January 92 to June 95	43
Figure 4.17	Parking of Bus on the Carriageway at Saidabad Road near Bus Terminal	50
Figure 4.18	Temporary Markets on the Carriageway at the Saidabad Road near Jatrabari Intersection.	51
Figure 4.19	Difference of Level Between Pavement Edge and Shoulder at Saidabad Road	51
Figure 4.20	Difference of Level Between Pavement Edge and Shoulder at Saidabad Road	52
Figure 4.21	Parking of Rickshaw's at Saidabad Road near Janapathmore	52
Figure 4.22	Dangerous Overtaking in the Absence of Lane Marking at Saidabad Road	53
Figure 4.23	Series of Parked Baby Taxi on the Carriageway at Saidabad Road	53

Page No.

Figure 4.24	Vehicle's Conflicts at Jatrabari Intersection	54
Figure 4.25	Absence of Median Islands, Lane Marking at Dhaka-Narayanganj Road near Jatrabari Intersection	54
Figure 4.26	Difference of Level Between Pavement Edge and Damaged Shoulder; Parking of Baby Taxi and Rickshaw Create Hazards Through Traffic at Saidabad Road	55
Figure 4.27	Narrow and Damaged Shoulder Create Potential Danger for Traffic and Pedestrian Flow at Saidabad Road	55
Figure 4.28	Vehicle Conflicts at Jurain Rail Crossing	56
Figure 4.29	Dangerous Turning of Vehicles, Absence of Lane Marking at Dhaka-Narayanganj Road near Postogola Intersection	56
Figure 4.30	Pavement Level is Not Same and Absence of Lane Marking at Dhaka-Narayanganj Road	57
Figure 4.31	Vehicle Conflict at Postogola Intersection near Buriganga-Bridge	57
Figure 4.32	Absence of Lane Marking at Dhaka-Chittagong Road near Jatrabari Intersection	58
Figure 4.33	Series of Parked Heavy Trucks on the Carriageway at Dhaka-Chittagong Road near Shanir-Aakhra	58
Figure 4.34	Vehicle Conflict at Shanir-Aakhra Intersection	59
Figure 4.35	Vehicle Conflict at Section of Dhaka-Chittagong Road near Jatrabari Intersection	59
Figure 4.36	Storage of Construction Materials on the Carriage Way at Demra Road	60
Figure 4.37	Parked Damaged Trucks on the Carriageway at Demra Road	60

		Page No.
Figure 4.38	Storage of Construction Materials on the Carriagway at Demra Road near Demra Police Station	61
Figure 4.39	Difference of Level between Pavement Edge & Shoulder at Demra Road	61
Figure 4.40	Difference of Level between Pavement Edge & Shoulder ; Parked Damaged Bus on the Carriageway at Demra Road Create Hazards Through Traffic	62
Figure 4.41	Absence of Lane Marking at Waes-Kuruni Intersection near Demra- Ghat.	62
Figure A.1	Accident Transcription Sheet	80
Figure A.2	Demra Thana Accident Data	81
Figure A.3	Police Accident Report Form (Bangladesh)	82

CHAPTER ONE

Introduction

CHAPTER 1

INTRODUCTION

90102
2-9-96
লাইব্রেরী, ঢাকা

1.1 BACKGROUND

Road safety in metropolitan Dhaka city emerges as a serious issue as the total number of accidents as well as their resulting casualties are increasing steadily over the years. Over the last decade (1983-1992) there were about 2661 fatalities and 9523 injuries in 11435 reported road accidents in Metropolitan Dhaka . The Table 1.1 shows the trends of accident problems in Metropolitan Dhaka.

Statistics also revealed that many of the fatalities and injuries are occurring on some specific roadway sections namely Dhaka-Chittagong road, Dhaka-Demra road, Dhaka-Narayanganj, Dhaka-Aricha road and Airport road particularly in the outskirt of Metropolitan Dhaka . In recent years these road links have shown their apparent inability to accommodate safe movement of both pedestrians and vehicular traffic.

More recently, it is being observed that many people are becoming very vulnerable and are exposed to accidents on these roads and the cumulative loss in road accidents is of considerable magnitude. However, very little works have so far been done to focus on a detailed spectrum of the analysis of road accidents on these roads for a full understanding of the accident problems and thereby developing effective low cost safety improvements which have been found to provide most effective economical results giving very good value for money spent. It is therefore, timely to study in detail the accident problems that occurred in major road links in the outskirt of Metropolitan Dhaka for improving the safety of the traffic. This study thus concerns with safety improvements of the selected arterial road sections.

Table 1.1
Road Accidents in Metropolitan Dhaka (1983-1992)

year	number of accidents	number of fatalities	number of injuries	total casualties
1983	1524	244	1782	2026
1984	1721	176	410	586
1985	1824	218	544	2162
1986	662	236	534	770
1987	747	217	675	892
1988	762	251	842	1093
1989	880	251	1209	1460
1990	873	417	1309	1726
1991	1031	337	1145	1482
1992	1411	314	1073	1387
Total	11435	2661	9523	13584

Source: Bangladesh Bureau Of Statistics (1983-1992)

1.2 THE STUDY AREA

The study area includes the following sections of the arterial roads:-

(1) Section of Dhaka-Narayanganj Road (from the Shamibagh rail crossing to the Postogola intersection).

(2) Section of Dhaka-Chittagong road (from the Jatrabari intersection to the Katchpur Bridge) and

(3) Section of Dhaka-Demra road (from the Jatrabari intersection to the Wisekuruni intersection, near Demra Ghat).

The locations of these roads are shown in Figure 1.1 and Figure 1.2. These road sections play an important role in the transportation between metropolitan Dhaka, the capital city and the southern, eastern and south-eastern regions of the country. It should be mentioned that the Dhaka-Chittagong road is a part of the Asian highway and connects the port city of Chittagong. The section of Dhaka-Naryanganj road is also important in the sense that it connects river port city of Naryanganj. The section of Dhaka-Demra road also plays a substantial role by way of connecting Demra Ghat and Dhaka-Chittagong road.

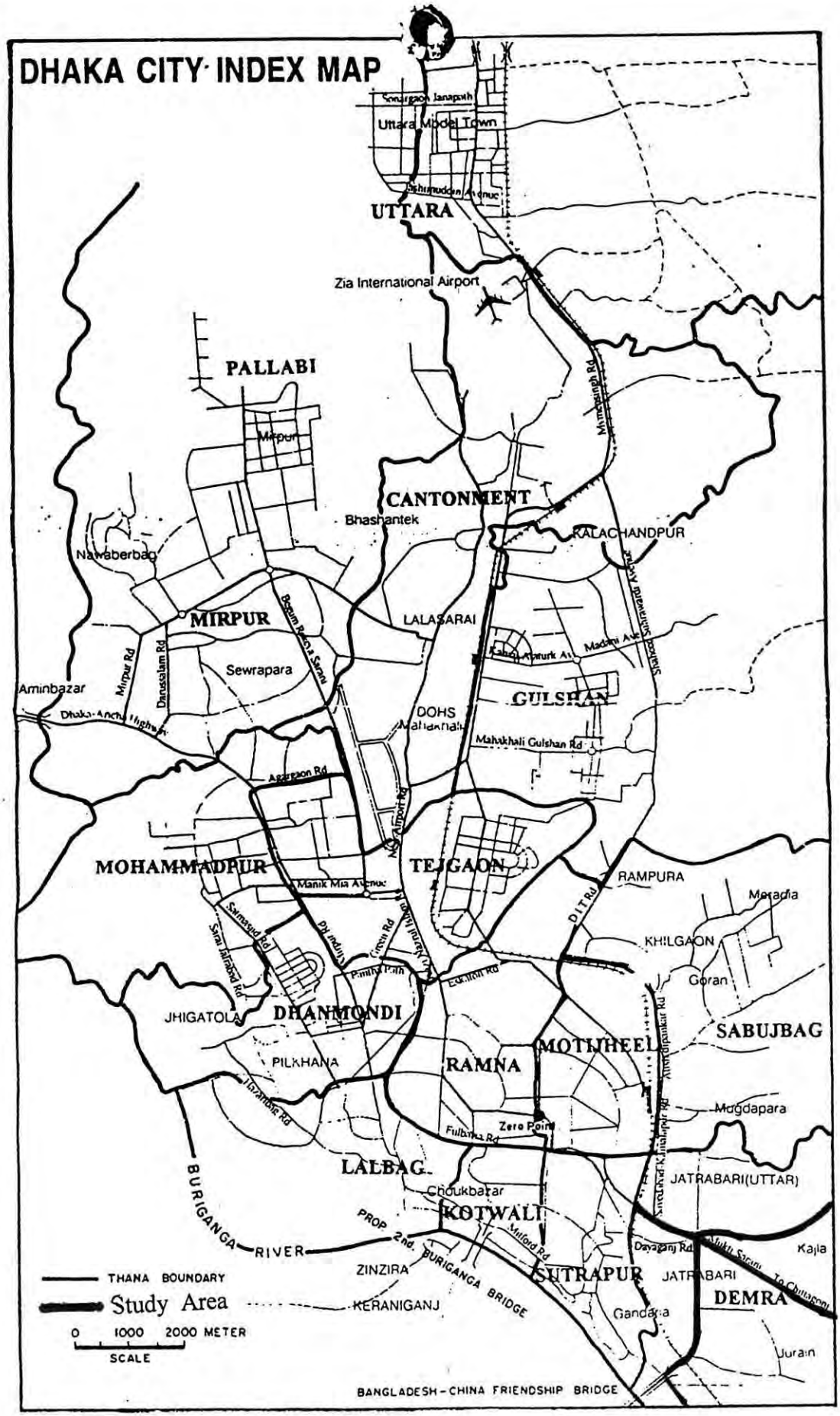


Figure : 1.1 Location of the Study Area

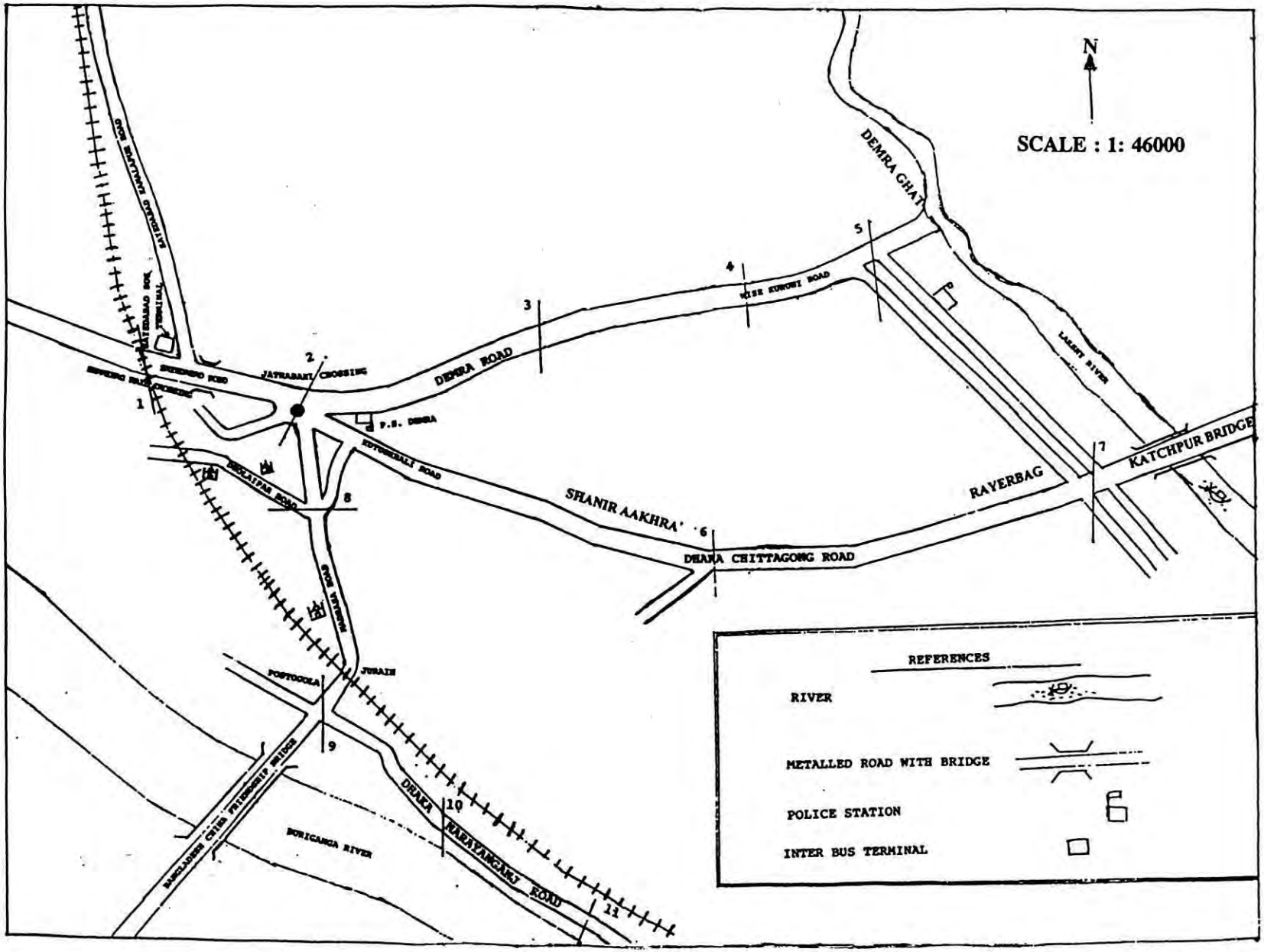


Figure : 1·2 Study Area Showing Sections of Selected Roads in Metropolitan Dhaka City

1.3 OBJECTIVES OF THE STUDY

The main objective of all safety works is to improve the safety situation on the highway/roadway system. The objective could be achieved only when both accidents and injuries are prevented substantially. The main objectives of the present study were:-

- To collect accident data from the respective police station and conduct field inventories of road ways and traffic flows.
- To collect traffic data (traffic volume and speed of vehicles) of the selected roads by field survey.
- To analyse accident data and investigate the characteristics of the accidents that occurred on the road sections in the study area.
- To identify the most frequent accident types and the road user groups involved in accidents.
- To identify the high accident locations, viz. intersections, links & other spots and asses safety deficiencies (road environmental hazards) of these locations.
- To suggest improvements through low cost engineering countermeasures (i.e improve road geometry, removal of road side obstacles, treatment of specific locations, regulatory warning signs, speed control measures, selective enforcement etc.)

1.4 STRUCTURE OF THE THESIS

The remainder of the Thesis is divided into four chapters.

Chapter 2 reviews the literature relevant and related to the theme of this study. This review sets out to understand the factors involved in road accidents, accident classifications, hazardous road location programs and low cost engineering remedies for accident prevention.

Chapter 3 presents an overview of the methods and data sources used in this thesis. This chapter outlines the different steps for accident research methodology, accident data sources and data collection procedures with the limitations of the study.

Chapter 4 presents the intensive analysis of accident data to represent the overall accident situation in the study area. This Chapter outlines the accident statistics, location wise accidents, accident by types, distribution of accident by time, day & month of the year, vehicles involved in accidents, investigations of hazardous

locations, accident costs, traffic studies of the selected roads, field observations and findings of the study.

Chapter 5 outlines the conclusions and recommendation of the study. Findings on intersections and mid-block accident problem characteristics are summarised in the conclusions and accident countermeasures are suggested based on such factual findings. Directions for future research are also discussed in this chapter.

CHAPTER TWO

Literature Review

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Before carrying out the investigation of road accidents at the selected arterial roads in Metropolitan Dhaka, it was necessary to conduct a review of literature on the related aspects. The first part of the review presents the factors which are generally involved in road accidents (i.e road factors and road environment factors). Causes of road accidents, accidents classifications, identification of hazardous road locations and low cost remedies of accidents are also discussed in this Chapter.

2.2 FACTORS INVOLVED IN ROAD ACCIDENTS

The road traffic system is composed of three components- the human, the vehicle and the road. Crashes, which may be thought of as a break down in the system, likewise have three components-precrash, in-crash and post crash. Putting these two concepts together a matrix known as the Haddon matrix is derived after William Haddon, one of the pioneers of the scientific approach to trauma analysis (shown in Table 2.1).These nine boxes each give a possible focus of attack on elements of the road trauma problem

Table 2.1

Nine Boxes For Possible Focus Of Attack On Elements Of The Road Trauma Problem

element	before crash	in crash	after crash
Human	Training education behavior (e.g. avoidance of drink driving). Attitudes conspicuous clothing on pedestrians, cyclists, etc.	In vehicle restraints fitted and worn	Emergency medical services
Vehicle	Primary safety (e.g. braking road worthiness, visibility), speed exposure etc.	Secondary safety (e.g impact protection)	Salvage
Road	Delineation road geometry surface condition, visibility etc.	Roadside safety (e.g. no hazardous poles)	Restoration of road and traffic devices.

Source: Ogden (1994)

It is extremely difficult problem to assign a single cause for the occurrence of accidents.Infact accidents are cotributed by several interfacting factors. Basically the following factors are involved indirectly or directly in road accidents:

Location factor : Intersection, link etc.

Road factors : Poor road geometry, pavement widths and surface conditions, unstable/untreated shoulders, lack of medians and foot ways, sight distances, alignment, curvature etc are some of the many road factors which contribute to accidents.

Road environmental factor: Hazardous objects and obstacles on the roads and roadside viz. fixed objects, construction materials, shops/markets and vendors, uncontrolled parking, poor visibility etc reduce road capacity and defer free movement of vehicles and contribute to accidents.

Vehicle factors : The presence of defective and road unworthy motor vehicles, interaction of slow and fast moving vehicles etc.

Driver factors : Indisciplined and inefficient driving, overspeeding,unlawful overtaking, overloading, poor education in road use, physical and mental conditions of the drivers etc.

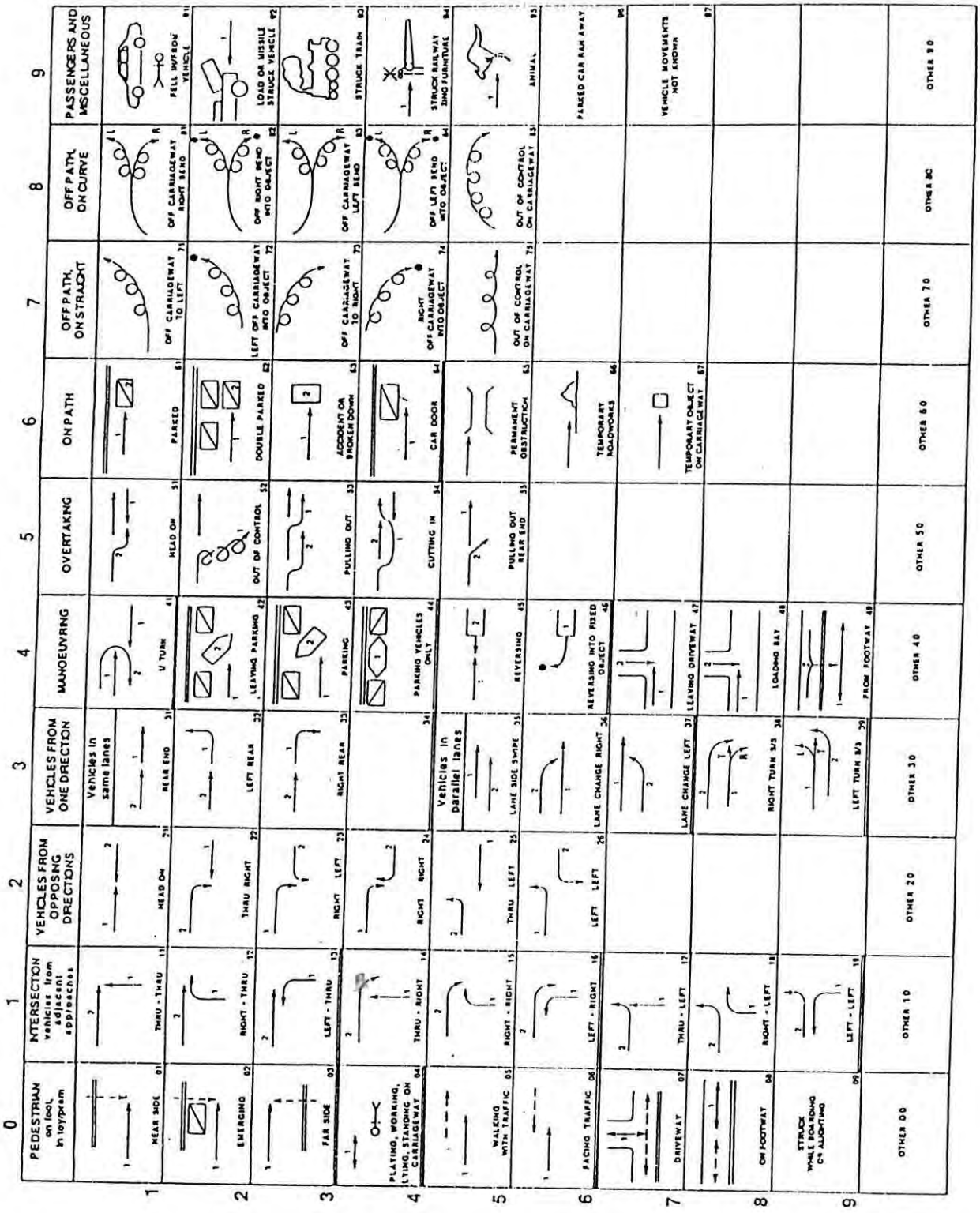
Institutional factors : Absence of an institutional setup to work on the major aspects of traffic problems and multiplicity in administration and management of the city street network.

Administration of laws relating to road accidents : Non compliance with legislation on traffic control and its failure to enforce strictly.

2.3 ACCIDENT CLASSIFICATIONS

One of the basic tools in accident analysis is classifications of accidents. In broad perspective, this classification often helps to reveal the approaches towards development of appropriate accident countermeasures (Hoque, 1988). In any event, a knowledge of the incidence of accident types and the relevance and effectiveness of particular countermeasures is an essential matter of the development of cost-effective countermeasures. Total accident figures simply indicate that a particular site has registered a given number of accidents in a given period of time, it is neither a comparative nor an analytical statistic.

Traditional approaches primarily classify traffic accidents by severity of results: fatal,personal injury and property damage only. The principle behind the determination of accident type is the accident event. An accident event must occur before an outcome results (Andreassend, 1983). This "event" is related to either collision or non collision and on or off the road carriageways.This study uses the DCA code (Definition for coding accidents) and is defined in Figure 2.1 for the analysis of accidents in the study area.



Source : Andreassen (1990)

Figure 2.1 : Definitions For Coding Accidents

2.4 HAZARDOUS ROAD LOCATIONS PROGRAMS

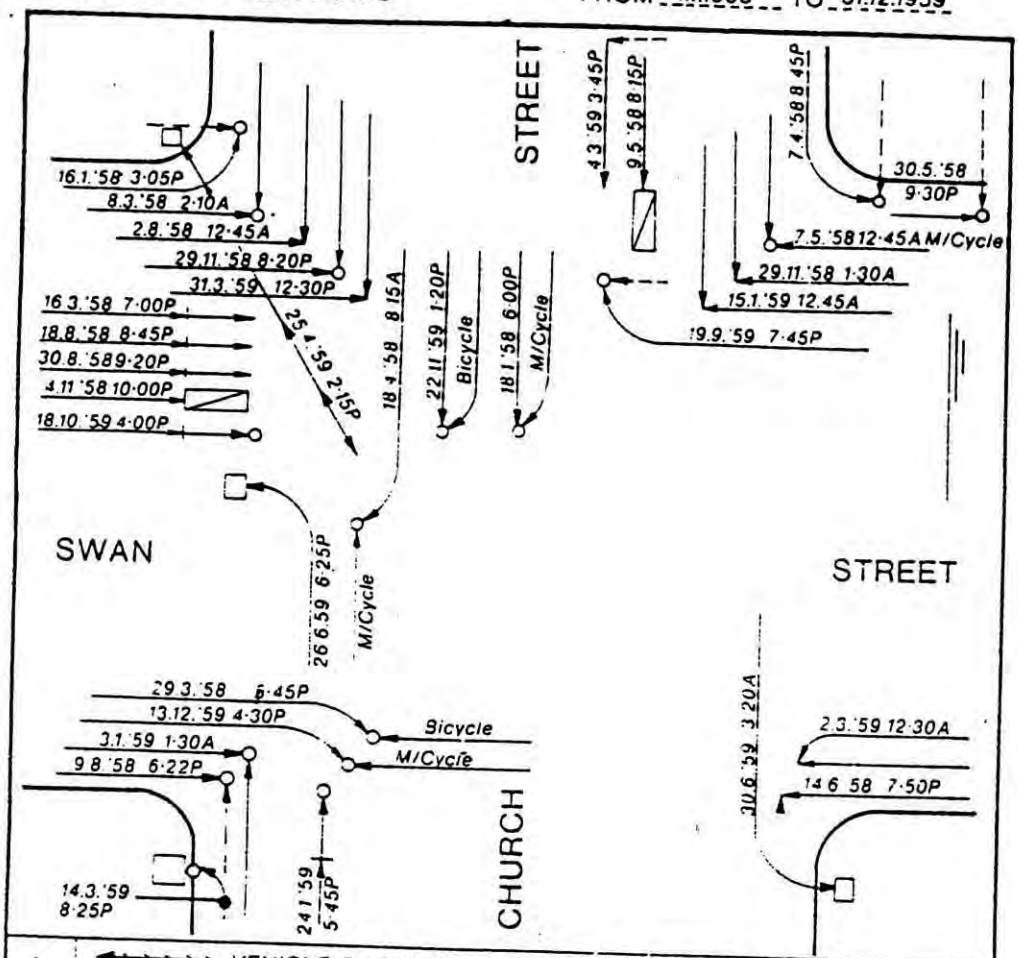
A high accident location is usually defined as a location that experiences abnormal high accidents frequencies, rates and severity of accidents.

In any program of hazardous road location identification, it is necessary to define a unit of road location. The unit might be an individual site (e.g. intersection , a spot or a road link). Two such basic units viz. intersections and links are used in this study. Collision diagram of hazardous location is illustrated in Figure 2.2. Figure 2.3 shows the hazardous road location program elements by using identification phase, investigation phase and program implementation phase.

MUNICIPALITY RICHMOND

INTERSECTION OF SWAN ST. WITH CHURCH ST.

PERIOD OF 2 YEARS FROM 1.1.1958 TO 31.12.1959



LEGEND

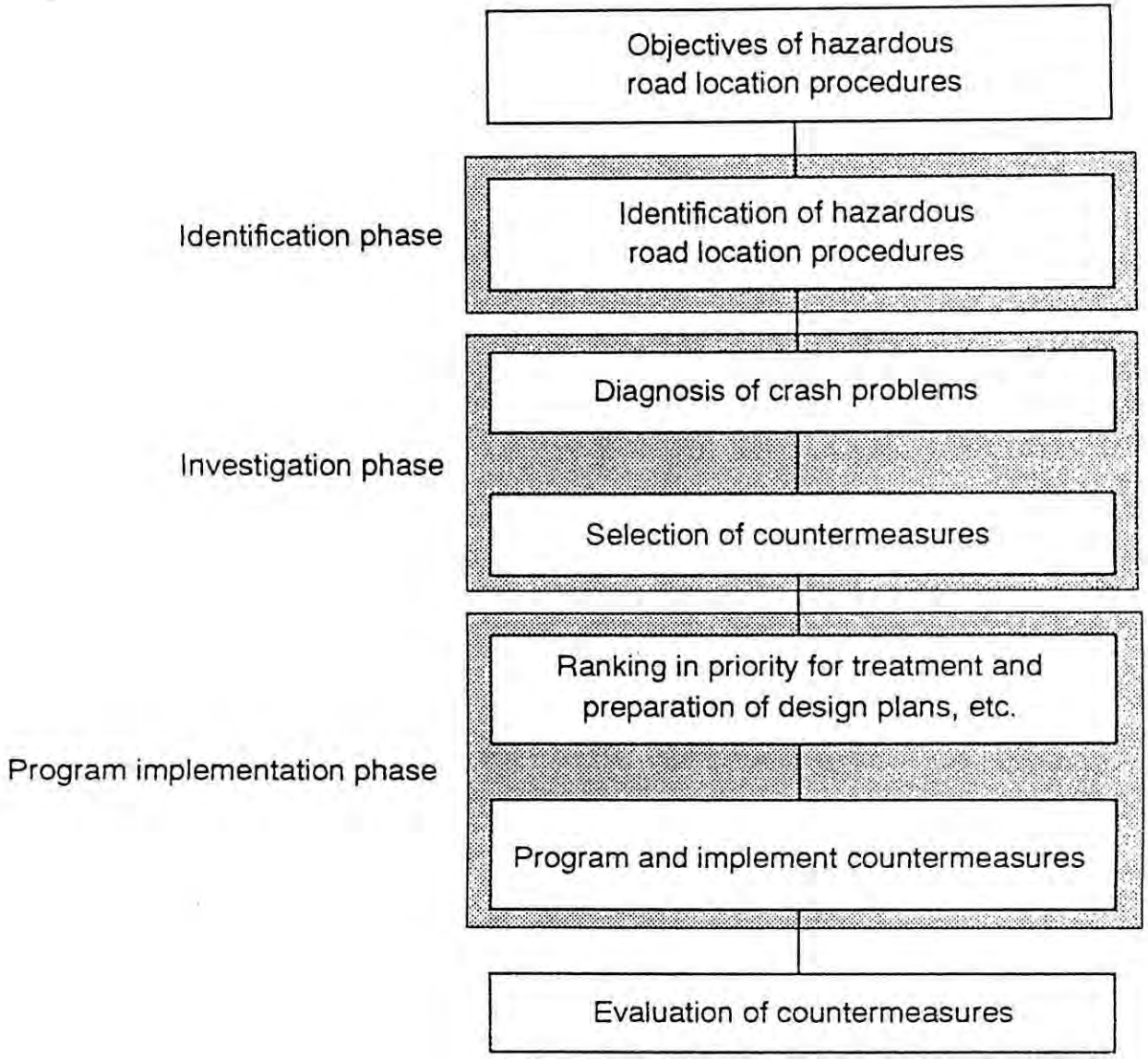
- VEHICLE BACKING
- MOVING VEHICLE
- PEDESTRIAN
- TRAMCAR
- STATIONARY VEHICLE
- PARKED VEHICLE
- FIXED OBJECT
- SIDE SWIPE
- OUT OF CONTROL
- FATAL ACCIDENT
- PERSONAL INJURY
- PROPERTY DAMAGE ONLY
- REAR END COLLISION

SUMMARY

YEAR	RESULTS OF ACCIDENTS				TOTAL
	FATAL	PERSONAL INJURY	EXTENSIVE PROPERTY DAMAGE	SLIGHT PROPERTY DAMAGE	
1958	-	10	4	14	18
1959	-	7	3	4	14

Source : National Association of Australian State Road Authorities (1976)

Figure 2.2: Typical Collision Diagram



Source: National Association of Australian State Road Authorities, 1988a

Figure 2.3 Hazardous Road Location Program Elements

2.5 LOW COST REMEDIES FOR ACCIDENT PREVENTION

Benefits of engineering countermeasures relating to the road environment are quite specific in relation to safety and flow of the traffic. The choice of specific countermeasure at a given site should be guided by scientific evidence of their expected effects on accidents as well as by engineering considerations in regard to implementation and cost.

Proven low cost engineering countermeasures are suggested for correcting the hazards of the road way sections as well as reducing accidents. Potentials of such low cost engineering countermeasures have been widely demonstrated in practice to provide the most economical result giving very good value for money spent. Some examples of low cost engineering countermeasures for reducing the accident hazards are outlined below.

- Improvement of roundabout
- Improvement of traffic signal
- Full right turn control at traffic signal
- Modifications to signals phasing
- Channelization
- Parking restriction
- Advanced warning signs
- Pavement markings
- Pavement resurfacing
- Improved street lighting
- Speed reducing humps
- Construction of median islands
- Removal or relocation of obstruction
- Prohibition of turns at guard rails
- Improved super elevation and alignment
- Improved delineation
- Skid resistant treatment etc.

Accident reduction by low cost engineering countermeasures are specifically detailed out in Table 2.2

Table 2.2
Low Cost Remedies For Specific Accident Hazard In Urban Areas.

Accident Type	Remedy
JUNCTION	
Turning traffic	Channelization.
	Roundabout or traffic signals
	Exclusive signal phase
	Prohibition of turn
Overshoot from minor roads	Traffic islands (real or ghost).
Pedestrian.	Traffic islands.
	Traffic signal with pedestrian phase.
	Refuges
	Crossing facilities
	Guard rails/fences
Restriction of sights	Removal or reducing of obstruction.
Overtaking	Channelisation
	Marking
Darkness	Lighting
	Reflective signing/marking
NON JUNCTION	
Pedestrian	Light controlled crossing (subway or bridges).
	Wider foot ways
	Guard rails/fences.
	Prohibition of parking.
	Speed reducing humps
Parked vehicles.	Parking controls
	Restriction on parking.
Cycle involvement.	Special lanes delineated.
Excessive speed.	Speed limits
	Enforcement.
	Speed reducing humps.

Source : SABEY, B.E. (1985)

CHAPTER THREE

Methodology and Study Design

CHAPTER 3

METHODOLOGY AND STUDY DESIGN

3.1 INTRODUCTION

This chapter outlines the different steps for accident data sources , data collection procedures and accident research methodology with the limitations of the study. Accident data recorded from Demra police station during January 92 to June 95 (3.5 years) and this data transcribed in the accident transcription sheet by using DCA codes (definition for coding accidents). This data used for detailed accident analysis such as collision diagram for hazardous section (intersection & link of road), Tables, Figures ,Photographs etc. The scope of the present study is limited because sufficient accident data & information are not available. Despite there limitations, an attempt has been made in this study for safety improvements of the traffic in the study area.

3.2 ACCIDENT RESEARCH METHODOLOGY

3.2.1 Methodological Considerations

Traffic accident research methods can be broadly categorized under three major headings: theoretical, empirical and simulative (Hoque, 1988). By far the largest amount of accident research has been attributed to the second category of approach i.e. empirical analysis of accidents. In general two broad division exist in a accident analysis namely (1) Detailed technical investigations of accident events and (2) Collection of accident data from the Police Stations. A sample of accident studies in the technical category is the analysis of accidents using a collision diagram. A collision diagram (shown in Figure 4.3 through Figure 4.6) is intimately concerned with a procedure to show the nature and associated details of all accidents that occurred at a location. Preparation of site specific collision diagrams determines the patterns of accident types and gives clues to the reasons for accidents and thus directs toward appropriate remedial measures.

3.2.2 Accident Type/Location Technique

Andreassend (1982) has developed an accident research methodology called "accident type/location" technique. This technique used accident type classifications similar to the concept of collision diagrams and combines with accident location descriptions such as intersection and link. This technique has been useful in determining the particular nature of an accident problem and assisted in the evaluation of accident countermeasures. (Andreassend 1980; Hoque and Andreassend 1980, Hoque 1986).

3.2.3 Framework of Accident Analysis

The application of the advanced technique has been demonstrated (Hoque, 1988) in assessing the safety problem on various road classes in a more objective manner and also in understanding the changing characteristics of the accident phenomenon over time. Collection of relevant data is seen as the first operational step in the analysis process. Together with accident data, it is vital to define and use two fundamental variables - accident types and road classes. The next step that in the process is the identification of accident location with respect to accident types and road classes. In order to use the information thus obtained in developing accident countermeasure programs, it is necessary to first determine the problems and hence to develop a ranking of accident types and locations in the priority program. By receiving and understanding the results obtained through analysis (performed as each step as described), an analysts is in a position to determine the specific nature of the accident problems and hence to develop appropriate measures to minimize it.

The primary source of accident data use the accident records as collected and maintained by the Police Department. The reporting procedure requires the reporting of accidents of all standard classified levels (viz. fatal, injury and property damage). Standard official report forms are used for reporting and investigation of accident. The Police Department maintains two different cases viz. First information report (FIR) and Motor collision report (MCR) depending upon the degree of severity of accidents. A sample of First information report (FIR) is shown in Appendix-A.(Figure A.3).

3.3 METHODOLOGY USED IN THE STUDY

This research is primarily concerned with detailed analysis of accident statistics and associated traffic information. The systematic approach followed in the following sections.

3.3.1 Preliminary Works

At the outset of the study , correspondences were made with the related agencies viz. the police department and Roads & Highway department for faciliting the collection of accident data. Respective police station was visited for knowing the availability and systems of recording information. This led to determination of the study period of 3.5 years (January 92 to June 95) for purposes of utilizing accident data.

3.3.2 Police Accident Records

The primary source of accident data use the accident records as collected and maintained by the Police Department. The reporting procedure requires the reporting of accidents of all standard classified levels (viz. fatal, injury and property damage). Standard official report forms are used for reporting and investigation of accident. The Police Department maintains two different cases viz. First information Report (FIR) and Motor Collision Report (MCR) depending upon the degree of severity of accidents. A sample of FIR is shown in Appendix-A. (Figure A.3).

3.3.3 Accident Data Collection

Accident information was not available in any format except the original accident report forms. Accordingly, a considerable amount of time and effort were spent in extracting and coding information from the record forms. Frequent trips were made to the respective police stations for this purpose. Since accident analysis is only as good as the data on which it is based , the basic data items required for any scientific investigation of the accident problem are normally summarized in three categories of variables viz. the road user variable, the vehicle variable, the environmental and other variable (Andreassen and Evangelon, 1990). The standard accident variables are shown in Table 3.1

Table 3.1
Common Core Data Items

A.	The Road-User Variables	
1	Road user type	Driver Motor Cyclist Pedal Cyclist Passenger Motor car passenger Pedal cycle passenger Pedestrian Other
2	Age in single year	
3	Sex	
4	Extent of injury	killed or died within 30 days injured, admitted to hospital injured, required medical treatment injured, not requiring medical treatment (also not injured, see item 7)
5	Licence Type	full learner probationer unlicensed
6	Licence Origins	state country
7	All Occupants	age sex seating position total number of occupants (injured or not)
B.	The Vehicle Variables	
1	Registration number	
2	Vehicle type	passenger car, utillity, panel van, wagon motorcycle other motor vehicle pedal cycle train tram other
3	Make and year of manufacture *	

4	Vehicle towed/not towed from scence				
5	Standardised code of damage and damage location recommended (Total number of vehicles is not specifically mentioned but without it total occupants is meaningless)				
C.	<u>Environment and Other Variables</u>				
1	Roadway features		intersection (cross, T, Y, multi, interchange) non intersection (. median opening, crossove . railway crossing . bridge, causeway, culvert) road alignment (straight, curve) divided/undivided		
2	Location type		local government area speed zone highways/other roads		
3	Accident type	(a)	vehicle/vehicle collision on carriageway - vehicles in traffic - vehicles parded		
		(b)	single vehicle accidents		
			(i)	on carriageway	overturning struck object struck pedestrain struck animal passenger accident
			(ii)	off carriageway	without colliding struck object struck vehicle struck animal struck pedestrian
			(iii)	other accidents	
4	Day				
5	Date				
6	Time (hourly intervals in tabulation)				

* could be obtained from registration records (total number of vehicles)

Source : Hoque (1990)

The specific accident items of data that were available from Police Statistics in Demra Thana included the following:

- Accident location : Intersection, link etc.
- Accident severity : Fatal, injury and property damage.
- Time of accident : Hour, day light/dark time etc.
- Date of accident : Month of the year, day of week etc.
- Vehicle types : Car, bus, truck, minibus, rickshaw etc.
- Accident type : Determining specific types by using DCA code.
- Number of persons killed
- Number of persons injured
- Objects hit : Tree, electrical pole, bridges, ditches etc.
- Damage costs : Vehicle, property damages etc.
- Age and sex of casualties
- Direction of vehicular travel

The above information was extracted from the accident report forms as well as other associated documents and the collected data were transmitted to the accident transcription sheets. The data were then processed by the computer for desired analysis and outputted results.

An accident transcription sheet was prepared to transcribe each of the elements of accident information from the original report forms. A sample transcription sheet is shown in Figure A.1 (Appendix -A).

3.3.4 Coding, Editing and Validation of Data

The specific details of accidents as transcribed in the transcription sheets were then numerically coded. Due to poor reporting system of accidents it was necessary to develop a process for rechecking and cross referencing of accident information particularly the location and type of accidents. This task was needed to increase the reliability and validity of the results.

The coded data were then processed manually to have the following outputs :

- Accumulated all accidents at each individual intersection location.
- Accumulated all accidents at each individual mid block location.
- Listing of detail accident characteristics.
- Listing of DCA codes (definition for coding accident) by decreasing frequency.
- Listing of detailed accident characteristics of selected arterial roads in Metropolitan Dhaka City.

3.4 LIMITATIONS OF THE STUDY

The scope of the present study is limited as many of the different and important aspects have not been available e.g. road conditions, lighting conditions, the road surface (wet, dry etc.) conditions, traffic control devices at the accident scenes, location of accidents whether at intersections or at road links (mid blocks) etc. These deficiencies created problems in the evaluation of basic causes of accidents. In addition, the sketch of a specific accident location and the initial events of accident were also needed. The above information if available would help for more detailed analysis of the accidents and to draw the collision diagrams at the most hazardous locations. The costing of road accidents in economic terms is very essential in carrying out proper economic or cost effectiveness analyses. But adequate details of accident cost information were not available. Despite these limitations an attempt has been made in this study to explore the possibilities of developing effective safety measures in the sense that very limited study pertaining to traffic accidents on selected arterial roads in Metropolitan Dhaka has been conducted so far.

CHAPTER FOUR

Data Analysis and Findings of the Study

CHAPTER 4

DATA ANALYSIS AND FINDINGS OF THE STUDY

4.1 ROAD INVENTORY

This study was made on the sections of Dhaka-Chittagong road, Dhaka-Naryanganj road, Dhaka-Demra road and Sayedabad road. These road sections accounted for a total length of 13.5 km (shown in Fig.1.2). These section of roads varied in geometrical and environmental conditions. For accident analysis purpose, the roads were divided into five intersections and eleven links (mid block locations) to locate the accident by location (shown in Fig.1.2).

4.2 ACCIDENT STATISTICS

Accidents reported only by the traffic police during the period January 92 to June 95 (three and a half years) on the selected arterial roads in Metropolitan Dhaka City were used in this study. Total 517 recorded accidents were analyzed in details in this study. There were 161, 150, 116 and 90 accidents occurred during the period of 1992, 1993, 1994 and 1995 (upto June) respectively. Table 4.1 shows the distribution of accidents by severity.

Table 4.1.
Number Of Accidents By Severity In The Study Area Under Demra Police Station (January 1992 To June 1995).

year	fatal/death	injury	property damage	total
1992	40/41*	83/177**	38	161
1993	59/62*	67/114**	24	150
1994	47/47*	59/85**	10	116
1995 (up to june)	29/34*	42/117**	19	90
grand total	175/184*	251/493**	91	517

Source :- Demra metropolitan police station accident data
*Persons killed.
** Persons injured.

Fig.4.1 shows that total number of accidents as well as the number of fatalities . It seems that the number of accidents are reducing from year to year but the fatalities are flactuating with increased number. These indicates the problems of inconsistent reporting of accidents.

Fig.4.2 shows the distribution of all accidents by severity, fatal 33.8 %, injury 48.6 % and property damage 17.6 %.

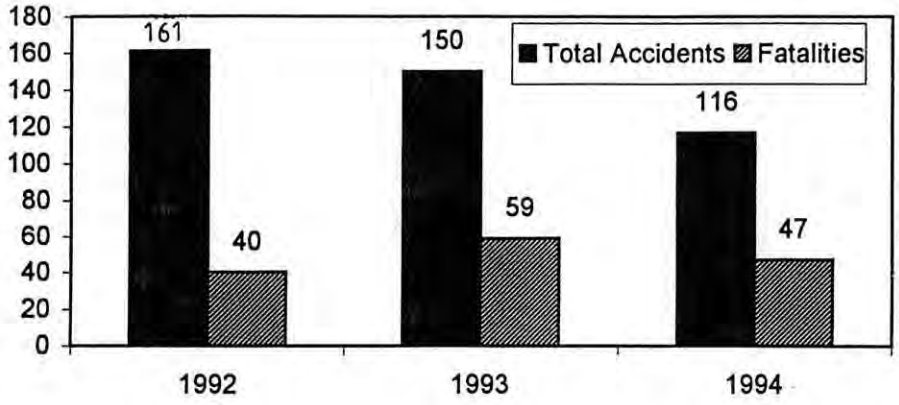


Figure 4.1 Number of Road Accidents and Fatalities for Demra Area From January 92 to December 94

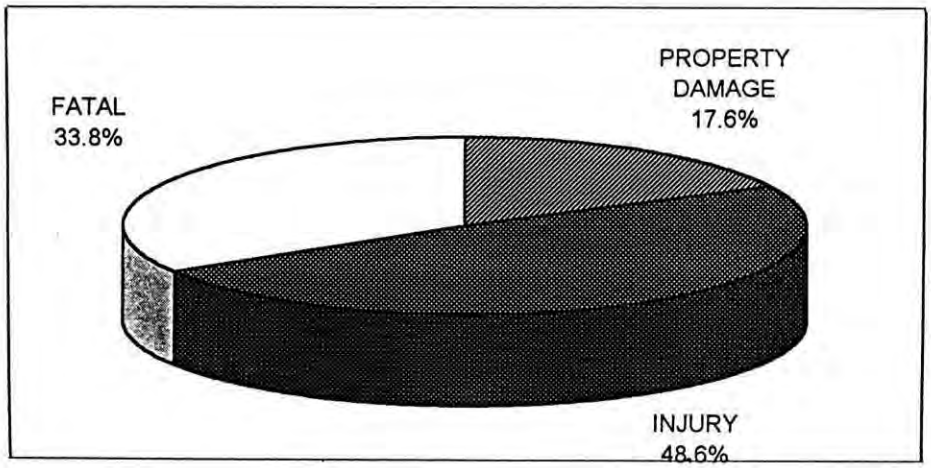


Figure 4.2 Percentage of Road Accidents by Severity from January 92 to June 95

4.3 DISTRIBUTION OF ACCIDENTS BY LOCATION

It is evident from the table 4.2 that the greatest percentage (29.6 %)of total accidents occured in the link 1-2 (Sayedabad road). This may be primarily due to high percentage of pedestrian accidents (DCA 01- 09) involved with fast moving vehicles in the poorly maintained roadway facilities. For further details data are given in Tables 4.2 to 4.6 for different years.It was found that out of 517 accidents, approximately 15.5% took place at intersection and rest 84.5% at mid-blocks.

Detailed location diagrams of accidents are shown in Figures 4.3 to 4.6. Figure 4.3 shows the collision diagram of accidents according to different locations with some detailed information such as date and time of accidents, type of vehicle and type of accidents involved . These locations are :

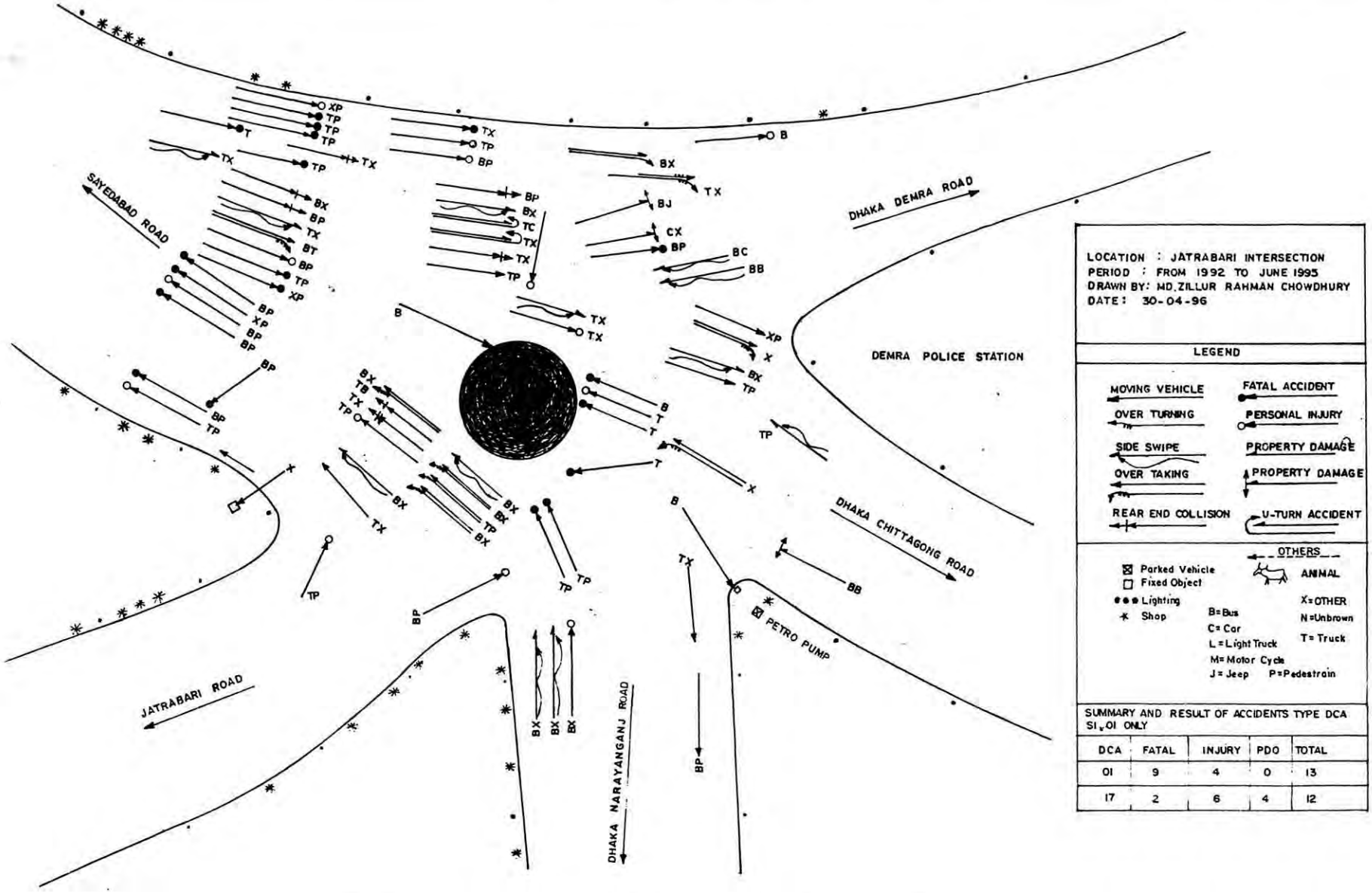
- Jatrabari intersection
- Sayedabad road (link 1-2)
- Section of Dhaka-Naryanganj road (link 8-9)
- Section of Dhaka-Chittagong road (link 2-6)

Table 4.2 shows the distribution of accidents; length of all link of roads in the study area during the year January 1992 to June 1995.

Table 4.2
Listing Of Frequent Road Accidents In Different Section Of Selected Arterial Roads In Metropolitan Dhaka From January 92 To June 95 (3.5 Years).

mid block section (see detail in fig.1-2)	length (mile)	no. of accident	percentage
1-2	0.7	153	29.6
8-9	1.25	90	17.4
2-6	2.25	76	14.7
2-8	0.5	51	9.9
2-3	1.25	43	8.3
6-7	2	39	7.5
9-10	0.75	25	4.8
3-4	1.25	18	3.5
4-5	0.62	16	3.1
5-7	1.75	4	0.8
10-11	1	2	0.4
total	13.325	517	100

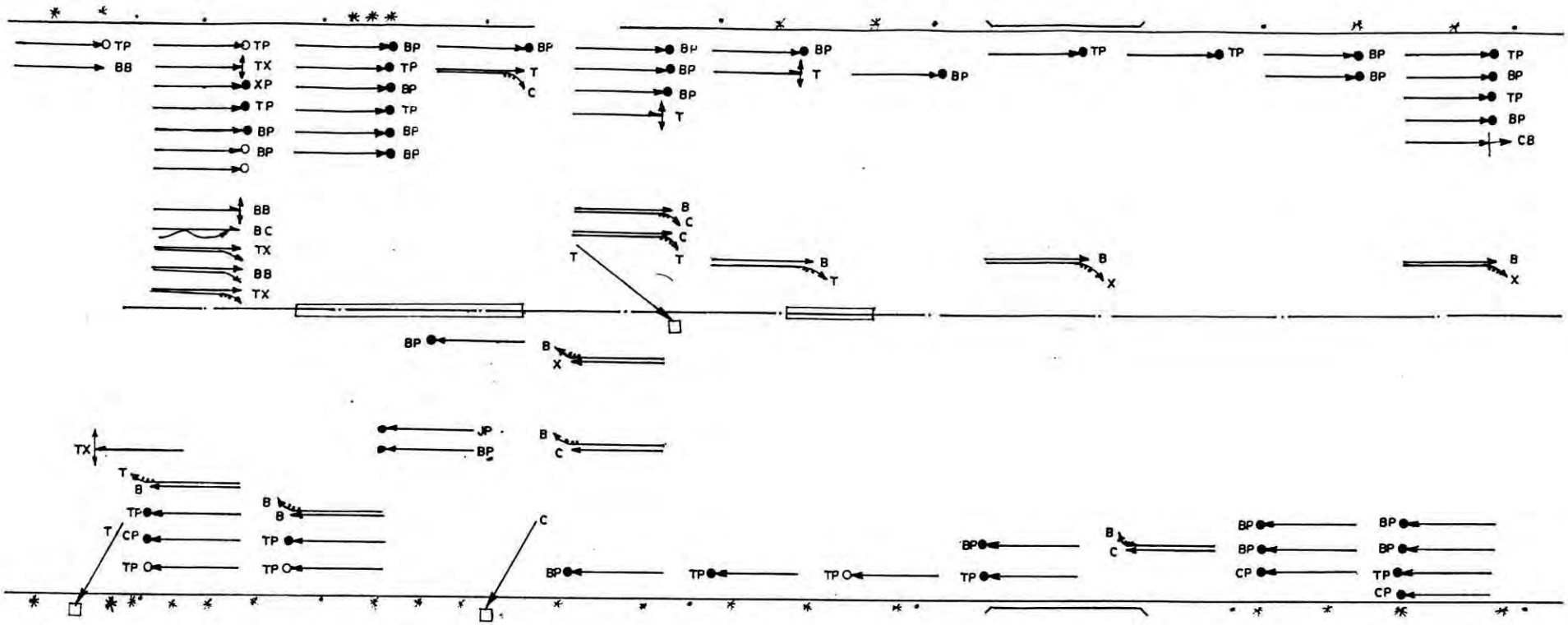
Source: Demra Metropolitan Police Station Accident Data



SUMMARY AND RESULT OF ACCIDENTS TYPE DCA SI, OI ONLY

DCA	FATAL	INJURY	PDO	TOTAL
01	9	4	0	13
17	2	6	4	12

FIGURE 4.3 DISTRIBUTION OF ACCIDENTS FOR "JATRABARI INTERSECTION"



ROAD : HIGHWAY
LOCATION : SHAMIBAGH RAIL CROSSING TO JATRABARY INTERSECTION
LENGTH : 0 7 mile
PERIOD FROM 1992 TO JUNE 1995
DRAWN BY : ZILLUR RAHMAN CHOWDHURY
DATE : 30. 04. 96

0 mile — 0.7 mile

SUMMARY AND RESULT OF ACCIDENTS TYPE DCA SI, OI ONLY

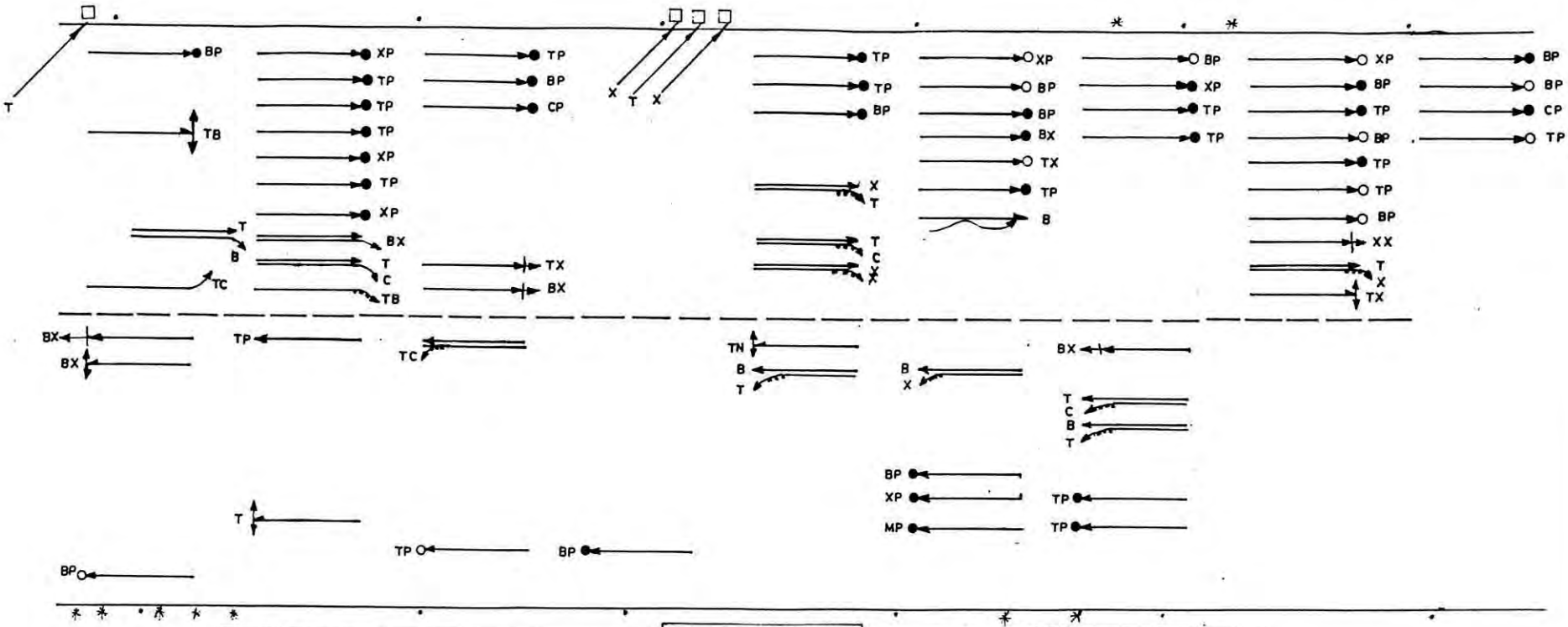
DCA	FATAL	INJURY	P.DAMAGE	TOTAL
SI	5	19	6	30
OI	16	5	0	21

LEGEND

MOVING VEHICLE
OVER TURNING
SIDE SWIPE
OVER TAKING
REAR END COLLISION
FATAL ACCIDENT
PERSONAL INJURY
PROPERTY DAMAGE
DRIVEWAY ACCIDENT
U — TURN ACCIDENT

Parked Vehicle
Fixed Object
Lighting
Shop
OTHERS
ANIMAL
B = Bus
C = Car
L = Light Truck
M = Motor Cycle
J = Jeep
X = Others
N = Unbrown
T = Truck
P = Pedestrain

FIGURE 4.4 DISTRIBUTION OF ACCIDENTS FOR LINK 1—2 (SAYEDABAD ROAD)



ROAD : HIGHWAY
LOCATION : DHOLAIPAR INTERSECTION TO POSTOGOLA INTERSECTION (DHAKA - NARAYANGANJ ROAD)
PERIOD : 1992 TO JUNE 1995
DRAWN BY: ZILLUR RAHMAN CHOWDHURY
DATE : 30. 04. 1996

SUMMARY AND RESULT OF ACCIDENTS TYPE DCA 51 01 ONLY				
DCA	FATAL	INJURY	PPO	TOTAL
51	7	12	7	26
01	17	6	0	23

Parked Vehicle
Fixed Object
Lighting
Shop
Others
Animal
X – Others
N – Unknown
T – Truck
B – Bus
C – Car
L – Light Truck
M – Motor Cycle
J – Jeep
P – Pedestrain

LEGEND
MOVING VEHICLE
OVER TURNING
SIDE SWIPE
OVER TAKING
REAR END COLLISION
FATAL ACCIDENT
PERSONAL INJURY
PROPERTY DAMAGE
DRIVEWAY ACCIDENT
U-TURN ACCIDENT

FIGURE 4.5 DISTRIBUTION OF ACCIDENTS FOR LINK 8 – 9 (DHAKA – NARAYANGANJ ROAD.)

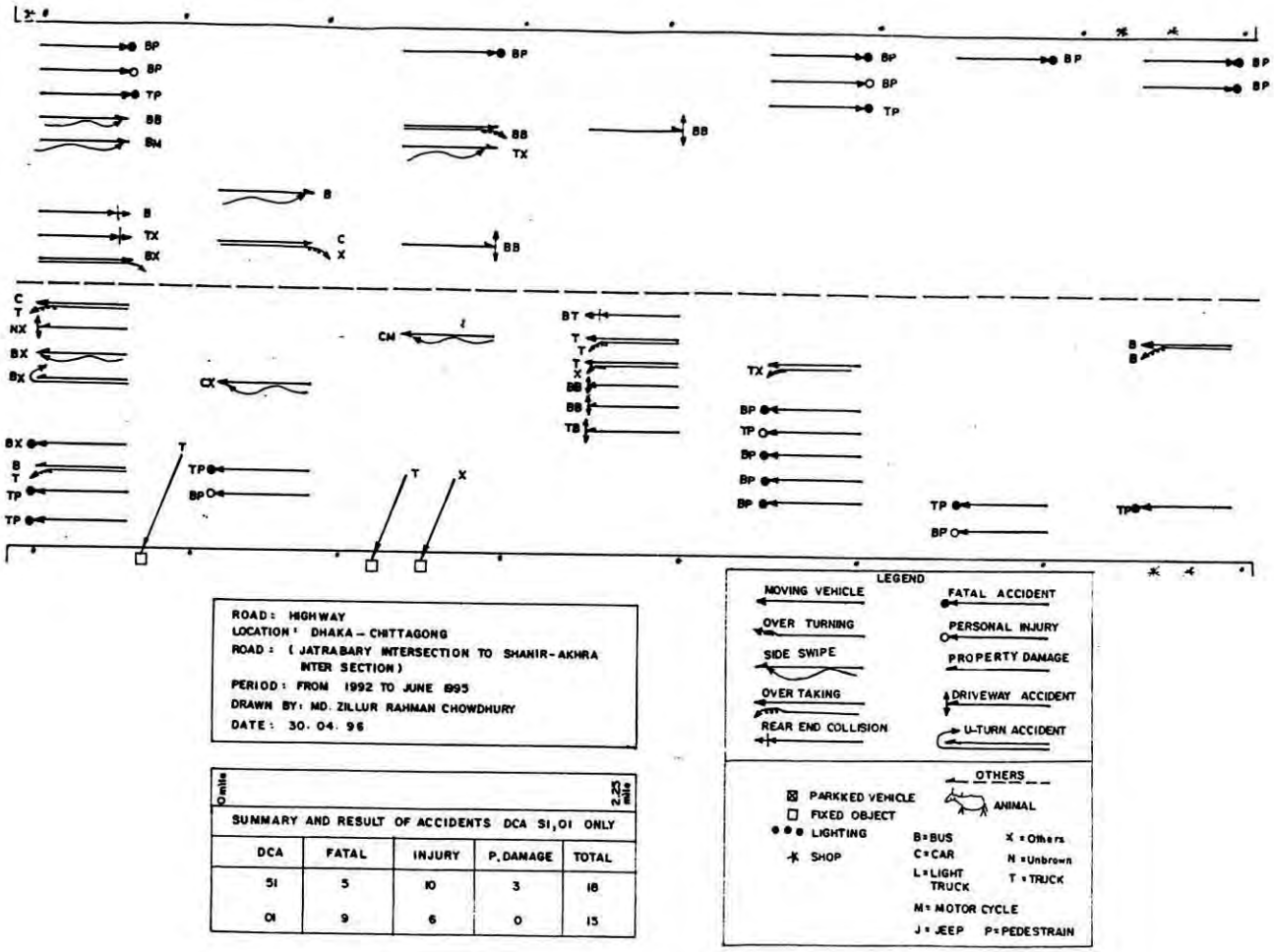


FIGURE 4.6 DISTRIBUTION OF ACCIDENTS FOR LINK 2–6 (DHAKA–CHITTAGONG ROAD)

Table 4.3 shows number of Fatal, Serious injury, Simple injury and Property damage accidents on the different links of selected roads in the year 1992.

Table 4.3
Different Types Of Road Accidents In Different Section Of Selected Arterial Roads During The Year 1992.

section	fatal	serious injury	simple injury	property damage
1-2	11	16	7	10
8-9	8	12	5	7
2-6	4	6	4	5
2-8	5	7	4	3
2-3	4	6	3	4
6-7	2	1	1	2
9-10	2	3	2	3
3-4	1	2	1	1
4-5	1	1	0	1
5-7	1	1	0	1
10-11	1	1	0	1
total	40	56	27	38

Source: Demra Metropolitan Police Station Accident Data

Table 4.4 shows number of Fatal, Serious injury, Simple injury and Property damage accidents on the different links of selected road in the year 1993.

Table 4.4
Different Types Of Road Accidents In Different Sections Of Selected Arterial Roads During The Year 1993.

section	fatal	serious injury	simple injury	property damage
1-2	20	15	6	8
8-9	8	6	3	2
2-6	12	6	5	5
2-8	4	4	3	2
2-3	4	3	1	2
6-7	3	3	1	2
9-10	2	2	1	1
3-4	3	3	1	2
4-5	2	2	1	0
5-7	1	1	0	0
total	59	45	22	24

Source: Demra Metropolitan Police Station Accident Data

Table 4.5 shows number of Fatal, Serious injury, Simple injury and Property damage accidents on the different links of selected road in the year 1994.

Table 4.5
Different Types Of Road Accidents In Different Selection Of Selected Arterial Roads During The Year 1994

section	fatal	serious injury	simple injury	property damage
1-2	15	12	5	3
8-9	9	8	3	2
2-6	5	5	2	1
2-8	4	4	2	1
2-3	5	4	2	1
6-7	5	5	2	1
9-10	1	1	0	0
3-4	1	1	0	0
4-5	2	2	1	1
total	47	42	17	10

Source: Demra Metropolitan Police Station Accident Data

Table 4.6 shows number of Fatal, Serious injury, Simple injury and Property damage accidents on the different links of selected road in the year 1995 (upto June).

Table 4.6
Different Types Of Road Accidents In Different Section Of Selected Arterial Roads During The Year 1995 (Upto June)

section	fatal	serious injury	simple injury	property damage
1-2	8	8	4	6
8-9	5	5	2	3
2-6	5	6	2	3
2-8	2	2	1	2
2-3	2	2	1	1
6-7	3	3	1	2
9-10	2	2	1	2
3-4	1	1	0	0
4-5	1	1	0	0
total	29	30	12	19

Source: Demra Metropolitan Police Station Accident Data

Comparative distribution of accidents by road links are shown in Figure 4.7 and 4.8.

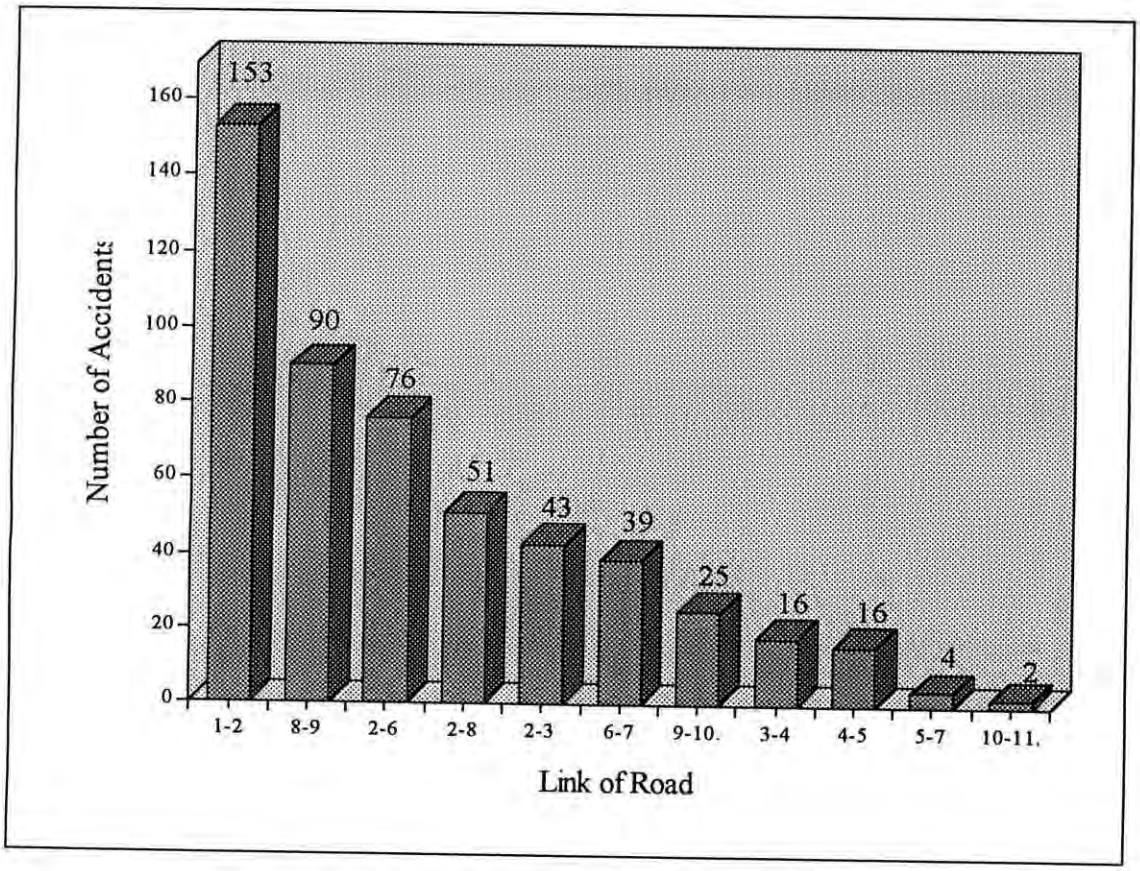


Fig. 4.7 : Total Number of Road Accidents in Different Links of Roads for Demra Area from January 92 to June 95.

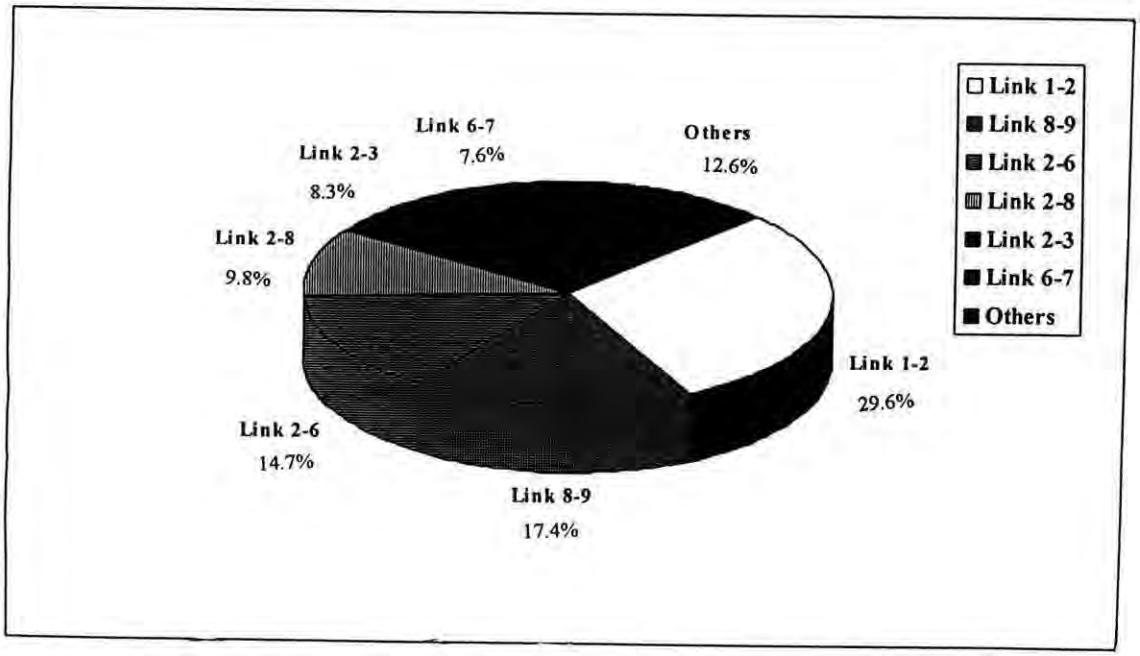


Fig. 4.8 : Percentage of Road Accidents in Defferent Links of Roads for Demra Area from January 92 to June 95.

Figure 4.9 shows the distribution of total number of accidents by four routes. It can be seen that highest number of accidents occured in the Dhaka-Naryanganj road section compared to other roads in the study area. The percentage of accidents were 32.5 % at Dhaka-Naryanganj road section, 29.6 % at Sayedabad road , 22.4 % at Dhaka- Chittagong road section and rest 15.5 % at Dhaka-Demra road .

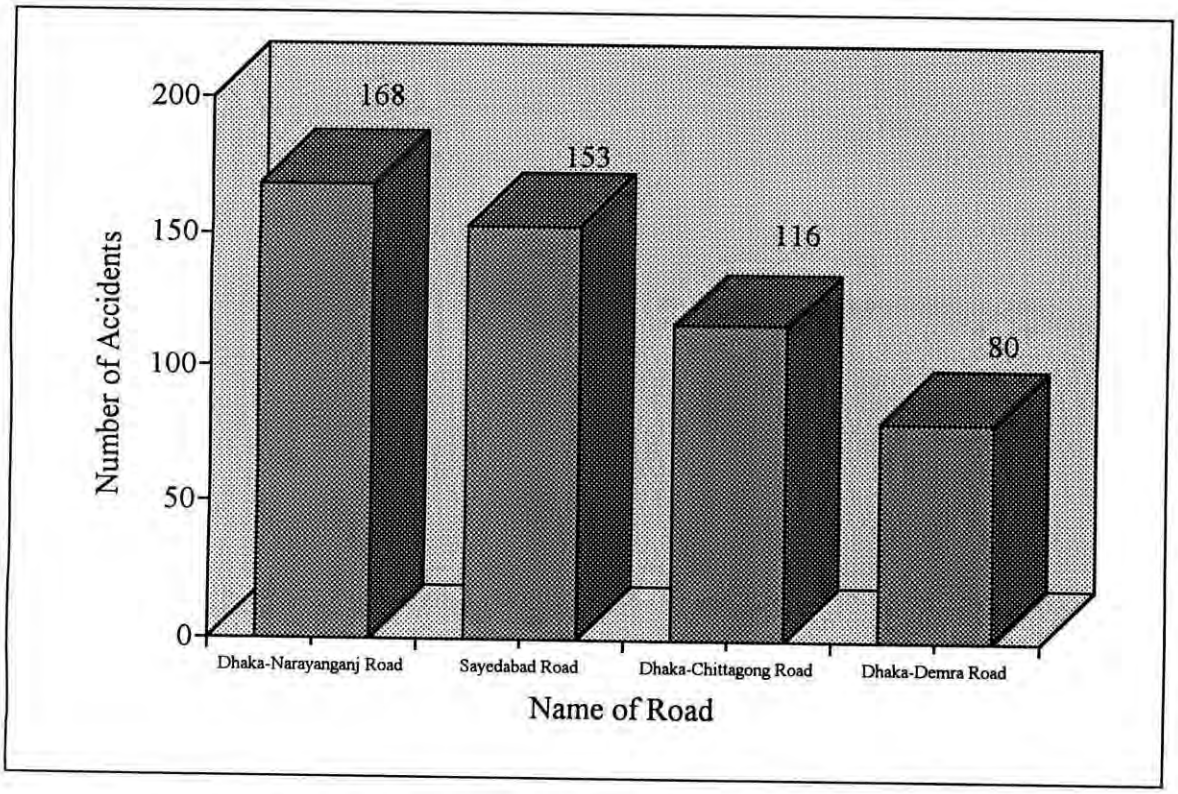


Fig.4.9 : Number of Accidents in Different Roads from January 92 to June 95.

4.4 ACCIDENTS BY TYPES

Figure 4.10 shows the percentage of accidents according to different types of DCA codes (shown in Figure 2.1). The results are also shown in Table 4.7. The accident type distribution shows DCA 51 (Overtaking accidents, head on) accident as the highest frequency accident type 20.1%). The second highest frequency (16.8%) accident type was DCA 21 (vehicles from opposite direction) accidents.Of course combining all pedestrian involved accident types (DCA 01 to DCA 09), the pedestrian accident problem was determined to be the greatest problem with approximately 33% of the accidents. It is also appropriate to consider of accidents in terms of multivehicle and single vehicle collisions to provide some insights into the roadside safety problem. There are two principal types of single vehicle collisions: striking a pedestrian and a vehicle leaving the roadway and/or striking fixed objects. In this study , 40% were single vehicles and 60% were multivehicle pedestrian involved accidents .

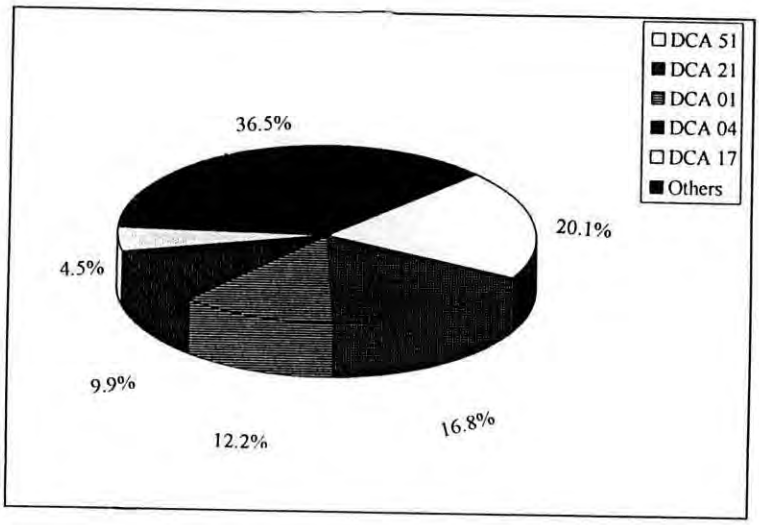


Fig. 4.10 : Distribution of DCA Code with Percentage of Accidents for Demra Area from January 92 to June 95.

Table 4.7
Distribution Of Dca Code With Number Of Accidents In Decreasing Frequently Accidents Type.

DCA	fatal	simple injury	property damage only	total	percentage
51	16	65	23	104	20.1
21	29	46	12	87	16.8
01	49	14	2	63	12.2
04	30	21	2	51	9.9
17	6	12	10	28	5.4
13	3	12	8	23	4.5
03	9	8	0	17	3.3
63	7	9	1	17	3.3
07	6	7	0	13	2.5
12	2	11	3	13	2.5
05	1	8	3	12	2.3
35	1	7	4	12	2.3
74	0	8	3	11	2.1
65	0	2	8	10	2.0
02	6	3	0	9	1.7
36	2	6	0	8	1.5
22	2	4	0	6	1.2
31	1	4	1	6	1.2
other	5	11	11	27	5.2
total	175	251	91	517	100.0
pedestrian accidents (all types)	104	67	0	171	33.0

Source :- Demra metropolitan police station accident data

4.5 DISTRIBUTION OF ACCIDENTS BY TIME, DAY AND MONTH OF THE YEAR

4.5.1 Distribution of Accidents by Time of Day

Hourly patterns indicate that traffic accidents vary considerably by hour of day. During certain hours of a day accidents occurred at the highest level. The daily time pattern of accidents is shown in Table 4.8. The occurrence of accidents during the day and night time is also tabulated. The distribution of accident were 68.7% day (6 a.m. to 6 p.m.), 30.1% night (6 p.m. to 6 a.m.) and for the rest 1.2% of accidents time of occurrence was not recorded in the accident report forms .

Figure 4.11 shows that the maximum number of accidents occured during 8.0 am to 2.0 pm . So, peak hour of accidents are 8.0 am to 2.0 pm . This Figure also shows that day time accidents are higher than night time accidents.

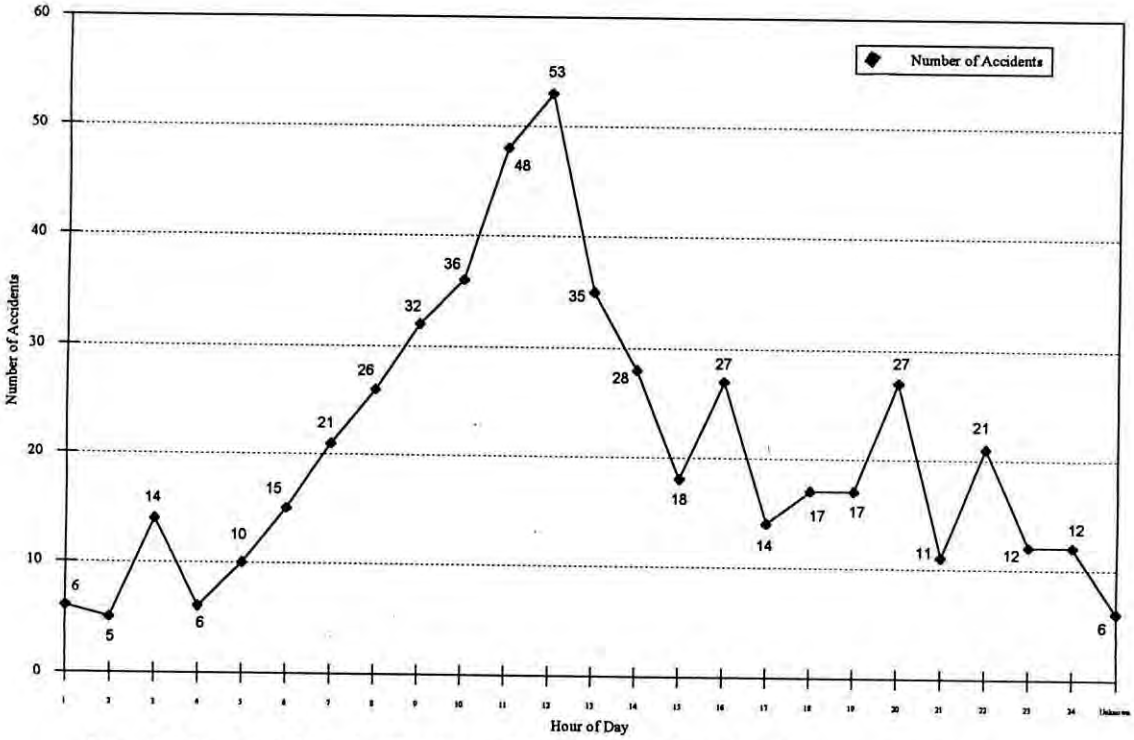


Fig. 4.11 : Hourly Distribution of Raod Accidents for Demra Area from January 92 to June 95.

Table 4.8
Hourly Distribution Of Road Accidents From January 92 To June 95 (3.5 Years).

hour of day	total accidents	
	number	percentage
00-01	6	1.1
01-02	5	1.0
02-03	14	2.7
03-04	06	1.1
04-05	10	2.0
05-06	15	2.9
06-07	21	4.0
07-08	26	5.0
08-09	32	6.2
09-10	36	7.0
10-11	48	9.3
11-12	53	10.2
12-13	35	6.8
13-14	28	5.4
14-15	18	3.5
15-16	27	5.2
16-17	14	2.7
17-18	17	3.3
18-19	17	3.3
19-20	27	5.2
20-21	11	2.1
21-22	21	4.0
22-23	12	2.3
23-24	12	2.3
unknown	06	1.2
total	517	100.0 %

Source :- Demra metropolitan police station accident data

4.5.2 Distribution Of Accidents By Day Of Week

Table 4.9 and Figure 4.12 show that the highest percentage of accidents (15.6 %) occured on Monday and the lowest percentage of accidents (11.6 %) occurred on Saturday. For about 1 percent of accidents day of week was not recorded in the data.and the rest 1.16 % of accidents was not recorded by considering day of week .

Table 4.9
Day Wise Distribution Of Accidents From January 92 To June 95 (3.5 Years)

Day	no. of accident	percentage
Monday	80	15.6
Sunday	76	14.9
Thursday	76	14.9
Wednesday	75	14.7
Tuesday	74	14.5
Friday	70	13.7
Saturday	60	11.7
Total	511	100.0

Source :- Demra metropolitan police station accident data

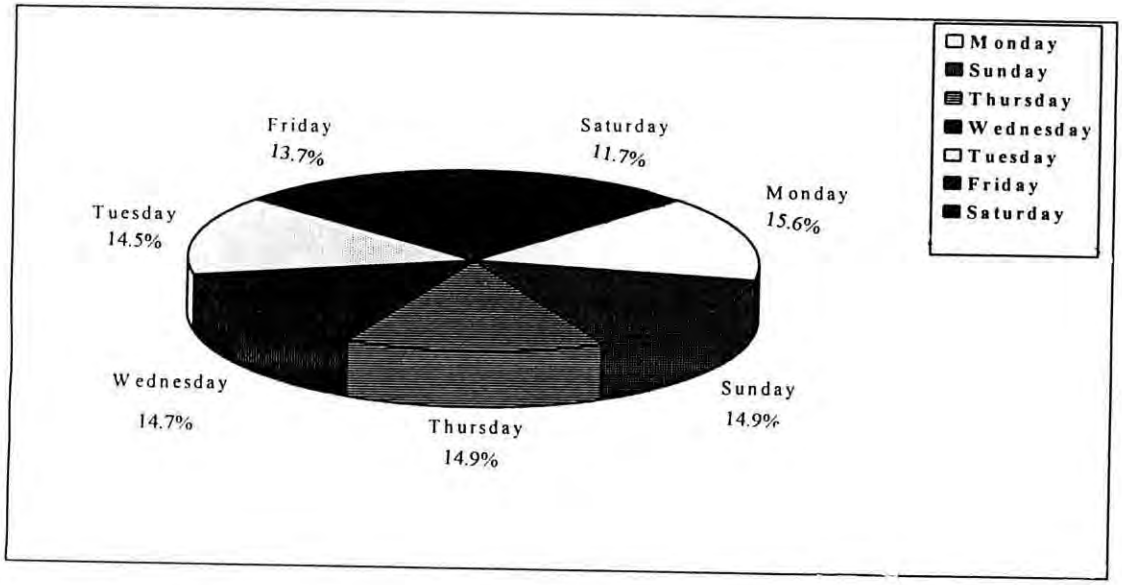


Fig. 4.12 : Distribution of Road Accidents by Day of Week for the Demra Area from January 92 to June 95.

4.5.3 Distribution Of Accidents By Month Of The Year

The number of accidents were likely to vary with different months of the year. The Table 4.10 and Figure 4.13 show the number of accidents involved in different month of the year. The average number of accidents per month is 36 (8.4%). Accidents were much above average in four months such as April, May, July and November and were below average in the remaining months. The highest percentage of accidents was observed in the month of April which accounted for about 47 (11.0%).

Table 4.10

Monthly Distribution Of Road Accidents From January 1992 To December 1994 (3 years)

month	total road accidents	fatalities	serious injuries	minor injury	property damage only
january	36	15	10	7	4
February	35	11	12	5	7
March	33	10	7	11	5
April	47	19	11	12	5
May	42	18	17	4	3
June	29	12	12	2	3
July	42	15	17	4	6
August	33	10	13	4	6
September	32	8	12	5	7
October	28	8	10	3	7
November	42	13	14	8	7
December	28	11	12	1	4
Unknown	90	25	26	12	27
Grand Total	517	175	173	78	91

Source :- Demra metropolitan police station accident data

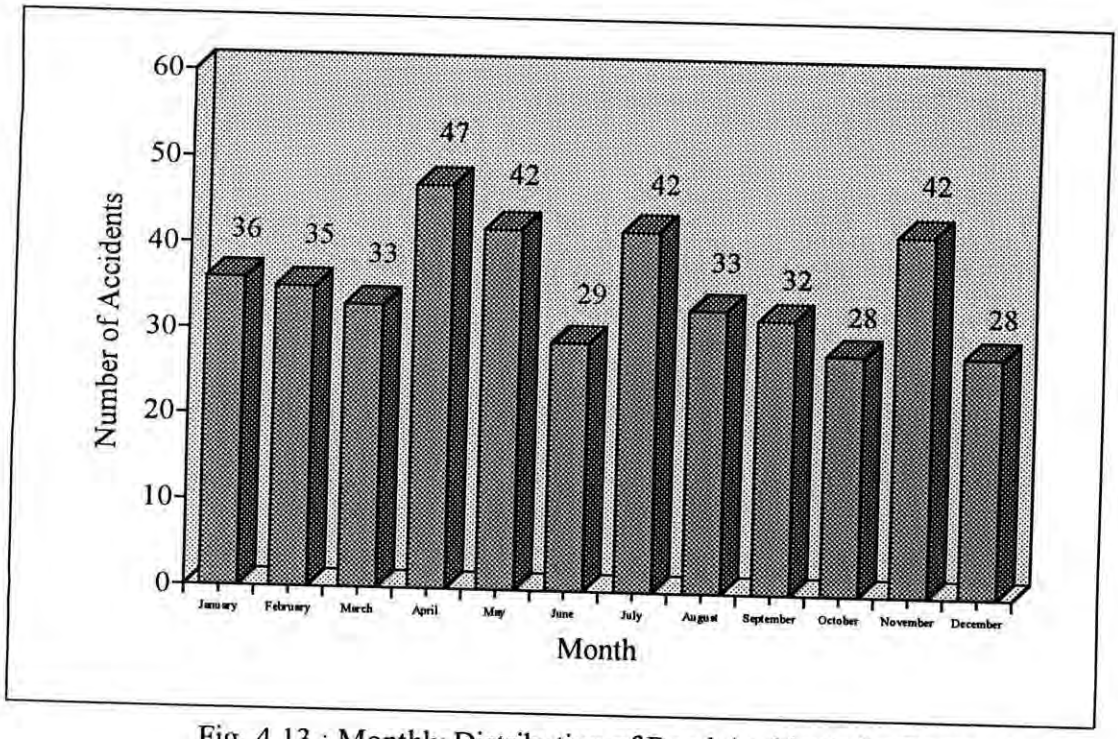


Fig. 4.13 : Monthly Distribution of Road Accidents for Demra Area from January 92 to December 94.

4.6 VEHICLES INVOLVED IN ACCIDENTS

It was found that a total of 605 vehicles was involved in 517 accidents. The greatest percentage was trucks (approximately 27.3 %) and the next highest group was buses (approx.imately 22.0 %). The Figure 4.15 shows the vehicles involved in the accidents without any consideration of the single vehicle or multivehicle involvement. The data are shown in Table 4.11 & Table 4.12). Table 4.11 shows the total number and percentage of vehicle involved in the total accidents during the year January 92 to June 95 . Table 4.12 shows the total number of predominant types of vehicles involved in the different category of accidents . Figure 4.14 also shows the percentage of vehicles involved in the accidents.

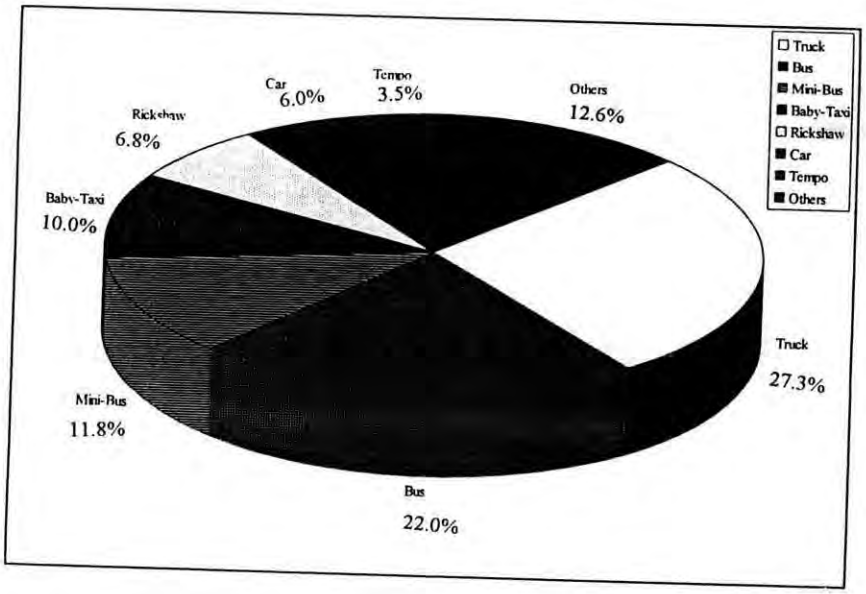


Fig. 4.14 : Type of Vehicles Involved in Road Accidents for Demra Area from January 92 to June 95.

Table 4.11

Types Of Vehicles involved In Road Accidents From January 1992 To June 95 (3.5 years)

types of vehicle	no. of vehicles involved in accidents	% of vehicles involved in accidents
Trucks	168	27.3
Bus	133	22.0
Mini-Bus	71	11.8
Baby-Taxi	60	10.0
Rickshaw	41	6.8
Car	36	6.0
Tempo	21	3.5
Motorcycle	13	2.2
Microbus	12	2.0
Jeep	5	0.9
Pushcart	5	0.9
Van	4	0.7
Cycle	4	0.7
Pickup	3	0.5
Unknown	8	1.3
Other	21	3.4
Total	605	100.0

Source :- Demra metropolitan police station accident data

TABLE 4.12

TYPES OF VEHICLE INVOLVED IN DIFFERENT CATEGORIES OF ROAD ACCIDENTS FROM JANUARY 92 TO JUNE 95 (3.5 YEARS)

type of vehicle	no. of vehicle involved	no. of vehicle involved in fatalities	no. of vehicle involved in serious injury	no. of vehicle involved in minor injury
Truck	168	32	36	100
Bus	133	23	31	79
Car	36	4	11	21
Tempo	21	2	12	7
Baby-Taxi	60	6	19	35
Motorcycle	13	2	4	7
Minibus	71	4	21	36
Rickshaw	41	0	4	37

Source :- Demra metropolitan police station accident data

4.7 PEDESTRIANS INVOLVED IN ACCIDENTS

Investigation of all accident types in the study area, revealed pedestrian accidents as the greatest problem having the highest percentage (approx. 33%) of total accidents as indicated earlier. This is due to lack of pedestrian facilities in the study area.The study also indicated that the maximum number of pedestrian accidents occurred in the Sayedabad road (Link 1-2). Comparing all pedestrian accidents, percentage of Fatal and DCA - 01 acciidents are the highest in the syudy area . Pedestrian crossing roads (near side) accounted for the greatest percentage of pedestrian accidents (12.2%). Of the fatal accidents, pedestrians accounted for about 60 percent .

4.8 DETAILED INVESTIGATION OF HAZARDOUS LOCATIONS

Accident types were further identified at different hazardous road locations viz. intersections & links . These are discussed in this section.

4.8.1 Hazardous Intersections

A total of five intersections were identified as potentially hazardous using the criteria of an intersection experiencing 10 or more accidents occurred during the study period (3.5 years). The analysis procedure particularly looks for the accident characteristics of the accident types and therefore, frequency of accident types were also identified at each intersection for effective remedial measures.

The Jatrabari intersection near Demra police station was determined to be the highest accident frequency location with 69 accidents and accounted for approximately 13.3 percent of total 517 accidents. Out of 69 accidents (all types) at this location, DCA- 51 (Overtaking accident, Head on) were 13 (18.9 %), DCA- 01 (Near side, pedestrian on foot) were 12 (!7.4%), DCA-04 (playing, working, standing on carriageway) were 11 (15.9%) .The next frequent accident type is DCA- 17 (vehicle from adjacent approaches through-left) approximately 14.5%. The frequency of DCA at this intersection is listed in Table 4.13. The second most frequent accident location was "Postogola intersection" at Dhaka-Narayanganj road near Buriganga Bridge and third most frequent accident location was "Shamibagh rail crossing" near Saidabad Bus-stand. Pattern of accidents by hour of day and day of week at selected intersections were also investigated.

The predominant types of vehicles also identified at Jatrabari intersection. Trucks were mostly involved in the accidents and were represented for about 40 % of the 69 accidents. The next highest group was buses which accounted for about 28 % of the 69 accidents.

Table 4.13
Different Types Of Road Accidents According To Dca Codes At Most Hazardous Intersection (Jatrabari Intersection)

DCA	fatal	injury	property damage only	total accident	percentage
51	9	4	0	13	18.85
01	2	6	4	12	17.4
04	0	6	5	11	15.92
17	6	4	0	10	14.5
other	8	10	5	23	33.34
total	25	30	14	69	100

Source :- Demra metropolitan police station accident data

Fig. 4.15 shows that DCA 01 accidents are dominantly involved in the accidents at Jatrabari intersection. Fig. 4.16 shows percentage of Fatal, Injuries and Property Damage type of accidents which occurred at Jatrabari intersection.

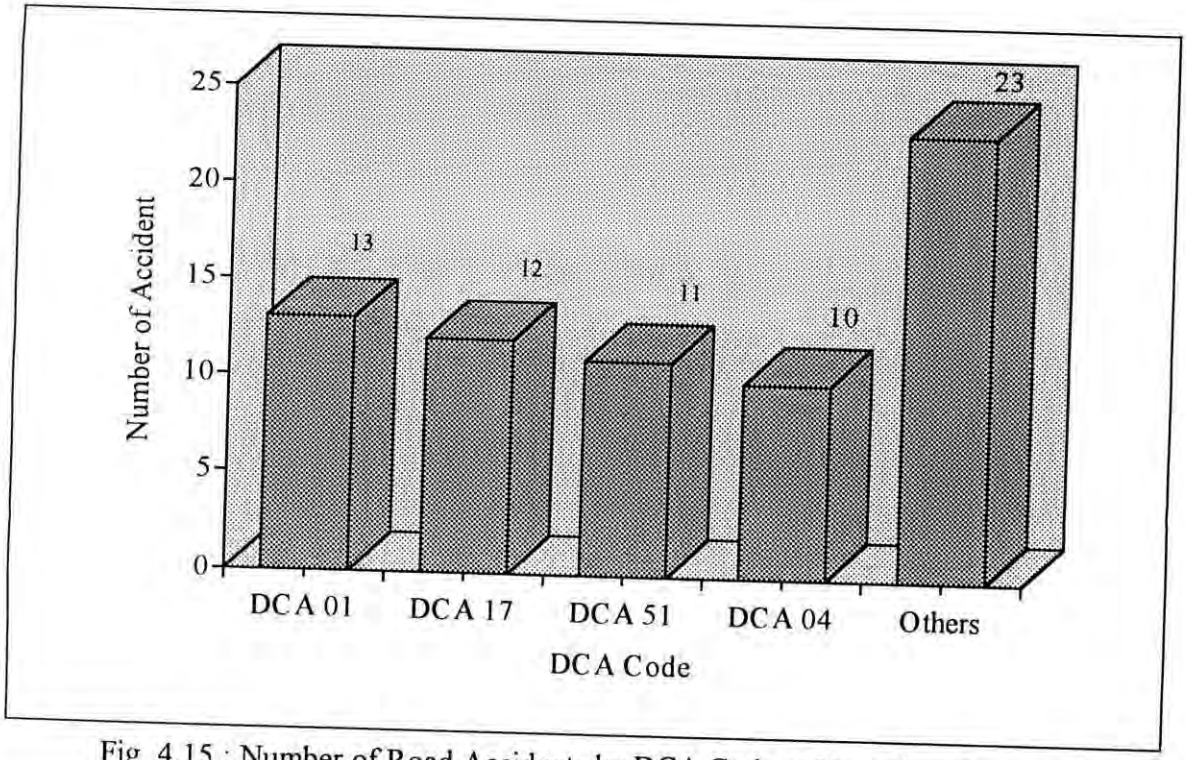


Fig. 4.15 : Number of Road Accidents by DCA Code at Hazardous Intersection 'Jatrabari' from January 92 to June 95.

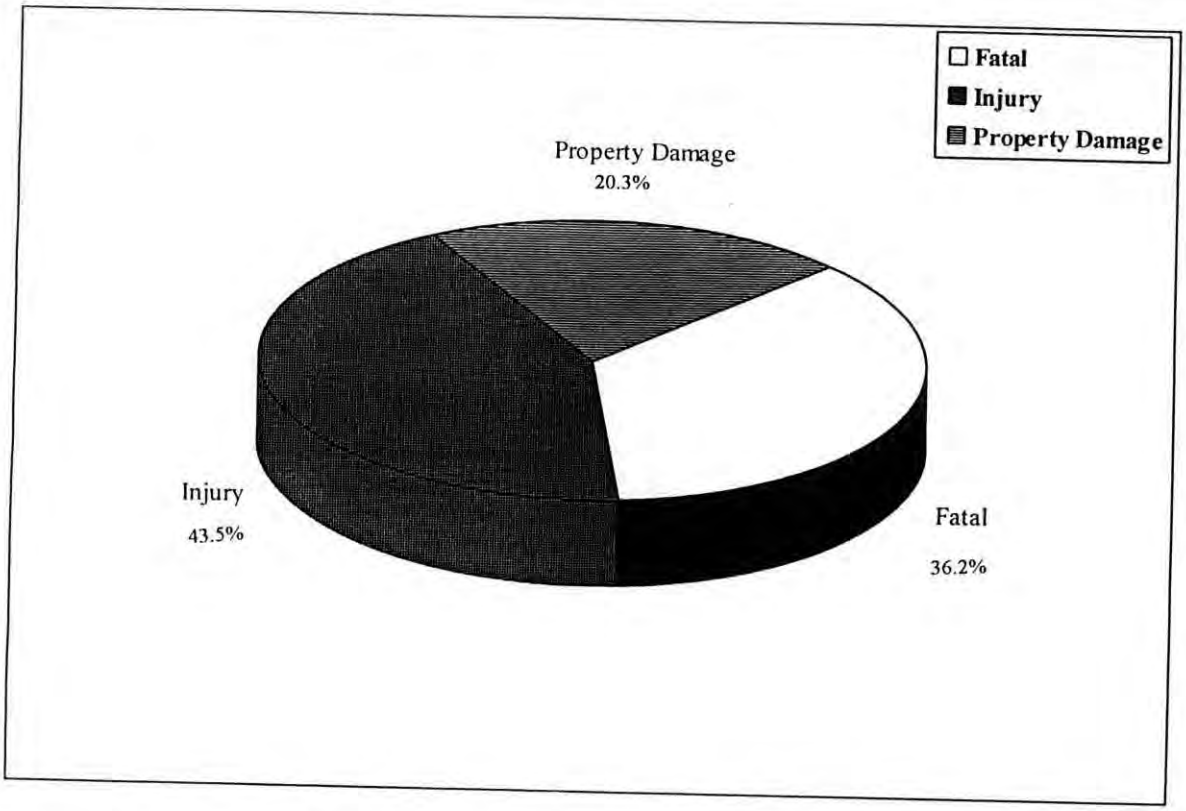


Fig. 4.16 : Road Accidents by Severity at Most Hazardous Intersection 'Jatrabari' from January 92 to June 95.

4.8.2 Hazardous Mid-Block Locations

The particular mid block locations were examined to determine the accident problem charecteristics at different links.

In all, the study identified eleven highway sections in the area under "Demra Police station" having 15 or more accidents. The sections vary in length and other characteristics such as types of roadway (two-lane, multi-lane divided and multi-lane undivided etc). Furthermore, from the accident report forms, the study identified locations as described in narrative form only (no sketch available for precise location). Because of that limitations, the study selected the hazardous locations based on the cluster of accidents as occurred more frequently within the sections of selected roads.

In the study area, nearly 62% of total accidents occurred within a section of 4.20 miles which comprises of three mid-blocks.

These are:

(i) Shamibagh rail crossing to Jatrabari intersection (section 1-2).

(ii) Jatrabari intersection to Dholaipar intersection (section 8-9)

(iii) Jatrabari intersection to Shanir-aakhra (section 2-6, section of Dhaka-Chittagong road).

It was found that 153 accidents took place within the mid-blocks (0.7 mile) from Shamibagh rail crossing to Jatrabari intersection. The most noticeable accident types,i.e., were DCA 51 (overtaking accident, head on) . The other predominant type of accidents were DCA 01-04 (pedestrian involved accidents) and DCA 17 (thru-left). Similar accident characteristics were found on the remaining mid-blocks.

It was found that 154 accidents look place within the four hazardous mid-blocks (section 2-8, 8-9, 9-10 & 10-11), having most noticeable accident types were DCA-51 (overtaking accident, head on).. Detailed accident characteristics interms of time of day, day of week and vehicles involved were also examined.

4.8.3 Distribution of Accidents by Accident Types

Overtaking accidents (DCA 51) both at intersections and mid-blocks were found to be the most frequent accident types (20.1%) in the study area. The DCA 21 accident problem stood as the second most frequent accident type (16.8%).

However, as a group of pedestrians (01 to 09), the pedestrian accident problem appeared to be the greatest problem. at all mid- block sections.

These particular type of accidents are mainly due to heavy loaded trucks and over loaded buses frequently moving on these roads , i.e., Dhaka-Chittagong road and Saidabad road (Shamibagh rail crossing to Jatrabari intersection) . More over, Dhaka-Demra and Dhaka- Naryanganj roads are narrow to accommodate all types of vehicles as well as pedestrians. The shoulders of these roads were also in poor condition.

Table 4.14 shows the most frequent accident types for link 1-2. This also shows the breakdown of accidents by fatal, injury and PDO accidents.

Table 4.14

Different Types Of Roads Accidents According ToDCACodes At Most Hazardous Location Section 1-2.

DCA	fatal	injury	pdo	total	percentage
51	9	14	9	32	21
01	18	10	0	28	18.3
04	13	14	2	29	19
17	4	8	4	16	10.5
Other	19	21	8	48	31.20
Total	63	67	23	153	100.0

Source :- Demra metropolitan police station accident data

Tables 4.15, 4.16 and 4.17 show the details of accident types for other most hazardous links ,with similar breakdown.

Table 4.15

Different Types Of Road Accidents According ToDCACodes At Most Hazardous Location Section 8-9.

DCA	fatal	injury	PDO	total	percentage
51	7	12	7	26	29
21	3	8	3	14	16
01	17	6	0	23	26
04	6	7	1	14	15.5
Other	4	5	4	13	13.50
Total	37	38	15	90	100.0

Source :- Demra metropolitan police station accident data

Table 4.16

Different Types Of Road Accidents According To DCA Codes At Hazardous Location (Section 2-6).

DCA	fatal	injury	pdo	total	percentage
21	5	4	2	11	14.5
51	5	10	3	18	24
01	9	6	0	15	20
04	6	2	0	8	10.5
Other	7	11	6	24	31.0
Total	32	33	12	76	100.0

Source :- Demra metropolitan police station accident data

Table 4.17

Different Types Of Road Accidents According To Dca Codes At Hazardous Location (Section 2-8).

DCA	fatal	injury	pdo	total	percentage
21	4	9	2	15	30.0
17	1	4	1	6	12
01	4	2	0	6	12
04	3	2	0	5	10
Other	6	8	5	19	36
Total	18	25	8	51	100.0

Source :- Demra metropolitan police station accident data

4.9 AGE DISTRIBUTION OF ACCIDENTS VICTIMS

Overall total of 184 fatalities and 493 injuries were involved in accidents. Age distribution was known for 119 fatalities and 138 injuries. Table 4.2 shows that accidents are highest (23.5% fatalities & 30.4 % injuries) for ages between 40 and 50 years.

Table 4.18
Age Distribution of Accidents Victims

age of victims	fatal/death		injury	
	number	%	number	%
0-10	42	35.3	14	10.1
10-20	7	5.9	1	0.7
20-30	7	5.9	15	10.9
30-40	7	5.9	28	20.3
40-50	28	23.5	42	30.4
50-60	7	5.9	14	10.1
60-70	21	17.6	24	17.5
total	119	100.0	138	100
Unknown	65		355	

Source :- Demra metropolitan police station accident data

4.10 ACCIDENT COSTS

It was attempted to estimate for the cost of property damages per accident from the recorded values in the accident report forms. The cost of average property damages per accident in different sections of the selected roads was around Tk. 35,000 (approx. $880). This estimate is based on information recorded in 75 accidents.

4.11 TRAFFIC STUDIES OF THE SELECTED ARTERIAL ROADS

Traffic studies such as volume of the traffic interms of number of vehicles (bus, truck, mini-bus & car) per hour, average speed and maximum speed of vehicles were carried out through traffic survey on the following roads :

- Dhaka-Chittagong road
- Dhaka-Naryanganj road
- Dhaka-Demra road.

The results are shown in Tables 4.19, 4.20, 4.21 and 4.22 and are discussed below :

Trucks were dominantly involved in the Saidabad road (link 1-2)

Buses were dominantly involved in the Saidabad road (link 1-2)

Mini-Buses were dominantly involved in the Saidabad road (link 1-2)

Cars were dominantly involved in the Dhaka- Naryanganj road .

The speed of vehicles ranges between 45 and 85 kph and average speed of vehicles was 64 km per hour. Traffic data were also compared with accidents at different locations. It was found that at sections of Dhaka-Chittagong road, trucks were over involved in accidents.

Table 4.19

Hourly Motorized Traffic Volume And Speed Of Vehicles In The Saidabad Road And Number Of Accident Involved By Vehicles

vehicle category	number of vehicles per hour	average speed of vehicles (km/hour)	maximum speed of vehicles (km/hour)	accident involved by vehicles
Bus	386	35	45	34
Truck	442	45	60	42
Mini-Bus	448	35	45	18
Car	164	40	50	10

Source: Traffic Survey.

Table 4.20

Hourly Motorized Traffic Volume And Speed Of Vehicles In The Dhaka Naryanganj Road And Number Of Accidents Involved By Vehicles

vehicle category	number vehicles per hour	average speed of vehicles (km/hour)	maximum speed of vehicles (km/hour)	accident involved by vehicles
Bus	120	55	75	37
Truck	236	47	64	46
Mini-Bus	145	50	70	20
Car	266	52	71	11

Source: Traffic Survey.

Table 4.21

Hourly Motorized Traffic Volume And Speed Of Vehicles In The Dhaka-Chittagong Road And Number Of Accident Involved By Vehicles

vehicle category	number of vehicles per hour	average speed of vehicles (km/hour)	maximum speed of vehicles (km/hour)	accident involved by vehicles
Bus	171	56	76	26
Truck	319	54	75	32
Mini-Bus	290	52	70	12
Car	399	60	85	7

Source: Traffic Survey.

Table 4.22

Hourly Motorized Traffic Volume And Speed Of Vehicles In The Dhaka-Demra Road And Number Of Accident Involved By Vehicle

vehicle category	number of vehicles per hour	average speed of vehicles (km/hour)	maximum speed of vehicles (km/hour)	accident involved by vehicle
Bus	85	52	70	18
Truck	205	45	66	22
Mini-Bus	108	48	65	10
Car	224	50	70	5

Source: Traffic Survey

4.12 PHOTOGRAPHS

Photographs are useful in confirming the facts or to establish a detailed inventory which might have been overlooked at the scene. For the reason, approximate views of road scene, road side hazards traffic behavioral and other conditions related to traffic hazards were taken. These are shown in Figure 4.17 -4.41 . The striking road side deficiencis were the following :

- Parking of Bus on the carriageway
- Temporary markets on the carriage way
- Difference of level between pavement edge and shoulder
- Parking of Rickshaws
- Series of parked baby taxi on the carriageway
- Absence of median islands / lane marking
- Narrow and damaged shoulder
- Parked heavy trucks on the carriage way
- Absence of lane marking and traffic signs
- Vehicles conflicts at intersection etc.

Photographs of some hazardous roads are shown below:

Fig. 4.17 Parking of Bus on the Carriageway at Saidabad Road Near Bus Terminal

Fig. 4.18 **Temporary Markets on the Carriageway at the Saidabad Road near Jatrabari Intersection**

Fig. 4.19 **Difference of Level Between Pavement Edge and Shoulder at Saidabad Road**

Fig. 4.20 **Difference of Level Between Pavement edge and shoulder at Saidabad Road**

Fig. 4.21 **Parking of Rickshaws at Saidabad Road Near Janapathmore**

Fig. 4.22 **Dangerous Overtaking in the Absence of Lane Marking at Saidabad Road**

Fig 4.23 **Series of Parked Baby-taxi on the Carriageway at Saidabad Road**

Fig. 4.24 **Vehicles Conflicts at Jatrabari Intersection**

Fig. 4.25 **Absence of Median Islands,Lane Marking at Dhaka Naryanganj Road Near Jatrabari Intersection**

Fig. 4.24 Vehicles Conflicts at Jatrabari Intersection

Fig. 4.25 Absence of Median Islands,Lane Marking at Dhaka Naryanganj Road Near Jatrabari Intersection

Fig. 4.26 **Difference of Level Between Pavement Edge and Damaged Shoulder;Parking of Baby-taxi and Rickshaw Create Hazards Through Traffic at Saidabad Road**

Fig. 4.27 **Narrow and Damaged Shoulder Create Potential Danger for Traffic and Pdestrian Flow at Saidabad Road**

Fig. 4.28 **Vehicle Conflict at Jurain Rail Crossing**

Fig. 4.29 **Dangerous Turning of Vehicles,Absence of Lane Marking at Dhaka-Naryanganj Road Near Postogola Intersection**

Fig. 4.30 **Pavement Level is not Same and Absence of Lane Marking Dhaka-Naryanganj Road**

Fig. 4.31 **Vehicle Conflict at Postogola Intersection Near Buriganga Bridge**

Fig. 4.32 **Absence of Lane Marking at Dhaka-Chittagong Road Near Jatrabari Intersection**

Fig. 4.33 **Series of Parked Heavy Trucks on the Carriageway at Dhaka-Chittagong Road Near Shanir-Akhra Intersection**

Fig. 4.34 Vehicle Conflict at Shanir-Akhra Intersection

Fig. 4.35 Vehicle Confict at Dhaka-Chittagong Road Near Jatrabari Intersection

Fig. 4.36 Storage of Construction Materials on the carriageway at Demra Road

Fig. 4.37 Parked Damaged Truck on the Carriageway at Demra Road

Fig. 4.38 **Storage of Construction Materials on the carriageway at Demra Road Near Demra Police Station**

Fig. 4.39 **Difference of Level Between Pavement Edge and Shoulder at Demra Road**

Fig. 4.40 **Difference of Level Between Pavement Edge and Shoulder, Parked Damaged Bus on the Carriageway at Demra Road Create Hazards Through Traffic**

Fig. 4.41 **Absence of Lane Marking at Waes-kuruni Intersection Near Demra Ghat**

4.13 FIELD OBSERVATION IN THE STUDY AREA

From the photographs and physical site investigations, the following roadside hazards and drawbacks were noted.:

- Typical roadside hazards such as deterioration of pavements and shoulders, construction materials, temporary stalls on the side of carriage ways and blockage of entire carriage way by slow moving vehicle such as rickshaw, van , pushcart etc .

- Uncontrolled and undesirable driveways along major arterial roads also creating hazards.Wrong usage of carriage way at intersection by vehicles.

- Illegal parking on the edge of carriage way and storage of construction materials on the roadways.

- Most intersection failed to meet the adequate geometric design elements such as inadequate sight distance creating view obstructions, improper right and left turning lanes, placement of signals etc.

- Surface of pavement is not so good.

- Violation of rules of road marking and signal.

- Pedestrian vehicular conflicts near pedestrian crossings.

- Poorly managed roadway and traffic situation.

- Insufficient provision of road drainage during rainy season.

- Stray animals on the streets.

- Lack of traffic education of road users.

- Median islands are absent in hazardous roads such as Dhaka- Chittagong road, Dhaka-Naryanganj road and Dhaka-Demra road.

- Absence of parking place and overtaking zone.

90102

- Temporary market in foot-paths/roads.
- Although slow moving vehicle (Rickshaw, Van etc.) are not directly involved for accidents , they create situation for accident occuring
- At Jatrabari intersection, no pedestrian crossing facilities.
- No available footpath in the side of roads for pedestrian walking.
- Shoulder condition particularly at the Sayedabad road and Dhaka-Demra road is very bad. So some pedestrian are bound to walking on the carriageway and create situation for accident occuring.
- Weak traffic rules and regulation in the study area.
- Absence of channelization
- Presence of Saidabad Bus Terminal.
- Absence of good lighting system at night.
- Presence of large number of petrol pump on the section of Dhaka Chittagong roads.
- Absence of Zebra-crossing for pedestrian.
- Police enforcement is not sufficient for controlling the traffic in the study area.

Detailed investigation of selected arterial roads (by traffic survey) is summarised in Table 4.23

Table 4.23

Road And Traffic Characteristics On Different Sections Of Selected Arterrial Roads

SECTION	GEOMETRIC FEATURES	TRAFFIC CHARACTERISTICS
1-2 (O.7 MILE)	Pavement width = 28'-0" Narrow eroded earth shoulder of varying width.	% of commercial vehicle = 68.5% % of Rickshaw = 7.25 % & Baby-Taxi
8-9 (1.25 MILE)	Pavement width=20'-0" Narrow eroded earth shoulder of varying width.	% of commercial vehicle = 66.67% % of Rickshaw = 9.34 %
2-6 (2.25 MILE)	Pavement width=30'-0" Narrow eroded earth shoulder of varying width.	% of commercial vehicle = 82.0% % of Rickshaw = 13.0 %
2-8 (0..5 MILE)	Pavement width = 21'-0" Narrow eroded earth shoulder of varying width.	% of commercial vehicle = 73.0% % of Rickshaw = 12.0 %
2-3 (1.25 MILE)	Pavement width = 18'-0" Narrow eroded earth shoulder of varying width.	% of commercial vehicle = 74.0% % of Rickshaw = 9.0 %
6-7 (2.0 MILE)	Pavement width = 30'-0" Narrow eroded earth shoulder of varying width.	% of commercial vehicle = 71.0% % of Rickshaw = 16.0 %
9-10 (0.75 MILE)	Pavement width = 20'-0" Narrow eroded earth shoulder of varying width.	% of commercial vehicle = 38.5% % of Rickshaw = 50.0 %
3-4 (1.25 MILE)	Pavement width = 18'-0" Narrow eroded earth shoulder of varying width.	% of commercial vehicle = 35.0%
4-5 (0.625 MILE)	Pavement width = 18'-0" Narrow eroded earth shoulder of varying width.	% of commercial vehicle = 38.5% % of Rickshaw = 8.0 %

4.14 FINDINGS OF THE STUDY

The result of the study can now be summarized as follows:

- Out of 517 reported accidents of selected arterial roads during 3.5 years period (Jan. 92 to June 95), 175 (33.9%) were fatal 251 (48.6%) were personal injury and rest 91 (17.6%) were property damage accidents (Table 4.1) . The total accidents have claimed at least 184 lives and 493 personal injuries. In recent year 1994, total 47 persons were killed by road accidents (Table 4-1). Of course, the actual number of persons killed would be more since estimation is based on spot deaths only.

- It was found that approximately 22.5% of total accidents took place at intersections and 77.5% at mid-blocks. It was also found that more than 29.6% of total accidents took place within the mid-block from Jatrabari intersection to Shamibagh rail crossing (section 1-2).

- Total pedestrian accidents were 171 number (33.0 %) of which number of fatalities was 104 (20.1%) and number of injuries was 67 (12.9%) [Table 4.7].

- By detailed investigation of the accident types, the study disclosed that the most noticeable accident types were DCA 51 (overtaking accidents 20.1%) and DCA 01 (pedestrian accidents 12.20%) [Table 4.7].

- The predominant accident types were determined by considering both frequency and severity of most frequent accident types. The pedestrian accident problems were found to be the greatest problem in the study area. This particular problem was found both at intersection and mid-blocks.

- Examination of all accidents by hour of day disclosed that maximum accidents occurred between 8 am to 2 pm . Figure 4.11 shows that critical time of accidents occurred between 10 am and 1 pm . The percentage of day time (6 am. to 6 pm) and night time (6 pm to 6 am) accidents were 68.7% and 30.1% respectively and for the rest 1.2%, time of occurrence were not mentioned in the accident report forms (Table 4.8).

- In the most hazardous link 1-2, total 153 accidents were occured where fatal was 54, injury was 72 and property damage was 27 only (Table 4.2 & 4.3). In the most hazardous link 8-9, total 90 accidents were occured where fatal was 31, injury was 45 and property damage was 14 only. In the most hazardous link 2-6, total 76 accidents were occured where fatal was 26, injury was 36 and property damage was14 only (Table 4.2 & 4.6).

- Accidents by day of week, month of the year were also investigated. Highest number accidents occurred on Monday nearly 15.5% much above average (12.3%) and in the month of April nearly 11% much above average (8.3%) [Table 4.1]. Accident variation also showed significant difference among three years.

- Total 605 vehicles were involved in 517 accidents which show that the greatest percentage was Trucks (nearly 27.30%) and the next higher group was Buses (nearly 22.0%) [shown in Fig. 4.14 & 4.15] .

- In all, 80 road intersection accidents and 437 mid-block location accidents were identified in the study area and were used in the accident analysis.

- The number of accidents were chosen as the criterion to identify the potentially hazardous intersection and mid-block locations with particular consideration of most frequent accident types. An intersection having 10 or more accident over 3.5 years was treated as hazardous. Using this criterion a total of two intersections were identified as hazardous intersection such as Jatrabari intersection and Shanirakhra intersection. All most all intersections have shown pedestrian/overtaking accident problems.

- The Jatrabari intersection near Demra police station was determined as the most hazardous intersection.

- Total four mid-blocks (road way sections) were identified as hazardous locations considering both number of accidents and length of roadway sections of which most hazardous link is 1-2. Most frequent accidents occuring in mid-block locations are respectively link 1-2, link 8-9, link 2-6 and link 2-8 [shown in Table 4.2].

- 90 accident occured on Dholaipar intersection to Postogola intersection (link 8-9) of which DCA -51 and DCA 21 were most noticiable accident types (shown in Table 4.15).

- 76 accident occured on Jatrabari intersection to Shanirakhra intersection (link 2-6) of which DCA -51 and DCA 21 were most noticiable accident types (shown in Table 4.16).

- 153 accident occurred on Shamibagh railway crossing to Jatrabari intersection (link 1-2) within a stretch of 0.7 mile of which DCA 51 and DCA 01 were most noticeable accident types (Table 4.14).

- 51 accidents occurred on Jatrabari intersection to Dholaipar intersection (section 2-8) of which DCA 51 and DCA 01 were most frequent accident types (Table 4.18).

- Postogola intersection to WASA treatment plant (section 9-10) location had 25 accidents of which DCA 51 and DCA01 were found most frequent types within a section of 0.75 mile.

- 76 accident occurred on Jatrabari intersection to Shaniraakhra (section 2-6) of which DCA 51 and DCA 01 were found most frequent types within a section of 2.25 miles.

- 39 accidents occurred on Rayerbag to Shanir-aakhra intersection (section 6-7) location of which DCA 51 and DCA 01 were most frequent accident types within a section of 2 miles.

- Table 4.19 shows that maximam volume of traffic is minibus (448 number), maximam number of accident (42) involved by truck and maximam speed of vehicle is involved by truck (60 km /hour). Table 4.20 shows that maximam volume of traffic is car (266 number), maximam number of accident (46) involved by truck and maximam speed of vehicle is involved by bus (71 km /hour). Table 4.21 shows that maximam volume of traffic is car (399 number), maximam number of accident (32) involved by truck and maximam speed of vehicle is involved by car (85 km /hour). Table 4.22 shows that maximam volume of traffic is car (224 number), maximam number of accident (42) involved by truck and maximam speed of vehicle is involved by bus &Car (70 km /hour).

- Peak hour time of accidents in the study area is 8.0 am to 2.0 pm (shown in Fig.4.11).

- On the basis on costs of property damaged reported in the forms, the average costs of property damaged per accident in the study area under Demra police station was approximately TK. 35,000 (US $ 880) .

- Accident for unknown age were 420 number and accident for 40 to 50 years ages were 70 number . (Table 4.18).

CHAPTER FIVE

Conclusion and Recommendation

CHAPTER 5

CONCLUSIONS & RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents the conclusions and recommendations of the study for the low cost road safety improvements of selected arterial roads in Metropolitan Dhaka. In particular conclusions on intersection accident hazards and mid block accident hazards are summarized. Suggested measures for minimizing accidents at intersections and links of roads based on such factual findings are highlighted. Directions for future research are also discussed in this chapter.

5.2 CONCLUSIONS

Out of the 517 reported accidents ,175 (33.8 %) were fatal, 251 (48.5%) were personal injury and 91 (17.6%) were property damage only accidents. The study represents that day time accident was 68.7 % and night time accident was 30.2% and peak time of accident was between 8.0 am and 2.0 pm. Accident type analysis was carried using the system of definitions for coding accidents (DCA) codes. The most frequent accident types were DCA 51 (overtaking accident, head on) and DCA 01 (pedestrian on foot, near side), accounted for 20.1% and 12.2% respectively. Considering all pedestrian accident types (DCA 01-09), pedestrian accidents were determined to be the biggest problem (33.8%). It was found that out of 517 accidents 22.5% took place at intersection and rest 77.5% at links of selected roads. Trucks were mostly involved in accidents (27.3%). Based on the results of accident analysis and findings from physical inspections, the following conclusions can be drawn for most hazardous intersections and mid-blocks with particular emphasis on contributory accident factors.

5.2.1 Intersection Accident Hazards

Most hazardous intersections such as Jatrabari intersection, Postogola intersection, Shaniraakhra intersection have deficiencies in geometric design standards, signal and pedestrian crossing facilities. Traffic is not strictly controlled due to the lack of enforcement resulting from the absence of adequate number of traffic police. Considerable number of slow moving vehicles such as rickshaws, rickshaw vans also create situation for the accident occurrence involving the fast moving vehicles at these intersections, particularly at the Jatrabari intersection. The

increased pedestrian vehicular conflicts clearly indicate the problem of pedestrian movement.It was observed that the pedestrian facilities are lacking in these hazardous intersections .

The study represents that Jatrabari intersection is the most hazardous intersection because five road links (shown in Figure 1.2) meet in this intersection. Total 69 accidents (13.34%) occurred in this intersection of which pedestrian accident, near side (DCA-01) is the highest number. The study also represents that most of the intersection accidents were involved by trucks and buses. Problem characteristics of accidents determined from the collision diagram (Figure 2.1). Some possible low cost remedies have been suggested for improving safety of the traffic at the hazardous intersections in the study area.

5.2.2 Mid-block Accident Hazards

Most hazardous links such as Sayedabad road (link 1-2), Dhaka-Naryangang route, sections of Dhaka-Chittagong road and Dhaka-Demra road, have deficiencies in geometric design standards, signal and pedestrian crossing facilities. Most hazardous link was Sayedabad road (1-2) because 153 accidents (29.60%) occurred in this link of which 54 fatal,72 personal injury and 27 property damage only accidents. Second and third hazardous links were Dholaipar intersection to Postogola intersection (8-9) and Jatrabari intersection to Shanirakhra intersection (2-6) respectively.

The most frequent accident types were pedestrian accident , near side (DCA-01) and overtaking accidents, head on (DCA-51), accounted for about 12.2% and 20.1% respectively. Peak time of accidents were between 8.0 am and 2.0 pm. Comparing day of week , maximum accidents occurred on Monday. Comparing month of the year ,maximum accidents occurred in April. Trucks and buses were dominantly involved in accidents, accounted for about 27.3% and 22.0% respectively. Maximum operating speed of vehicles was 85 km per hour and average speed of vehicles was 64 km per hour. Considerable number of slow moving vehicles such as rickshaws, rickshaw vans etc., create situation for accident occurrence involving the fast moving vehicles on these links of roads, particularly at the Sayedabad road (link 1-2).

From field observations and photography study, major factors involved in road accidents are listed below :

- Uncontrolled parking of buses, trucks, baby-taxis, rickshaws etc on the hazardous links such as Sayedabad road (1-2), Jatrabari intersection to Postogola intersection (2-9), Jatrabari intersection to Shanir aakhra intersection (2-6) and sections of Demra road (2-3) respectively.
- Storage of construction materials in the side of link road such as Sayedabad road and Dhaka-Demra road etc.
- Geometric and structural design of shoulder is not so good.
- Absence of pedestrian crossing facilities on hazardous links such as Sayedabad road, Dhaka-Naryanganj rout, sections of Dhaka-Chittagong road and Dhaka-Demra road.
- Absence of median islands, lane marking and edge marking in the hazardous links such as Sayedabad road, Dhaka-Naryanganj road, Dhaka-Chittagong road and Dhaka-Demra road.
- Absence of regulatory sign, warning sign, information sign in the hazardous links such as Sayedabad road, Dhaka-Naryanganj road, Dhaka-Chittagong road and Dhaka-Demra road
- Presence of temporary markets on the shoulder of Sayedabad road which reduce the road capacity.
- Presence of tree, poles, objects etc on the side of Dhaka-Demra road also created situation for accident occurrence.
- Presence of large number of rickshaws which are not dominantly involved in the accidents but created situation at initial event leading to accidents of fast moving vehicles in the hazardous links of selected roads.
- Curbside parking, parking of vehicles, un-regulated pedestrian movements, presence of large number of petrol pumps at the side of the roads are also creating hazards to through movements in the hazardous links of selected roads.

Finally, it is to be noted that factors which have been described in thiese links indicate the lack of improper attention in engineering, enforcement, and education for the safety of the traffic. Unless these errors are minimized through comprehensive corrective measures, traffic operations in the hazardous links such as Sayedabad road, Dhaka-Naryanganj rout, section of Dhaka-Chittagong road and Dhaka-Demra road will continue to deteriorate with the resultant increase of the safety hazards.

5.3 RECOMMENDATIONS

The proceeding observations and findings lead to a clear view of roadway accident problems and provide some insight into the scenes of high accident potential where safety efforts on the basis of priority ought to be directed. The problems of course, can be corrected to a great extent by simple engineering techniques as well as by the enforcement of traffic laws. Such measures ought to be taken as early as possible. In this regard some possible low cost remedies have been suggested for correcting the hazards of the mid-blocks of selected arterial roads in Metropolitan Dhaka. These remedies are discussed in the following sections.

5.3.1 Recommendations to Minimize Accidents at Intersections

(a) Hazardous Intersections :

Following low cost engineering countermeasures are suggested for safety improvements of the hazardous intersections such as Jatrabari intersection, Postogola intersection, Dholairpar intersection, Shaniraakhra intersection and Wisekuruni intersection :

- Jatrabari intersection which is a signalized intersection and has a history of pedestrian accident, head on (DCA-01) and intersection accidents, thru left (DCA-17). For minimizing accidents at this intersection , provision of exclusive right turn lane based on right turn traffic for separating decelerating and stopped vehicles from through lane.
- Installation of pedestrian cross-walks with central refuge islands and construction of pedestrian barriers will improve the situation and reduce pedestrian vehicular conflicts.
- Pedestrian accidents could be reduced by provided traffic signal with Pedestrian phase,guard rail and fences for pedestrian control .
- Restriction of truck movement during peak hours (8.0 am to 2.0 pm) will reduce the accident hazards.
- Pedestrians, cyclists and slow moving vehicles (e.g. , rickshaw van etc.) could be segregated from other moving vehicles.
- Elimination of curb side parking, bus stop page and standing vehicles from intersection area.
- Some treatment of road surface with skid resistant material could be beneficial.
- Exclusive right turn lane with proper channelization.
- Overtaking accidents in the intersections could be reduced by providing channelization, marking and sufficient number of traffic signs.
- Right turning of traffic could be controlled by providing round about or traffic signal at the hazardous intersection.
- Left turning of traffic could be controlled by providing channelization.

- Speed of vehicles could be reduced by providing speed limit sign post and speed reducing humps.
- Parking of traffic near hazardous intersection could be restricted by providing proper warning sign and controlled by traffic police.
- As trucks are mostly involved for large number of accidents, restriction of truck movement between 8.0 and 2.0 pm should be provided on the most hazardous intersections, particularly at Jatrabari intersection .

(b) Hazardous Rail Crossing :

- Installation of regulatory/warning signs would also be beneficial.
- Strict enforcement at least when train crosses the road will reduce the accident hazards.
- The improvement should include the provision of guard rail as well as guard fencing.

5.3.2 Recommendation to Minimize Accidents at Midblocks

Following low cost remedies have been suggested for safety improvements of the hazardous links such as Sayedabad road, Dhaka-Chittagong road, Dhaka-Demra road and Dhaka-Narayanganj road:

- Damage shoulder should be properly treated.
- Provision of uniform non-skid pavement surface or strict enforcement on poor tyre use.
- Bus stoppage on the road to be strictly prohibited by providing adequate traffic signs at the side of carriageway.
- Greater restriction on illegal parking of through traffic and this is controlled by providing proper warning sign and traffic police.
- Elimination of central hazards created by poles, post and other objects by relocation at proper places.
- Provision of pavement marking to separate flows and edge delineation.
- Provision of wider footways for safety of the pedestrians.
- Provision of wide and stable treated shoulder as interim.
- Installation of regulation/warning signs would also be beneficial.
- Installation of median islands could also be beneficial.
- Restriction of truck movements during peak hour of accidents (8.0 am to 2.0 pm).
- Street lighting should be improved for reducing night time accidents.
- Warning sign, regulatory sign and information sign should be provided on the two sides of the road & bridge for reducing number of accidents.
- For controlling slow moving vehicles, separate lane should be provided by constructing island at the side of the carriageway.

- Parking should be restricted by providing parking area in the hazardous roads.
- Temporary market on the side of hazardous road such as Sayedabad road, Dhaka-Naryanganj road etc should not be allowed.
- For reducing overtaking accidents at particular section of the selected roads, overtaking could be controlled by provided overtaking zone, proper warning sign etc.
- For reducing pedestrian accidents, wider footways, guard rail/fences should be provided at the hazardous link roads.
- Restriction for storing of construction materials at side of hazardous roads.
- For reducing night time accidents light post should be increased at the side of hazardous roads.
- Proper warning sign and construction of channelization should be provided where petrol-pump is standing on the side of roads (specially for Dhaka-Chittagong road).

5.4 RECOMMENDATIONS FOR FUTURE STUDY

More comprehensive study of selected arterial road accidents should be carried out in order to find out causes of road accidents at the high accident sites. : Such investigation will be needed for full information data as follows :

1. Fundamental Accident Information

- Reference : location
- Number of involved vehicles
- Casualty records
- Accident location with sketch

2. Information about Road

- Type of road
- Type of carriageway and number of lanes
- Speed control.
- Road surface condition (wet & dry).
- Type of intersection & operational control devices at the accident site.
- Road geometry.
- Surrounding obstructions (tree, lamp, electric post etc).

3. **Environmental Condition of Road**

- Condition of light.
- Climate.
- Condition of road surface.
- Carriageway hazards.
- Skidding.

4. **Information about Driver.**

- Age & sex.
- Influence of alcohol.

5. **Information about Casualty.**

- Type of road users.
- Movement of pedestrians.

The above information would help for more detail analysis of the accidents and to draw the collision diagrams of the most hazardous locations. In the new accident report form for collecting above information new item (based on above information) should be added. Similar study may be effective for other arterial roads in Metropolitan Dhaka, Bangladesh.

REFERENCES

REFERENCES

1. **AASHTO (1994),** *A Policy on Geometric Design of Highways and Streets.* Washington D.C., U.S.A.

2. **Ahmed, K.A. (1980),** "*Traffic Problems in Dhaka City*." Local Government Institute, Dhaka.

3. **Andreassen D.C. (1982),** " *A Technique to Resolve Road Accident Problems*". Ph.D. Thesis, Dept. of Civil & Mining Engg. The University of Wollongong, Australia.

4. **Andreassen D.C. (1990),** *"Report of the Road Safety Working Group*." Road Safety Workshop, Road Engg. Association of Asia and Australia (REAAA), Kuala Lampur .

5. **Andreassend, D.C. and Evangelou, J.N. (1990),** " *The Quality of Accident Data*". Proc. 15th ARRB conf.,15(7), 167-177, Australia

6. **Biswas, S. K.(1995),** "*Road Safety Strategy in Bangladesh*". Published in the Bangladesh Observer".

7. **Editor (1995),** "*Wanted for Over Bridge Near Saidabad Bus Terminal*".Published in the Daily Ittefaq.

8. **Bangladesh Bureau of Statistics** (1994), *"Statistical Year Book of Bangladesh* ". Government of the Peoples Republic of Bangladesh.

9. **Hoque, M. M. and Sanderson, J.T. (1988**), " *Road Safety Countermeasures for Urban Roads*." Royal Automobile Club of Victoria (RACV) Ltd. Melbourne, Australia.

10. **Hoque, M. M. (1986),** "*Traffic Accidents in Dhaka.* " Proceedings of the 13th ARRB/5th REAAA Conference in Australia, Vol. 13(2), Engineering and Transportation Planning.

11. **Hoque, M.M. (1988**), "*Towards Successful Investigations of Urban Road Accident Problems*". Proc. ICORT (Tata Mc. Graw Hill), University of Roorkee, India.

12. **Hoque, M. M. (1990),** *"Some Aspects of Road Safety Problems in Bangladesh"*. 6th REAAA conf. Proc. Vol.2, Kuala Lampur .

13. **Hoque, M. M. (1991),** *Accident Investigation for the Safety Improvements of Dhaka-Aricha Highway, Bangladesh*, Vol. 17, No. 3-4, July- October 1989.

14. **Hoque, M.M. (1995),** " *Towards Improving Road Safety in Bangladesh*". Paper Presented in the World Congress, Montreal, Canada.

15. **Jacobs, G.D. and Badsley, M.N. (1977),** *"Research on Road Accidents in Developing Countries".* Traffic Engineering and Control, Vol.18, No. 4.

16. **Lay,M.G. (1986), "***Roads and Road Safety*." New Approaches, Accident Research Centre, Monash University.

17. **Matson, T.M., Smith, W. S. and Hurd, F.W. (1955),** *Traffic Engineering.* Mc.Graw Hill, Civil Engineering Series.

18. **National Association Of Australian State Road Authorities (1976),** *"Guide to Traffic Engineering Practice".* Sydney, Australia.

19. **Ogleby, H.C, Hicks, G.R. (1982),** *Highway Engineering*. Fourth Edition, John Wiley and Sons, New York, U.S.A.

20. **Ogden,K.W. (1994), "** *Traffic Engineering on Road Safety, a Practitioners Guide*." Federal Office of Safety, CR 145, Department of Civil Engineering, Monash University.

21. **PPK Consultants Ltd. (1993),** *"Greater Dhaka Metropolitan Area, Integrated Transport study".* Australia in Association with Delcan International Corporation, Canada and Development Design Consultants, Bangladesh . (work paper no. 2, Accident Analysis)

22. **Ritter, L.J. and Paquette, R.J. (1960),** *Highway Engineering.* Third Edition.The Ronald Press Company.

23. **Seraj, S. M. (1981),** *"Road Accidents in Dhaka City"*. Deficiency in Traffic Engineering and Transportation Planning.

24. **Sabey, B.E.(1985),** *Accident Reduction by Low Cost Engineering".* New Zealand Ministry of Transport Division, Newzealand.

25. **VICTORIAN ROADS CORPORATION (1990),** "*Traffic Engineering and Planning*". The 15th Australian Road Research Board Conference Proceedings, Part 5, 6-31 Aug.1990.

26. **Wright, P.H. and Paquette. R.J. (1987),** *Highway Engineering.* John Wiley and Sons, New York, U.S.A.

27. **Transport Research Laboratory and Overseas Development Administration (1994),** "*Towards Safer Roads in Developing Countries*". A Guide for Planners and Engineers.

APPENDIX-A

Sample Data Sheets

Figure A.1 shows the "Accident Transcription Sheet" which is used for accident data collection.

Figure A.2 shows the example of "Thana Accident Data" by using accident transcription sheet.

Figure A.3 shows the "Police Accident Report Form" which is uses for police accident records.

Acc no.	Location	Acc sev.	Year	Month	Day	Day of week	Hour	Light.	Veh/ped involved	Obj hit	DCA code	Collision diagram	Damage cost	VICTIMS Dead			Grav. inj.			Injured			Remark
														rug	sex	age	rug	sex	age	rug	sex	age	

Figure A.1 : Accident Transcription Sheet

DEMRA THANA ACCIDENT DATA (JAN. 92 TO JUNE 95)

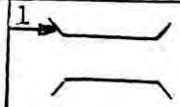
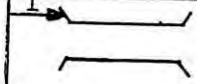
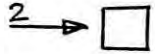
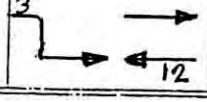
Acc no.	Location	Acc sev.	Year	Month	Day	Day of week	Hour	Light.	Veh/ped involved	Obj hit	DCA code	Collision diagram	Damage cost	VICTIMS Dead rug	Dead sex	Dead age	Grav. inj. rug	Grav. inj. sex	Grav. inj. age	Injured rug	Injured sex	Injured age	Remark
01	8-9	2	92	1	3	7	13.	1	2-9		21						9	1 2 1 2	14 35 10 8				
02	3-4	2	92	1	4	1	8.30	1.		1-5	65						1	1 1 1 1	9 9 9 9				
03	3-4	3	92	1	4	3	23. 30	2 21		1-5	05		50,000 Tk.										
04	2-8	2	92	1	6	3	23. 30	2 21	1-16		05						16	1	60				
05	2-8	1	92	1	6		05. 20	1	1-16		05			16	1	30							
06	1-2	2	92	1	7	4	05. 20	1		2.10	67						10	1 1 1 1	9 9 9 9				
07	9-10	1	92	1	8	5	13. 15	1	3-12		51			12	1	9							

Figure : A - 2 Demra Thana Accident Data

বাংলাদেশ ফরম ৫৩৫৬

প্রাথমিক তথ্য বিবরণী

3125

FIRST INFORMATION REPORT

(নিয়ন্ত্রণ নং ২৪৩)

থানায় পেশকৃত ফৌজদারী বিধান কোষের ১৫৪ নং ধারায় ধর্তব্য অপরাধ সংক্রান্ত প্রাথমিক তথ্য

উপজেলা..... জেলা .....

নং..... ঘটনার তারিখ ও সময় .....

পেশ করার তারিখ ও সময়	ঘটনার স্থান, থানা হইতে দূরত্ব ও দিক এবং দায়িত্বাধীন এলাকা নং	থানা হইতে প্রেরণের তারিখ

বিঃ দ্রঃ—প্রাথমিক তথ্য অবশ্যই সংবাদদাতার স্বাক্ষর অথবা টিপসহি সম্বলিত এবং লিপিবদ্ধকারী অফিসার কর্তৃক সত্যায়িত হইতে হইবে।

সংবাদদাতা এবং অভিযোগকারীর নাম ও বাসস্থান/ঠিকানা	আসামীর নাম ও বাসস্থান/ঠিকানা	ধারাসহ অপরাধ এবং লুণ্ঠিত দ্রব্যাদির সংক্ষিপ্ত বিবরণ	তদন্ত চালনার কর্ম তৎপরতা এবং বিলম্বে তথ্য রেকর্ড করার কৈফিয়ত	মামলার ফলাফল

(প্রাথমিক তথ্য নিম্নে লিপিবদ্ধ করিতে হইবে)

স্বাক্ষর.....

পদ মর্যাদা.....

নোটঃ তথ্যের পাদদেশে সংবাদদাতার স্বাক্ষর অথবা টিপসহি থাকিতে হইবে।

বাংলাদেশ: ৯৪/৯৫ ১০০৬১/জ ১০,০০০ বই, ১৯৯৪

Source :- Demra metropolitan police station

Fig. A.3 : Police Accident Report Form (Bangladesh)

APPENDIX-B

Accident Related Definition

1. Coding Conventions of Accident Data for Selected Roads in Metropolitan Dhaka City:

1. Accident Number : 01, 02, 03,---- etc.

2. Location : 1- intersection,
2- link,
3- unknown

3.Accident severity: 1-fatal,
2-injury,
3-property damage only;

4.Month: 1-january,2-February,March,------- 12-December ;

5.Day : 1,2,3,-------29,30,31 etc.ie.day of month.

6.Day of week: 1-Saturday,2-Sunday,3-Monday,4-tuesday,5-Wednesday,6-Thursday, 7-Friday.

7.Hour: 24:00hrs system;eg.0345,1645 etc.

8.Lighting condition: 1-day;2-night,9-Unknown;21-street light present; 22-no street light;23-not known.

9.Vehicle/pedestrian involved:

1-Bus,	6- Microbus	11-Cycle	16-Pedestrian
2-Truck,	7-Pickup	12-Rickshaw	19-Unknown
3-Minbus,	8-Tempo	13-Van	
4-Car,	9-Babytaxi	14-Pushcart	
5-Jeep;	10- Motorcycle	15-Road puller	

10. Vehicle/Objects involved:

1-Tree	6-Ditch	19-Unknown
2-Road island;	7-Wall	
3-Traffic post	8-Petrolpump	
4-Electric post	9-Footpath	
5-Bridge/culvert;	10-Shop	

12.Damage cost: Exact amount in taka

13.Victims:
rug(road user group): as defined according to column number-9
Eg.pedestrian-16, byclist-11 etc.
Sex (eg.male and female)
Age:10,20,50 etc. (9= unknown age)

Source : Andreassend 1983 b

2 DEFINITIONS AND CONVENTIONS

It is important to describe some of the terms used in the text in order to aid in comprehensison. Some fo the mroe improtant terms relating to acciedents and accident locations are given in the following sections.

2.1 Terms Relating to Accident Location

For the prupsoes of this study the following locational definitions were used and will be extracted form Hoque (1987).

1.Road: A thoroughghfare open to public by right or custom. Exclusdes off-street parking, access areas and other private proeprty not regarded as a thoroughfare, e.g. railway yards, sports areas etc.

2.Carriageway: Portion of a road improved, designed or ordinarily used for vehicular traffic and incldues the shoulders and areas at the sides or centre of the carriageway used for the standing or parking fo vehicles and if a road has two ro mroe such protions divided by a reservation or reservations, a carriageay means each portion separatley.

3. Intersection: A place where two or more roads intersect or join and incldues the area where vehicles tavelling on different joining or intersecting roads may collide. In this study, it isthe point at which any road meets/cross the highway.

4.Link: A section of a road between two consecutive intersections.

5.Intersection Accidents: Intersection type accidents are regarded as haivng occurred within 30 feet of the itnersection.

6.Between-intersection accidents: All other accidents except those as defined in (5). These have been referred to as link accidents".

1 .2.2 Terms Relating to Accidents

Definitions on some of the commonly used terms relating to accidents are given below:

1. **Road traffic accident:** an accident which follows from the movement of at least one road vehicle on a road (defined earlier), was reported tot he police, and resulted in a casualty or a non-casualty.

2. **Road Traffic Casualty:** a casualty is a person who either died or was injured as per definitions (3) and (4).

3. **Road traffic death:** recorded when any person is killed at the time of road traffic accident, or succumbs to injuries received in a road traffic accident upto 30 days after the accident. (For this study, it is on-the-spot death).

4. **Road traffic Injury**: is a bodily injury suffered as a result of road traffic accident.

5. **Road Traffic Fatal Accident:** recorded when one (or more) death, as defined in (3), occurs as a result of the accident.

6. **Road Traffic Injury Accident:** is an accident in which any person is injured as defined in (4). It is to be noted that an accident is classed by the most severe result.

7. **Road traffic Casualty accident**: is one in which a person either died or was injured, and is generally the sum of definitions (5) and (6).

8. **Road traffic non-injury accident**: is recorded for accidents except those defined by (5) and (6) bvoe. This is referred to as the property damage only (PDO) accident".

9. **Accident Type:** accident type referred to in this study, as the specific definition for coding accident (DCA) in Fig. 2.1 (Chapter 2).

10. "Severity level" vs "Casualty class": this requires some clarification. There exists a difference between "severity level" and "casualty class". while the casualty class referswto a person involved in an accident, the severity level refers to an accident, which is classified based on the most severe casualty class received by any person involved in that accident. The severity levels (fatal, injury, and POD) are used to classify accidents.

3 Arterial Road :

Arterial roads are such roads which are designed to carry through traffic. They pass through city limits and link state or national highway system with a limited access. Most of the existing arterial roads come across highways or roads. The traffic on cross roads is regulated by stop signs or signals.

90102
2-9-96
লাইব্রেরী, ঢাকা