EVALUATION OF THE EXISTING SITUATION FOR CHILDREN-SAFE STREETS IN DHAKA CITY

by

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The thesis titled, **"EVALUATION OF THE EXISTING SITUATION FOR CHILDREN-SAFE STREETS IN DHAKA CITY"** submitted by **Md. Abu Nayeem Shohag,** Roll No: 100515022(F), Session: **October 2005,** has been accepted as satisfactory in partial fulfillment of the requirements for the degree of **MASTER OF URBAN AND REGIONAL PLANNING (MURP)** by Coursework and Thesis on 21 March. 2009.

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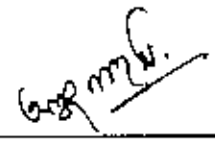

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This study involved questionnaire surveys of pedestrians, road users, parents/guardians, and children in particular, as well as interviews of concerned road safety officials like highway/traffic engineers, transport planners, consultants and police officers. Additionally, face to face interviews were held with the head teachers/principals of the pre-selected 15 schools of Dhaka. The author would like to thank all these persons who gave their valuable time to take part in the surveys, especially students and teachers of different schools.

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ABSTRACT

The traditional assumption that a city fit for adults is also fit for children seems to be untrue. The present traffic environment in the cities is designed considering adult movement and behavior, seldom reckoning children's and older age groups' limitations. Thus the risk to children from vehicular traffic has greatly increased today than that in the past. Basic problem in dealing with children safe street in cities like Dhaka includes limited or lack of information about the accident characteristics affecting children and the impacts of the street safety measures in alleviating risk of accidents.

A considerable percentage of traffic deaths are accounted to people under the age of 15 and this threat of road accidents to children increased with increase in motor cars. It is assumed that most of the streets of Dhaka city are unusable, unsafe and not people friendly, more particularly for the children. The national road accidents statistics also indicates that the existing road network pose serious threats to children.

While this problem seems to be serious, but in reality only a limited number of studies and researches have been done in our country regarding safety of children while using the roads. These deal with identification of involvement of children in road traffic accidents and also planning and engineering of roads for promoting pedestrian safety in Bangladesh. Most of the planning and engineering works have been carried out regardless of the specific needs of people of different ages and abilities.

Children safe street depends on various factors like children behavior on the streets, knowledge of street safety and traffic rules, roadway features along with vehicle characteristics, environmental features, level of implementation of traffic rules and regulations, etc. In the case of Dhaka, all these factors are lacking/non-existent or exist to a very nominal degree to bring about significant changes. Therefore, high incidence of child fatalities and injuries from accidents at roads and streets is inevitable in Dhaka city where no street safety education for the children exists, people generally fail to perceive the dangers of street accidents and the state of administration of traffic rules is very poor.

The objective of this study is to investigate and analyze the present condition of children's usage and accessibility of city streets by comparing current accident history in the roads and streets of Dhaka as well as to examine the factors that are responsible for causing accidents in the streets. From an in-depth investigation and analysis suggestions for a 'children safe street' has been formulated. Furthermore, a review of the measures adopted in the Strategic Transport Plan (STP) 2004 – 2024 for Dhaka city has been conducted to find out how it has accommodated children safe road issues. The outcome of this research intends to help for the future planning and designing of children safe street network as well as to improve the existing street layout of the study area.

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
ARI	Accident Research Institute
BANBEIS	Bangladesh Bureau of Educational Information and Statistics
BIWTA	Bangladesh Inland Water Transport Authority
BRTC	Bangladesh Road Transport Corporation
BRTOA	Bangladesh Road Transport Owners Association
BRTA	Bangladesh Road Transport Authority
CPD	Center for Policy Dialogue
CUS	Center for Urban Studies
DCC	Dhaka City Corporation
DITS	Dhaka Integrated Transport Study
DMA	Dhaka Metropolitan Area
DMP	Dhaka Metropolitan Police
DRSC	District Road Safety Committee
DTCB	Dhaka Transport Coordination Board
DUTP	Dhaka Urban Transport Project
ESCAP	Economic and Social Commission for Asia and the Pacific
GRSP	Global Road Safety Partnership
IDA	International Development Association
IDC	Institutional Development Component
LGED	Local Government Engineering Department
LOS	Level of Service
MAAP	Microcomputer Accident Analysis Package
MV	Motorized Vehicle
NMV	Non Motorized Vehicle
NRSC	National Road Safety Cell
NRSSAP	National Road Safety Strategic Action Plan
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation and Development
RAJUK	Rajdhani Unnayan Kartipakha
REAAA	Road Engineering Association of Asia and Australia
RHD	Roads and Highways Department
RSC	Road Safety Cell
RSE	Road Safety Education
RTAs	Road Traffic Accidents
RTIs	Road Traffic Injuries
RUM	Road User Movement
SI	Severity Index
STP	Strategic Transport Plan
SSZ	School Safety Zone
TDM	Transport Demand Management
WHO	World Health Organization

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CHAPTER 1: INTRODUCTION

1.1 Background and Present State of the Problem

The traditional assumption that a city fit for adults is also fit for children seems to be untrue. The new perspective is that city streets designed for children in mind will be more inclusive of people of all ages, gender and abilities (UNICEF, 2004). In this regard, the planning and designing of street network within the city should be given due consideration not only to children but people of different ages, gender and abilities during the overall planning of the city. Hence the creation of a safe and usable street network for children seems to be logical in producing a more people friendly city.

The present traffic environment in the cities is designed considering adult movement and behavior, seldom reckoning the limitations of children or people of other ages and abilities. Thus the risk to children from vehicular traffic has greatly increased today than that in the past (Malini and Victor, 1990). It is seen that most of the streets of Dhaka city are unusable, unsafe and not people friendly, more particularly for children. The national road accidents statistics also indicate that the existing road network poses serious threats to children while using them. From the economic point of view, these accidents incur insurmountable loss both for individual families and the nation which consequently have negative impacts on the national and economic development (Hoque et al, 2007). Because the loss of an active adult, in most cases, turns families into destitutes and throw them into severe hardships; the nation also loses productive manpower. Also, injuries from severe street accidents frequently results in lifelong disabilities and create burdens for the families and the society. Thus, increasing threats to street users, especially in developing world, has led to the ever increasing demand for priority attention for safety be given to vulnerable street user groups, in this case the children.

It is evident urban growth is most rapid in developing countries and, by the year 2025, six out of every ten children in the developing world will be living in cities (www.childfriendlycities.com); and hence, the need for safe street network within the city is of paramount importance. Compared to the developed countries, the proportion of fatalities to children under 16 years of age in developing countries is nearly two and half times higher (Jacobs and Baguley 1997; Ross Silcock and TRL 1996, TRL and Ross Silcock 1996). In Bangladesh, this problem is aggravated, largely as direct

consequences of rapid growth in the number of population, urbanization and increasing use of motor vehicles. Each year nearly 4000 people are reported to be killed in Bangladesh from road accidents of which a staggering 21 percent are children under 16 years of age (Hoque et al. 2007).

Dhaka is one of the cities of Bangladesh having the highest number of schools (Table 1.1). Fearing for the safety of their children, parents and guardians of Dhaka

Table 1.1: Number of Schools in the Metropolitan Cities of Bangladesh.

Educational Institutions	Dhaka	Chittagong	Rajshahi	Khulna	Barisal	Sylhet
High School (Govt., Non-Govt. and Junior)	675 (419702)	578 (408680)	403 (186319)	364 (156974)	354 (163450)	218 (133456)
Primary School (Govt., Non-Govt. and Others)	1175	2240	993	1000	1216	1320
Kindergarten	343	--	8	--	11	--
Madrasa	165	217	267	205	698	148
Total	2358	3035	1671	1569	2279	1686

Source: Bangladesh Bureau of Educational Information and Statistics, 2005.
Note: Figures in the parentheses indicates corresponding enrolment/number of student.

accompany their children/wards to schools and even colleges and universities. It is rarely seen that a child goes to school unattended or unaccompanied. It is also seen that hundred of mothers wait outside all school premises on footpaths during school time and thus spent their valuable time in an uneconomic and inefficient exercise just because of the lack of safe streets. It is not only parents who are waiting, along with them are personal cars, and vendors who want to do some quick business in bargain. This results in traffic congestion, increased transportation cost, loss of valuable productive hours, long waiting hours, pollution, etc. in one hand and on the other hand anxieties, fatigues, stress, etc. The present Strategic Transport Plan (STP) for Dhaka (2004 -2024) supposed to be a 'very well thought out plan' have evidently not taken all such details into account and provide a more realistic and humane solution regarding children – inclusive safe streets.

Dhaka is the capital city and as a result urbanization in Dhaka is much higher than any other cities of Bangladesh. Increasing car ownership, traffic congestion, lack of adequately designed street network in Dhaka, lack of proper management and maintenance of streets, lack of awareness, and so many other problems increases the

Table 1.2: Child Causality of Road Traffic Accidents in Dhaka city by Class.

Causality Class	2001	2002	2003	2004	2005	2006	2007	Total
Fatal	33	47	40	52	37	75	43	327
Grievous	33	22	31	16	30	67	22	221
Simple	3	2	4	0	0	3	1	13
Total	69	71	75	68	67	145	66	561

Source: Accident Research Institute Database (2008).

risk of accidents. Different government and non-government organizations have been working to alleviate this problem. But, their efforts are un-coordinated without vision or of particular focus. Till date, there has no comprehensive study to pin-point where the flaws lay.

This study intends to evaluate the existing situation and factors which hinders the development of 'Safe Street' for people of all ages, gender, income and abilities. Resource constraints, however, limits this study to one that for children. It is thought streets designed with children in mind will be inclusive of all people (including ages, gender, income and abilities). In the study, 'child' means a person who has not completed sixteen years of age (Ahmed, 1996).

1.2 Objectives of the Study

In order to evaluate the existing situation of safe streets for children in Dhaka city the broad aim is to ensure children safe streets in the city. The more specific objectives are as follows:

- To examine the factors that necessitates forming safe street network for children.
- To ascertain the influence of the above factors on children's usage and accessibility of roads and streets in terms of the following activities, such as,
  - (i) going to school and play fields daily, and
  - (ii) going to the recreational areas of the city occasionally.
- To analyze the present Strategic Transport Plan (STP) for Dhaka (2004 -2024) in order to find out how it has accommodated the children of Dhaka and also to suggest measures to rectify flaws, if any, in the present STP.

1.3 Methodology of the Study

1.3.1 Purpose of the Study

This study was undertaken in order to evaluate the existing situation for children safe streets in Dhaka. The main focus was to investigate and evaluate the overall safety

states of the various roads which children are using to go to school, playfields or recreational areas in the city of Dhaka. This included initially an investigation and evaluation of the existing situation that makes streets safe or unsafe and risky for use, especially by children. This evaluation automatically entailed an investigation as to what constitutes safe streets for children, their design and planning, and making them safe for use at all time of the day throughout the year. Following this an in-depth investigation needed to be done as to how the streets of Dhaka has been planned and designed, and what barriers/factors make them unsafe, if any, for use by the children all by themselves, i.e. without chaperone or without help of any adults, how to remove these barriers and make the streets safe not only for children but people of all ages, gender and abilities.

1.3.2 Selection of the Study Area

Dhaka, the capital city, has been selected for the study as it has a high level of car ownership; it is also the most congested city in Bangladesh and has a high record of traffic accidents. In order to conduct this research, the area of the Dhaka City Corporation (DCC) has been taken up for study. As the primary movement activity of the children involves going to school, the roads besides the following 15 (fifteen) schools within Dhaka were surveyed. The schools included in the surveys were –

- Ideal School and College, Motijheel
- Viqarunnisa Noon School and College, Ramna
- Dhanmondi Government Boys High School, Dhanmondi
- International School of Dhaka (I.S.D.), Gulshan
- University Laboratory High School, Shahbagh
- Government Laboratory High School, Newmarket
- Scholastica School, Uttara
- Residential Model School and College, Mohammedpur
- B.A.F Shaheen School and College, Cantonment
- Monipur High School, Mirpur
- Badda Alatunnessa High School, Badda
- Holy Cross School and College, Tejgaon
- Agarani Girls School and College, Lalbagh
- Khilgaon Ideal School, Khilgaon and
- Jatrabari Ideal High School, Demra.

Also, the roads and streets connecting the following 6 (six) popular amusement parks and recreational places of the city and 6 (six) neighborhood play grounds from three urban settings (two playgrounds from planned area, two from unplanned area and two from govt. staff quarters) had also been studied in order to get a picture of how safe are these routes for children. These are -

- Shishu (children's) Park, Shahbagh
- National Zoo, Mirpur
- Wonderland, Gulshan
- Ramna Park, Ramna
- Dhanmondi Lake, Dhanmondi and
- Fantasy Kingdom, Aushulia.

Selected six playgrounds are as follows:

- From planned area.
  - Kalabaghan Play Ground, Dhanmondi
  - Old DOHS Play Ground, Banani.
- From unplanned area.
  - Dhupkhola Play Ground, Sutrapur
  - Jurain Play Ground, Shaympur.
- From Government staff quarters.
  - AGB Colony Fidgah Play Ground, Motijheel
  - Education Board Colony Play Ground, Mirpur.

1.3.3 Study Deign

The study required mainly data collection from primary sources, as information on this topic in Bangladesh was not readily available or non-existent. Information from published sources, mainly from outside Bangladesh, helped to refine concepts and focus on the issue(s) to be emphasized. A reconnaissance survey of streets around the study area helped to select specific schools, playfields and recreational areas for this study. Most importantly relevant theories, policy guidelines and recommendations were sought extensively as part of the literature survey.

Data collection from primary source included questionnaire surveys of students and parents/guardians. The questionnaire was the main tool of collection of information. Four sets of questionnaire were designed – one for the school going children, one for

their parents/guardians, one for school officials and the other for experts and consultants. Surveys were conducted to collect information regarding existing condition and accident scenario of the study area. Interviews of street-users, more specifically school going children, their parents/guardians, traffic engineers, transport planners and officials from Roads and Highways Department, Ministry of Communications were as well conducted. The main intention of the interviews was to find out usage and accessibility of the roads of Dhaka by children and major flaws of road design and facilities from children's point of view.

1.3.4 Literature Survey

Only a limited number of studies and researches have been done in our country regarding this issue. Most of these studies were carried out considering all members of the society, and do not say anything specifically about children. In addition, relevant theories, policy guidelines and recommendations, other thesis works, journals, conference proceedings, articles in news papers and periodicals of home and abroad have been studied extensively to enrich this study. This is elaborated in Chapter 2.

1.3.5 Data Collection

Data both primary and secondary in nature were collected according to the requirements of the study. Crucial data were collected through questionnaire survey, observational investigation and interviews whereas different concerned government as well as non-government organizations and national and local legitimate databases were the major sources of resulting data used in the study.

The questionnaires were pretested for necessary corrections and improvement. The sample sizes selected for the pre-test were same as that selected for the final one. However, the respondents were different for the two cases.

1.3.5.1 Secondary Source

Secondary data had been collected from different relevant government as well as non-government organizations. Different present and past Road Safety National Action Plans had been of use also. Necessary figure, drawing, design and maps along with required data had been collected from the concerned authorities like Accident Research Institute (ARI), Bangladesh University of Engineering and Technology (BUET); National Road Safety Cell (NRSC),

Bangladesh Road Transport Authority (BRTA); Road Safety Cell (RSC), BRTA; Dhaka City Corporation (DCC); Roads and Highways Department (RHD), Ministry of Communications; Traffic Division, Dhaka Metropolitan Police; etc.

1.3.5.2 Primary Source

All the data and information composed from secondary sources eventually helped to decide the remaining data and information essential for the study to assemble through the following primary sources.

1.3.5.2.1 Questionnaire survey / Sample survey

As part of the study, questionnaire-based surveys among the children and their parents/guardians of the pre-selected schools, play fields and recreational places had been conducted to gather information on relevant aspects. A total of 270 sample surveys as representation of the study area (10 questionnaire surveys from each 15 schools = 150 and 10 questionnaire surveys from each 6 parks and recreational places and also from 6 neighborhood play grounds = 120; total 270) had been conducted.

1.3.5.2.2 Reconnaissance survey

All the areas identified for the study were visited to get information and hand in experiences on existing condition and accident scenario of the roads and streets besides those pre selected schools, play fields and recreational places in the study areas. It also helped a lot to have an insight about the existing state of condition of street safety physical infrastructures and measures for the children as well as major hindrance for children against the usage and accessibility of city streets with ease.

1.3.5.2.3 Interview

The pedestrians, road users, and children in particular as well as concerned road safety officials like highway/traffic engineers, transport planners, consultants had been interviewed extensively in two phases to get ideas regarding children's usage and accessibility of the roads of Dhaka, major flaws of road design and facilities, problems faced by children in one hand and on the other hand about the Strategic Transport Plan (STP) for Dhaka,

its drawbacks, if any, and the scopes to accommodate children road safety measures therein. Here, about 50 interviews in total had been carried out on a random basis through pre-designed interview script.

1.3.6 Data Interpretation, Analysis and Development of Recommendations

The data collected from different primary and secondary sources had been arranged in a suitable form for the statistical analysis. Different statistical techniques for example correlation matrix, multi co-linearity, ANOVA and subsequent multiple regression and correlation analysis have been effectively carried out to determine the significant factors for children safe street network of Dhaka. Application of software like Microsoft Excel facilitated the statistical analysis as well to prepare graphical illustrations like bar chart, pie chart, column chart, doughnut, etc. At the end of the study, a set of options/recommendations had also been prepared in the light of major findings of the study.

1.4 Scope of the Study

An analysis of factors that necessitate forming children friendly street networks within the city is of paramount importance to make it safe and usable by all. But no such research has been done in our country to understand the necessity of the safety aspects of children using the roads of Dhaka with regard to their movement pattern, accessibility and usability. The outcome of this research will help by providing guidelines for children safe street network for the future planning and designing of city streets as well as to improve the existing street layout of the study area. It is also expected that the findings of this study will help to understand the underlying problems involved in road accidents so as to provide directions for safe roads/streets to children.

1.5 Limitations of the Study

Road safety is a vital concern for any society. Several factors are associated with the safety at roads such as road user behavior, vehicle characteristics, roadway and environmental features, administration and enforcement of traffic laws and regulations, traffic management, etc. Respect for traffic laws and regulations of a society have strong influence on road safety, especially for the children. All factors that influence road safety could not be included in the study due to time limitations and dearth of fund. Only some specific roadway features were selected to study their association with the safety of children in a particular area. As different areas have

distinctive characteristics, these particular physical features may have different level of influence. Above all, survey works were performed only at the preselected areas which constraints its applicability in general.

1.6 Organization of the Study

Chapter 1 contains an introduction, with an account of the background and present state of the problems, identification of objectives, rational of limitations of the study and the organization of the thesis. Apart from this chapter, the remainder of the thesis has been divided into five chapters.

Chapter 2 highlighted the theories and practices necessary for a children safe street network along with the factors that contribute to road traffic accidents and as well reviewed available literature related to the theme of this investigation. Recent trends in transportation planning, amenities needed for pedestrian comfort and the definition of some critical terms were discussed in the chapter. Literature review helped to understand the nature of our road transport and safety organizations, child accident situation in Bangladesh, child accident problems in the context of global and developing countries, and children friendly transport planning options. This chapter also provided an overview of the previous research works on the same or relevant topics with suggested remedies.

Chapter 3 depicted the systematic statistical consequences used to point out the factors influencing street safety for children in Dhaka city. Moreover, data and information collected through questionnaire survey from the pre-selected schools, play fields and recreational areas were analyzed in this chapter. Analysis was done through graphical representation of the data and information collected.

Chapter 4 analyzed the present Strategic Transport Plan (STP) for Dhaka (2004 - 2024) in order to find out how it has accommodated the children in Dhaka and also suggested measures to rectify the flaws of the STP along with a good practice recommendation to formulating a Road Safety Plan.

Chapter 5 highlighted a clear-cut description of major findings of the study.

A conclusion along with a set of options that had been prepared in the light of the findings from processing and analyzing the collected data and information as well as from analyzing and investigating the present STP for Dhaka were presented at Chapter 6, the last chapter.

1.7 Flow Chart of the Methodology

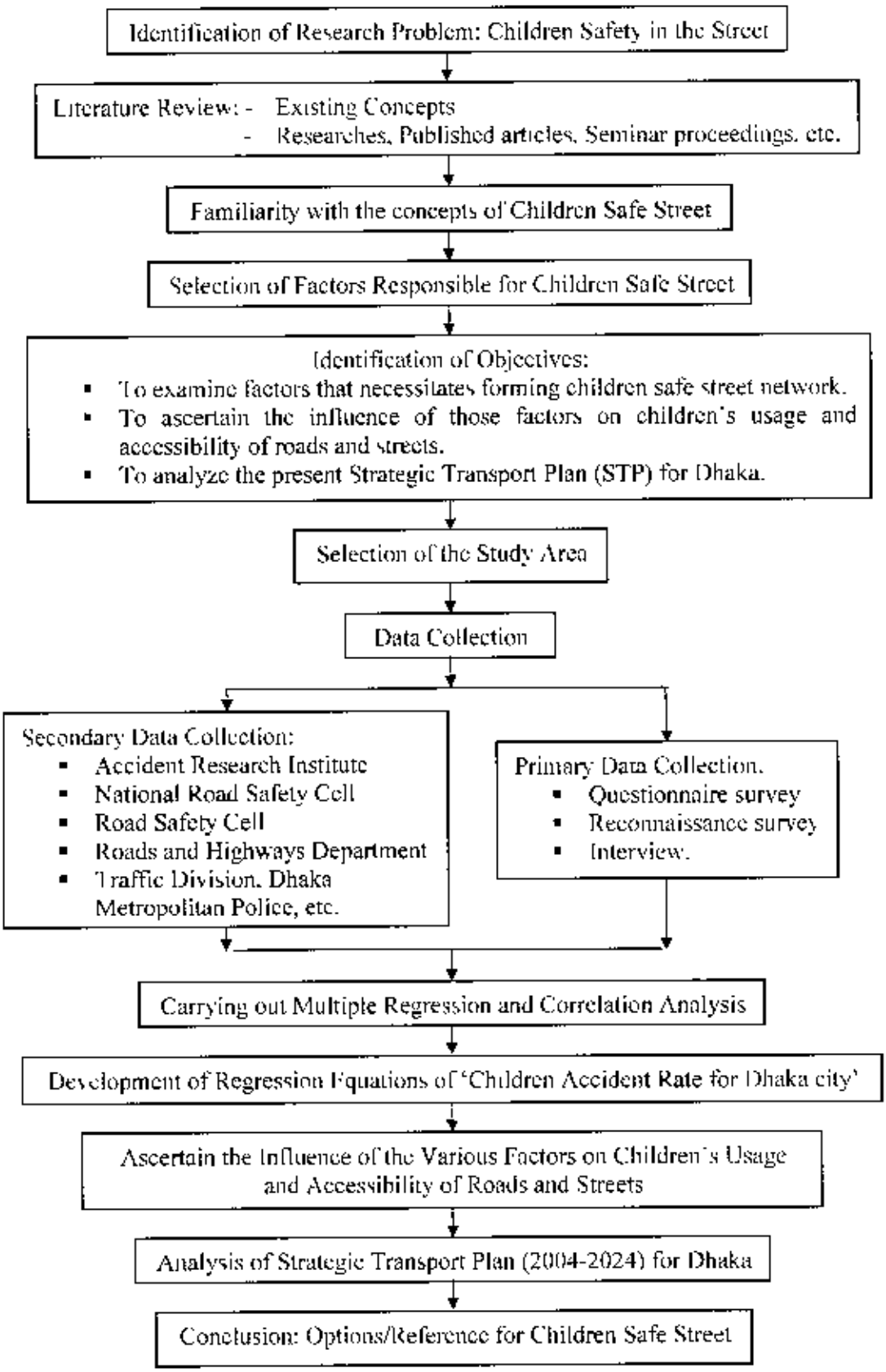


Figure 1.1: Flow Chart of the Methodology.

CHAPTER 2: SAFE STREETS – THEORY & PRACTICES

At the present time, the existing conditions of the roads and streets in Dhaka are an example of the absence of good management of accessible resources resulting in the chaotic disorder that exists on many roads. Traffic management maximizes road safety; a safe and efficient street network could be achieved easily by using traffic operation/enforcement materials and equipments. Despite the economic and social benefits derived from a road network, there is a serious cost that society pays in terms of the numerous collisions and loss of life that are directly associated with the safety aspects of road network. Once the causes are clearly determined, a good street network could be achieved and thereby improved safety on roads.

2.1 What Constitute a Safe Street?

A safe street network should be free from hazards, accessible for all ages and abilities, especially for children with continuity, easy and present to use. Visual character of the streetscape, limited but necessary uses of the pedestrian way are also important.

2.1.1 Safety

Design facilities to be free of hazards and to minimize conflicts with external factors such as unnecessary/through traffic and protruding architectural elements.

2.1.2 Accessibility

Accommodate the needs of people regardless of age or ability. A continuous unobstructed path connecting all accessible elements and spaces in an accessible building or facility that can be negotiated by a child alone, a person using a wheelchair and that is

Photo 2.1: Pedestrians of Dhaka city are minimally experienced with accessible paths.

usable by people with other disabilities. Pedestrian facilities used by the general public to be planned, designed, constructed, and maintained for use by a wide range of people, including children.

2.1.3 Continuity

Provide continuous, direct routes and convenient connections between destinations, including homes, schools, playfields, shopping areas, recreational opportunities, public services, transit, etc.

2.1.4 Easy and Pleasant to Use

Street network should be designed so that people can easily find a direct route to a destination and so that delays are minimized. Consider the effects of spray or splash from

Photo 2.2: Is it an easy, pleasant and continuous walkway?

vehicles of the adjacent roadway onto the pedestrian facility.

2.1.5 Provide Good Places

Enhance the look and feel of the adjacent environments. The urban street environment includes open spaces such as plazas, courtyards, and squares, as well as the building facades that give shape to the space of the street. Amenities such as street furniture, banners, art, plantings and special paving, along with historical elements and cultural references promote a sense of place.

2.1.6 Encourage Different Uses

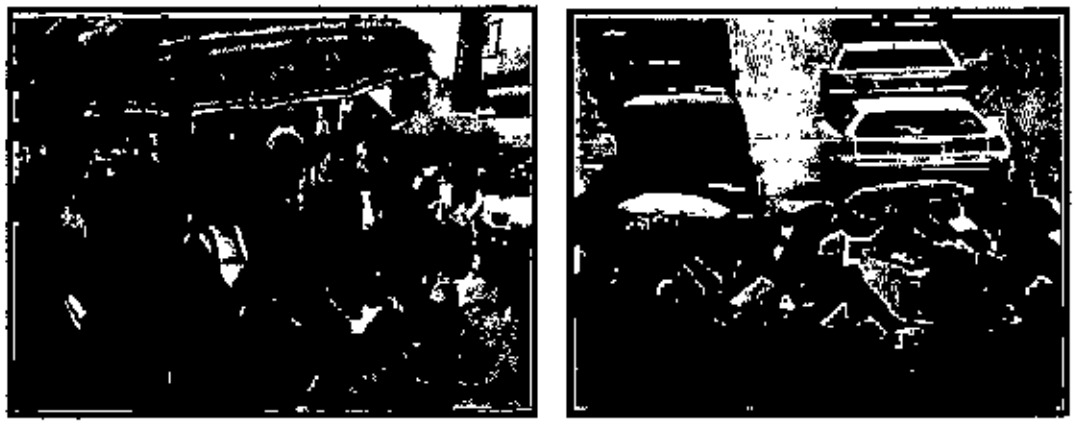
The street environment is a place for public activities and social exchange. Commercial

activities such as dining, vending and advertising may be permitted on streets or sidewalks when they do not interfere with safety and accessibility.

2.1.7 Protection

Scope of protection from inclement weather is one of the important contributors for being a good and user-friendly street environment.

Photo 2.3: Children are crossing streets at their own peril.



2.2 Amenities for Pedestrian Convenience and Safety

As a part of the pedestrian environment, pedestrian facilities are defined as the physical infrastructure that allows for or promotes walking as a form of travel, regardless of ages. Examples of pedestrian facilities can include:

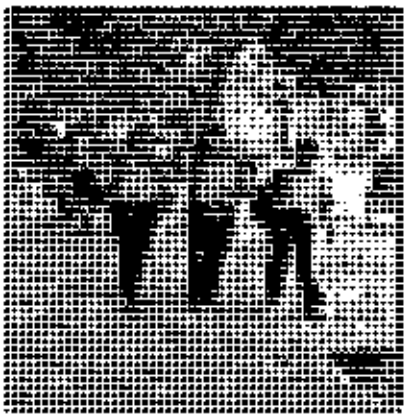
- Sidewalks / Walkways
- Crosswalks
- Streetscape
- Street Corners
- Traffic controls (such as walk / don't walk signals)
- Overpass and underpass
- Multiuse paths
- Curb cuts and ramps to provide easy access for all pedestrians.

Pedestrian facilities also include transit stops, such as the connection to the stop and the waiting pad, other loading areas and grade separations. Although paved shoulders are not

by definition considered pedestrian facilities, these treatments can still act to provide pedestrians with an important safety zone away from traffic along busy highways.

2.2.1 Sidewalks

In most communities, sidewalks are the primary transportation facility for walking. As such, the sidewalk system must be continuous and provide access to all pedestrian destinations. The sidewalk corridor is usually parallel to the road from corner to corner. It encompasses the area from the edge of the road to the property line and provides an area for walking, separated from vehicle traffic, and additional space for signs, streetscape, and amenities. It must be adequately maintained to remain useful. Table 2.1 shows the sidewalk installation guidelines for different roads and areas.



Sidewalks provide places for children to walk, run, skate and play, and are often used by young bicyclists. Sidewalks improve mobility for pedestrians and provide access for all types of pedestrian travel to schools, as well as work, parks, shopping areas, transit stops and other destinations.

Table 2.1. Sidewalk Installation Guidelines.

Accessibility – Sidewalks should be easily accessible to individuals of all ability levels.
Continuity and connectedness – As the primary transportation facility for walking, the sidewalk route should be clear to users and should not be interrupted by gaps and intervening obstacles and conflicting uses.
Safety – Sidewalks should be adequately separated from traffic, well lighted and free of dangerous surface irregularities.
Landscaping – Trees and landscaping within the sidewalk corridor should be used to contribute to physical, psychological and visual comfort.
Social Space – The social aspect of sidewalk corridors should not be ignored so that standing, sitting, visiting and children's play can occur.
Community Form – Sidewalk corridors should be recognized as a community asset and used to contribute to the character of neighborhoods and business districts, and to

strengthen community identity.

Source: Vermont Pedestrian and Bicycle Facility Planning and Design Manual (2002).

2.2.2 Crosswalks

Crosswalks accommodate the most hazardous stage of any pedestrian trip, crossing the street. The purpose of crosswalks is to concentrate pedestrian crossing movements so that the potential number of conflict points between pedestrians and motor vehicles are reduced. There are two types of crosswalks: marked and unmarked.

Crosswalks are the natural extension of the sidewalk at corners (or if there is no sidewalk, the area that would extend if there were a sidewalk). The majority of crosswalks are unmarked. Crosswalks are sometimes marked at mid-block locations. Pedestrians have

Photo 2.4: i) Provision of street crossing without crosswalk, ii) Crosswalk prevails on a very poor state.

the right-of-way at crosswalks but are required by law to obey traffic control devices and laws.

Table 2.2: Features of an Effective Crosswalk.

Clarity – It is clear where to cross and easy to understand possible conflict points with traffic. **Visibility** – Pedestrians can see and be seen by approaching traffic – lighting is adequate and obstacles and the location of the crosswalk do not obscure the view. **Appropriate Intervals** – The potential demand for crossing is reasonably well served by available crossing opportunities.

Adequate Crossing Time – The pedestrian is allotted or can take an adequate amount of time to cross and does not need to wait an unreasonably long time to begin crossing.
Limited Exposure – The distance required to cross is short or it is divided into shorter segments with median refuges.
Continuous Path – The crosswalk is a direct extension of the pedestrian travel path and is free of obstacles and hazards.

Source: Vermont Pedestrian and Bicycle Facility Planning and Design Manual (2002).

2.2.3 Streetscape

The term streetscape refers to the physical setting shaped by the relationship and design of the buildings, parking lots, streets, sidewalks, trees, lighting, street furniture (such as benches, plants, kiosks, and bus shelters) and public art. The relationship between all of

Photo 2.5: Typical streetscape of Dhaka city.

these elements and the quality of their design are what shape the image and scale of communities.

2.2.4 Street Corners

Street corners are busy places. Pedestrian activities are concentrated at street corners.

Street corners are important in the larger scheme of street systems. They are the logical location for hardware such as street name signs and traffic control signs or traffic signal bases. Street corners house much of the hardware (traffic signal, etc.) that controls the complicated movements at intersections. The design of the corner affects the speed with which turning traffic can maneuver through an intersection.

They are of vital importance to the safe integration of automobile and pedestrian traffic. Here, people socialize, buy their newspapers, mail letters, and window shop while waiting for changing light traffic or buses.

The most dangerous and complicated part of an individual's walk, crossing intersections, occurs at street corners.

Table 2.3: Street Corners Considerations.

Adequate Space – Corners should be large enough to accommodate the typical number of pedestrians waiting to cross, congregating for social reasons or waiting for transport. They also must be able to accommodate curb ramps, poles and signs, as well as street furniture, transit shelters and other amenities.
Separation from Traffic - Corner design should effectively discourage the encroachment of motor vehicles into the pedestrian area.
Visibility – Pedestrians must be able to see and be seen by motorists at all times. Traffic controls and signals must also he visible from the pedestrian perspective.
Legibility – Signals, signs, and pavement markings should communicate clear messages to the pedestrian.
Accessibility – All corner features including ramps, landings, call buttons, pavement markings and textures must meet standards.

Source: Vermont Pedestrian and Bicycle Facility Planning and Design Manual (2002).

2.2.5 Traffic Controls

Traffic control is a critical element in the safe and efficient operation of any transportation system. Elaborate operational procedures, rules and laws, and physical

Photo 2.6: Traffic control measures near Junior Laboratory School, Dhanmondi.

devices (*e.g.*, signs, markings, lights, etc.) are but a few of the components of any traffic control system.

At the broadest level, road traffic control includes the layout of streets to serve a variety of travel needs in a region. Highways or expressways carry through traffic at high speed; arterial streets carry traffic within and across urban areas; and local streets provide low-speed travel but access to many local destinations. The hierarchies of streets that perform

Photo 2.7: A shocking state of the traffic control measures is common enough in Dhaka city.


at different levels of speed and provide different levels of access form the foundation upon which traffic control problems evolve. Long delays and frequent accidents are common outcomes of inadequate road planning, which results in an insufficient number of roads to meet travel needs. While traffic control may help, it is not a substitute for adequate provision of transportation supply.

2.2.6 Overpass/Underpass

Pedestrian overpasses and underpasses allow for the uninterrupted flow of pedestrian

Photo 2.8: Overpass at Azampur, Uttura and Sahinbagh, Farmgate.


movement separate from the vehicle traffic. Overpass/underpass is usually more appropriate to install safe crossings that are accessible to all pedestrians. Grade separated facilities are extremely high-cost.

It is natural that many pedestrians will not use an overpass or underpass if they can cross at street level in about the same amount of time or less. Overpasses work best when the topography allows for a structure without ramps (e.g., overpass over a sunken freeway). Underpasses work best when designed to feel open and accessible. Grade separation is most feasible and appropriate in extreme cases where pedestrians must cross highways or barriers such as train tracks.

2.3 Amenities for the Pedestrians

It is important to provide opportunities for the pedestrians and street users to rest, to shield themselves from the weather or sun, to refresh themselves with a drink of water or to provide an illuminated route of travel. Therefore, amenities that provide these benefits should be considered and included as essential components of every project.

Following items should be considered for comfort, sense of security and convenience of pedestrians of all ages, especially for the children:

- Lighting
- Trash Receptacles
- Information and directional signage
- Benches and street furniture
- Information kiosks
- Drinking fountains
- Public telephones
- Transit shelters
- Distance markers
- Bicycle parking
- Restrooms
- Picnic tables and protective shelters
- Ramps and stairways

Following items should be considered with high regard to soften and enhance the pedestrian environment:

- Grassy areas and buffer strips
- Shade trees
- Planters
- Textured walkways surfaces
- Ornamental fountains
- Selective relocation of utility poles or burial of utility cables
- Up lighting of trees, monuments

- Statuary or artwork (sculpture, etc.) and gazebos.

2.3 1 Lighting

Consideration should be given to the need for lighting on paths used by commuters or students during twilight and nighttime hours and for any path at a street crossing. Special consideration should be given to lighting at pedestrian street crossings Lighting should also be considered in underpasses, overpasses and tunnels and where nighttime security could be an issue.

2 3.2 Trash Receptacles

Along walkway paths trash receptacles should be provided taking into account the nature of the surroundings and environment. which reduces maintenance along paths.

2 3 3 Information and Directional Signage

Pedestrian oriented signs should be developed to assist visitors and even residents who may not realize that the best route on foot is shorter than using motorized vehicles. Examples of key destinations to include are libraries, post offices, government offices, transit centers, schools, museums, entertainment centers, shopping centers, parks, public rest rooms, and tourist attractions.

Signs should be unobtrusive, easy to read, and aesthetic. Placing enough signs lead a pedestrian confidently to the destination by the best route.

2.3 4 Benches and Street Furniture

Signs, street furniture, and other items that could be considered obstacles should be placed outside of the pedestrian through zone All items installed for pedestrian use should be accessible. Disabled and elderly pedestrians, children appreciate benches at regular intervals along all public streets, especially where sidewalks slope steeply. Benches should be placed on level, paved surfaces.

2.3 5 Information Kiosks

Because pedestrians expend their own energy getting to a destination, it is important to maximize way finding opportunities to reduce the possibility of out of direction travel. In addition, destinations that are familiar to a resident may be unknown to a visitor.

Frequently spaced information kiosks and directional signs can alleviate these problems and make the environment more inviting to walking.

2.3.6 Drinking Fountains

Children accessible and standing-height drinking fountains should be combined when installed on public sidewalks and paths. Both drinking fountains and telephones need to be carefully located to avoid projecting into a circulation route.

2.3 7 Public Telephones

Where public pay telephones are grouped in a public space. at least one instrument should be installed at a children height as well as wheel-chair accessible height while another should be mounted higher to enable pedestrians who have difficulty bending or stooping to use it easily.

2 3.8 Bus stops and Transit Shelters

At bus stops, transit stations and other locations where pedestrians must wait, a shelter makes the wait more comfortable. Shelters should provide undercover seating including enough spaces for people of all ages.

Transit shelters should always be created on a paved surface and connect the transit shelter to the pedestrian network in a paved walkway. It requires enclose three sides of the shelter to provide maximum weather protection Provide windows or use transparent material on the sides of the shelter for maximum visibility and security. Illumination is required to the shelter and area around the shelter for nighttime use. Bus schedules and route maps within each shelter are of paramount importance.

When locating transit stops, consideration should be given to placing the stop on the far side of an intersection instead of on the near side of an intersection. For pedestrian safety and maximizing sight distance at intersections. far side stops are preferred.

2.3 9 Distance Markers

Provide kilometer or mile markers to orientate path users. Distance markers are especially beneficial to those engaged in fitness activities.

2.3 10 Bicycle parking

Lack of secure parking facilities is frequently cited as a deterrent to bicycling in urban or village settings. People may avoid bicycling when:

- There is no place to park their bicycles at their destination.
- They perceive their bicycle or components may be subject to theft or vandalism or they have to walk too far to a building's entrance.
- Their equipment will be exposed to weather
- The parking area is poorly lit or perceived as unsafe.

The principal considerations for bicycle parking are.

- Appropriate level of security required for the anticipated parking period.
- Location of bicycle parking area.
- Spatial requirements.
- Signing and identification of the parking area and Devices.

2.3.11 Public Restrooms

Conveniently located restrooms are welcomed by both residents and tourists and take the pressure of business owners from having to provide sanitary facilities for the general public.

2.3.12 Picnic Tables and Protective Shelters

Shelters and picnic tables with roofs and protected seating areas are required where to be greater exposures to the sun and other elements.

2.3 13 Stairways

Where a connection is needed to a destination or another path at a different elevation, a stairway can be used where the terrain is too steep for a path. To accommodate bicyclists, a 75 mm (3 inch) groove (wide enough to accept a bicycle tire) can be provided in the top of the stringer on both sides of the stairway so bicyclists can easily guide their bicycles up or down the stairway.

2.3.14 Other Amenities

Other items commonly found on sidewalks and along paths are fire pull stations, mailboxes, information and sales kiosks, and fixed vending. The placement or installation

of such items should not narrow the minimum clear, unobstructed sidewalk and path width, particularly at turns, access points and ramps and in places that requires additional maneuvering space.

2.4 Street Design, Planning and Engineering for Children

Engineering approaches for the roads and streets can improve children's safety to enable safe walking and bicycling. Engineering is a broad concept used to describe the design, implementation, operation and maintenance of traffic control devices or physical measures, including low-cost as well as high-cost capital measures. This section serves as a discussion of various engineering techniques aimed to highlight the principles behind safe streets for children.

2.4.1 Along the School Route

Children who walk or bicycle to school or other destination need safe and well-designed facilities between their home and school / destination.

2.4.1.1 Sidewalks

Sidewalks, specifically paved sidewalks, are an important piece of a walking route to school. Paved sidewalks are "pedestrian lanes" that provide people with space to travel within the public right-of-way separated from motor vehicles and on-road bicycles. They should have a level, hard surface and be separated from motor vehicle traffic by a curb, buffer or curb with buffer.

Many parents are not willing to allow their children to walk to school if there is no place for them to walk. Streets that do not have sidewalks, particularly those on routes where children walk or bicycle to school, should be identified and assessed to determine if retrofitting these streets with sidewalks is appropriate.

- Sidewalk Surface Types

While concrete is the most common sidewalk material, other construction materials may be acceptable, but may require more maintenance. Sidewalks can be surfaced with a variety of materials to accommodate varying budgets and contexts. While urban, suburban and heavily used sidewalks are typically

made of concrete, less expensive walkways may be constructed of asphalt, crushed stone or other materials if they are properly maintained and accessible.

- Sidewalk Placement

Sidewalk placement, or setback, along streets should take into account worn paths and buffer zones. Sidewalks also need to provide a continuous path. Just as streets are designed and built to provide a continuous network, sidewalks also should provide users with a continuous path.

- Sidewalk Width

The preferred minimum sidewalk width is five to six feet. The six-foot width allows for two people to walk comfortably side-by-side and provides sufficient space for pedestrians crossing in the opposite direction. Sidewalks with a width of eight to ten feet or more should be built where there is no sidewalk buffer along an arterial street and along roads adjacent to school grounds where large numbers of walkers are expected.

- Sidewalk Buffers

The space between the sidewalk and closest lane of moving vehicles is the sidewalk buffer. In general, there are four types of sidewalk buffers:

  - Planting strip of grass and trees

    This is the preferred buffer as it provides a more pleasant, shaded environment to walk
  - Bicycle lane

    If a planting strip is not possible, a bicycle lane can provide an acceptable buffer between pedestrians and motor vehicles.
  - Parked motor vehicles

    Parked motor vehicles can provide a buffer between pedestrians and moving vehicles, but can also create a visual screen for pedestrians as they cross at mid-block.
  - Street furniture

    May include benches, newspaper boxes, street lighting, public art, etc.

- Curb Ramp Design

Curb ramps should be perpendicular wherever possible, where each corner has two ramps installed perpendicular to the face of the curb (vs. a single ramp facing diagonally into the intersection). A big advantage of having two ramps at the corner and small curb radii is that the curb ramps can lead directly along the line of travel.

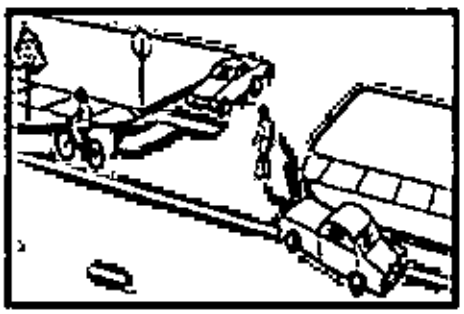
Photo 2.9: Each corner should have two curb ramps, one for each crossing.

When a corner is retrofit with new curb ramps, the crosswalk markings may have to be moved so that the curb ramp fully aligns within the crosswalk.

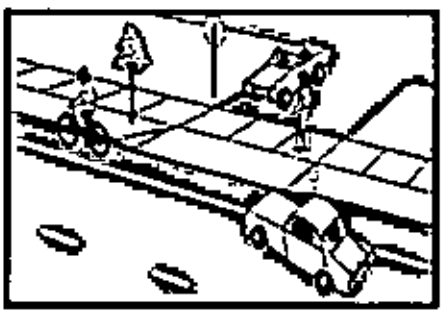
- Driveway Design

Properly designed driveways, as they cross sidewalks, can enhance pedestrian safety by providing a consistent surface and reminding drivers that they are crossing a sidewalk. The following principles should be applied to driveway design:

- The sidewalk continues across the driveway at the same elevation or level.
- The driveway apron does not go through the sidewalk.



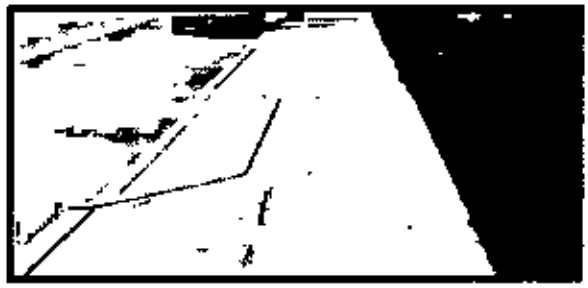
Radius-type driveways allow higher motor vehicle speeds. Driveways should not be designed like this.



Wing-type driveways provide the best pedestrian crossing as long as the driveway apron does not extend into the sidewalk area.

Ramps may be necessary at intersections when pedestrians cross the street, but the rest of the sidewalk network should be continuous and at one level. At

driveways, there is no need to break the sidewalk network. Driveways should not look like intersections. Radius driveway designs, like the one pictured here, encourage higher turning speeds and makes it less likely that the drivers will yield to pedestrians on the sidewalk.



Sidewalks must allow a flat driveway crossing that is at least three feet wide with a side slope of less than 2 percent.

2.4.1.2 Street Lighting

Street lighting improves pedestrian visibility and personal security. Street lighting improves safety by allowing pedestrians and drivers to see each other. It also adds to personal safety and aesthetics. Two-sided lighting should be considered along wide streets, and it is especially important to provide lighting at the crossings. Lighting can also be helpful along streets adjacent to the school grounds to minimize school vandalism and improve security.

2.4.1.3 On-street Bicycle Facilities

When providing student travel facilities along the street, it is not just about walking, but about bicycling too. Bicycling is an important way for children to travel to and from school.

- Bicycle Lanes

Bicycle lanes provide a striped and stenciled lane for one-way bicycle travel on roadways. Bicycle lanes offer a comfortable space for older or more experienced children to ride. Bicycle lanes should include the lane line and bicycle lane symbol. Bicycle lanes located next to motor vehicle parking should be at least five feet wide. The preferred width of bicycle lanes next to a curb is also five feet, although four feet, excluding the gutter pan, may be

adequate. Bicycle lanes should be designated through the use of signs or painted symbols and motor vehicle parking restrictions.

- Paved Shoulders

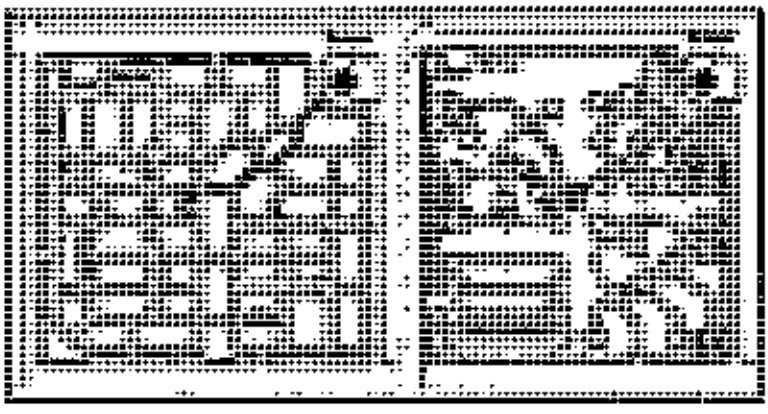
Paved shoulders benefit both bicyclists and drivers. They provide a place for bicyclists to ride that is removed from the motor vehicle travel lane and reduce the likelihood of crashes from motor vehicles drifting out of their travel lane (run off the road crash).

- Bicycle Boulevards

Bicycle boulevards are designed to prioritize bicycle traffic on residential streets that are parallel to a nearby arterial road with high or potentially high bicycle traffic, and are too narrow to install a bicycle lane or have such low vehicle volumes that a bicycle lane is unnecessary. Direct, cross-town routes are preferable for bicycle boulevards.

2.4.1.4 Connectivity

The connectivity of various bicycle and pedestrian facilities directly impacts the ability to walk or bicycle to school. Characteristics of a well-connected road or path network include short block lengths, numerous three and four-way intersections and minimal dead-ends (cul-de-sacs). As connectivity increases, travel distance decreases and route options increase. A network of streets,



The diagram on the left illustrates a street layout based on a grid system, and the diagram on the right illustrates a layout which consists of many dead end streets with few exits or entrances. The diagram on the left provides a greater street connectivity than the diagram on the right. A trip from home to school for a child who lives in the neighborhood on the left is feasible on foot or by bicycle. It features a short distance using local streets with no major

streets to navigate. For the child who lives in the neighborhood on the right, the trip is longer and takes place mostly on busy streets. As a result, many parents will choose to drive their child to school, which will overburden the arterial street system and create unnecessary traffic congestion at the school.

sidewalks, bicycle lanes and paths in which all parts are well-connected to each other reduces the distance children have to travel to get from home to school, allows for the use of more local streets rather than major roadways and provides a greater choice of routes to travel to and from school.

2.4.2 Crossing the Street

A child's journey to school by foot or on a bicycle will likely require crossing one or more streets. Underlying good, safe design at pedestrian crossings is the need to keep the street crossing simple. The development of safe crossings for children is guided by several principles including the need to:

- Establish or identify good crossing locations.
- Reduce crossing distances.
- Use appropriate traffic controls such as marked crosswalks, traffic signals and warning signs or flashers.
- Slow motor vehicle speeds.

2.4.2.1 Tools to Reduce Crossing Distances for Pedestrians

Wide, high-speed, busy, multilane roads are barriers to walking and bicycling to school. In an effort to provide safe routes for children, such roads should mark the boundary of a school walking zone.

The distance required to cross a street and the length of time that a pedestrian is exposed to traffic can be shortened with curb extensions and crossing islands. Curb extensions, also known as curb bulbs or bulb-outs, reduce the distance pedestrians must walk in the street, while crossing islands also simplify a crossing by breaking it into two pieces. 'Crossing Islands for Offset or Two-Stage Crossing' is another solution in this respect. Nevertheless, following considerations are important for the children as well as other pedestrians.

- Waiting Areas and Stand-back Lines

Larger waiting areas and stand-back lines are low cost measures to improve

safety at busy crossings. Large groups of students should not be waiting to cross immediately next to high-speed moving traffic. Waiting areas at crosswalks can be provided along with stand-back lines painted to keep children further back from busy streets when waiting to cross

- Multiple Lane VS Fewer Lanes

Street crossings are safer for pedestrians when there is a fewer number of lanes to cross. Multiple lane threat is a problem that arises when pedestrians have to cross more than one lane in each direction. A multiple-threat pedestrian crash is a crash type that occurs when a motor vehicle in one lane stops and provides a visual screen to the driver in the adjacent lane. The driver in the adjacent lane continues to move and hits the pedestrian. This type of collision, where the pedestrian is hit in the second, third or fourth lane is common on multilane roads and typically results in a more serious collision due to a higher impact speed. Additionally, providing yield lines and set-back stop lines can also reduce the risk of a multiple threat crash.

2.4.2.2 Marked Crosswalks

A marked crosswalk can benefit pedestrians by directing them to cross at locations where appropriate traffic control, including traffic signals or pedestrian / children crossing signs, either currently exist or can be provided.

There are several reasons to install marked crosswalks, a few being:

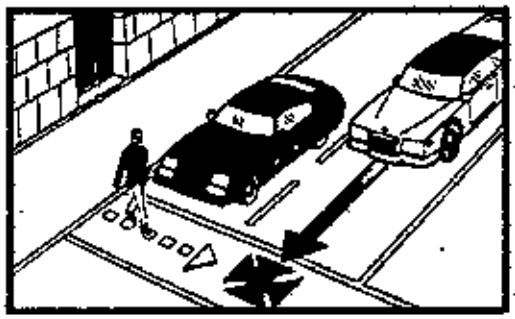
- To indicate a preferred pedestrian crossing location.
- To alert drivers to an often-used pedestrian crossing
- To indicate school walking routes.

2.4.2.3 Enhanced-visibility Crosswalks

- Yield lines and set-back stop lines

Yield lines and set-back stop lines in advance of crosswalks improve a driver's view of the pedestrian in the crosswalk, reduce the number of motor vehicles encroaching on the crosswalk, and indicate that drivers should yield to pedestrians in advance of crosswalks. Stop lines are used in advance of marked crosswalks at

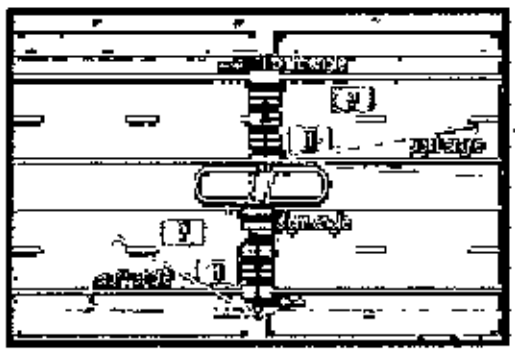
signalized intersections, while yield lines are placed in advance of unsignalized crosswalks.



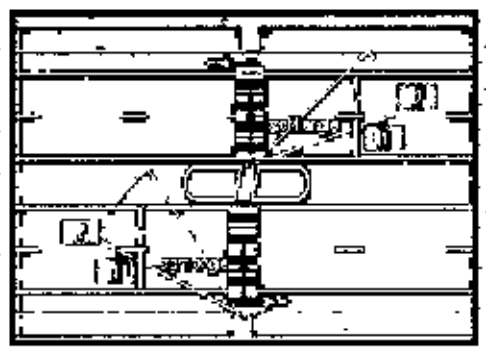
This image illustrates a multiple-threat collision.

Painted triangles (shark's teeth) are used as the yield line at unsignalized locations.

A line of painted triangles, also referred to as "shark's teeth" yield markings are appropriate for use as the yield line at unsignalized locations. If the stop lines are placed more than 50 feet away, drivers are more likely to ignore the line and stop only a few feet prior to the crosswalk or in the crosswalk.



Problem: Motor vehicle 1 stops to let pedestrian cross; vehicle 1 masks vehicle 2, obstructing the pedestrian's and vehicle 2's view of one another. Vehicle 2 doesn't stop and may hit the pedestrian at a high rate of speed.



Solution: Place advance stop/yield line so motor vehicle 1 stops further back. Vehicle 1 no longer masks vehicle 2, which can better see and be seen by the pedestrian.

- Parking Restrictions at Corners

Restricting parking at corners improves visibility of the crossing for both drivers and pedestrians. At a minimum, 30 feet should be kept clear in advance of marked crosswalks to help pedestrians and drivers see each other better. Distances greater

than 30 feet are generally better, but parking restrictions have to be balanced with the need of the driver. For example, if parent parking is severely restricted or completely removed near schools, parents may ignore all parking restrictions.

2.4.2.4 Traffic Signals

Signalizing busy intersections and providing signalized crosswalks help create safe routes to schools for children. Traffic signals are the highest form of traffic control. However, their benefit to the pedestrian network is contingent upon the application of several principles including:

- Mark all legs of an intersection.
  Pedestrian paths (marked crosswalks) should be provided on all sides of an intersection where pedestrian crossings are desired. A school walking route plan may limit crossings to three or fewer legs, but all options should be available for school children to select the most desirable crosswalks to use.
- Provide pedestrian signal heads in all directions.
  Pedestrian signal indications (WALK, flashing DON'T WALK, DON'T WALK, or walking man and raised hand symbols) should be provided at every signalized crossing.
- Only use pedestrian pushbuttons if they are needed.
  Push buttons are generally appropriate at locations with low or intermittent pedestrian activity. If used, they should be in clear view, wheelchair accessible and responsive to those who push the buttons. However, we are yet to use pedestrian pushbuttons for our Dhaka city.
- Install landings on all corners.
  Fully accessible landings should be in place on all corners to provide a safe place for people or children to wait.
- Paint stop bars for motor vehicles on all approaches
  Stopping motor vehicles in advance of the marked crosswalk keeps the crosswalk clear for pedestrians and can reduce right-turn-on-red conflicts.
- Install curb ramps on each corner.
  Two curb ramps per corner; eight per intersection is generally

recommended, although there are situations where one diagonal ramp per corner is an acceptable option (e.g., where there is a wide turning radius and two ramps per corner is not feasible).

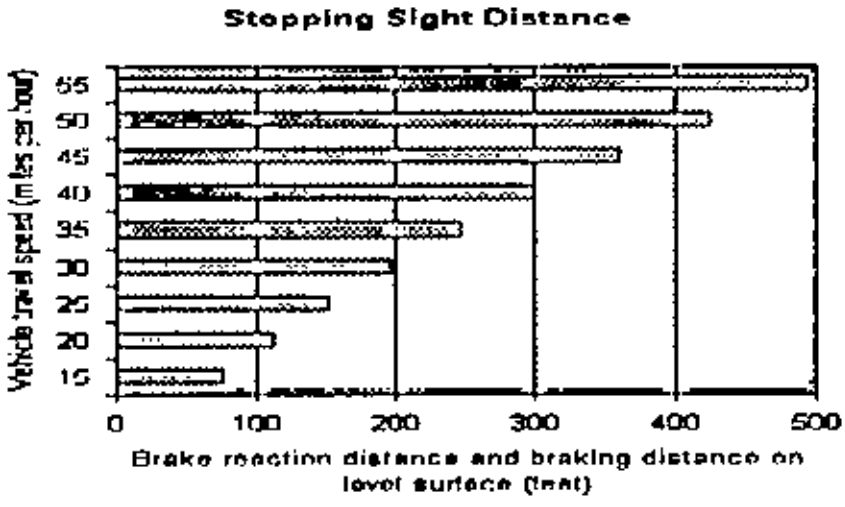
- Provide streetlights on all four corners.

2.4.3 Slowing Down Traffic

Wide high-speed streets can create a barrier to walking to school. This is the type of condition that should not occur along a child's route to school. High-speed motor vehicles pose a serious threat to the safety of children who are crossing streets. One of the biggest challenges in providing children with safe walking and bicycling routes to school involves slowing down traffic.

Slower motor vehicle speeds allow drivers to stop in a shorter distance and reduce the chance of injuring a pedestrian or bicyclist. A motor vehicle traveling on a level surface at a rate of 40 mph will need nearly 300 feet between the vehicle and the child to stop in time to avoid a collision. This distance is reduced to approximately 197 feet for a vehicle traveling at 30 mph, 112 feet for a vehicle traveling at 20 mph and 77 feet for a vehicle traveling at 15 mph.

Figure 2.1: Relationship between Motor Vehicle Speed and Braking Distance when Traveling on a Level Surface.



When slowing or 'calming' traffic, the right design invites the right driver response. The guiding principle of traffic calming is to influence driver speeds and behavior through good design whenever possible, rather than by traffic control measures such as traffic

signals and STOP signs.

There are many design and engineering tools that can be used to slow down traffic and make it safer for children to walk and bicycle to school which are as follows:

2.4.3.1 Narrow Lanes

There are several ways to narrow a street. Paint is a simple, low cost and easy way to narrow the street or travel lanes. If the narrower lanes can result in a striped shoulder, the shoulder will provide a buffer for pedestrians, a place for bicyclists to ride and can provide a refuge for disabled motor vehicles. The shoulder stripe also provides better driver guidance. Interior traffic lanes can be narrowed to 10 feet wide to encourage slower speeds. Narrow lanes can also result from road-diet projects which can include painted medians, center turn lanes, bicycle lanes or parking lanes.

2.4.3.2 Speed Humps

Speed humps represent one type of traffic calming measure that has been used in Dhaka city for slowing traffic. Modern speed humps have a rounded appearance that is 2.5 to 4 inches high at the center. Longer and flatter speed humps are referred to as speed tables. Speed humps have been shown to reduce motor vehicle speeds on streets where they were installed.

2.4.3.3 Raised Pedestrian Crosswalks

Raised pedestrian crosswalks serve as traffic calming measures by extending the sidewalk across the road and bringing motor vehicles to the pedestrian level. The raised crosswalks allow the pedestrian to cross at nearly a constant grade without the need for a curb ramp and makes the pedestrian more visible to approaching drivers. They have a trapezoid-shaped cross-section to slow drivers.

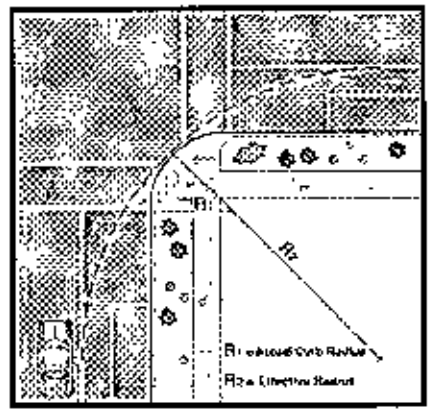
Photo 2.10: A raised crosswalk provides a level area for pedestrians crossing the street.

2.4.3.4 Neighborhood Traffic Circles

Traffic circles can help slow traffic on local and collector streets and calm traffic for pedestrians. While traffic circles are typically not ideal for use at a school crossing location, they can help calm traffic along a street, making the crossing locations on that street safer. Neighborhood traffic circles on local streets do not need to have raised splitter islands, but they should be illuminated with streetlights.

2.4.3.5 Reduced Corner Radii

There is a direct relationship between the size of the curb radius and the speed of turning motor vehicles. A large radius may easily accommodate large lorries, trucks and school buses, but it also allows other drivers to make high speed turns, and it increases the crossing distance for pedestrians. Drivers who drive faster are less likely to stop for pedestrians. A larger radius will also result in a longer crossing distance for the pedestrian. The solution is to reduce the curb radius. It is important to consider what motor vehicles actually need when turning.



2.5 The Road Traffic System

The road traffic system can be said to be comprised components, the human, the vehicle and the road (Ogden and Bennett, 1989). Accidents, which may be thought of as breakdown in the system, likewise have three components: pre-crash, in-crash and post-crash (Ogden, 1994). Combining these two concepts Haddon Matrix (Table 2.4) was introduced a possible focus of attack on elements of the road trauma problem.

It is also important to look at the factors contributing to accidents in the road traffic system. In 1980, USA and UK identify the contributory factors of road accidents which are road, road user or vehicle or interaction among them. These factors are predominant because they highlight the key role of the accident. However, such analyses are of limited

value in developing countermeasures. for two reasons.

Firstly. these analyses are based on the premise that the outcome would have been different if a particular feature had not been present. For example, a head on crash on a dry well lit roadway would likely be entirely liable to road users. But that crash would have not been occurred if the road had been divided highway. Secondly, factors which contribute to a crash do not necessarily point in the direction of cost effective countermeasures, such as vehicle related factor.

From a traffic engineering point of view, the important point to note from above that since the driver is the key, the human factor must be considered for the effective use of

Table 2.4: The Haddon Matrix.

	Pre-Crash	Crash	Post-Crash
Human	Information Attitudes / Behavior Impairment Police Enforcement Conspicuous clothing on pedestrian and cyclists, etc	In vehicle restrains fitted and worn Impairment	First-aid skill Access to medics Emergency medical services.
Vehicles & Equipment	Road worthiness Lighting Braking Handling Speed management	Occupant restraints Other safety devices Crash-protective design	Base of access Fire risk
Road / Environment	Delineation Road Design, Geometry & layout Speed limits Surface Condition Pedestrian facilities	Crash protective roadside objects i.e. roadside safety (such as on hazardous poles).	Rescue facilities Congestion

Source: Haddon (1968).

traffic engineering application and countermeasures (Odgen, 1994). Conversely, it needs

to be emphasized that although road related factors contribute to accident; countermeasures have a much greater contribution to influence the behavior of predominant factor, namely the driver. The recent road safety strategy is to develop and apply traffic control systems, such as signals, signs, and road markings to help road users drive safely. Almost all traffic engineering and

traffic measures work through their influence on human behavior and thus these are an important component of overall road safety strategy.

2.6 Road Traffic Accidents

In the following subsequent sections road traffic accidents are discussed in various types/forms.

2.6.1 Accident Classifications

One of the basic tools for accident analysis is to subdivide accidents into a variety of classes. In broad perspective, this sub division often helps in developing appropriate accident countermeasures (Hoque, 1988) for reducing either the occurrence of particular events (such as rear end, head on, hit to pedestrian, hit to road side objects, side hit collisions, etc.). It is also important to identify the clustering of accident characteristics/factors, because when a relatively few characteristics are account for a large proportion of crashes, countermeasures to these characteristics/factors can give a big overall reduction in crashes.

Road accidents of different types may vary depending upon prevailing circumstances. Some accident types may occur throughout the road network. In this regard, it is hypothesized that accident of same type may occur from similar traffic situations and/or similar behavior of drivers. It is therefore often useful to categorize accidents by the type of traffic and perhaps the road layout and configuration.

2.6.2 Accident Sub-divisions

Traffic accidents are traditionally classified by severity of accidents i.e. fatal, grievous injury, simple injury, and collision only. Secondary classifications of accidents are categorized by location, such as rural accidents, urban accidents, and accidents at links or intersections.

Andreassend (1983) proposed a different approach to the sub-division of accidents. He used collision and non-collision events in junction with accident location to describe the number of vehicles involve in an accident, i.e. multi-vehicle accidents and single vehicle accidents. These accidents are then dis-aggregated at desired levels to determine detailed accident types, severity, etc.

Photo 2.11: Children of Dhaka are more vulnerable to road accidents.

2.6.3 Accident Types

Andreassend (1982) identified and discussed extensively the international practices of documented accident types in the context of accident studies. Andreassend summarized that there is a number of accident type system in use around the world, they differ only by the extent to which they are categorized and the lack of definitions for the types used. The principal behind the definition of accident type is the accident event. This 'event' is related to collision, non-collision and on/off the road carriageway. In essence, it is the same concept as used in the traditional collision diagrams.

The accident type system used in Victoria (Australia) since 1968 is known as Road User Movements (RUM). It describes accident by the movements of road user involved in an accident for determining accident problems and subsequently for identifying high accident locations, i.e. intersections or mid-blocks. In 1981, Andreassend modified and introduced a new system of classifying accident types which is known as Definition for Coding Accident types (DCA code), to provide a detailed view of the accidents which is brought by the changes in the road system and traffic control environment (Andreassend, 1983). The application of this system in accident studies highlights its value in determining the particular nature of accident problem which require solution and evidence of countermeasures. This DCA code is successfully used in Australia (Ogden, 1994) for developing countermeasures by classifying accident types with the diagrammatic representation of various vehicle-to-vehicle and vehicle-to-other road users movements.

2.6.4 Road Traffic Injury Indicators

Indicators are important tools not just for measuring the magnitude of a problem but also for setting targets and assessing performance. The most frequently used absolute and relative indicators for measuring the magnitude of the road traffic injury problem are presented in Table 2.5.

Table 2.5: Commonly Used Road Traffic Injury Indicators.

Indicator	Description	Use and limitations
Number of injuries	Absolute figure indicating the number of people injured in road traffic crashes. Injuries sustained may be serious or slight.	Useful for planning at the local level for emergency medical services Useful for calculating the cost of medical care. Not very useful for making comparisons. A large proportion of slight injuries are not reported.
Number of deaths	Absolute figure indicating the number of people who die as a result of a road traffic crash.	Gives a partial estimate of the magnitude of the road traffic problem, in terms of deaths Useful for planning at the local level for emergency medical services. Not very useful for making comparisons.
Fatalities per 10 000 vehicles	Relative figure showing ratio of fatalities to motor vehicles.	Shows the relationship between fatalities and motor vehicles. A limited measure of travel exposure because it omits non-motorized transport and other indicators of exposure
Fatalities per 100 000 population	Relative figure showing ratio of fatalities to population.	Shows the impact of road traffic crashes on human Population. Useful for estimating severity of crashes.
Fatalities per vehicle-kilometer traveled	Number of road deaths per billion kilometers traveled.	Useful for international comparisons. Does not take into account non-motorized travel.
Disability-adjusted life years (DALYs)	Measures healthy life years lost due to disability and mortality. One disability-adjusted	DALYs combine both mortality and disability

	life year (DALY) lost is equal to one year of healthy life lost, either due to premature death or disability.	DALYs do not include all the health consequences associated with injury, such as mental health consequences.

Source: WHO World Report on Road Traffic Injury Prevention (2004).

Two very common indicators are the number of deaths per 100,000 populations, and the number of deaths per 10,000 vehicles. Both of these indicators have limitations regarding their reliability and validity that place restrictions on how they can be used and interpreted.

2.7 Definitions of Different Terms

It is important to describe some of the terms used in the text in order to help in comprehension. Some of the more important terms relating to accidents and accident characteristics are given in the following subsequent sections.

2.7.1 Accident

The term 'accident' is used to mean an event that produces, or has the potential to produce an injury (Berger and Mohan 1996). Many public health experts believe that widespread use of the term 'accident' has not only caused semantic confusion; it has actually inhibited efforts to reduce injuries (Haddon and Baker 1981 and Robertson 1983). This is because many people think of an accident as being something unpredictable and random, and therefore not predictable. Another connotation of accident is that they are the result of human carelessness, which the injured person is to blame for his/her injury (Berger and Mohan 1996). Actually the events which produce damage to people are non-random, have identifiable risk factor, and involve interaction among people, vehicles, equipments and the physical and social environment.

In this study the term 'accident' is used to denote the events which produce damage to people or property due to movement of at least one road vehicle

2.7.2 Casualty Class

Casualty class is defined as the degree of injury sustained by a person involved in an accident. It is categorized as follows:

2.7.2.1 Fatalities

Casualty refers to person/persons who had died within one year of the accident as a result of injuries sustained in the accident. But Dhaka Metropolitan Police (DMP) reported it only as a casualty on the spot death. Generally it is presented as 'Fatal' in the question of working suitability.

2.7.2.2 Grievous Injury

Casualty refers to a person/persons who have admitted to hospital for treatment of injuries for one night or more. Generally it is presented as 'Grievous' in the question of working suitability.

2.7.2.3 Simple Injury

This is the accident for which one or more people gets hurt or receive minor injury. Normally property damage of vehicles is involved in this type of accident. In table it is presented as 'Simple' in the question of working suitability.

2.7.2.4 Collision Only

This is simple collision between the vehicle and pedestrian or between two or more vehicles where nobody gets hurt. Generally it is presented as 'Collision' in the question of working suitability.

2.7.3 Accident Severity

Accident severity is defined as the most severe casualty class received by any of the persons involved in that accident. It says nothing about the number and severity of injury of the persons involved in the accident nor the number of vehicles involved. For example, if an accident results in one dead, two grievous injuries and two simple injuries, the accident is then referred to as a 'Fatal Accident' depending on the most serious casualty.

Accident severities are categorized as follows:

- Casualty Accident: i) Fatal
  ii) Grievous injury and
  iii) Simple injury.

- Property Damage Only Accident. When there is no personal injury but property is damaged is called 'Property Damage Only Accident'.

2.7.4 Severity Index

For accidents, it is a measure about the intensity of accidents of a road section. Zeeger (1986) described it as: Severity Index (SI) equal to summation of fatal and grievous accidents divided by total accidents.

And for casualty, it is a measure about the intensity of casualties of a road section. Zeeger (1986) described it as: Severity Index (SI) equal to summation of fatal and grievous casualties divided by total casualties.

2.8 Factors Involved in Road Accidents

The following have been identified as the major factors directly or indirectly responsible for road accidents:

- Roadway features
- Vehicle characteristics
- Road user behavior
- Environmental features
- Administration of laws relating to road accidents.

2.8.1 Roadway Features

The width, surface condition, geometric standards of the roads markedly affects traffic accidents.

The capacity of a roadway decreases with the decreases in pavement width. The passing and overtaking maneuvers of two vehicles are difficult in two-lane roads with narrow pavement. The danger is further increased when the shoulders are narrow and unstable and lie at a level lower than that of the pavement with hazardous ditches caused by rainwater and movement of vehicles. Poor quality of road surface is no less hazardous for motor vehicles. On a road with bad surface condition the driver is more likely to lose control of the vehicles, and may meet an accident, particularly at a high speed of movement.

Geometric standards of roads are very important for movement of motor vehicles. Degree of curvature not consistent with the topography and vehicle speed enhances the chances of accidents. On horizontal curves considerable side friction must develop to keep the vehicle on the curved path. Lack of required side friction will produce a tendency to outward skidding for a vehicle. Horizontal and vertical curves with restricted sight distances may also create accident producing situations.

2.8.2 Vehicle Characteristics

The condition and characteristics of vehicles may be responsible for causing road accidents. The following are recognized as the major defects of vehicles.

- Defects in the braking system may bring about accident since the vehicle cannot be stopped when required to do so.
- Defect in the steering system may also bring about accident.
- Old and worn-out tires will have low frictional coefficient and vehicle braking distance for vehicles with such tires may substantially increase. A vehicle having relatively smooth tiers will have more chances of skidding outside the road, particularly on curves.
- Defects in the lighting system and signaling device of a vehicle may also cause accident. Headlight glare from one vehicle may disturb the concentration of the driver of an opposing vehicle. Defect in the signaling device of a vehicle may mislead the driver of another vehicle resulting in hazardous situations.
- Deviation from specifications of some key aspects of the vehicle, such as laden weight, overhang, length and width may not match the structural as well as geometric design of the road, thereby causing accident.
- The presence of vehicles of varying speeds and operational characteristics in the same traffic stream creates hazards and conflicts.

2.8.3 Road User Behavior

Road users may be grouped into two categories (i) Pedestrian and (ii) Drivers. Their contribution to road accident is discussed in the following paragraphs.

2.8.3.1 Pedestrian

Photo 2.12: We are more likely to cross roads with risks rather than using overpass.

Lack of pedestrian control can lead to traffic accidents. Pedestrian controls includes physical features such as sidewalks, cross walks, special pedestrian barriers, pedestrian refuge islands, pedestrian tunnels and overpasses, highway lighting as well as enforcement control. Pedestrians' lack of knowledge regarding traffic rules and regulations may also bring about accidents.

2.8.3.2 Driver

The driver of a vehicle is an important road user. He can cause an accident due to a number of reasons of which the following are important.

2.8.3.2.1 Inefficient and Undisciplined Driving

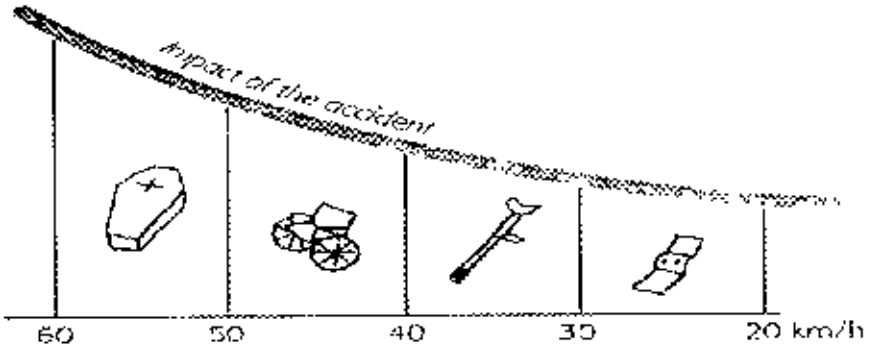
Driving is a technique which for its successful accomplishment involves almost all the sensory organs at a time. Educational background and professional skill together bring about efficiency in driving. A driver with reasonably good educational background is likely to behave more responsively in the traffic stream than an illiterate driver. An inefficient driver is more likely to be undisciplined. He may not have sufficient knowledge of traffic laws and attitude for observing them. Non observation of traffic rules and general unawareness of the risks involved in road traffic on the part of the driver may create accident.

2.8.3.2.2 Over speeding

Some drivers have a tendency to run a motor vehicle at speeds which may over exceed the operating or design values. There may be many reasons for which a driver can take resort to over speeding. Some of the main causes are to increase the number of trips for maximizing profit, to make up the time

that might have been lost and craze for speed.

Figure 2.2: Schematic Relationship between Vehicle Speed and Accident Severity.



Source: Child and youth friendly land use and transport planning guidelines, Ontario (2005).

Over speeding will increase sight distance requirement and may exceed other designed values, thereby creating dangerous situation.

2.8.3.2.3 Overtaking

This is a normal phenomenon when a vehicle is on the road. The act of overtaking is not an offence and may not normally lead to accidents. But dangers are involved in overtaking in wrong time and in places where it is prohibited.

2.8.3.2.4 Overloading

There is a large scale tendency among the public transport vehicles to overload. Overloading may cause an accident in any of the following ways:

a. Overloading makes the vehicle unstable which may, in turn, make the driver to lose control of the vehicle.

b. Overloading increase momentum of the vehicle and as a result, the stopping sight distance of the vehicle increases and brake failure may also occur.

c. Continuous overloading damages the condition of the road which in turn creates problem to road safety.

Photo 2.13: Overloaded vehicles in the roads of Dhaka city.

2.8.3.2.5 Physical and Mental Condition of the Driver

A driver has to be both mentally and physically fit to perform his duties. Also if a driver works for many hours together without any rest, he may get fatigued and lose concentration while driving. This becomes dangerous for traffic safety.

2.8.4 Environmental Features

A traffic stream having vehicles of varying range of speed creates great hazard that may lead to road accident. The slow-moving vehicle will block the way of the fast moving vehicles, thereby creating danger to road safety.

Sometimes markets are held right on the road which reduce the effective width of the road. They may also bring about haphazard and undisciplined movements of pedestrian on the road. Again the presence of schools or colleges beside the road will increase the pedestrian flow in the road. This situation can easily lead to an accident.

2.8.5 Administration of Laws Relating to Road Accidents

The inadequacy or lack of standard traffic control signs, signals and road markings greatly encourage occurrence of road accidents.

Also the traffic rules and regulations have to be enforced and administered strictly by the relevant authorities for the proper functioning of a road.

2.9 Transportation Planning – Recent Trends.

Over the last several decades, street design has been heavily influenced by road design standards that are used by traffic engineers to regulate and standardize street construction. These standards have favored the construction of streets that are wide, smooth, and straight, conditions that encourage high-speed, motorized travel and discourage walking and bicycling. Traffic engineers have generally come to view pedestrians and bicyclists as obstructions that impede the smooth flow of traffic.

Fairly recently, however, transportation departments in various cities and states have begun to develop Level of Service (LOS) standards for pedestrians of all ages, similar to long-established standards for motorized traffic. Level of Service standards is a

Photo 2.14: Level of Service for the children, pedestrian and road users of Dhaka city.

measurement tool used to describe how well roadways are operating for pedestrians, passengers, or motorists. Creating LOS standards for pedestrians are increasingly considered to be important in understanding the design conditions that will encourage people of all ages to use the sidewalks/footpaths (Epperson, 1994).

Again, road speed limits are now-a-days fixed and adjusted considering the road function and road design. Physical measures related to the road and the vehicle, as well as law enforcement by the police, all contribute significantly to ensuring compliance with maximum posted speed limits and to the choice of an appropriate speed for the existing conditions. Recent international experience points to the effectiveness of setting and enforcing speed limits in reducing the frequency and severity of road accidents and crashes. Some examples of the impacts of changes in speed limits are given in Table 2.6.

Table 2.6: Effects of Speed Limit Changes – Overseas Examples.

Year	Country	Type of road	Speed limit change	Effect of change on speed	Effect of change on number of fatalities
1985	Switzerland	Motorways	130 km/h to 120 km/h	5 km/h decrease in mean speeds	12% reduction
1985	Switzerland	Rural roads	100 km/h to 80 km/h	10 km/h decrease in mean speeds	6% reduction
1985	Denmark	Roads in built-up areas	60 km/h to 50 km/h	3–4 km/h decrease in mean speeds	24% reduction
1987	USA	Interstate highways	55 miles/h (88.5 km/h) to 65 miles/h (104.6 km/h)	2–4 miles/h (3.2–6.4 km/h) increase in mean speeds	19–34% increase
1989	Sweden	Motorways	110 km/h to 90 km/h	14.4 km/h decrease in median speeds	21% reduction

Source: WHO World Report on Road Traffic Injury Prevention (2004).

On another point, collisions are more likely to occur and are more likely to be severe when, other things being equal, speeds are high. Moreover, speeding traffic frightens

Table 2.7: Traffic Speed Limits in Europe (kilometer/hour).

Country	Residential areas	Traffic calming zones	School areas	Pedestrian streets	Fast urban roads
Austria	10	30, 40		6	
Denmark	30	30	30	30	60, 70, 80

Finland	20, 30, 40	30, 40	30, 40		60, 70
Germany		6, 30	30	6	60, 70
Greece	30	20, 30			70, 80
Netherlands	30	30	30		70
Sweden	30	30	30	30	70
UK	32	32	32		64, 96
Hungary	20, 30	20, 30			60, 70, 80
Iceland	50	30			60, 70
Latvia	20		30, 40		
Lithuania	50	40			60
Norway	30, 40	30	30		60, 70
Romania	30				60
Slovakia	20, 30	20, 30		40	60, 80
Slovenia		20, 30, 40	40		
Switzerland	20	30			60, 70
Ontario	40, 50	30, 40	40		60, 70

Source. Child and youth friendly land use and transport planning guidelines, Ontario (2005).

cyclists and pedestrians and generally reduces the congeniality of streets. Children in cars may not be as secure as adults and they may be more fearful of speeds. Thus the imperative to travel slowly and carefully when children are passengers is strong, as well as the more general requirements regarding vehicle speed practiced in the European countries (Table 2.7).

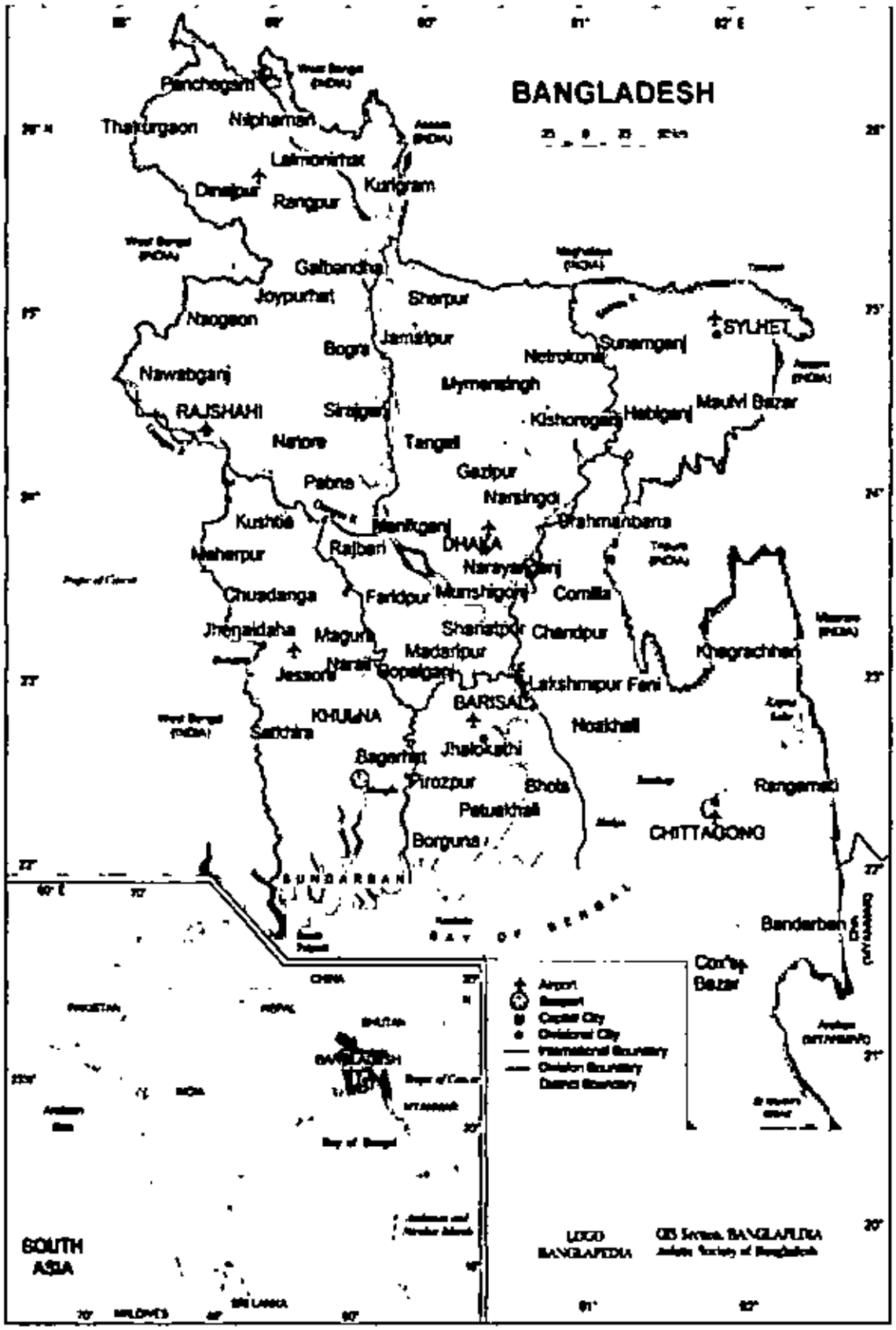
2.10 Dhaka and its Road Transport System

2.10.1 Urbanization in Dhaka

The Dhaka metropolis is located in central Bangladesh at 23°42'0"N 90°22'30"E / 23.7°N 90.375°E / 23.7; 90.375. The city is surrounded by the distributaries of the two major rivers i.e. the Brahmaputra and the Meghna. The surrounding rivers are Buriganga in the south, Turag in the west, Tongi khal in the north, and Balu in the east. Geographical location and surrounding low-lying physiography limit uniform horizontal expansion of the city and found northward expansion.

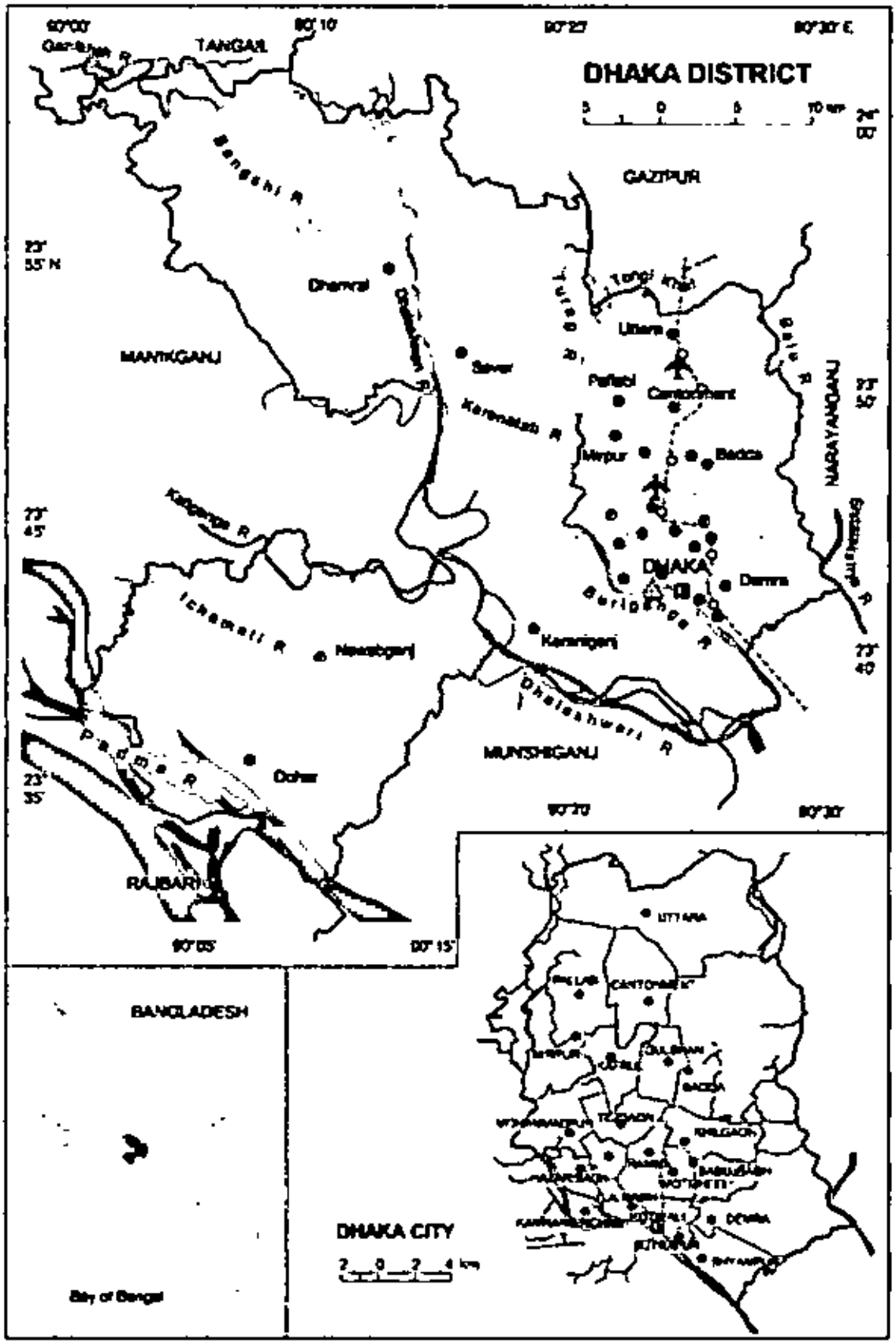
Dhaka is the capital of Bangladesh. At present its population is approximately 14 million with a growth rate of 8 percent per annum. At present Dhaka shares 8 percent of the total population of the country and 33 percent of the total urban population of Bangladesh. The contribution of Dhaka to the GDP of the country is nearly 15 percent. Over the years, higher population growth without adequate spatial expansion of the city area has

Map 2.1: Map of Bangladesh.



Source: Survey of Bangladesh (2008).

Map 2.2: Map of Dhaka.



Source: Survey of Bangladesh (2008).

increased population density with a concomitant rise of motorized and non-motorized vehicles to provide passenger services. Despite increased number of vehicles, the vehicle-passenger ratio has decreased, which in turn aggravated the problems of transport. Higher population density and increased number of vehicles together has affected both transport and traffic system. Moreover, the rising number of passengers has raised traffic density, as the slow growth of road facilities cannot keep pace with that of the vehicles. The major concerns of the city are road accident and traffic congestion.

2.10.2 Types of Transports in Dhaka

Road transportation dominates the transport systems in Dhaka providing passenger services and transportation of commodities in the urban area. Road transport system is the main means for carrying passengers and commodities within the city. Rail and water transport systems are mainly used by commuters and for transporting commodities. By virtue of being surrounded by the rivers, water transport played significant role in early age both inside and periphery of the urban areas. Navigability in the dry season has deteriorated over the years due to urbanization and siltation in the riverbed. However, in the monsoon season water transport is playing a significant role in transporting commodities and passengers.

Dhaka City Corporation (DCC) and Department of Roads and Highways are mainly responsible for maintaining road infrastructure while traffic management is operated by the traffic police department. Dhaka Transport Coordination Board (DTCB) is pursuing the coordination and planning of transport sector strategies and plans with other government and private bodies. There are two core organizations. National Road Safety Council (NRSC) and Road Safety Cell (RSC) under Bangladesh Road Transport Authority (BRTA), responsible for preparing the National Policy on Road Safety and ensuring its implementation. Bangladesh Railway Department operates rail system through own operation and maintenance system and Bangladesh Inland Water Transport Authority (BIWTA) is responsible for operating and maintaining the waterways.

2.10.3 Transport Profile of Dhaka

Even though Bangladesh is a riverine country, road transport plays an important role. The

number of registered motor vehicles increased after the liberation of Bangladesh and this has steadily increased by 85 percent over the last decade from 3,39,448 in 1990 to 6,29,488 in 2000. The motor vehicle composition on road is characterized as motorcycle 41 percent, motorcars 27.5 percent, truck 6 percent. Green taxis or CNG 3.2 percent, bus 1.5 percent, minibus 2 percent, taxi 2.5 percent, jeep or station wagon 11 percent and other 5.3 percent. Despite phenomenal growth in the number of motor vehicles, the country's transport demand is still predominantly met by non-motorized modes particularly rickshaws and the level of motorization is far below the levels observed in other Asian countries. The present number of rickshaws in Bangladesh is about 8,00,000 (www.brta.gov.bd). To cater for the growing demand of road transport, the major road network (national highways, regional roads and feeder roads) increased from 14,949 km to 21,174 km in 2000 (Hoque et al, 2003). National and regional highways from the primary road network of Bangladesh carry 38 percent of freight traffic and 60 percent of passenger traffic with overall modal share of about 60 percent freight and 70 percent passenger on road. Although the rates of motor vehicle registration and road kilometerage have grown considerably, they are still considered to be far short of the looming demand. These factors together with the large shift of traffic from other modes (viz. rail and water) to road, the process of rapid urbanization in conjunction with socio-economic parameters (such as education, income, increasing car ownership, etc.) have resulted in increasing road traffic accident.

Road network of Dhaka consists of 3,000 km (with only 450 km primary and secondary/collector roads) lengths of roads. The total number of vehicles of Dhaka is nearly 4,25,000 with huge number of rickshaws (5,00,000). In Dhaka, the percent of trip catered by Mass Transport is 10 percent. Cost of congestion and accident is Tk 3,000 crore (US $ 520 million) per annum (Hoque et al, 2003). Air pollution and noise level is 4 (in 1-10 scale), percentage of fatalities who are pedestrians is 60 percent. Here, it should be mentioned that nearly 65 percent of world's urban poor live in 5 Asian countries – Bangladesh, China, India, Indonesia and Pakistan.

2.10.4 Types of Vehicles Operating in the City and their Growth Pattern

The metropolitan area of the city has several precincts – old city, newly developed areas, developing areas, satellite towns, etc. with their own characteristics including social and

cultural tradition and income disparity. These lead to a variation of demand for transport services and subsequently proliferate different types of vehicles. The bottom income group mostly depends on the low cost transportation including non-motorized vehicles.

Public buses - both air conditioned and non-air-conditioned - are operated by the state-run Bangladesh Road Transport Corporation (BRTC) and by private companies and operators. Three-wheel scooters (auto rickshaw), air-conditioned and non-air-conditioned taxis and privately owned automobiles are increasingly becoming popular with the city's growing middle class. The government has overseen the replacement of two-stroke engine taxis with 'Green taxis' locally called CNG, which run on compressed natural gas. However, Dhaka is known as the rickshaw capital of the world. 500,000 cycle rickshaws run each day and cycle rickshaws and auto rickshaws are the main mode of transport for the inhabitants of the city. Relatively low-cost and non-polluting cycle rickshaws nevertheless cause traffic congestion and have been banned to operate on a number of city streets.

With continues growth of population including floating population and sprawling of the city with increased commercial activities and growth of secondary and tertiary industries, the demand for transport is accelerating at a very high rate while the public transport system (bus operation) could hardly be developed. In this context, para-transit penetrated deeply and quickly in the public transport system. A convoy of small passenger vehicles, four-stroke four-wheeler, with passenger capacity ranging from 10 to 15 started coming in operation from the beginning of the last decade

The economically well off city dwellers have their own vehicles including car, jeep, station wagon, microbus as means of their transportation. It is revealed from the transport registration department that on an average about 7000 - 8000 cars and 3000 - 3500 microbuses per annum are entering into city. There is a declining trend of registration of Auto-rickshaw and Taxi in the metropolis due to discouraging policy of the government. Table 2.8 presents annual registration of different vehicles in the metropolis.

Table 2.8 Motor Vehicles Registered in Dhaka

Types of Vehicles	Up to 2003	2004	2005	2006	2007	Total
Motor Car	87866	4734	5633	7403	10244	115880
Jeep/St. wagon/	32391	2114	3303	4548	4372	46728

Micro Bus						
Taxi	9369	523	514	266	00	10672
Bus	2614	779	728	949	1082	6152
Minibus	7460	368	118	75	77	8098
Truck	20342	1437	1104	1480	830	25193
3 Wheeler	10687	2344	139	230	121	13521
Motorcycle	119299	7872	12879	16284	17303	173637
Others	13187	1300	2361	2728	2913	22489
Total	303215	21471	26779	33963	36942	422370

Source: BRTA (2008).

2.10.5 Dhaka Urban Transport Project

The Dhaka Urban Transport Project (DUTP) was one of the first World Bank projects aimed at easing the complex transport problems facing Bangladesh's capital. As the city's urban transport problems cannot be solved by any single project, this project focused on the most urgent infrastructure issues.

The World Bank's aim was to help the Government of Bangladesh develop, refine, and implement appropriate strategies for managing road traffic and services in Dhaka. It also aimed to assist in the preparation of an urban transport policy and a 20-year Strategic Transport Plan (STP) for the Dhaka Metropolitan Area (DMA). The project closed on June 30, 2005.

The project has brought about some marked improvements:

- Phasing out of two-stroke three wheelers has improved air quality;
- Pedestrian footbridges and footways have been built as a first effort to make movement easier for the city's poorest people who can only afford to walk;
- Flood damaged roads have been rehabilitated;
- Traffic conditions have improved with better traffic management on arterial corridors and at major junctions with some 60 traffic signals installed;
- The Mohakhali Flyover, the single largest contract under the project, is easing traffic congestions and delays;
- Some public transport services along project corridors have improved;
- Three major inter-district bus terminals have been rehabilitated;
- National vehicle and driver licensing systems have been computerized and agency personnel trained:

- The regulatory framework for public transport has been reviewed, a policy for enforcing parking restrictions drafted, and bus route-franchising pilots proposed to improve bus services;
- An urban transport policy, a plan for institutional strengthening and capacity building and a Strategic Transport Plan (STP) for improving transport services in Dhaka have been developed for the 2004-2024 period.

Despite the many improvements, however, these changes have not reached the levels intended at the project design stage. This is because the project's components had to be restructured at the time of the mid-term review in early 2002, and were reduced by 40 percent due to unsatisfactory progress. Also, the project had limited impact on strengthening the DMA's institutional and policy framework to address transport planning and coordination issues.

2.10.6 Road Safety

The function of a road is primarily to provide for the movement of people and goods. Other subsidiary functions, such as parking and use of roads for services, are often also permitted. A safe road environment is one which allows road users to perform the primary function of movement without undue risk of injury or damage.

To move about the road system safely, road users must negotiate the physical road environment and avoid or resolve conflicts with other road users. This requires road users to perceive and process information, make decisions, and react within specific time intervals.

Photo 2.15: Streets of Dhaka are full of dangers for the children.

Comfortable and safe driving and riding occurs when motorists are operating well below a stressful processing and decision-making rate and above a minimum level of arousal.

This aspect is a critical component in the development and maintenance of a safe road environment.

A safe road environment should:

- WARN the road user of any substandard or unusual features;
- INFORM the road user of conditions to be encountered;
- GUIDE the road user through unusual sections;
- CONTROL the road user's passage through conflict points or conflict sections;
- FORGIVE the road user's errant or inappropriate behavior.

From this it can be seen that:

- Road users expect similar situations to be treated in similar ways. Otherwise there will be a reliance on warning, which may or may not counteract other information and expectations. Things to be avoided are:
    - Inadequate treatment (not treating a situation to an appropriate level).
    - Mistreatment (using the wrong treatment for the situation).
    - Excessive treatment (using 'more treatment for more safety', thereby masking other similar situations which have already been treated to the appropriate level).
- Optimum values for design parameters should be applied as often as possible, compatible with terrain or other prevailing constraints.
- Advance information and warning should be used to strengthen the delineation of a road.
- Driver overload, which may cause vital information to be overlooked or discarded, should be avoided. Overload can result from too many signs, conflicting messages or lack of delineation.

Therefore, a safe road environment is one which:

- PROVIDES NO SURPRISES in road design or traffic control (expectancy factors).
- PROVIDES A CONTROLLED RELEASE of relevant information (not too much at once).
- PROVIDES REPEATED INFORMATION where pertinent to emphasize danger.

As different road user groups (e.g. car drivers, motorcyclists, truck drivers, cyclists, bus drivers, pedestrians, children, etc.) and the individuals within each group will have different abilities and needs, a safe road environment will be one which is designed, constructed and managed with these different road user abilities and needs in mind

2.11 Review of Related Researches and Studies

Literature review is an essential part of a study which upgrades the ideas and perception to achieve its objectives. Only a limited number of studies and researches have been done in our country regarding this issue.

2.11.1 Thesis and Research Articles

Hoque, M.M. (1991) conducted a comprehensive study on Dhaka - Aricha highway 'Accident Investigation for the Safety Improvement of Dhaka - Aricha Highway (A Section of the Asian Highway)'. In a total length of 81.4 km of the highway, 965 accidents (419 fatal, 504 injury and 22 property damage only) were recorded during the five year period of study, 1985 - 1989. Data on accidents occurring on the highway and available to police during the aforesaid period were examined and the characteristics of those accidents were analyzed. The characteristics included those relating to locations, road user movements, vehicles and time of accidents, accident rates, road side hazards and road casualties. Analyses revealed that each year there are at least 114 fatalities and 968 injuries resulting in about 6 casualties per accident on the highway. Accident occurred mostly on highway links. The most frequent accident types were determined by the use of Road User Movement (RUM) codes. The predominant accident type was RUM (00-08) 'pedestrian' accounting for 34 percent of all accidents. This was followed by 'rear-end' accidents (14%), 'running-off road/out-of-control' accidents (10%) and 'head on' accidents (9%). The most vulnerable movements of pedestrian involved while crossing the highway and walking with traffic along the highway. A statistical quality control method was employed to identify hazardous sections. The highway links from Mirpur Mazar road intersection to Hemayetpur intersection and from Golora road intersection to Hariarnpur road intersection were determined to have the highest accident frequency with about 2 accidents per kilometer per year. Buses and trucks were highly over represented in accidents. Most of the accidents victims tended to be young and

middle-aged in the 10-39 year age group. This group accounted for 50% of fatalities and 68% of injuries. Various low-cost engineering treatments like shoulder improvements, delineation, installation of guardrails, provision of overtaking lanes and improvements of deteriorating traffic lane and narrow bridge approaches were suggested by him.

Hoque (1981) made another study on traffic accidents in Dhaka Metropolitan Area (DMA) to identify and investigate high accident locations. He collected road accident data from Dhaka Metropolitan Police for the period of January 1977 to June 1980, from the analysis of the reported accident data, he demonstrated the actual accident features of Dhaka city. He determined the percentile distribution of accidents in terms of accident severity, location, number of vehicles involved, time of a day, day of a week, etc. He identified four intersections and nineteen links as hazardous location and Monday and August as the most predominant day and month respectively. Considering the above finding, he suggested some recommendations. These are related to correction of geometric design and reconstruction of road way with channelized road to segregate individual maneuvers, illumination of illegal parking and bus stops, redesign and reinstallation of traffic signals and road signs, provision of exclusive right turn lanes, provision of non-skid pavement surface, installation of pedestrian cross-walks with central refuse islands and construction of pedestrian barriers, provision of wide and stable treated shoulders, involvement of street lighting and deployment of more traffic police for better regulation and control of traffic.

Ahmed (1980) carried out a study on the traffic problems of Dhaka city. His study was not related to any specific location(s) and generally pointed out the various factors causing traffic problem. The factors identified were inadequate road features; mechanical defects of the vehicle, sharp increase in the number of vehicles with regard to road capacity; inefficient, undisciplined, ill-trained and psychologically unfit drivers; and improper traffic rules and regulations controlled by the enforcement authority. Considering the above factors he gave some general suggestions, which are mainly related to enforcement of law and reducing traffic problems. He suggested that the Department of Traffic Police should be made stronger and more efficient; traffic authorities should have its own engineering cell and co-operative with other different development authorities. Besides these, he also suggested to install speed breakers at

intersections and rails and barriers at the sidewalks; enforce strict administrative measures, control against fitness of vehicle, issuing of driving license and redistribute traffic among the roads to tackle the jam and traffic problem.

Sharmeen (1996) performed a study on truck accidents of metropolitan area covered by the three Thanas of the DMP. She collected accident data from related Thanas. She identified predominant accident types, hazardous links and intersections. She also identified the property damage costs of accidents. She suggested that following countermeasures may reduce the number of accidents:

- In order to reduce road user's carelessness, reckless driving, defects in vehicles, overloading, dangerous overtaking, etc. increased effort should be given to traffic law and education.
- As road safety improvements are very cost effective, it is wise to take remedial measures. Hence road safety schemes should form a part of the Roads and Highway Authority's annual programme.
- Highway rules and traffic safety lessons would be promoted among the road users through training and mass media education.

Rafuzzaman (2003), in his M.Sc. Engineering dissertation from Civil Department of Bangladesh University of Engineering and Technology, conducted a study on the characteristics of road accident on selected arterials of Metropolitan Dhaka. For the thesis the selected arterial roads were Darussalam-Mirpur 10 arterial road, Moghbazar - Mohakhali arterial road, Gabtali - Nilkhet arterial road, Abdulalhpur - Mohakhali road and Presselub - Motijheel arterial road for the time period of 1996-2001. Accident characteristics were analyzed in terms of collision types, severity, modes used by the victims, weather condition and temporal distribution. Accident in the study area varied with severity level as fatal 37.09% (685), grievous 40.06% (740), simple 10.18% (188) and collision only 13.22% (234). Overall 71.36% (13,185) accidents occurred on links and 28.64% (5,291) occurred at intersections. For further research, some aspects such as more detailed studies including all user groups was defined to identify the actual accident characteristics, the characteristics of pedestrians and vehicles, etc.

Another study by Taslim (2005) on pedestrians and bicyclists in the neighborhoods of Dhaka investigated whether the existing street network within the community was able to

ensure accessibility, health, livability and economy for the residents. He examined the design and planning criteria of existing neighborhoods of Dhaka city. In order to investigate the prevailing conditions of access facilities of pedestrians and bicyclists on the street network in Dhaka, and also find ways and means to accommodate the pedestrians and the bicyclist in the neighborhood streets, a planned residential area (Dhanmondi) and an unplanned residential area (Kalabagan) were selected for the study. The collected data were analyzed in order to find out why people prefer to walk or use bicycle and also the reasons why they are debarred/restrained from walking or bicycling. Recommendations were made based on the findings for accommodating the pedestrians and bicyclists in the present transportation network.

The study on 'Road Accidents in Mirpur Thana, Dhaka' by Jahan (2006) discussed about characteristics of accidents and hazardous locations at Mirpur Thana. She collected road

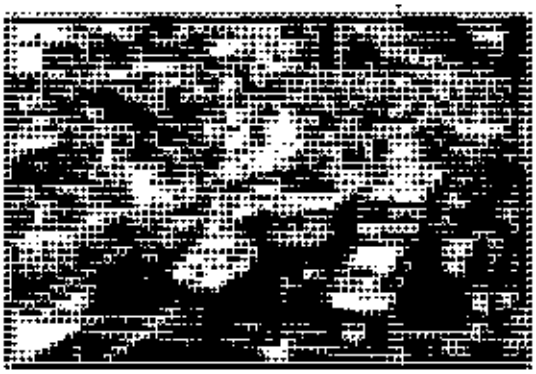
Photo 2.16: Adjacent land use of roads plays a vital role in accidents.

accident data from the Traffic Division of Dhaka Metropolitan Police and Accident Research Center (ARC) of Bangladesh University of Engineering and Technology (BUET) for the period of 1998 to 2005, from the analysis of the reported accident data, she demonstrated the hazardous locations and most frequent types of accidents at Mirpur Thana, most frequent types of vehicles responsible for accidents in the study area. She also pointed out that various factors like traffic volume, type of transport, land use beside roads, awareness of people, etc. are contributing factors to accidents. At the final stage she also recommended an action plan (stage wise) for the study area and its implementation process for improving the road safety situation.

2.11.2 Symposium and Seminar Proceedings

In 1983 the Ministry of Communication formed a committee to identify the causes of road accidents and possible solutions for remedial measures. The committee published their report by collecting data from Dhaka Metropolitan Police (DMP), the Ministry of

Photo 2.17: Presence of mixed traffic and dominance of non-motorized vehicles in Dhaka.



Home Affairs, Bangladesh Road Transport Corporation (BRTC) and Bangladesh Road Transport Owners Association. The committee pointed out some causes of road accidents form their personal experience, visiting some accident locations and interviewing some owners and drivers of vehicles. The committee identified that the absence of a well defined and coordinated national road transport policy, lack of enforcement of traffic control rules, lack of observance and knowledge of traffic rules by road users, reckless and dangerous driving of unskilled and inexperienced drivers, overtaking, unsafe over speeding and overloading, inadequate number of passenger transport vehicles, poor conditions and unauthorized use of roadway, presence of mixed traffic and predominance of non-motorized vehicles, unsatisfactory working and living conditions of drivers, lack of traffic signs, signals, road marking and lighting and construction of road on high embankments and presence of ferry hazards on the roads were the major causes of accidents. Beside these causes the committee stressed on drivers fault with less emphasis on geometric features of roadway.

The committee also put up some recommendations to reduce traffic hazards which are as follows:

- Proper design standards and specification should be followed for the construction

of new roads, reconstruction of damaged roads and placing sign, signals, marking, lighting, etc.

- Vehicles should be mechanically fit and over speeding, wrong over taking should be strictly prohibited.
- Mental and physical fitness of the driver should be assessed during issuing license.
- The transport worker should have a job security and restriction on their working hours.
- Reservation of separate lanes for fast moving, slow moving vehicles and pedestrians. Unauthorized and unregistered rickshaws should be eliminated.

- Illegal parking and stopping should be strictly prohibited.
- The traffic rules and regulations should be strictly enforced. Different new traffic rules should be implemented for reducing road accidents.

In 1993 Dhaka Integrated Transport Study (DITS, 1993) for the Metropolitan Area published a report on accident analysis by analyzing road accidents occurring between July, 1991 and June, 1992. In this report the DITS investigated the road safety by giving due considering on reporting process by the Police Department and Health Officials to identify the accident characteristics monitored, the level of understanding of accident analysis, identification of hazardous location and patterns of accident types or high risk groups for targeting countermeasures to their most effective use.

In 1995 an International Seminar on Road Safety was organized by the Bangladesh Road Transport Authority (BRTA) in association with the World Bank and Official Development Assistance (ODA). In this seminar the causes of accidents and how they can be prevented were tried to identify in view of solving accident problems of Bangladesh.

2.11.3 Children Accident Scenario

Road Traffic Injuries (RTIs) is a major threat in public health and hence is a social and economic burden worldwide – Bangladesh is no exception. Globally RTIs are projected to rise by 2020 from 9th in 1998 to 2nd leading cause of disability adjusted life years lost in developing countries and 3rd in developed countries (WHO, 2001). RTIs are the

world's number one cause of death among young people (ITC, 2003). It is a silent, hidden and unrecognized epidemic.

2.11.3.1 Children Accident Scenario in Dhaka

The statistics of Accident Research Institute, Bangladesh University of Engineering and Technology revealed road accidents as a serious threat to the children of Dhaka. Even though different government and non-government organizations have been working to alleviate this problem, from Table 2.9 it is observed that the rate of child fatalities in Dhaka city is, however, escalating over the past few years.

Table 2.9: Child Fatalities of Road Traffic Accidents in Dhaka city.

Age Group	2001	2002	2003	2004	2005	2006	2007	Total
0-5	9	12	7	10	6	47	11	102
6-10	13	15	19	21	13	11	12	104
11-15	11	20	14	21	18	17	20	121
Total	33	47	40	52	37	75	43	327

Source: Accident Research Institute Database (2008).

Table 2.10: Child Fatalities in Dhaka city by Age Group and User Category (2001 - 2007).

Casualty Age	Pedestrian	Passenger	Driver /Others	Total
0 – 5	134	59	0	193
6 – 10	134	29	0	163
11 – 15	149	48	8	205
Total	417	136	8	561

Source: Accident Research Institute Database (2008).

Of total child fatalities of road accident in Dhaka city, a significant portion is involved as 'Pedestrian' with the dominant age group of 11-15 years which is shown in Table 2.10. Nearly 36% of the total pedestrian fatalities are children between the age of 11-15 years and thus they are dominant age group of pedestrian fatalities. Both the age groups of 0-5 and 6-10 years are governing in the 'Pedestrian' category.

2.11.3.2 Children Accident Scenario in Bangladesh

The national road statistics in Bangladesh (RSC, 2001) revealed road accidents as a serious threat to children. The incidence of overall child involvement in road accident fatalities in Bangladesh is found to be very high, accounting for about 21

percent of the fatalities (Table 2.11). The involvement of children under 15 years of age in road accident fatalities is much higher than those in other developing countries. It is important to note that compared to industrialized countries, the proportion of fatalities to under 15 years of age in developing countries is approximately two and half times higher.

Of total child fatalities of road accident, nearly 81 percent involved as 'Pedestrian' with the dominant age group of 6-10 years which is shown in Table 2.12. Indeed, more than half (54%) of the total pedestrian fatalities are children between the age of 6-10 years and thus they are dominant age group of pedestrian fatalities. Age group of 11-15 years is governing in the 'Passenger' and 'Others' categories. The female child pedestrians are disproportionately higher than male child pedestrians (44.6% vs. 28.9%, Bangladesh Health & Injury Survey Report).

Table 2.11: Child Fatalities of Road Traffic Accidents in Bangladesh

Year	Children fatalities (age 0-5)	Children fatalities (age 6-10)	Children fatalities (age 11-15)	Total Children fatalities (age 0-15)	% of Children fatalities (out of all)
1998	82	210	122	414	22%
1999	71	221	148	440	19%
2000	99	224	150	473	21%
2001	68	173	102	343	21%
2002	67	210	108	385	21%
2003	68	216	111	395	20%
2004	86	182	103	371	21%
2005	73	140	103	316	21%
Total	614	1576	947	3137	21%

Source: MAAP Database.

Note: Traffic fatalities with known age within seven years are 15278 (66%) out of 23194 in the period of 1998-2004

Table 2.12: Child Fatalities by Age Group and User Category.

Casualty Age	Pedestrian		Passenger		Others	Total
0 – 5	516 (68%)	18%	243 (32%)	22%	5 (1%)	764 (100%)
6 – 10	1569 (81%)	54%	360 (19%)	32%	7 (0%)	1936 (100%)
11 – 15	811 (58%)	28%	523 (38%)	46%	60 (4%)	1394 (100%)
Total	2896 (71%)	100%	1126 (28%)	100%	72 (2%)	4094 (100%)

Source: MAAP Database. Note Figures in brackets are row percentage.

2.11.4 Awareness Creation and Ensuring Safety

2.11.4.1 Research Institute - Accident Research Institute (ARI) at BUET

In response to the growing accident problem in Bangladesh, the concerned authorities have started to realize the need for scientific study and research regarding the causes of accident and commensurate remedial measures. The highest level of commitment in this regard came from the then Honorable Prime Minister to establish an independent Accident Research Center (ARC) within the top priority programs of the government. Accordingly the ARC has been established at Bangladesh University of Engineering and Technology (BUET) in 2002 to carry out scientific research for clear understanding of the road safety problems and ascertaining the underlying causative factors, which contribute to accidents on roads, railways and waterways.

The ARC, presently named the Accident Research Institution (ARI), is playing major role to develop pragmatic, cost-effective scientific solutions and bringing about significant improvements in the capability of the professionals and workers in the field of transportation to a meaningful level of expertise for accident prevention and injury control and thereby contribute to the safer road environment for all users and operators. Importantly, ARI conducts appropriate training programs and workshops to develop qualified human resources for professional capacity building and also for creating mass awareness regarding road safety. Collaborative external assistance and requisite resources are vital for accomplishing these requirements in Bangladesh. Efforts are underway by ARI

for integrating different organizations both at public and private sectors, civil societies, communities and individuals towards identifying their specific roles and responsibilities and thereby developing effective measures to tackle road safety problems.

The development objectives of the institution are to:

- Develop a comprehensive accident and injury database.
- Ascertain the causes of accident background factors.
- Develop countermeasures on the basis of scientific study and engineering knowledge.
- Monitor and evaluate accident countermeasures for accidents.
- Assess the economic and social impact of accidents
- Conduct high quality research on technological, behavioral and educational safety improvement opportunities and their cost-effectiveness.
- Provide training and education in accident prevention and safety technology.
- Disseminate and share knowledge and translate it into safety policies and practices, and
- Foster safety research excellence through exchange and linkage with institutions/organizations at regional and international levels.

A number of useful and valuable publications, research papers, posters, handbooks and newsletters have already been published by the ARI along with the successful accomplishments of series training programs for the road safety professionals, students and heavy vehicles drivers. The ARI was expected to achieve the following outputs, some of which are already achieved in the meantime:

- Improved understanding of the accident and injury problem characteristics.
- Development of cost effective safety measures and techniques.
- Improved capacity for conducting research on traffic accidents and their countermeasures
- Established programmes for Diploma, Masters, and Ph D. degrees in safety studies, accident control, injury prevention and management.
- Trained safety professionals with knowledge on accidents and safety issues.

- Established facilities for safety education, research and training; and
- Sustained awareness of traffic safety among policy-makers and practitioners.

ARI is also exploring avenues for exchanging knowledge and technologies through collaboration with an extensive number of renowned overseas institutions, organizations and universities etc. at local, regional and international levels to facilitate transfer of knowledge and technologies. The centre would also initiate professional exchange programme with similar overseas organizations and institutions for updating and sharing of knowledge on matters related to accidents and safety. The center through its wide expansion of research work is being driven with the motto of developing a National Accident Research Institute – as a Center of Excellence for advancement in safety research and training.

2.11.4.2 International / Regional Cooperation of Developing Countries

The report of the Economic and Social Commission for Asia and the Pacific (ESCAP)/Asian Development Bank (ADB) seminar cum workshop (ESCAP, 1996) advocates the need of greater international and regional cooperation and assistance in implementing comprehensive road safety action plans through improvements in various sectors/activities outlined in ESCAP/ADB road safety guidelines specifically prepared for the developing countries of the Asia and Pacific region. Support, guidelines and advice from organizations like ESCAP, ADB, the World Bank, Global Road Safety Partnership (GRSP), Road Engineering Association of Asia and Australia (REAAA) and other international aid agencies and the specialized institutions could play a vital role in implementing planned series of initiatives in Bangladesh including strengthening research activities of the newly established Accident Research Institute at Bangladesh University of Engineering and Technology. Much more efforts are needed in establishing a real network of road safety researches and the centers of excellence in the region for mutual benefits as envisaged in the ESCAP road safety guidelines which detailed various models of regional, sub-regional and technical coordination in specific aspects of road safety (ESCAP, 1996).

2.11.4.3 Child Friendly Transport Planning Options

Within the transport and planning literature, there are concepts and guidelines that

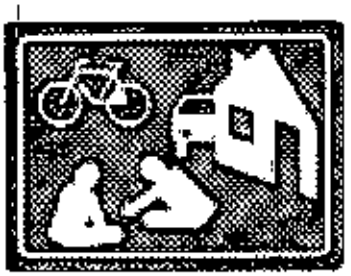
may be helpful in the preparation of child-friendly planning guidelines. They include:

- Comprehensive Transport Planning:

Litman (2003) discussed the value of moving beyond conventional transport planning and incorporating a more comprehensive view of impacts, costs, and benefits. Comprehensive planning takes into account additional costs that often result from increased roadway capacity the additional vehicle traffic it produces and it takes into account additional benefits provided by transport demand management (TDM) strategies that improve transport opinions and encourage more efficient use of transport system capacity. These additional factors justify policy and planning decisions that emphasize increased transport system diversity and efficiency. Understanding of the costs and benefits of transport on children's health and the limits to their mobility can contribute to more comprehensive planning.

- Universal Design:

Urban Design also called 'inclusive design', 'accessible design' or, simply, 'accessibility'. The concept often refers to transport systems that meet the needs of people with disabilities, but its use is evolving to include all people who may experience an accessibility challenge, including children, adults with baby carriages, and cyclists. Developing children-friendly transport guidelines would assist efforts to create more inclusive and accessible transport systems.



- New Urbanism:

Many new urbanist designs strive to achieve more attractive and efficient communities. They may also afford greater mobility for children. "If you live in a New Urban neighborhood you can conveniently go shopping and perform other personal walking or cycling, and your children can

walk to school and parks." Other terms such as New Community Design capture elements of New Urbanism, including promotion of pedestrian-friendly neighborhoods and less dependence on the automobile.

- Walkable/Livable Communities:

Dan Burden (www.lgc.org) is well known for his promotion of walkable communities. His description of a walkable community takes children's destinations into account.

- Social Exclusion:

Applied to transport this concept refers to "constraints that prevent people from participating adequately in society.....particularly people who live in an automobile dependent community and are physically disabled, low income or unable to own and drive a personal automobile". The goal of an inclusive transport system could incorporate many of the concepts above so that children and other people with limited choices and abilities could have more transport options. Disabled children cannot go anywhere, especially schools, because of the absence of accessible streets and related amenities.

- Transport Resilience:

This concept is usually applied to transport planning regarding security and a system's response to emergencies. Litman (2003) notes that transport demand management (TDM) strategies contribute to the resilience of transport systems by providing greater transport diversity

- Public Health and Land Use Planning:

Recognition that land use planning has impacts on health, physical activity, and mobility is increasing worldwide. Active Living by Design in the United States is spearheading efforts to demonstrate the new collaborations in planning are needed to create environments that contribute to active living and help the public choose more active lifestyles. This involves cooperation amongst governments departments across several jurisdictions. Child-friendly transport planning could contribute to more active lifestyles for children and even the wider population

who currently have limited transport options or who are affected by heavy traffic density and speed.

2.12 Organizations and Action Plans for the Development of Safe Roads in Bangladesh

Road safety action requires the involvements of different disciplines and the cooperation of the wide range of government, private and civil sectors with the firm government/ organizational commitment. The recognition of the seriousness of road accident problem by the Government of Bangladesh is reflected by various measures taken to combat the alarming situation (Quazi, 2003). The National Road Safety Council (NRSC) was established in 1995, which drew up "National Road Safety Strategic Action Plan" covering the period from July 1997 to June 1999. The planned period has since expired although in a number of areas desired result could not be achieved. Subsequently a revised three-year Action Plan (2002-2004) was prepared in November 2001. The Road Safety Cell (RSC) started functioning since March 2001. Subsequently the National Road Safety Council (NRSC) of Bangladesh formulated an updated "National Road Safety Strategic Action Plan 2005-2007" which provides an important opportunity for improving safety in a comprehensive way and makes an effort to approach the issues holistically. The Action Plan, with actions in nine sectors is further classified into several sub-sectors. Actions were separately specified for each lead agency. The concept of multiple lead-agencies being responsible for one action is untenable and therefore dropped. Lead agents must contribute to the specification of outputs. In this manner, the outputs will be consistent with the lead agent's works program, budget provisions and technical resources, and lead agents are more likely to take ownership of outputs they specify. A vision and goal for road safety improvement was stated in the plan.

- The vision – fifty percent reduction in the annual number of fatal road accidents within the next fifteen years.
- The goal – ten percent reduction in the annual number of road accident fatalities by the end of the year 2007 (NRSC 2005).

Currently there are two core organizations responsible for preparing the National Policy on Road Safety and ensuring its implementation. These are National Road Safety Council

(NRSC) and Road Safety Cell (RSC). The NRSC acts as apex body for approving and driving forward the national policy and plans, whereas the RSC established at the Bangladesh Road Transport Authority (BRTA) carries out preparation of plans, coordination, monitoring and evaluation of planned activities assigned to different agencies and implementation of some programmes assigned to it. Besides NRSC, District Road Safety Committees (DRSCs) at the district and metropolitan levels have been formed to undertake local road safety programmes according to local needs. The Road Safety Action Plan 2005-2007 identified the nine priority sector activities for improving road safety. The nine sectors are:

- Planning, Management and Co-ordination of Road Safety
  National and local multi-sectoral plans under the guidance of the National Road Safety Council and monitored by the BRTA and RSC.
- Road Traffic Accident Data System
  To establish an accurate and comprehensive National accidents and casualties database to identify problems and remedial measures.
- Road Safety Engineering
  Safety-conscious planning, design, construction and maintenance of roads and improve hazardous locations using low-cost engineering measures and road safety audit.
- Road and Traffic Legislation
  Revise and update traffic legislation promoting road user compliance with regulations intended to maintain a safe and efficient traffic flow.
- Traffic Enforcement
  Effective and efficient implementation of Traffic Law and capacity building of Traffic Police through the use of modern training, equipment and expanded power.
- Driver Training and Testing
  To ensure minimum standards for driver competence through improved driver training and testing procedures.
- Vehicle Safety
  To improve the road worthiness of vehicles to reduce the negative impact of

transport on the environment, especially in terms of air pollution.

Photo 2.18: Traffic signs in Dhaka city.

- Road Safety Education and Publicity

  To improve the knowledge, attitudes and behavior of all road users.
- Medical Services for Road Traffic Accident Victims

  To improve the emergency assistance, hospital care and rehabilitation.

The focus activities of the strategic action plan are similar to those covered by the Asian Development Bank (ADB)/Economic and Social Commission for Asia and the Pacific (ESCAP) road safety guidelines (ADB, 1997). For the purpose of implementation of the road safety action plan, seven leading agents had been nominated. These are:

- Roads and Highways Department (RHD)
- Dhaka City Corporation (DCC)
- Bangladesh Police
- Road Safety Cell (RSC)
- Bangladesh Road Transport Authority (BRTA)
- Ministry of Education, Government of Bangladesh
- Ministry of Health, Government of Bangladesh.

Efforts are underway for strengthening the capabilities of key agencies through a programme of the Institutional Development Component (IDC) funded by DFID (UK). It is increasingly apparent that non-governmental groups have a key role to play in dealing with road safety problems. The Non-Governmental Organizations (NGOs) are becoming active in the area of road safety in Bangladesh. The activities of the two leading NGOs such as Bangladesh Rural Advancement Committee (BRAC) and Center for Rehabilitation of the Paralyzed (CRP) are quite noticeable in this regard (Quazi, 2003). The major programmes being undertaken include:

- Community Road Safety;
- Training of Students;
- Road Safety Training for Office Staff;
- Community Road Safety NGO Network;
- Publicity and Awareness;
- Research,
- Driver's training; and
- Treatment and Rehabilitation of Paralyzed People.

2.13 Child Accident Problem: The Context of Global and Developing Countries

Road accidents affecting children is a 'global tragedy' with ever rising trends in fatalities and injuries. Children under 15 years of age form a high percentage of road accident fatalities in the developing countries, typically 15 percent compared to under 6 percent in the industrialized countries and deaths due to road accidents for children under 15 in developing countries is increasing (Jacobs and Baguley 1997; Ross Silcock and TRL 1996; TRL and Ross Silcock 1996).

Nantulya and Reich (BMJ, May 2002) reported that poor people in developing countries have the highest burden of injuries and fatalities due to road traffic crashes. In 1998, more than 85% of deaths and 90% of disability occurred worldwide because of road traffic crashes in the developing countries (BMJ, May 2002). They stressed that policy makers in these countries should give high priority to the problem relating to road traffic injuries.

The risk to children in traffic has greatly increased today than that in the past (Malini and Victor, 1990). The modern technological developments have imposed greater pressure on

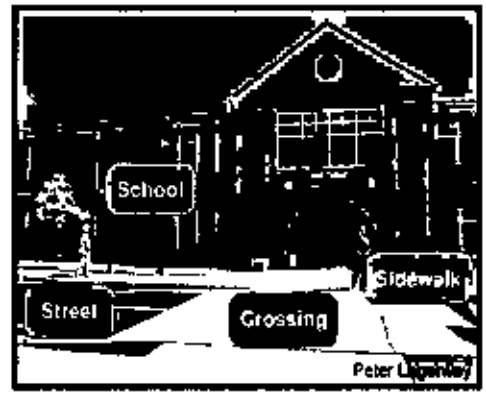
children to adapt to new situations at home, at school and most of all on roads. These risks were brought about by adults. The present traffic environment is designed by adults and invariably from the point of view of adult behavior, seldom reckoning children's limitations. There is indication that traffic accidents tend to predominate over diseases as the single biggest threat to the children in many developing countries and the threat of road accidents to children will further increase with increasing motorization and urbanization. Several factors as outlined below contribute to increasing risks to children in developing countries (ADB 1997).

- both speed and volume of motor vehicles will increase, especially on rehabilitated roads.
- roadside friction will continue as poor land use planning, operational control, and limited road space lead to conflicting uses of road and road margins.
- road improvements tend to focus on motor vehicle requirements and not on pedestrian needs.
- traffic police can offer only limited help as they are poorly equipped to control motor vehicle traffic and not properly trained to consider pedestrian needs.
- most parents are unable to provide road safety training to children as they themselves never received any such training and even if they did, traffic conditions have changed dramatically since their childhood.

2.14 Pedestrian Environment near School in the USA and UK

Studies in USA and Great Britain indicate that pedestrian accidents account for a disproportionately large share of fatal traffic accidents, and children are disproportionately vulnerable to pedestrian accidents. Available evidence suggests that much walking, and many pedestrian accidents, occur near schools. A study in Great Britain found that 39% of pedestrian casualties among children ages 10 to 16 occurred on the trip to or from school (Preston, 1994). In response to a perceived pedestrian safety problem near schools requires to create the safe routes to school

In California, injuries to pedestrians and bicyclists account for more than 60% of transportation-related injury, hospitalization/ death for each one-year age group from 5 to 12 years (Agran, 2001). Pedestrian and bicycle injuries in traffic are the third leading cause of death among children 5-14 years of age (National Center for Health Statistics, 1999).



A research conducted in California showed that traffic environment is an important determinant of walking activity near schools, and observed a striking difference in pedestrian volumes at five school sites (Anderson, 2003). The two schools with vehicle traffic associated with unsafe walking environments had few pedestrians – approximately 75 pedestrians per hour at Sheldon and approximately 30 pedestrians per hour at Jasper. The observations at the three schools with vehicle traffic characteristics consistent with safer walking environments had pedestrian counts reengaging from 150 to 600 per hour. This suggested the possibility that the traffic environment was an important determinant of walking activity near schools, although statistical verification of that hypothesis required more data.

Some other studies examined the influence of environmental variables on the risk of pedestrian injury (LaScala, 2000; Kraus, 1996; Agran, 1996; Mueller, 1990). Speed was an important risk factor for injury and an important determinant of injury severity (Leaf, 1999). Poor visibility was also a risk factor, as was demonstrated by the Association of Pedestrian Injuries among Children with the presence of parked cars (Agran, 1996). On the other hand, education of child pedestrians does not appear to be effective (Rivara, 1991).

2.15 Overview

Walking, bicycling or any other mode of travel can be enjoyable, impressive, pleasant, memorable, easy, efficient, untiring, etc. if the proper environment is executed. This chapter has reviewed and analyzed in detail how to make streets safe for travel. Initially it might be costly to build safe streets, in the long run, however, it becomes cost-effective and benefits ensuring from safe streets are incalculable.

CHAPTER 3: STREETS OF DHAKA - AN INVESTIGATION OF CHILDREN SAFE STREETS.

This chapter discusses about the factors that affect safety of children in the streets and thus this episode dwells especially on the physical factors. In this regard, the question raised is what makes a safe street? The design and planning characteristics that constitute to children safe streets have been discussed in chapter 2. This section investigates how far the streets of Dhaka are safe for children. As already stated children safety will be evaluated with regard to the accessibility to different schools, playgrounds and recreational places, the overall environmental conditions of the area along with the features and safety components of the street that children pass by and the cars/vehicles that children travel through daily, regularly or occasionally was assumed to be important. So initially the Thanas, within which the schools, parks, or playgrounds, etc. are located, were investigated to determine the significant factors which influence children street safety. Then questionnaire surveys were conducted among children, parents, guardians, etc. to gather information on the influence of the street safety factors to children's usage and accessibility of roads and streets (i) to go to school and play fields daily, and (ii) to go to the recreational areas of the city occasionally. It is important to mention that all the Thanas studied as listed below represent different accident zonation groups such as high, medium and low accident prone areas for children.

High accident zonation group:

- Uttura (Scholastica School)
- Mohammedpur (Residential Model School and College)
- Tejgaon (Holy Cross School and College)
- Mirpur (Monipur High School)
- Demra (Jatrabari Ideal High School).

Medium accident zonation group:

- Motijheel (Ideal School and College)
- Ramna (Viqarunnisa Noon School and College)
- Shahbagh (University Laboratory High School)
- Gulshan (International School of Dhaka)

- Badda (Badda Alatunnessa High School).

Low accident zonation group:

- Newmarket (Government Laboratory High School)
- Cantonment (B.A.F. Shaheen School and College)
- Dhanmondi (Dhanmondi Government Boys High School)
- Lalbagh (Agarani Girls School and College)
- Khilgaon (Khilgaon Ideal School).

3.1 Determination of significant factors

The multiple regression and correlation analysis have been carried out to determine the significant factors for children safe street network of Dhaka city. Two regression equations of children accident rate, one for children for whom walking is the mode of transportation and another for children who travel through car, bicycle or any other vehicle, have been formulated through a stepwise procedure.

3.1.1 List of variables considered for children while walking

Even though there are many factors which influence the risk of accidents for children while walking, only some physical factors of the roads/streets have been considered herein. The following factors have been considered for the determination of significant factors which control walking children street safety to a great extent.

1) Length of Guard Railing (LGR)
2) Length of Central Islands' Iron Fence/Barrier to prevent pedestrian crossing (LIB)
3) Number of Crosswalks/Zebra crossing (ZC)
4) Number of Overpass/Underpass (O/U)
5) Avg. number of Traffic Police engaged (TP)
6) Avg. width of Main Road (WMR)
7) Avg. width of Footpath (WFP)
8) Avg. number of Roads have to Cross (CR)
9) Number of spots/points having Traffic Signal Light to facilitate crossing (TSL)
10) Surface condition of the Roads/Streets (SR/S)
11) Distance Traveled (DT)

Letters in parentheses of corresponding factor are used in the later part of this chapter for the convenience of the study.

3.1.1.1 Description of the determination of significant factors

For the determination of significant factors, the data on above mentioned factors for the fifteen Thanas have been collected from field survey, questionnaire survey, secondary survey and in some cases from the GIS maps of the respective areas also. The analysis procedure is discussed stepwise in the following portion.

Table 3.1: Collected data on different factors influencing road safety for walking children.

Thana	Cldn. Rd. Acdnt. (2001-2006)	LGR (m)	LIB (m)	ZC (No.)	O/U (No.)	TP (No.)	WMR (ft)	WFP (ft)	CR (No.)	TSL (No.)
Motijheel	16	381.64	68	35	0	102	68.5	6	3	29
Ramna	20	592.76	532	29	5	134	62	6	4	35
Sahabagh	20	807.94	213	30	2	68	55	6	1	43
Uttara	50	197.13	430	9	5	52	79	6	4	14
Dhanmondi	10	291.305	143	37	2	106	65	5	3	48
Mohammedpur	40	114.695	0	11	2	55	71	6	2	13
Cantonment	4	883.19	720	36	4	162	69	5.5	2	27
Newmarket	10	745.01	410	25	2	41	63	5	3	21
Mirpur	38	915.53	0	16	6	47	58	5.5	2	23
Gulshan	15	186.76	110	27	1	77	68	6	1	34
Demra	43	53.66	0	8	3	107	66	5.5	4	15
Badda	24	197.27	0	7	2	47	60	5	2	7
Tejgaon	52	587.685	310	14	7	80	74	6.5	1	31
Lalbagh	7	403.978	80	24	2	89	54	4.5	4	27
Khilgaon	6	539.98	0	18	1	63	62.5	4.5	3	17

Source: Field survey/Questionnaire survey and Secondary sources.

Step 1:

First of all, from the above mentioned variables some factors have been deducted because they are not valid for doing the analysis of these 15 Thanas. As for example, traveling distance (DT) has been removed first because from the sample survey it would really difficult to find the average traveling distance of walking children to reach to school, playground or amusement parks. This data does not imply any significant correlation in this regard. For this it has been removed from the list first. Then the surface quality of the roads/streets (SR/S) has been removed

from the list because almost all the areas' roads/streets are metalled. So at the end of this step the rest nine factors have been taken for multiple regression analysis.

Step 2:

In this step at first a correlation matrix has been prepared to display all possible simple coefficients of correlation. That is, it shows the correlations between the rest of nine independent variables and the dependent variable (number of children road accident) as well as the correlation among the independent variables. The result of the correlation matrix has been shown in the Table 3.2

Table 3.2: Correlation Matrix.

Correlation Matrix									
	Children Road Accident	LGR	LIB	ZC	O/U	TP	WMR	WFP	CR
LGR	-0.29181								
LIB	-0.13454	0.464562							
ZC	**-0.72942**	0.426974	0.38981						
O/U	**0.616304**	0.351507	0.435752	-0.30557					
TP	-0.33126	0.128205	0.506911	0.583809	0.086146				
WMR	**0.505816**	-0.37066	0.30932	-0.21495	0.264576	0.076035			
WFP	**0.60326**	-0.02534	0.270323	-0.03166	0.407463	0.113656	**0.554943**		
CR	-0.06912	-0.28025	0.073053	-0.06985	-0.04423	0.20598	-0.00924	-0.395	
TSL	**-0.35321**	0.334597	0.243236	0.795937	-0.01352	0.431931	-0.20933	0.2046	-0.228

From the table it is seen that the four dependent variables namely Number of Crosswalks/Zebra crossing (ZC), Number of Overpass/Underpass (O/U), Average width of Main Road (WMR), and Average width of Footpath (WFP) have correlation with the children accident rate. Other variables have low degree of correlation with the accident rate of children. As a result keeping the above mentioned four variables four next step of analysis, the other variables have been eliminated from the list in this step. So the factors have reduced to four from nine.

There is another important thing to be considered. That is, now it is necessary to test the multi-co linearity, or the correlation among the last four independent variables. Such correlation is undesirable because it can cause distortion in the standard error of estimate and can lead to incorrect conclusions about which of the independent variables have significant net regression coefficients. Here, the largest correlation among the independent variables — between average width of main road and average width of footpath — is 0.554, which is not large enough to

cause a problem. Because the correlation must be stronger than – 0.70 or + 0.70 to be a problem. So there is no problem in taking the last four independent variables namely 'ZC', 'O/U', 'WMR', and 'WFP' for analysis in the next step.

Step 3:

The overall ability of the set of last four variables to explain the variation of the dependent variable, namely children accident rate is tested in this step. That means, can the hypothesis that all the regression coefficients are zero be rejected? For this the null hypothesis is that the net regression coefficients for 'ZC', 'O/U', 'WMR', and 'WFP' are all equal to zero. That is none of these variables is useful in explaining the variation in the occurrence of children road accident in Dhaka City. The following computer output gives the regression equation, the ANOVA table, and other statistics for the data in Table 3.1:

The Regression equation is:

Road Accident for walking children

$$= -73.66 - 0.93\ ZC + 2.49\ O/U + 0.45\ WMR + 12.93\ WFP.$$

Table 3.3: Output of Regression Analysis.

Predictor	Coefficients	Standard Error	t Stat	P-value
Constant	**- 73.662192**	27.26699143	- 2.70152	0.042707
ZC	**- 0.938928974**	0.593162308	- 1.58292	0.174287
O/U	**2.493119799**	1.923581037	1.296083	0.251545
WMR	**0.454649911**	0.454649911	1.222757	**0.275907**
WFP	**12.93277831**	12.93277831	**3.693834**	0.014089

Table 3.4: Regression Statistics.

Multiple R	0.983254606
R Square	0.96678962
Adjusted R Square	0.907010935
Standard Error	5.059064446
Observations	15

Table 3.5: ANOVA.

SOURCE	df	SS	MS	F	P
Regression	9	3725.362668	413.9292	**16.17282**	**0.003442741**
Residual	5	127.9706653	25.59413		
Total	14	3853.333333			

From the Table 3.3 it is seen that the net regression coefficients of – 0.93 for ZC, 2.49 for O/U, 0.45 for WMR and 12.93 for WFP are estimates of the areas' values

respectively $\beta 1$, β_2, β_3 and β_4. Now it is tested whether these factor values are zero or not. The null and alternative hypotheses are stated as follows:

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$

$H_a:$ Not all the β_S are 0

Not to reject the null hypothesis implies that the regression coefficients are all zero. Logically, this means that none of them is useful in explaining the variation in accident rate of children.

To perform the test, the *F* distribution is employed. The degree of freedom for the numerator of the *F* distribution is equal to 9 and for the denominator is equal to 5 as reported in the Table 3.5. The column headed *df* reports the degrees of freedom. Using the 0.05 significance level and the *F* distribution table, the critical value of *F* is found to be 2.14. The null hypothesis is rejected if the computed value of *F* exceeds 2.14. The computed value of *F* is 16.17 (Table 4.5).

Since the computed *F* value of 16.17 exceeds the critical value of 2.14, the null hypothesis is rejected, and it can be concluded that at least one of the regression coefficients is not equal to zero. The *p* value is 0.003, so there is little likelihood that H_0 is actually true. At least one independent variable is useful in explaining the variation in accident rate of children. The next step is to find which of the set of variables is useful.

Step 4:

In this step individual regression coefficients are evaluated. If any of the four regression coefficients could be equal to zero, it is to be considered eliminating them from the regression equation. To do so, a test of hypothesis for each of the four regression coefficients is conducted individually.

For ZC	**For O/U**	**For WMR**	**For WFP**
$H_0: \beta_1 = 0$	$H_0: \beta_2 = 0$	$H_0: \beta_3 = 0$	$H_0: \beta_4 = 0$
$H_a: \beta_1 \neq 0$	$H_a: \beta_2 \neq 0$	$H_a: \beta_3 \neq 0$	$H_a: \beta_4 \neq 0$

The test statistics is the *t* distribution with n-(k+1) degrees of freedom in each case. There are 15 Thanas in the sample, so there are n–(k+1) = 15–(4+1) = 10

degrees of freedom in the test. Assuming a 0.05 significance level and using a two tailed test, it is found that the critical values are –2.23 and 2.23.

Now referring to the Table 3.3, it is necessary to explain the column of standard error. Here a sample of 15 Thanas is selected and the information on the dependent variable (number of children road accident) and each of the four independent variables for each Thana is obtained. If another random sample of 15 Thanas was selected and the regression equation on that sample is computed, it would probably obtain the similar but slightly different regression coefficients. If the process were to repeat many times, it could be obtain a sampling distribution for each of the regression coefficients. The value reported in the Standard Error column reflects the variability in these coefficients.

From the Table 4.3 it is seen that the *t*- values for 'WFP' exceed the critical values but *t* values for 'ZC', 'O/U' and 'WMR' do not. Therefore, the variable 'WFP' is included in the regression and those for 'ZC', 'O/U' and 'WMR' are dropped. But here the three variables 'ZC', 'O/U' and 'WMR' are not dropped at a time because if there is correlation among them, removing anyone will often make the others significant. Here exists low/medium degree of correlation between those three variables. So, at this step one variable whose *p*-value is the higher that means the variable 'WMR' (*p*- value 0.27) is dropped. That means at the end of this step three variables remain as significant factors of children accident rate namely 'WFP', 'ZC' and 'O/U'

Step 5:

In this step the regression computation is again run using the rest of three variables that are significant. The result of the regression computation is given in the Table 3.6. Assuming a 0.05 significance level and using a two tailed test, it is found that the critical values –2.20 and +2.20 for 11 degrees of freedom. From the table it is seen that the *t*-values for 'ZC' and 'WFP' exceed the critical values, and t-values for 'O/U' do not. Therefore, the variables 'ZC' and 'WFP' are included in the regression and the variable 'O/U' is dropped and at the end of this step only two variables remain as significant factors of children accident rate.

The Regression equation is:

Road Accident for walking children

$$= -33.726 - 1.015\ ZC + 1.78\ O/U + 13.41\ WFP.$$

Table 3.6: Output of Regression Analysis.

Predictor	*Coefficients*	*Standard Error*	*t Stat*	*P-value*
Constant	- 33.7265	14.80955	- 2.27735	0.04374
ZC	- 1.0153	0.154556	**- 6.56917**	4.03E-05
O/U	1.785629	0.887428	2.01214	0.069346
WFP	13.41348	2.788432	**4.810401**	0.000544

Table 3.7 Regression Statistics.

Multiple R	0.95091
R Square	0.904231
Adjusted R Square	0.878112
Standard Error	5.79209
Observations	15

Step 6:

In this step again the regression computation is run using only the two variables that are significant. Table 3.8 shows the regression analysis result. Assuming a 0.05 significance level and using a two tailed test, it is found that the critical values – 2.18 and +2.18 for 12 degrees of freedom. From the table it is seen that the *t*-values for both the variables 'ZC' and 'WFP' exceed the critical values. So last of all the two variables 'ZC' and 'WFP' are included in the regression equation.

From the Table 3.9 it is seen that 86.9 percent of the variation in accident rate of waling children is explained by the two variables 'ZC' and 'WFP'. So a reduction of two independent variables caused a loss of about ten percentage points in explained variation - worthwhile trade because the new model, with only two independent variables, is easier to understand. In addition, in the revised regression model, the two independent variables have significant net regression

coefficients. The *p*-values in the output are both less than 0.05, which indicates that they are significant at the 0.05 level.

Table 3.8: Output of Regression Analysis.

Predictor	*Coefficients*	*Standard Error*	*t Stat*	*P-value*
Constant	- 39.2982	16.29197	- 2.41212	0.032786
ZC	- 1.11502	0.163941	**- 6.80135**	1.9E-05
WFP	15.75865	2.836761	**5.555157**	0.000125

Table 3.9: Regression Statistics.

Multiple R	0.932192
R Square	**0.868981**
Adjusted R Square	0.847145
Standard Error	6.486258
Observations	15

Finally the following regression equation of accident rate of walking children for Dhaka City is found:

Road Accident for walking children = $-39.29 - 1.115\ ZC + 15.758\ WFP$

Where,

ZC = Number of Crosswalks / Zebra crossing

WFP = Average width of Footpath

And about 86.9% of the variation in children accident rate of Dhaka City is explained by these two variables for the walking children.

3.1.2 List of variables considered for children while traveling

The following factors have again been considered for the determination of significant factors which control street safety for children while traveling through car, bicycle or any other vehicle to a great extent.

1) Avg. Distance Travelled (DT)
2) Avg. Duration of the Journey (DJ)

3) Avg. number of Traffic Police engaged (TP)

4) Avg. width of Main Road (WMR)

5) Number of Crosswalks/Zebra crossing have to cross/bypass (ZC)

6) Number of Speed Breakers have to pass (SB)

7) Avg. speed of the Car or Vehicle (SCV)

8) Avg. number of Intersection or Turns have to cross/make (IT)

9) Usage of Seat Belt (STB)

10) Following Safety Rules (SR)

3.1.2.1 Description of the determination of significant factors

The data on above mentioned factors for the fifteen Thanas have been collected from field survey, questionnaire survey, secondary survey and in some cases from the GIS maps as well of the respective areas. The analysis procedure is discussed stepwise in the following portion.

Table 3.10: Collected data on different factors influencing road safety for traveling children.

Thana	Cldn. Rd. Acdnt. (2001-2006)	DT (km)	DJ (min)	TP (No.)	WMR (ft)	ZC (No.)	SB (No.)	SCV (km/h)	IT (No.)	STB (%)	SR (%)
Motijheel	16	381.64	68	102	68.5	35	9	60	5	87.5	85
Ramna	20	592.76	532	134	62	29	14	55	5	80	82.5
Sahabagh	20	807.94	213	68	55	30	18	60	3	92.5	82.5
Uttara	50	197.13	430	52	79	9	15	60	7	85	85
Dhanmondi	10	291.305	143	106	65	37	19	50	7	98	87.7
Mohammedpur	40	114.695	0	55	71	11	10	52	6	82.5	85
Cantonment	4	883.19	720	162	69	36	23	48	5	96	95
Newmarket	10	745.01	410	41	63	25	9	45	4	85	87.5
Mirpur	38	915.53	0	47	58	16	14	53	3	77.5	82.5
Gulshan	15	186.76	110	77	68	27	13	50	5	85	87.5
Demra	43	53.66	0	107	66	8	17	58	3	50	82.5
Badda	24	197.27	0	47	60	7	6	55	2	85	85
Tejgaon	52	587.685	310	80	74	14	9	58	4	65	77.5
Lalbagh	7	403.978	80	89	54	24	10	48	3	80	80
Khilgaon	6	539.98	0	63	62.5	18	11	51	2	94	85

Source: Field survey/Questionnaire survey and Secondary sources.

Step 1:

At first a correlation matrix has been as well prepared to display all possible simple coefficients of correlation. The result of the correlation matrix has been shown in the Table 3.11.

Table 3.11 Correlation Matrix.

Correlation Matrix										
	Clin Rd Acdnt (2001-2006)	DI	DJ	TP	WMR	ZC	SB	SCV	IT	STB
DI	0.101917									
DJ	0.036257	0.119116								
TP	-0.33126	0.50383	-0.29514							
WMR	0.388466	0.198515	0.214486	0.042874						
ZC	-0.3577	0.512851	-0.12535	0.522398	-0.03729					
SB	-0.13942	0.602869	-0.2723	0.601369	0.051364	0.460536				
SCV	0.625591	-0.09894	-0.18743	-0.0491	0.190918	-0.03295	-0.019			
IT	0.138724	0.815683	0.389895	0.251665	0.733402	0.353364	0.335969	0.016714		
STB	-0.66386	0.061447	0.12877	0.027683	0.073227	0.360238	0.190531	-0.33515	0.262071	
SR	-0.5208	0.121342	-0.27827	0.336746	0.314151	0.224842	0.477735	-0.47407	0.350104	0.596529

From the table it is seen that the three dependent variables namely Avg. speed of the car or vehicle (SCV), Usage of Seat Belt (STB), and Following Safety Rules (SR) have correlation with the children accident rate. As a result keeping the above mentioned three variables four next step of analysis, the other variables have been eliminated from the list in this step. So the factors have reduced to three from ten.

Here, the largest correlation among the independent variables – between following safety rules and using seat belt – is 0.596, which is not large enough to cause a problem. Because the correlation must be stronger than – 0.70 or + 0.70 to be a problem. So there is no problem in taking the last three independent variables namely 'SCV', 'STB', and 'SR' for analysis in the next step.

Step 2:

The null hypothesis in this step is that the net regression coefficients for 'SCV', 'STB', and 'SR' are all equal to zero. The following computer output gives the regression equation, the ANOVA table, and other statistics for the data in Table 3.10.

The Regression equation is:

Road Accident for traveling children

$$= -0.86 + 1.533\ SCV - 0.692\ STB - 0.0022\ SR.$$

Table 3.12: Output of Regression Analysis.

Predictor	Coefficients	Standard Error	t Stat	P-value
Constant	**-0.86024**	99.12001	-0.00868	0.993231

SCV	**1.533312**	0.711445	2.155207	0.054154
STB	**- 0.69229**	0.312798	**- 2.21321**	0 048944
SR	**- 0.00223**	1.024351	- 0.00218	**0.998301**

Table 3.13: Regression Statistics.

Multiple R	0.789783
R Square	0.623757
Adjusted R Square	0 521146
Standard Error	11.48037
Observations	15

Table 3.14: ANOVA

SOURCE	df	SS	MS	F	P
Regression	3	2403.545	801 1817	**6.078818**	**0.010768**
Residual	11	1449.788	131.7989		
Total	14	3853.333			

From the Table 3.12 it is seen that the net regression coefficients of 1.533 for SCV, – 0.692 for STB, and – 0.0022 for SR are estimates of the areas' values respectively $\beta 1$, β_2, and β_3. Now it is tested whether these factor values are zero or not. The null and alternative hypotheses are stated as follows:

H_0 : $\beta_1 = \beta_2 = \beta_3 = 0$

H_a : Not all the β_s are 0

To perform the test, the *F* distribution is employed. The degree of freedom for the numerator of the *F* distribution is equal to 3 and for the denominator is equal to 11 as reported in the Table 3.14. The column headed *df* reports the degrees of freedom. Using the 0.05 significance level and the *F* distribution table, the critical value of *F* is found to be 2.14.

Since the computed *F* value of 6.07 exceeds the critical value of 2.14, the null hypothesis is rejected, and it can be concluded that at least one of the regression coefficients is not equal to zero. The *p* value is 0.010, so there is little likelihood that H_0 is actually true.

Step 3:

In this step individual regression coefficients are evaluated and to do so, a test of hypothesis for each of the three regression coefficients is conducted individually.

For SCV	For STB	For SR
$H_0: \beta_1 = 0$	$H_0: \beta_2 = 0$	$H_0: \beta_3 = 0$
$H_a: \beta_1 \neq 0$	$H_a: \beta_2 \neq 0$	$H_a: \beta_3 \neq 0$

The test statistics is the *t* distribution with n–(k+1) degrees of freedom in each case, so there are n–(k+1) = 15–(3+1) = 11 degrees of freedom in the test. Assuming a 0.05 significance level and using a two tailed test, it is found that the critical values are –2.20 and +2.20.

From the Table 4.12 it is seen that the *t*- values for 'STB' exceed the critical values but *t* values for 'SCV', and 'SR' do not. Therefore, the variable 'STB' is included in the regression and those for 'SCV', and 'SR' are dropped. But, at this step one variable whose *p*-value is the higher that means the variable 'SR' (*p*-value 0.99) is dropped. That means at the end of this step two variables remain as significant factors of children accident rate namely 'STB' and 'SCV'.

Step 4:

In this step the regression computation is again run using the rest of two variables that are significant. The result of the regression computation is given in the Table 3.13.

The Regression equation is

Road Accident for traveling children = – 1.049 + 1.53 SCV – 0.692 STB.

Table 3.15 Output of Regression Analysis.

Predictor	*Coefficients*	*Standard Error*	*t Stat*	*P-value*
Constant	-1.04947	45.69101	-0.02297	0.982053
SCV	1.533874	0.634816	2.416251	0.032539
STB	-0.69265	0.254415	-2.72251	0.018522

Table 3.16: Regression Statistics.

Muluple R	0.789783
R Square	**0.623757**
Adjusted R Square	0.56105

Standard Error	10.99162
Observations	15

Assuming a 0.05 significance level and using a two tailed test, it is found that the critical values –2.18 and +2.18 for 12 degrees of freedom. From the table it is seen that the *t*-values for both the variables 'SCV' and 'STB' exceed the critical values. Therefore, last of all the two variables 'SCV' and 'STB' are included in the regression equation.

Finally the following regression equation of accident rate of children for Dhaka city is found:

Road Accident for traveling children = – 1.049 + 1.53 SCV – 0.692 STB.

Where,

SCV = Avg. speed of the Car or Vehicle

STB = Usage of Seat Belt

Therefore after completing the multiple regression analysis for the determination of significant factors of accident rate for traveling children of Dhaka city, only two significant factors namely 'Avg. speed of the car or vehicle' (SCV) and 'Usage of Seat Belt' (STB), are found from the ten primary factors. And about 62.4 % of the variation in children accident rate of Dhaka city is explained by these two variables.

3.2 Road Environment at School Fringe Areas of Dhaka

All the areas identified for the study were visited to get information and hand in experiences on existing condition and accident scenario of the roads and streets besides the pre selected schools, play fields and recreational places of Dhaka city. To conduct the study investigation surveys were adopted at the fringe areas of the following five schools:

- Viqarunnisa Noon School and College, Ramna
- Ideal School and College, Motijheel
- Khilgaon Ideal School, Khilgaon
- Dhanmondi Government Boys High School, Dhanmondi

- Holy Cross School and College, Farmgate

For this purpose Headmasters/Principal of the above mentioned schools were interviewed along with reconnaissance surveys of the areas. Opinions and views of the teachers, guardians, and students were taken into cognizance. The following section highlights the existing state of condition of the street safety physical infrastructures and measures of the areas; in addition, the walking routes that school pupils usually follow were identified.

3.2.1 Viqarunnisa Noon School and College, Ramna

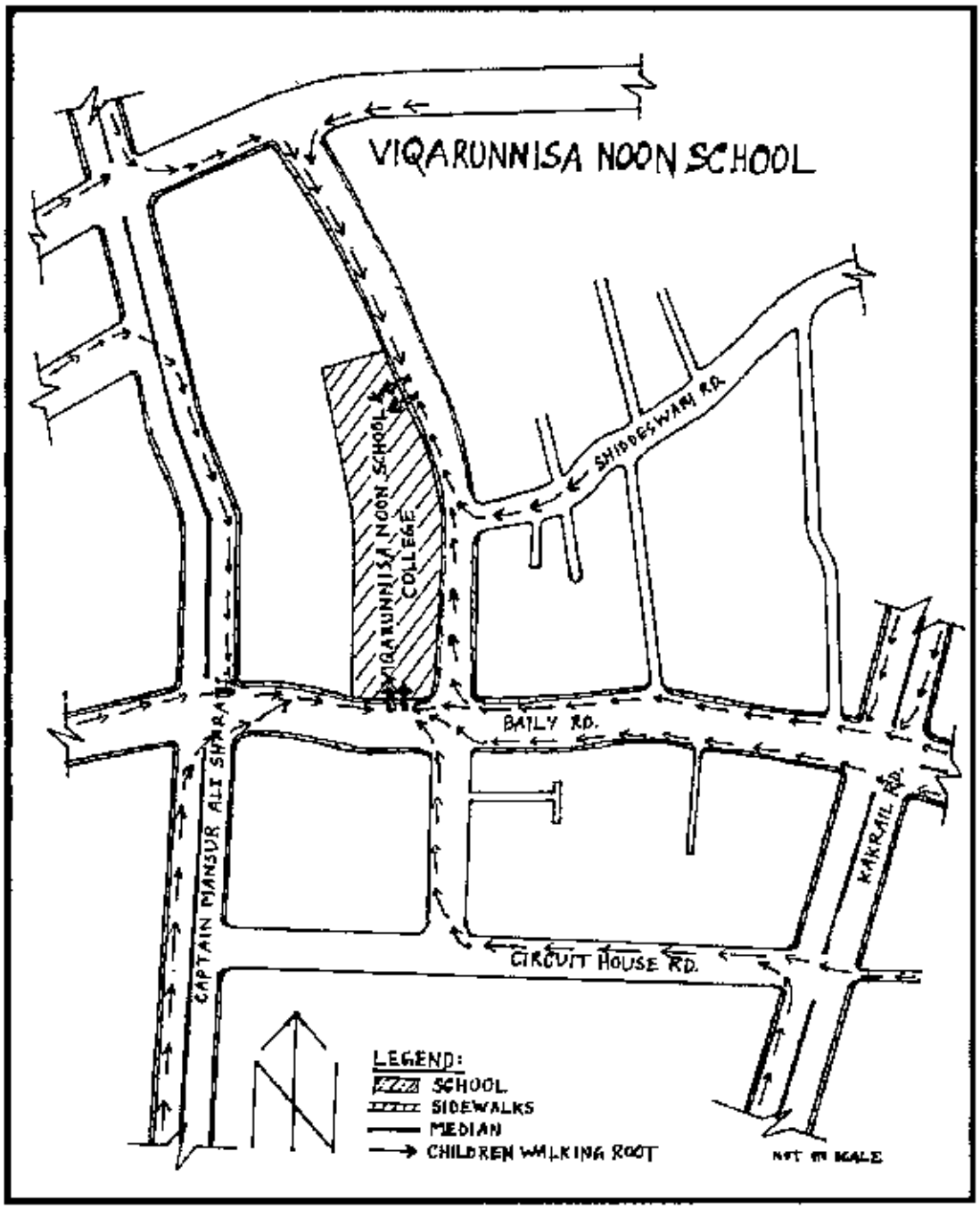
Viqarunnisa Noon School is at 1, New Baily Road, Ramna, Dhaka and is one of the renowned girls' schools in Bangladesh. The school was established in 1952. It is surrounded by Captain Munsur Ali Sharani to west, Baily Road to south and Shiddeswari road to east and the area where it is located is a mixed-use type area having commercial as well as residential setting.

Students are coming to this campus from different parts of Dhaka city ranging from Uttara to Jatrabari. Most of the school pupils come from the surrounding catchment areas of the school like Shantinagar, Malibagh, Rajarbagh, Moghbazar, Rampura, Khilgaon, Eskaton, Paltan, Motijheel, Fakirapool, Segunbagicha, Kamlapur, etc. and thereby school van and rickshaws are dominant as the mode of transportations of the students; however, private car also represents a large share during the school opening and closing times. Only on-street parking provision exists for this school, which ultimately results huge traffic jam and congestion during the school opening and finishing hours

3.2.1.1 Characteristics of the adjacent roads

Only the Baily Road, adjacent to Viqarunnisa Noon School, is a one way road and the surrounding Captain Munsur Ali Sharani and Shiddeswari Road are two ways roads. Instruction boards to drive at 20 miles per hour (mph) are placed at three or four positions of these roads and three distinct speed breakers force the drivers to drive slowly. However, most of the through traffic appears reluctant to follow the speed limit. Again, only the Captain Munsur Ali Sharani is designed with pedestrian refuge islands and Baily Road, Shiddeswari Road are without medians. Average width of the sidewalks of these roads is 6 to 7 feet and all the sidewalks are without any protection barrier or railing. School signage is prominent at

Figure 3.1: Surrounding Roads and Streets of Viqarunnisa Noon School and College.



four/five locations and two distinct marked crosswalks facilitate the road crossings of the school children. Furthermore, only Captain Munsur Ali Sharani holds marked division for the Non Motorized and Motorized vehicles. No bus shelter / bus stop and bus bay is accommodated on the nearby roads of the school. Road signage and other markings of these roads are satisfactory and Signal Lights

Photo 3.1: Speed Breaker and Marked Crosswalks adjacent to Viqarunnisa Noon School and College.

properly works.

3.2.1.2 Children/Pedestrian characteristics

It is evident that the students, who employ sidewalks to come to Viqarunnisa Noon School, usually use the Baily Road and Shiddeswari Road and other lanes and streets of the locality (Figure 3.1). Captain Munsur Ali Sharani is rarely used by the walking children. Two traffic polices are solely designated during the school opening and closing hours to maintain the huge traffic flow at that time. Even though Viqarunnisa Noon School is a renowned school, no 'Car Free Zone' or 'School Safety Zone' exists for this school.

3.2.1.3 Safety measures by the school authority

Regarding children street safety, one day workshops have been arranged for the last two years to educate school children the principals of road safety. These workshops have been arranged in collaboration with Dhaka Metropolitan Police (DMP) and Dhaka City Corporation (DCC) and in future would be continued on a regular basis. Non Motorized school vans are operated to pick up and drop the school children of the surrounding catchment areas and are administered by a separate entity employed by the school authority. Here it can be mentioned that the school authority have the 'Fast Aid' arrangement for its students.

3.2.2 Ideal School and College, Motijheel

Ideal School, established in 1965, is positioned next to the intersection of Motijheel Mazar Road and Outer Circular Road and is also one of the renowned schools in Dhaka. It is surrounded by Outer Circular Road to east, Motijheel Mazar Road to west and Motijheel A.G.B. Colony to south and the area where it is located is a residential area.

Students are coming to this academia from diverse parts of Dhaka city. Most of the students come from the surrounding catchment area of the school like Shantinagar, Malibagh, Rajarbagh, Mugda, Basabo, Moghbazar, Khilgaon, Eskaton, Paltan, Arambagh, Fakirapool, Segunbagicha, Kamlapur, Gupibagh, Wari, etc. and thereby school van, rickshaw and walking are leading as the style of transportation of the students; however, private car is visible to a negligible coverage during the school opening and closing times. Only on-street parking provision exists for this school. Marginal traffic jam and congestion happens at the surrounding roads of the school merely during the school opening and finishing hours

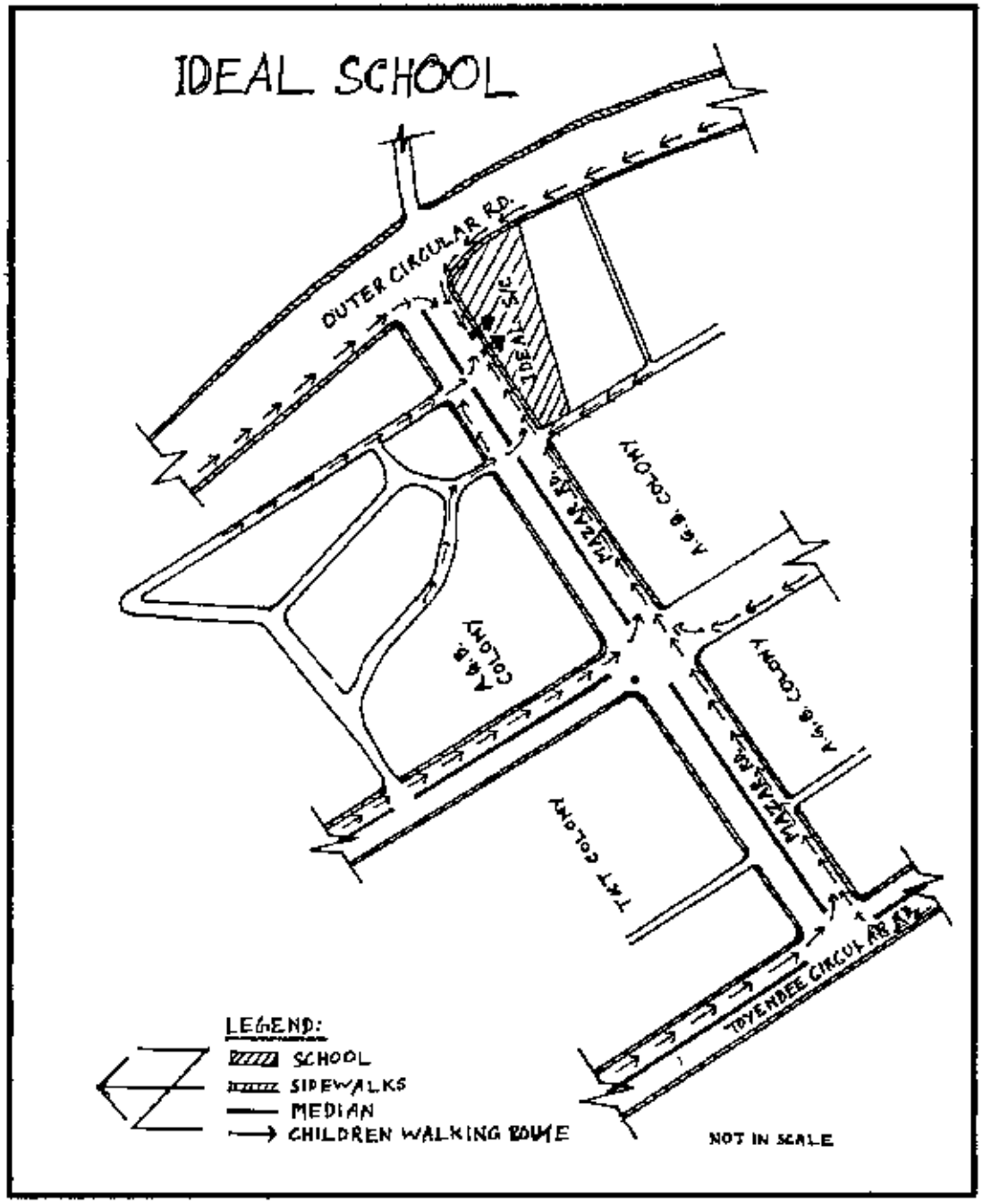
3.2.2.1 Characteristics of the adjacent roads

Outer Circular Road and Motijheel Mazar Road, adjacent to Ideal School, are both ways roads. Instruction boards to drive at 20 miles per hour (mph) and 'Drive Slowly' are placed at three positions of the roads and two distinct speed breakers warn the drivers to drive slowly. Again, both of the above mentioned roads are designed with medians. Average width of the sidewalks of these roads is 6 to 7.5 feet and all the sidewalks have no protection barrier. School signage is prominent at two locations and two marked zebra crossings facilitate the road crossings of the school boys and girls. Furthermore, no marked division is provided for the Non Motorized and Motorized vehicles of these roads. Even though one designated bus shelter / bus stop is located just beside the school, on the intersection of Mazar Road and Outer Circular Road, it becomes useless due to poor maintenance and outlook. Road signage and other markings of the roads are reasonable and Signal Lights properly works.

3.2.2.2 Children/Pedestrian Characteristics

From the reconnaissance survey it is evident that the students, who take up

Figure 3.2: Surrounding Roads and Streets of Ideal School and College, Motijheel.



sidewalks to come to Ideal School, usually use all the roads, streets and lanes connected towards the school (Figure 3.2). Both of the roads, Outer Circular Road and Motijheel Mazar Road, carry the same imprtance for the walking children and their parents of the school. Designated traffic police during the school opening

and concluding hours is seen on a random basis to maintain the traffic flow. No 'Car Free Zone' or 'School Safety Zone' exists for this school.

Photo 3.2: Road Safety Measures around Ideal School and College, Motijheel.

3.2.2.3 Safety measures by the school authority

During the early periods of each academic year a class lecture of 30 to 40 minutes on 'Children Street Safety' for each class type, from class 1 to class 10, have been arranged regularly by the school authority for the last three or four years to educate school children the principals of road safety. These class lectures are usually carried out by the school teachers having no specialized knowledge to conduct such sessions, the teachers only make use of their knowledge, understanding and information about road safety. Non-motorized school vans are as well operated to pick up and drop the school children of the surrounding catchment areas and are administered by a separate entity employed by the school authority; parents have to pay BDT 500 to 600 per month as the fare. The school authority has the 'Fast Aid' collection for its students while needed.

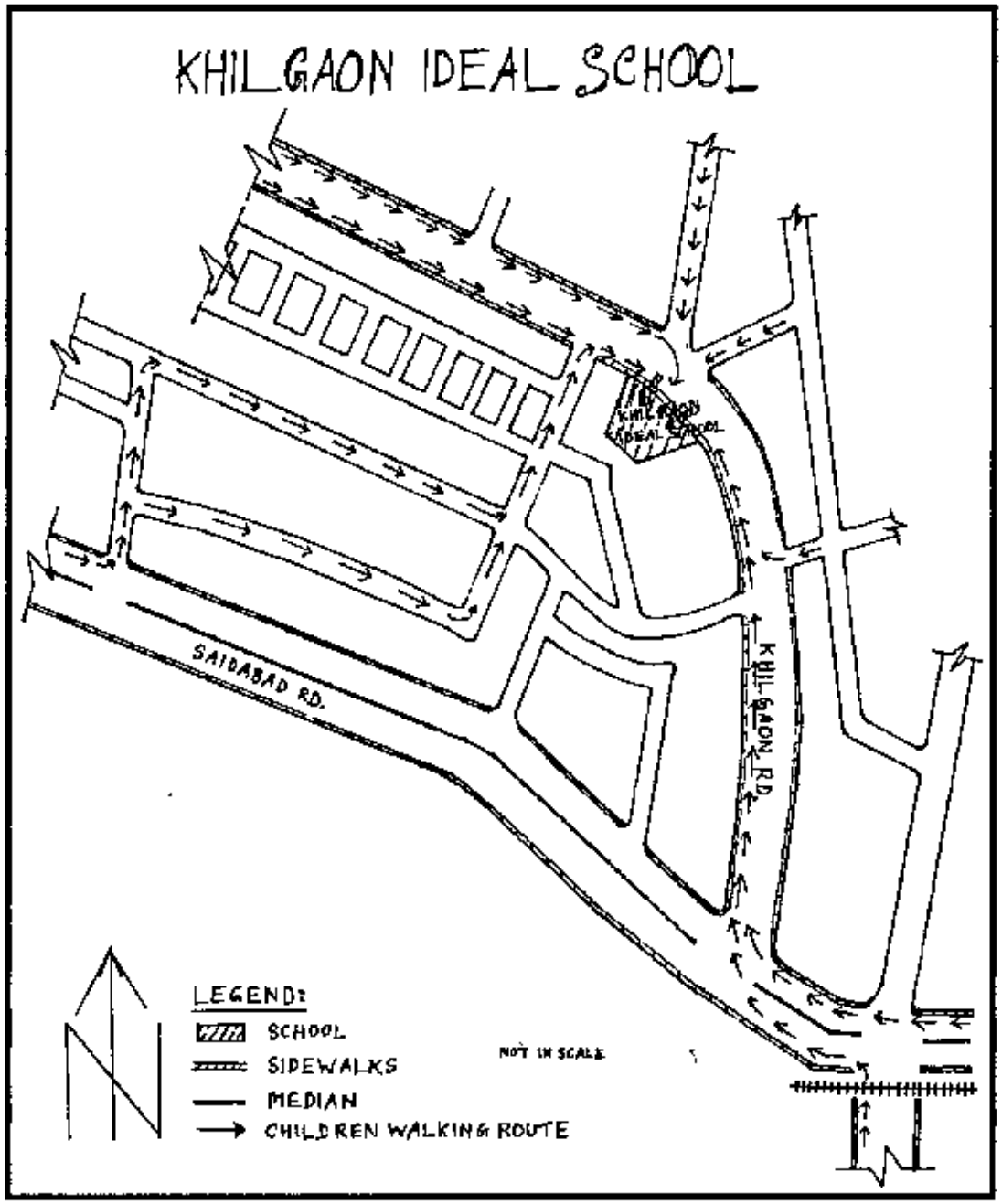
3.2.3 Khilgaon Ideal School, Khilgaon

Khilgaon Ideal School is sited beside Khilgaon Road, Khilgaon and was established in 1972. It is surrounded by Saidabad Road to south, Khilgaon Road to other sides and the area where it is located is a residential area setting.

Approaching students to this campus are from the adjacent areas of Khilgaon, ranging from Goran to Mugda and Basabo. Herein, school van and rickshaws as well as walking

are governing mode of transportation of the students; however, bicycle is noticeable to a minor extent as well. Secondary traffic jam and congestion for a period of 20 to 25

Figure 3.3: Surrounding Roads and Streets of Khilgaon Ideal School.



minutes happens at the surrounding roads of the school merely during the school opening and finishing hours.

3.2.3.1 Characteristics of the adjacent roads

Khilgaon Road, beside which Khilgaon Ideal School is situated, is a two ways road and without median. Unnecessary or through traffic is heavily influenced all the way through of this road. No instruction board for speed limit is placed on the Khilgaon Road and only one speed breaker tries the drivers to drive slowly, which is useless due to the absence of other road safety measures. Average width of the sidewalks of the road is 4 to 5 feet and all the sidewalks are without any protection railing or measures and in most of the cases are illegally used by the adjacent shopkeepers. Neither school signage nor marked crosswalks are designed to facilitate the movement of the boys and girls of the school, let alone marked division for the Non Motorized and Motorized vehicles of the road. Moreover, Khilgaon Road is connected with Saidabad Road and this Saidabad Road is also used by the school pupils who reside in the nearby areas. Several temporary bus stops are located on the Saidabad Road which are basically used by the local people for long distance journeys.

3.2.3.2 Children/Pedestrian characteristics

Khilgaon Road and other lanes and streets, directly connected with the school, carry the optimum weight age for the walking children of the school and their parents, whereas Saidabad Road is less important as the children walking route. It is obvious that the students, who employ sidewalks to come to Khilgaon Ideal School, usually use only the roads, streets and lanes directly connected towards the school (Figure 3.3). No designated traffic police to maintain the traffic flow of the locality is seen; only patrol traffic police sergeant or other police forces visit the road on a random basis.

3.2.3.3 Safety measures by the school authority

No active lessons or class lectures are arranged till date for the students of Khilgaon Ideal School to provide road safety knowledge and understandings. Regarding transportation arrangements by the school influence, non-motorized three-wheeler school vans are operated to pick up and drop the school children of

the immediate catchment areas. The school authority has lacking as well in the arrangements of 'Fast Aid' for its pupils.

3.2.4 Dhanmondi Government Boys High School, Dhanmondi

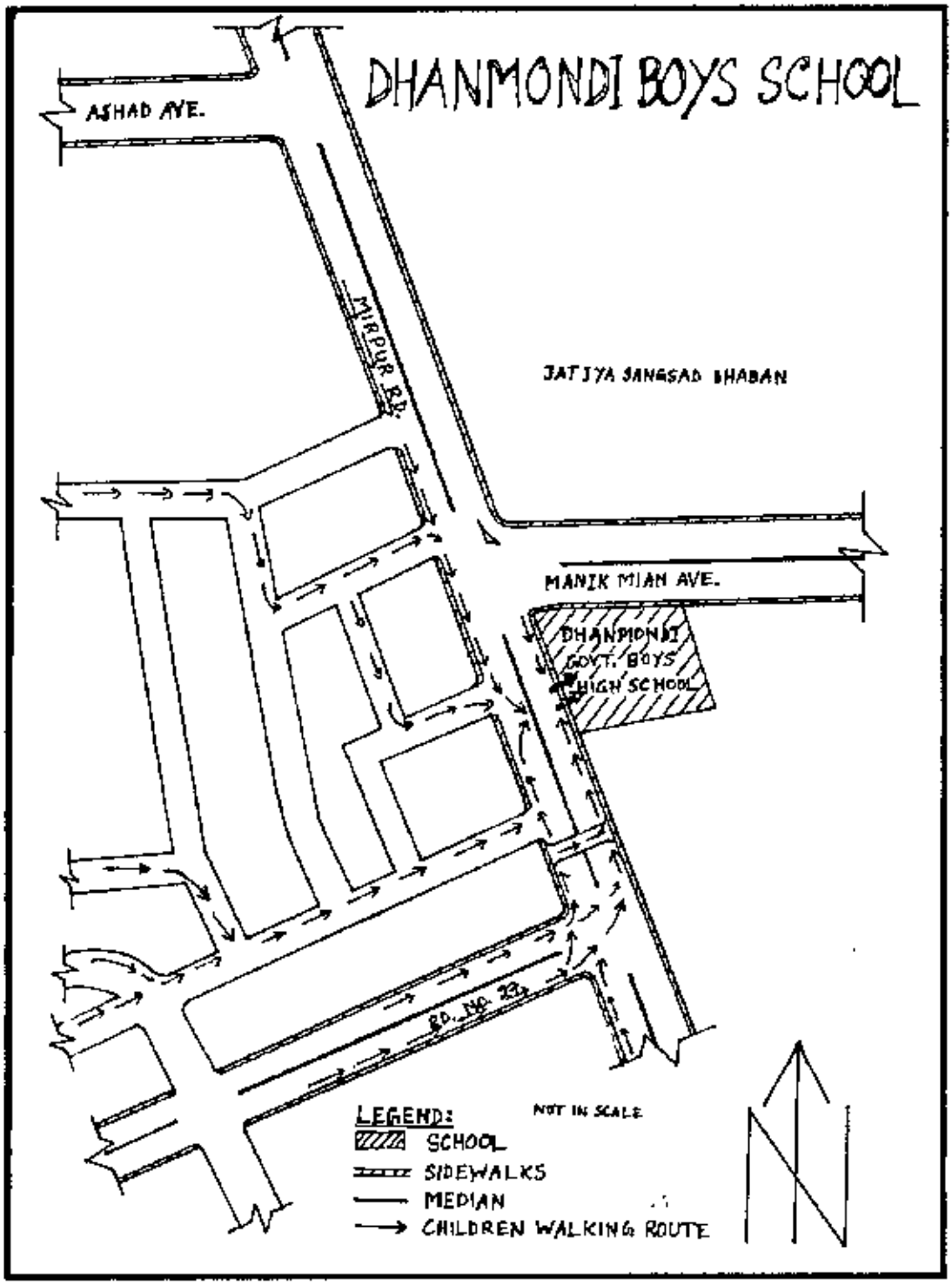
Dhanmondi Government Boys' High School, commonly known as Dhanmondi Boys, is a prestigious public educational institute located at the intersection of Mirpur Road and Manik Miah Avenue in Dhanmondi, Dhaka. The school was established in 1965.

Students are coming to the academy from diverse parts of Dhaka city, having the largest share from the contiguous areas of Dhanmondi (Lalmatia, Mohammadpur, Sankar, Kalabagan, Tejgaon, Jigatola, Newmarket, Kathalbagan, etc.). Private car, bus, school van, rickshaw and walking are central as the transport mode of the students; private car is perceptible to a great extent during the school opening and closing times. Only on-street parking provision exists for the school. Middling traffic jam and congestion, sometimes severe in nature, happens at the surrounding roads of Dhanmondi Boys' during the school opening and finishing hours.

3.2 4.1 Characteristics of the adjacent roads

Mirpur Road and Manik Mian Avenue, bordering to Dhanmondi Government Boys High School, are two ways roads. 'Drive Slowly' posts are placed at two positions of the school fringe area and one well maintained and designed over pass facilitates the road crossing of the children and pedestrian. Again, Roan No. 27, Dhanmondi is just beside of the school and all these roads are designed with pedestrian refuge islands. Average width of the sidewalks of these roads is 5 to 6 feet and only a few portion of the sidewalks are designed with protection barrier or railing. School signage is prominent at two locations and three distinct marked crosswalks facilitate the road crossings of the school boys and girls. Furthermore, Non Motorized vehicles can move only up to Dhanmondi Roan No. 27 and Mirpur Road, Manik Mian Avenue are banned for the Non Motorized vehicles from 2004. Three/four temporary bus stops are located just beside the school and these bus stops are helpful to the students of the school. Road signage and other markings of the roads are quite reasonable.

Figure 3.4: Surrounding Roads and Streets of Dhanmondi Government Boys High School.



3.2.4.2 Children/Pedestrian characteristics

Dhanmondi 27 No. Road and Mirpur Road carry the same weight age for the

walking children and their parents of Dhanmondi Boys. It is obvious that the students, who employ sidewalks to come to Dhanmondi Government Boys High School, usually use all the connecting roads, streets and lanes towards the school (Figure 3.4). Traffic polices, regardless of school opening and concluding hours, are employed to maintain the traffic flow of the roads. Like other schools, no 'Car Free Zone' or 'School Safety Zone' exists for the school.

3.2.4 3 Safety measures by the school authority

Day long workshop on 'Road Safety' along with 'Class Lectures' have been arranged irregularly by the school authority for the last four or five years to educate school children the principals of road safety. Non-motorized three-wheeler school vans are as well operated to pick up and drop the school children. Again, the school authority provides 'Fast Aid' to the students while required.

3.2 5 Holy Cross School and College, Farmgate

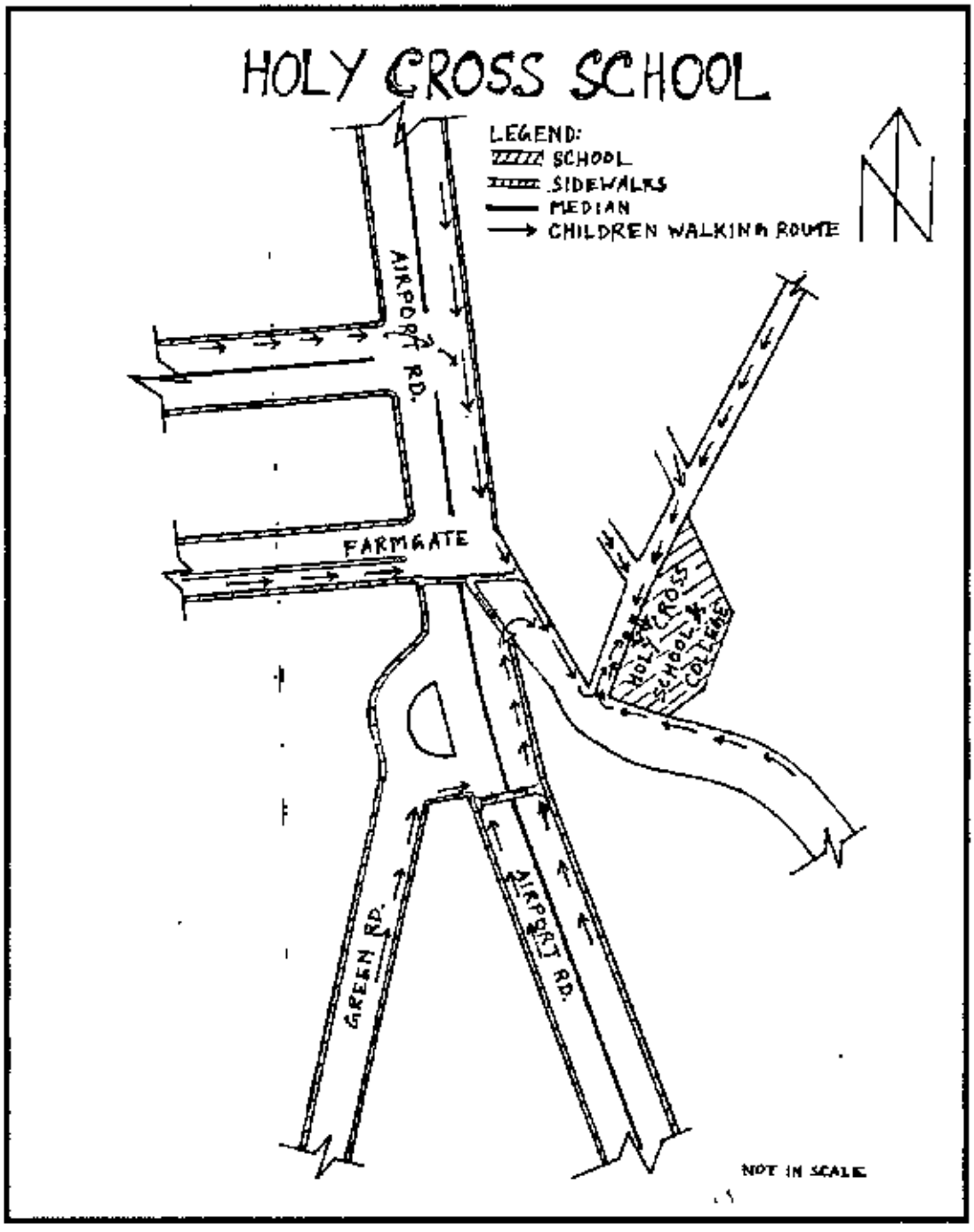
Holy Cross Girl's High School is a Roman Catholic secondary school for girls founded in 1950 by the Sisters of the Holy Cross of Notre Dame, Indiana, United States, in Tejgaon in the city of Dhaka, Bangladesh. At present, it is surrounded by Airport Road to west, Government Science College, Dhaka to east and Holy Rosary Church to north. The area where it is located is a mixed-use type area having commercial, academic as well as residential setting.

Whole Dhaka city serves as the catchment area of the school. Private car, bus, CNG driven three wheeler are principal transportation means for the long distance students and school van, rickshaw are prime choice for the school pupils of short distance: however, walking also represents a large share to reach and back from the school No parking provision, on street or off street, exists for this school due to unavailability of land or space of doing so

3.2.5.1 Characteristics of the adjacent roads

Airport Road, Green Road and other neighboring roads, adjacent to Holy Cross School and College, are two way roads and the surrounding lanes connected with the school are as well serve both directions. No instruction boards to move slowly

Figure 3.5: Surrounding Roads and Streets of Holy Cross School and College.



appear at the school vicinity. Again, Airport Road is designed with the type of median that rejects pedestrian to cross the road on ground level and thus two over passes at Farmgate Junction facilitate the crossing of all the pedestrians and children. Green Road and other neighboring roads of the locality are without

medians. Average width of the sidewalks of these roads varies from 6 to 7 feet and a medium fragment of the sidewalks are with protection barrier and railing and the rest are without protection barrier. Neither school signage nor marked crosswalks are available at the school fringe area. Only Motorized vehicles are operated through Airport Road, whereas Green Road and other lanes allow both the Motorized and Non Motorized vehicles. Two designated bus shelters / bus stops and one bus bay at Farmgate junction are accommodated to ease the movement of the people. Road signage, Signal Lights and other markings of these roads are pleasing.

3.2.5.2 Children/Pedestrian characteristics

Sidewalks of the surrounding roads and lanes of the school along with Green Road are in use far and wide by the school girls to reach and back from the school (Figure 3.5). Airport Road is rarely used by the walking children, in contrary the lanes and distributory streets adjacent to Holy Cross School are extensively used on foot. Traffic polices are always on duty at Airport Road and Farmgate juntion to maintain the massive traffic flow throughout the day. Even though Holy Cross School and College is a renowned school, no 'Car Free Zone' or 'School Safety Zone' exists for the school as well.

3.2.5.3 Safety measures by the school authority

Regarding children street safety, one day workshops along with class lectures have been arranged for the last three/four years. These workshops have been arranged in collaboration with Dhaka Metropolitan Police (DMP) and Dhaka City Corporation (DCC) to educate school children the principals of road safety. Non-motorized school vans are operated to pick up and drop the school pupils of the surrounding catchment areas of Holy Cross School.

3.3 Questionnaire Survey

As the primary movement activity of the children involves going school, the roads surrounding 15 (fifteen) schools within the study area had surveyed and the names of the 15 schools had already mentioned. Furthermore, the roads and streets connecting 6 (six)

popular amusement parks and recreational places of the city and 6 (six) neighborhood play grounds from three urban settings (two playgrounds from planned area, two from unplanned area and two from govt. staff quarters) had also studied in order to get a picture of how safe are these routes for children.

Recreational areas/amusement parks (6) studied are as follows:

- Shishu (children's) Park, Sahabagh
- National Zoo, Mirpur
- Wonderland, Gulshan
- Ramna Park, Ramna
- Dhanmondi Lake, Dhanmondi and
- Fantasy Kingdom, Aushulia.

The selected playgrounds (6) are as follows:

- From planned area.
  - Kalabaghan Play Ground, Dhanmondi
  - Old DOHS Play Ground, Banani.
- From unplanned area.
  - Dhupkhola Play Ground, Sutrapur
  - Jurain Play Ground, Shaympur.
- From Government staff quarters.
  - AGB Colony Eidgah Play Ground, Motijheel
  - Education Board Colony Play Ground, Mirpur.

A total of 270 sample surveys (10 questionnaire surveys from each 15 schools = 150 and 10 questionnaire surveys from each 6 parks and recreational places and also from 6 neighborhood play grounds = 120: total 270) had been conducted. The questionnaire paper used to conduct the survey work is attached herewith as Appendix A, B, C, and D. To facilitate the communication and understanding with the respondents, a Bengali version of the questionnaire paper was as well prepared.

3.3.1 General Discussion

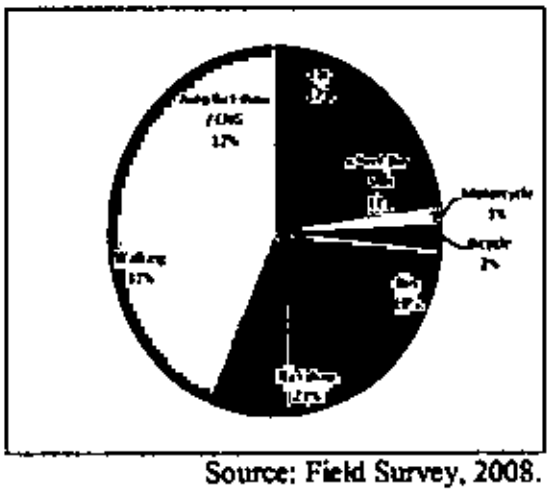
Children were interviewed at the school premise and outside, playgrounds and recreational

areas/amusement parks, whereas their parents/guardians were surveyed only at school premises or outside and recreational areas/amusement parks. Demographic data of the respondents collected from the survey were not considered for analysis as the data represents homogeneity in nature.

3.3.1.1 Mode of transport

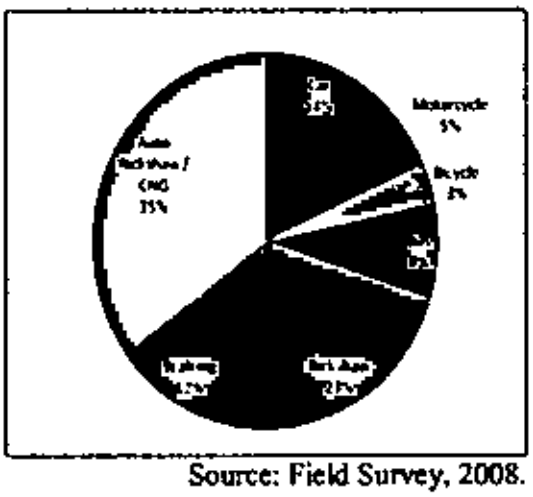
Mode of transport, apparently, plays a major role in making a safe street network for children. Surveys revealed that most of the children of Dhaka city regularly walk to school and playground. The second largest mode of transport for the same is rickshaw (21%), whereas school bus/school van, auto rickshaw/CNG and private car also is in practice with almost same weight-age (11% - 12%).

Fig. 3.6: Means of transport to reach to school and playground.



Source: Field Survey, 2008.

Fig. 3.7: Means of transport to reach to recreational areas.



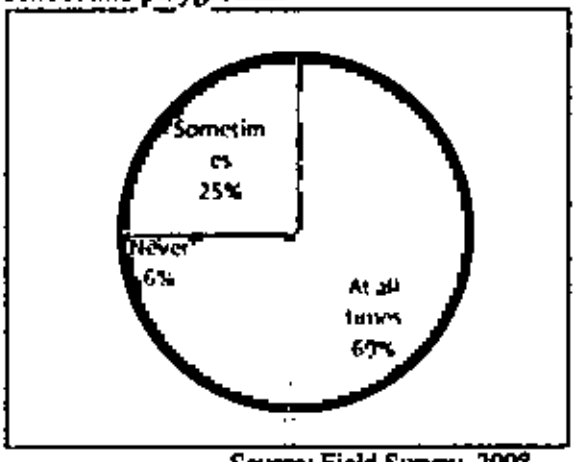
Source: Field Survey, 2008.

A different picture is seen for the children to reach to amusement parks/recreational areas. Here, auto rickshaw/CNG is the prime choice followed by rickshaw. The distance that children and their parents have to pass through to reach recreational areas might be the decisive factor in this regard.

3.3.1.2 Usage of safety equipment

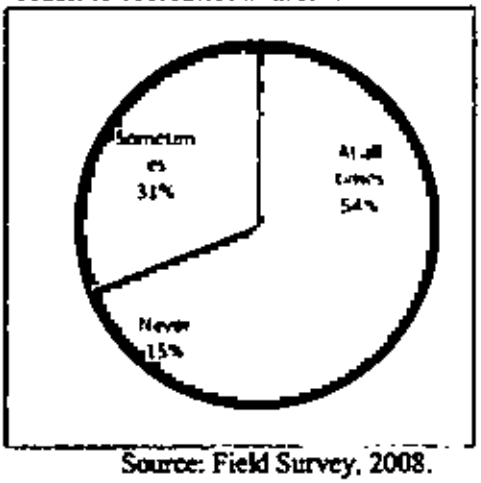
Most of the children confirmed that they use safety equipment while traveling by private/family cars to reach school and playground; on the contrary, a very small group of children indicated their negligence of using safety equipments while travelling in cars.

Fig. 3.8: Use of safety equipment to reach to school and playground.



Source: Field Survey, 2008.

Fig. 3.9: Use of safety equipment to reach to recreational areas.



Source: Field Survey, 2008.

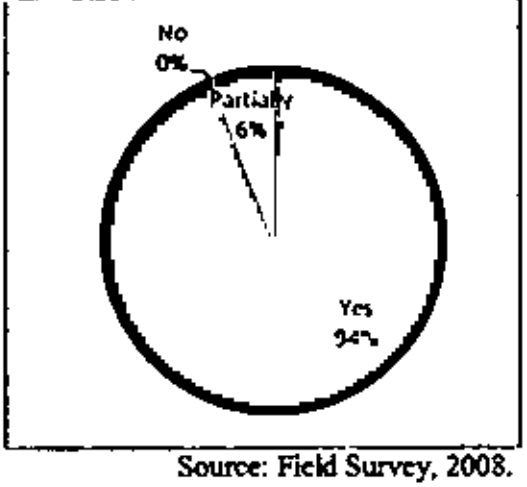
One fourth respondent (25%) established also that they pay due attention, only at times, to safety equipments. The scenario is almost same for the children to reach to recreational areas. Most of them, in this case, also pay due attention to safety equipments and nearly one-third (31%) opined their attention as random basis.

3.3.2 Knowledge on Road Safety

3.3.2.1 Distribution of familiarity with basic road safety knowledge

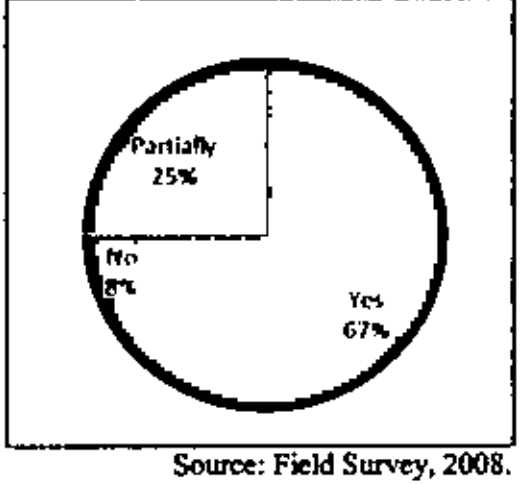
Children: 94% of the school/playfield going children declared their familiarity with road safety knowledge and 67% children surveyed at recreational areas were also in the same opinion. But this is not the true picture as when they were asked some basic rules of using roads, they were incorrect and in most of the cases,

Fig. 3.10: Basic knowledge of road safety (response from children at school and playground).



Source: Field Survey, 2008.

Fig.3.11: Basic knowledge of road safety (response from children at recreational areas).



Source: Field Survey, 2008.

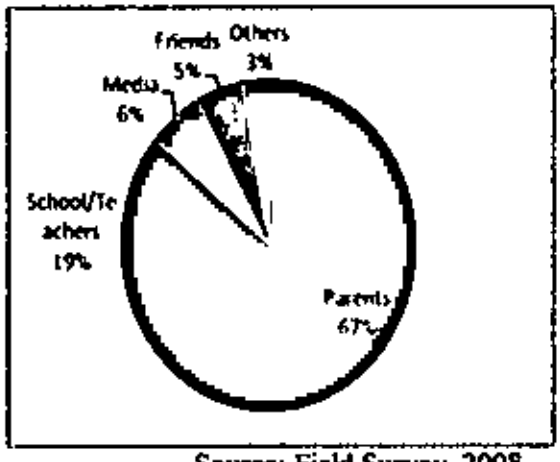
were unable to present the right answers or any answer. Only 8% children, surveyed at recreational areas, straightforwardly agreed their lack of knowledge on road safety. However, 6% children at school/playground and 25% children at recreational areas expressed that they are aware about basic road safety issues a little bit.

Parents: All the parents and guardians surveyed at schools and recreational areas opined in favor of their acquaintance with essential road safety rules and traffic regulations.

3.3.2.2 Distribution of the sources of road safety knowledge

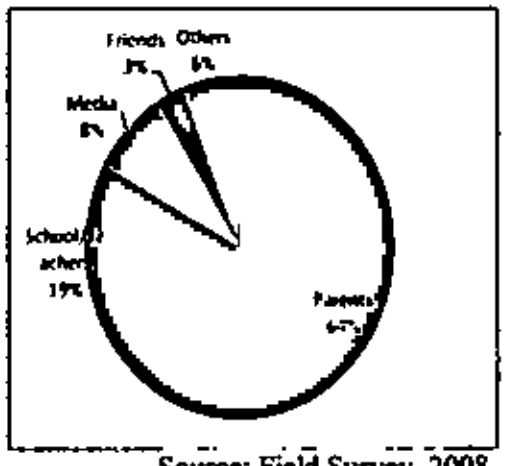
It is well known that parents play a vital role in educating children the basic rules and regulations of using roads i.e. issues of road safety. Other sources like teachers, friends, media (television and newspaper), etc. also play a contributory role in this regard. Children surveyed at schools and playfields highlighted parents as the major source of their road safety knowledge, which was followed by school/teachers as the second largest source (19%). The same scenario was derived from the interviews of kids at recreational areas/amusement parks.

Fig. 3.12: Sources of road safety knowledge (response from children at school and playground).



Source: Field Survey, 2008.

Fig. 3.13: Sources of road safety knowledge(response from children at recreational areas).



Source: Field Survey, 2008.

3.3.2.3 Children as competent road user

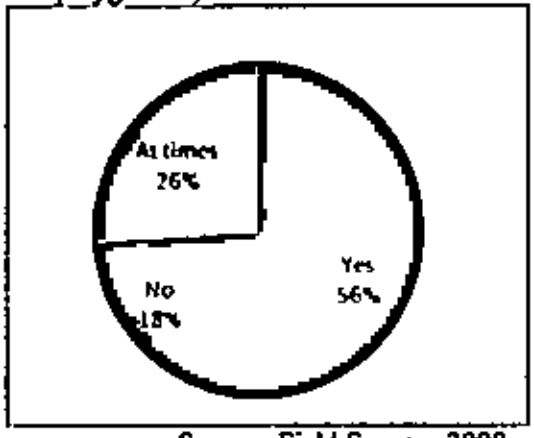
The higher the percentage of using roads by children themselves, the higher the risk of road accident for children as in the crucial moments children fail to do the

right thing at roads/streets which results severe road accidents and subsequent fatalities, injuries and disabilities. Thus it is very important to prepare our kids as a competent road user.

- Parents allow children using roads alone – Response from children

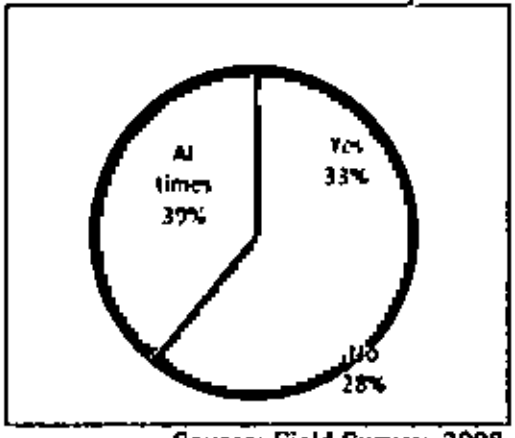
Using roads by children themselves unaided is really a serious concern, particularly for the children under 11 years of age. From the survey, it is seen that most of the parents (56%) permit their children to go to schools/play grounds by their own, whereas this ratio is much lower for children in the event of visiting parks and recreational areas. 39% parents/guardians allow their children to visit parks and recreational areas by their own on a random basis and a considerable percentage of guardians (18% - school/playground, 28% - recreational areas) do not allow children to use roads alone or without supervision. It indicates that at

Fig. 3.14: Parents allow children using roads alone (response from children at school and playground).



Source: Field Survey, 2008.

Fig. 3.15: Parents allow children using roads alone (response from children at recreational areas).



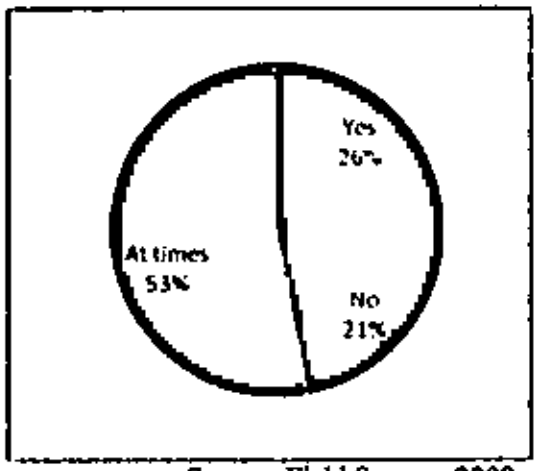
Source: Field Survey, 2008.

least some guardians are aware of the risks of traveling long distances by children themselves alone.

- Parents allow children using roads alone – Response from parents

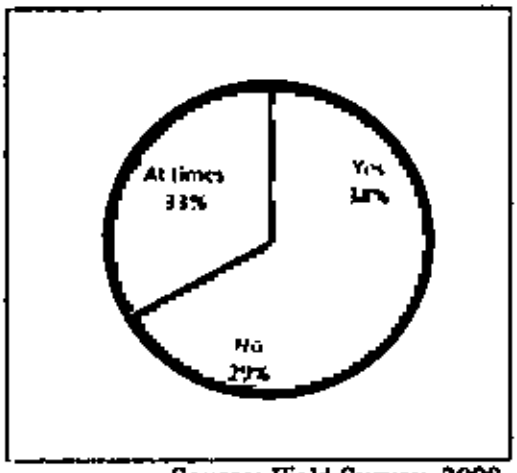
Most of the parents (53%) allow their infants to use the roads/streets at times to arrive at school or playground and on the other hand, one third guardians (33%) act in the same manner on the subject of reaching their kids at recreational areas. A substantial portion of children are permissible to use roads by themselves as

Fig. 3.16: Parents allow children using roads alone (response from parents at school).



Source: Field Survey, 2008.

Fig. 3.17: Parents allow children using roads alone (response from parents at recreational areas).



Source: Field Survey, 2008.

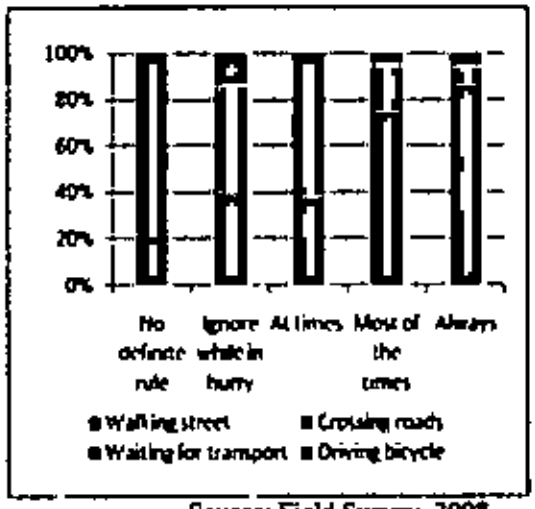
their parents agree to do so and the exact opposite situation prevails for a considerable section of children as well – these guardians are intelligent to understand the threats allied with using streets by children alone.

3.3.2.4 Implementation of road safety knowledge

- Distribution of the trend to follow traffic rules by children

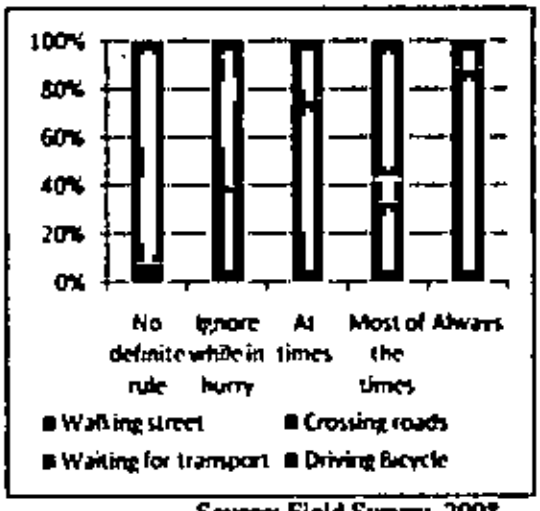
It is observed that even though most of the children follow no definite rule while waiting for transport to reach to either school, play grounds or recreational areas, they offer high attention (23% most of the times and 77% always) in crossing

Fig. 3.18: Following traffic rules by children (response at school and playground).



Source: Field Survey, 2008.

Fig. 3.19: Following traffic rules by children (response at recreational areas).



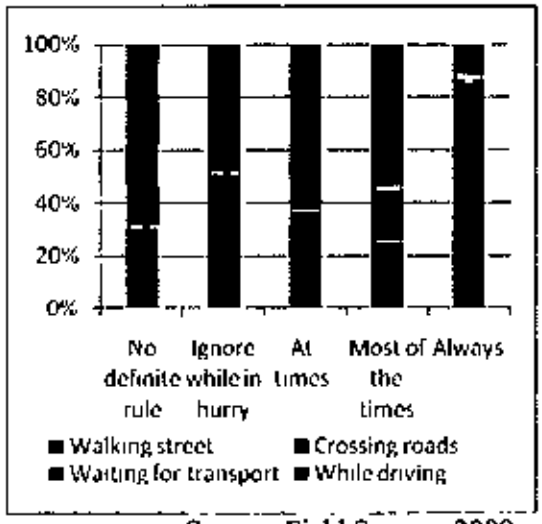
Source: Field Survey, 2008.

roads. Kids try to follow traffic rules most of the times while they drive bicycle to recreational areas and follow safety rules at times in the event of walking street.

- Distribution of the trend to follow traffic rules by parents

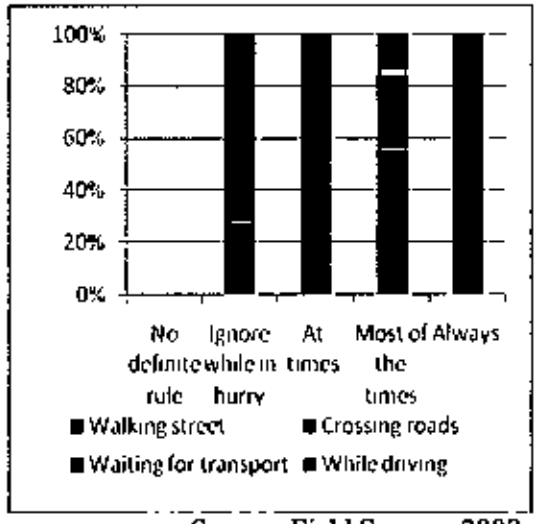
When the question of following traffic rules by the parents/guardians came in the questionnaire survey, it was really difficult to illustrate a valid picture. However, it can he assumed that parents are solemn to follow safety rules always in crossing roads and also while driving. But they as well ignore the safety rules, while in hurry, for the events like walking streets and waiting for transport. On the issue of maintaining safety rules always, undue attention is provided by the parents/guardians for the event of waiting for transport. Parents are serious to cross the roads as they confirmed to obey the rules most of the times, if possible always.

Fig. 3.20: Following traffic rules by parents (response at school).



Source: Field Survey, 2008.

Fig. 3.21: Following traffic rules by parents (response at recreational areas).



Source: Field Survey, 2008.

3.3.3 Road/Street Problems

All the children and parents declared, without any hesitation, that they face a number of problems in using the roads and streets of Dhaka city. To facilitate the analysis, all the problems highlighted by the respondents were divided into the following three groups:

i) Problems concerning roadway facilities.

ii) Problems concerning operation and administration.

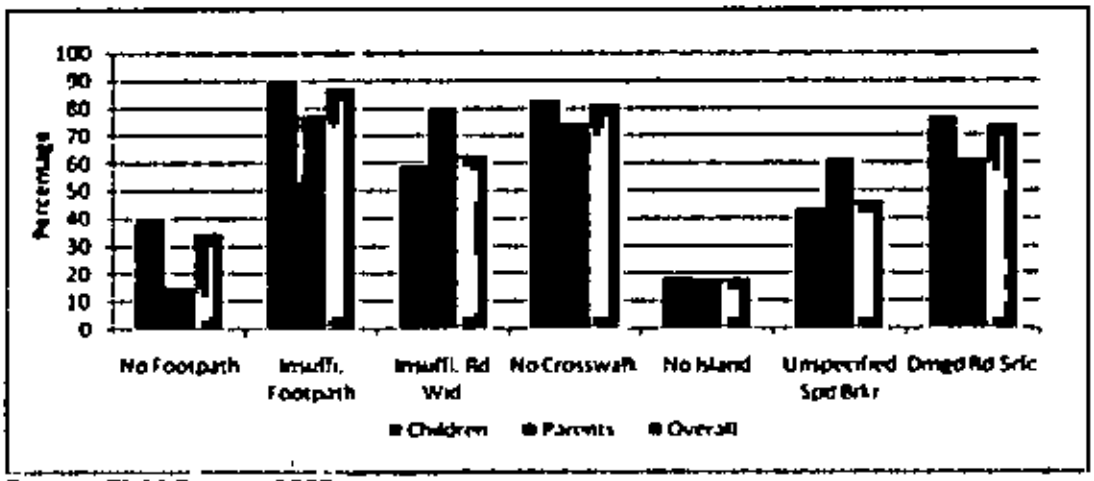
iii) Problems concerning legislation and enforcement.

3.3.3.1 Problems concerning roadway facilities

Insufficient footpath, insufficient road width, having no crosswalks, unspecified speed breakers and damaged road surface seem to be the major problems pertaining to roadway facilities to reach to school, playground and recreational areas. Children opined insufficient footpath as the main problem in reaching school and play fields and damaged road surface as the main hindrance

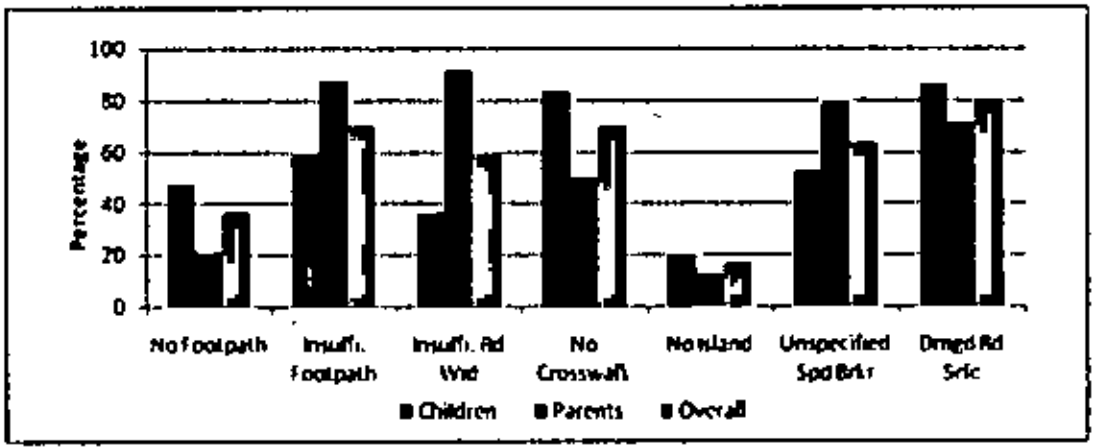
Photo 3.3: Severely damaged road surface.

Figure 3.22: Problems concerning roadway facilities (response at school and playground).



Source: Field Survey, 2008.

Figure 3.23: Problems concerning roadway facilities (response at recreational areas).



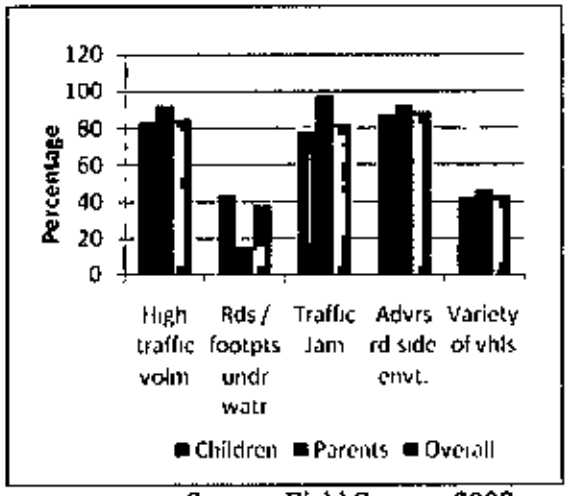
Source: Field Survey, 2008.

in reaching recreational areas. On the other hand, parents indicated insufficient road width as the major setback of the streets of Dhaka city. Most surprisingly, having no median/island at some roads is not a serious distress.

3.3.3.2 Problems concerning operation and administration

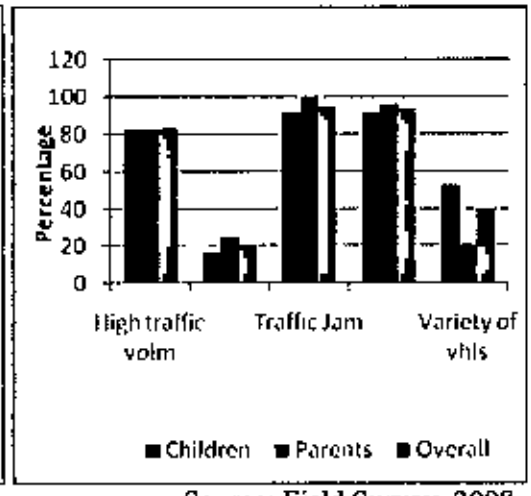
Among the operation and administration related problems, high traffic volume, traffic jam, and adverse roadside environment are the major cancers according to the survey opinion. Roads/footpaths submerged under water and variety of vehicles seems to be less serious matters. However, both the parents and children highlighted adverse road side setting and traffic jam as the prime operative and administrative hindrance to reach to school, playground and recreational areas. In overall comparison, adverse roadside condition is the major operative drawback whereas roads/footpaths under water as the minor administrative concern.

Fig. 3.24: Problems concerning operation and administration (response at school and playground).



Source: Field Survey, 2008.

Fig. 3.25: Problems concerning operation and administration (response at recreational areas).



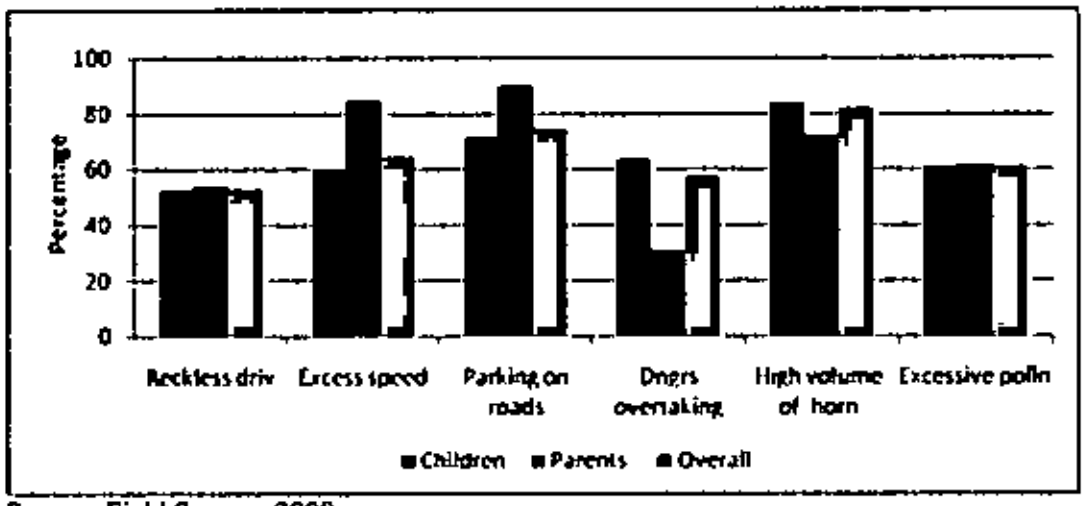
Source: Field Survey, 2008.

3.3.3.3 Problems concerning legislation and enforcement

Excessive speed, parking on roads and high volume of hydraulic horn seem to be the key problems concerning legislation and enforcement of traffic rules to reach to school, playground and recreational areas. Children opined high volume of hydraulic horn as the foremost legislative crisis in reaching school and play fields and excessive pollution as the central hindrance in reaching recreational areas. On

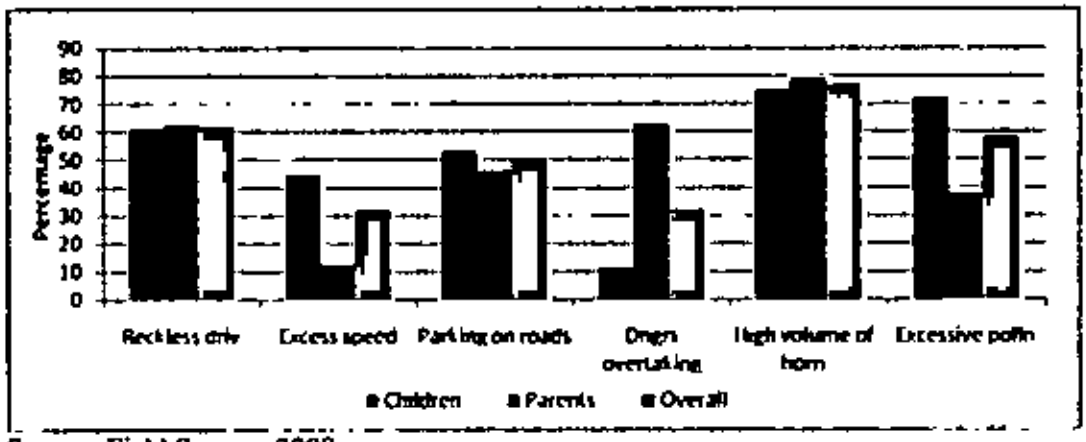
Photo 3.4: Sight & Space obstruction of sidewalks and Parking on roads are very common in Dhaka city.

Figure 3.26: Problems concerning legislation and enforcement (response at school and playground).



Source: Field Survey, 2008.

Figure 3.27: Problems concerning legislation and enforcement (response at recreational areas).



Source: Field Survey, 2008.

the other hand, parents indicated parking on roads and high volume of horn are the major problems of city roads. In general, reckless driving and dangerous overtaking are not serious legislative concerns according to the respondents.

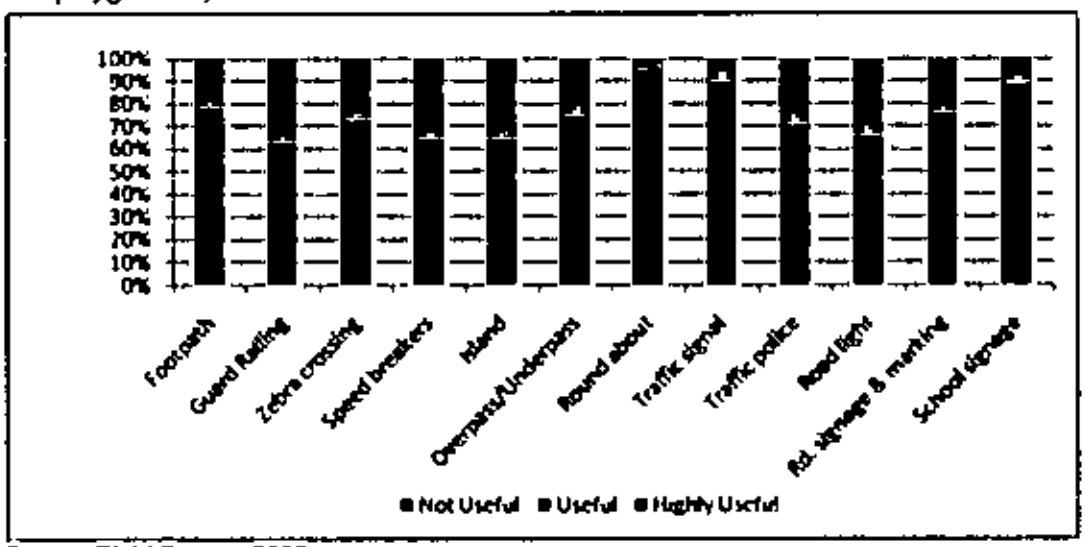
3.3.4 Street Safety Components and Measures – Usefulness, Importance & Present Conditions

Children and parents were asked about the usefulness, importance and present conditions of the street safety components and facilities considering the scope of their usage and accessibility to reach to school, playfield and recreational areas/amusement parks.

3.3.4.1 Usefulness of street safety components– Response from children

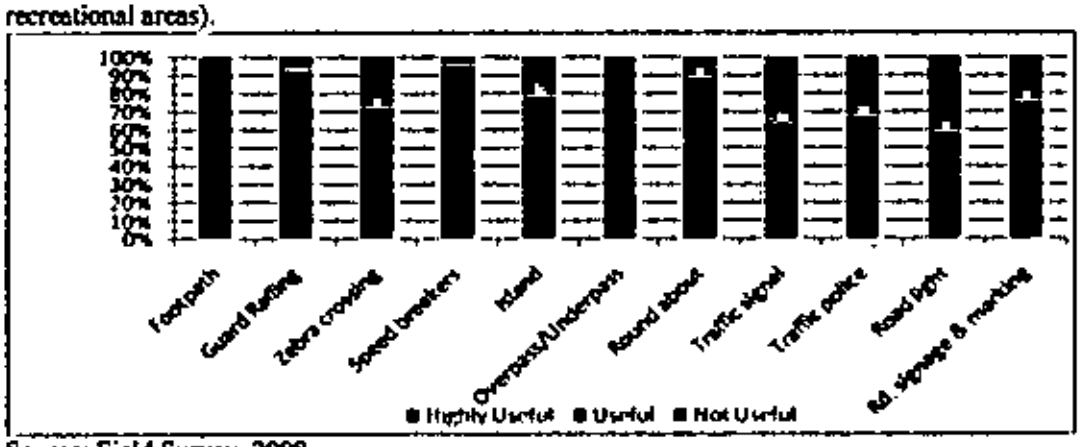
According to the judgment of children for street safety components considering the scope of their usage and accessibility, it is found that guard railing, zebra crossing, speed breakers, median/island and road light have been indicated as highly useful for the children to reach to school and playground, and zebra crossing, traffic signal, traffic police and road light have been marked as highly useful to reach to recreational areas. On the other hand, road light, overpass/underpass and traffic police were noticed as not useful by school going children and overpass/underpass, roundabout, guard railing and footpath were highlighted the same as not useful to reach to recreational areas. School children branded footpath, island, zebra crossing and school signage as useful road safety

Figure 3.28: Usefulness of street safety components (response from children at school and playgrounds).



Source: Field Survey, 2008.

Figure 3.29: Usefulness of street safety components (response from children at recreational areas).



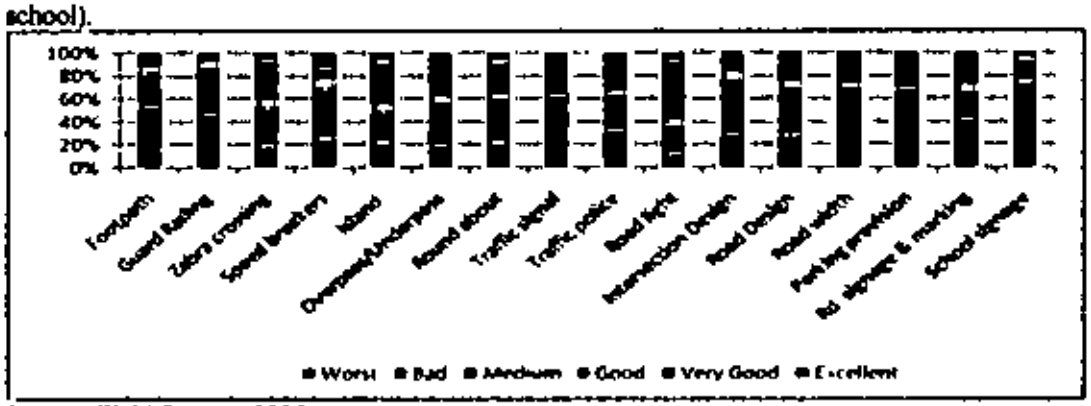
Source: Field Survey, 2008.

components and children at recreational areas identified road island/median, traffic signal, road signage and marking as useful.

3.3.4.2 Present condition of street safety components – Response from parents

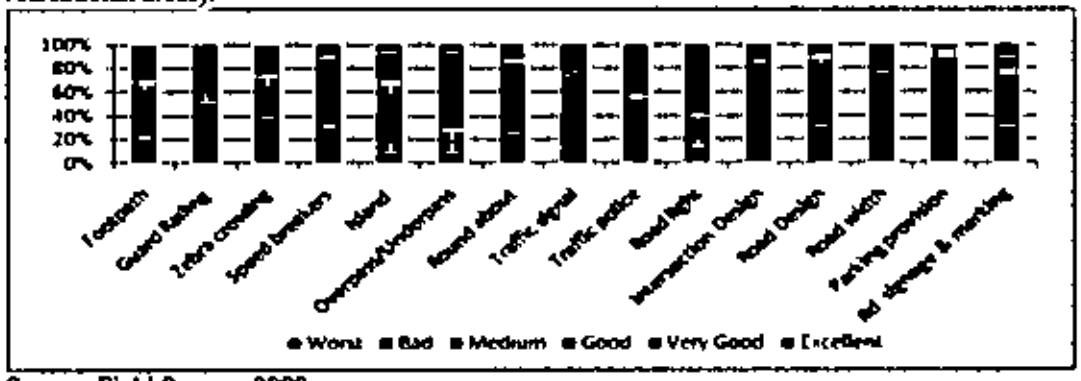
Most of the street safety components were ranked as bad and at best, medium by

Figure 3.30: Present condition of street safety components (response from parents at school).



Source: Field Survey, 2008.

Figure 3.31: Present condition of street safety components (response from parents at recreational areas).



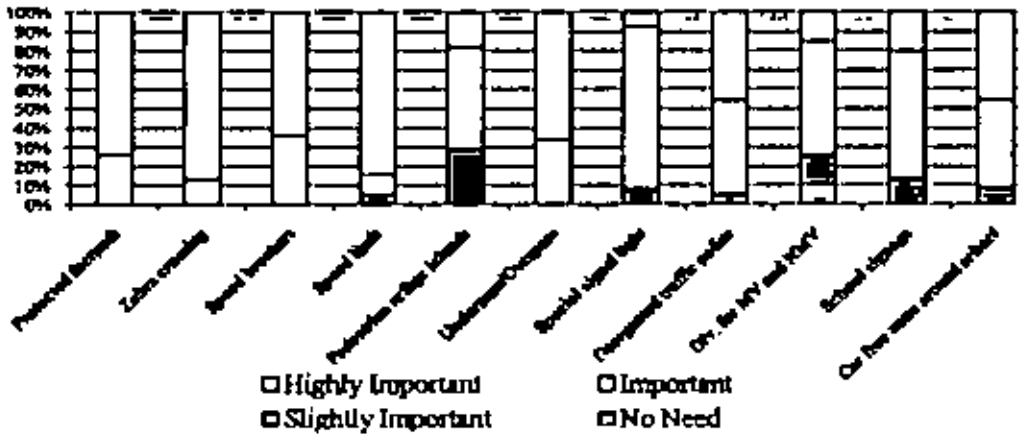
Source: Field Survey, 2008.

the parents/guardians. Some of them believe zebra crossing, road island/median, overpass/underpass, traffic police and road light are in proper condition; a very small fraction opined the condition of median and intersection design likely excellent. On the other hand, a small fraction of the parents interviewed at recreational areas ranked zebra crossing, speed breakers, median and road signage of Dhaka city as in very good order. The condition of median and intersection design was only noticed as excellent to a very small extent.

3.3.4.3 Importance of street safety measures – Response from parents

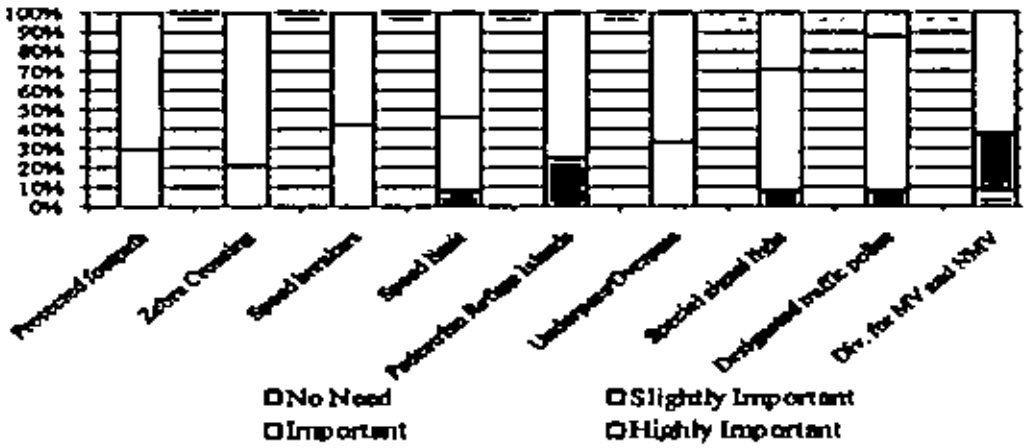
Again from parents' point of view, protected footpath, zebra crossing, speed breakers, speed limit, and underpass/overpass are 'highly important' safety

Fig. 4.32: Importance of street safety measures – Parents judgment (response at school).



Source: Field Survey, 2008.

Fig. 3.33: Importance of street safety measures – Parents judgment (response at recreational areas).



Source: Field Survey, 2008.

measures for children near the school fringe area. Pedestrian refuge island, special signal light, designated traffic police, school signage, division for Non Motorized Vehicle (NMV) and Motorized Vehicle (MV) were indicated as 'important' around the school zone. A small section of the guardians also believe pedestrian refuge island and division for NMV and MV are of slight importance.

3.3.5 Footpaths

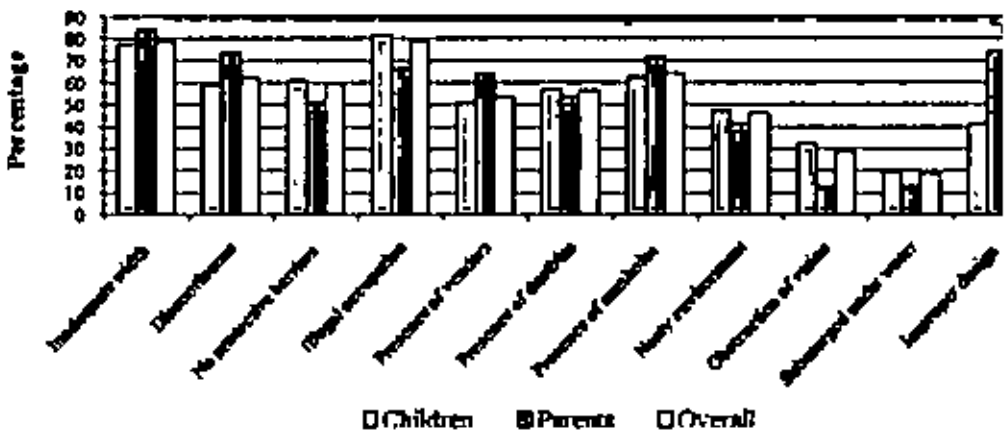
Children and parents were asked about the safety and accessibility of the footpaths of Dhaka city and all of them acknowledged that the footpaths are not in a position to access by the children and also is not safe for a number of reasons.

Photo 3.5: Footpaths of this nature is of very limited use.

3.3.5.1 Safety and accessibility of footpaths

Almost each and every parents and children strongly believe that the footpaths of Dhaka city are not accessible. Among the various problems and mismanagements, they identified inadequate width, no guard railing/protective barriers, illegal

Figure 3.34: Problems relating to footpaths of the city (response at school and playground).



Source: Field Survey, 2008.

occupation, presence of uncovered manholes and discontinuation of footpaths are the basic troubles and hindrance of having a safe and hazard free footpath channel

Figure 3.35: Problems relating to footpaths of the city (response at recreation areas).

Source: Field Survey, 2008.

for our children to reach to school and playground. Again, presence of uncovered manholes, vicious environments and improper design of footpaths were highlighted as the major drawbacks by the parents and children interviewed at entertaining areas.

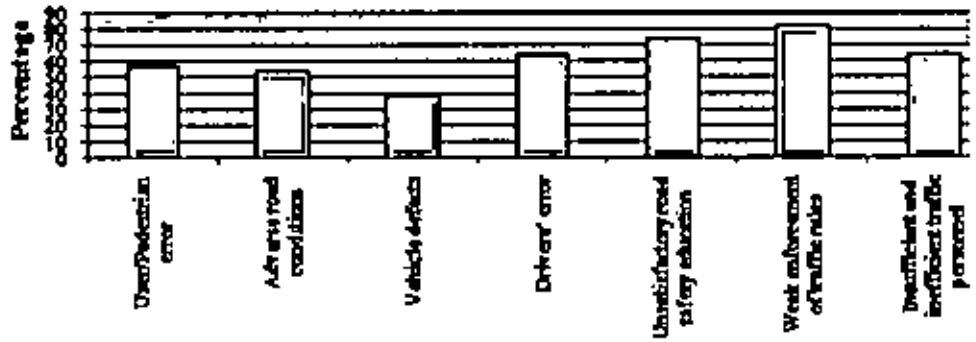
3.3.6 Road Traffic Accidents (RTAs)

Increasing number of Road Traffic Accidents (RTAs) poses a serious threat to the overall street safety concern and in this regard an effort was made to underline the major causes behind Road Traffic Accidents (RTAs) in Dhaka city from the response of the parents only. Even though a number of factors are involved behind the scenario, only a few prime causes were presented to the parents to give their opinion.

3.3.6.1 Causes behind Road Traffic Accidents

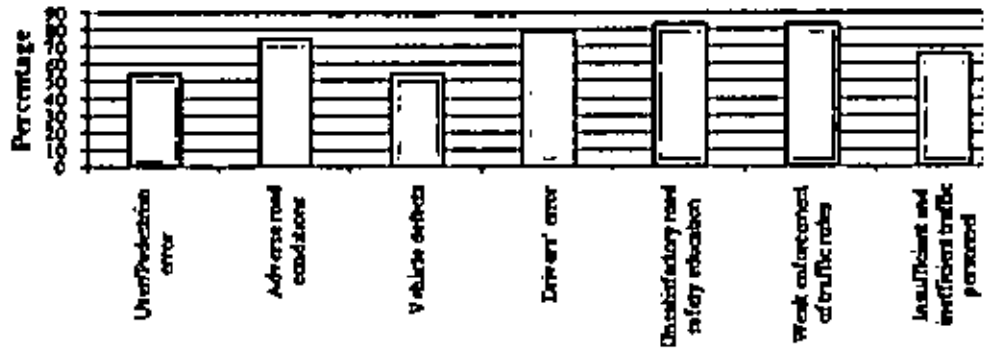
All the parents were asked about the reasons of increasing number of Road Traffic Accidents (RTAs) and they answered, without any hesitation, unsatisfactory road safety education, weak enforcement of traffic laws, insufficient and inefficient traffic personnel, and driver's fault are the major causes behind the set-up. However, unpleasant roadside conditions, vehicle defects and pedestrian inaccuracy, according to the respondents, are also answerable to a medium extent.

Figure 3.36: Major causes behind increasing RTAs - Parents Judgment (response at school).



Source: Field Survey, 2008.

Figure 3.37: Major causes behind increasing RTAs - Parents Judgment (response at recreational areas).



Source: Field Survey, 2008.

3.4 Overview

There are many other significant factors of accident rate of children for Dhaka City except 'Number of Crosswalks/Zebra crossing', 'Average width of Footpath', 'Average speed of the Car or Vehicle' and 'Usage of Seat Belt'. Since for this analysis only some physical factors, safety measures and other issues are considered which are mentioned earlier, these four factors, among those physical factors and safety measures have become the most significant factors influencing children accident rate in Dhaka city. On the other hand, only systematic and data-led management of the leading road accident problems and understanding about the underlying problems concerning roadway facilities, operation & supervision, legislation & enforcement, special needs of the children, etc. will significantly reduce crash risks. Nevertheless, the entire findings outlined from this

analysis were done based on both the primary and secondary data sources; it represents the existing scenario of children road safety issues, considerations, and priorities of Dhaka city to a greater extent.

CHAPTER 4: ANALYSIS OF STRATEGIC TRANSPORT PLAN (2004-2024) FOR DHAKA

The high rate of fatal accidents in Bangladesh is cause for alarm and unacceptable. The creation of NRSC and adoption of Road Safety Strategic Action Plans are welcome moves towards improving road safety. However, not many tangible results have been achieved so far. The recent Strategic Transport Plan (STP) 2004 – 2024 for Dhaka city visions to create a safe, efficient and effective multi-modal transport system that serves the needs and interest of the inhabitants of Dhaka. Thus, it is imperative to review the measures adopted in the STP to identify the problems of implementation and thereby improving or modifying them so that they can be more effective.

4.1 Background of STP

The Government of the People's Republic of Bangladesh (GOB), with the assistance of the International Development Association (IDA) is implementing a major transportation improvement project for the Dhaka Metropolitan Area (DMA) – the Dhaka Urban Transport Project (DUTP). The total estimated cost of the DUTP is USD 140 million, including USD 100 million for civil works. The development objectives of DUTP are to:

- Improve urban transport services in the Dhaka Metropolitan Area in an economically and environmentally sustainable manner;
- Strengthen institutional and capacity building of the concerned organizations dealing with transport issues; and
- Address long-term transport planning and coordination issues for the Greater Dhaka area.

Implementation of the DUTP is shared among different governmental organizations including Dhaka Transport Co-ordination Board (DTCB), Dhaka City Corporation (DCC), Rajdhani Unnayan Katripakha (RAJUK), Bangladesh Road Transport Authority (BRTA), Dhaka Metropolitan Police (DMP), Roads and Highways Department (RHD) and Local Government Engineering Department (LGED). DTCB provides the overall coordination of various aspects of project preparation and implementation. As per existing conditions, all projects forming part of the STP study will be subject to acceptance by the Planning Commission.

The DUTP includes a broad spectrum of projects, programmes and actions organized into four project components:

(i) Infrastructure Development

(ii) Equipment Support

(iii) Institutional Strengthening and Capacity Building; and

(iv) Policy Support and Future Studies

STP, included as part of the fourth project component, is a key objective of the project – to establish a sound policy framework to ensure the sustainability of the current and future investments in the transport sector. Critical to this objective, is the preparation of a long term (20 years) Strategic Transport Plan (STP) for the Dhaka Metropolitan Area that establishes a multi-modal transport plan based upon an assessment of the inter-relationship between land use and transportation.

As a means to achieve this objective, the Dhaka Transport Co-ordination Board (acting for the Ministry of Communications and representing the Government) signed a contract in March 2004 for consultancy services for the preparation of a Strategic Transport Plan study with the Louis Berger Group, Inc and Bangladesh Consultants Ltd.

4.2 Safety Plans, Strategies and Recommendations in STP: An Overview

Chapter 3 of STP 'Existing Transport Conditions' provides an understanding and assessment of the present transportation services and facilities of Dhaka city, chapter 6 'The Strategic Planning Approach' depicts different transportation approaches in light of the vision and strategic goals, chapter 8 'Evaluation of Alternative Transportation Strategies' subjectively evaluates ten alternative transportation strategies and chapter 9 'Recommendation' provides some recommendations.

4.2.1 Accident Scenario and Safety Improvements

In chapter 3 of STP it was recognized that despite the economic and social benefits derived from transport systems, there is a serious cost that society pays in terms of the numerous collisions and loss of life that are associated with the movement of people and goods. While most people are aware and accept the fact that no form of transportation can

ever be completely risk-free. it is equally clear that more can and should be done in order to reduce the number and severity of crashes and injuries particularly on roads.

4.2.1.1 Road Accidents in Bangladesh

STP outlined the key statistics of road accidents in Bangladesh for the period 1982-2000. which suggest that in addition to a moderate increase in the number of incidents. there is an alarmingly large increase in their severity both in terms of total number of fatalities as well as the fatality rate.

4.2.1.2 Safety Improvements

Improved safety requires a multi-dimensional comprehensive approach involving issues related to road conditions, regulations, enforcement. driver training. vehicles, public education, awareness, incident response and information, all of which should be applied, according to STP, in a systematic manner over time and with adequate funding STP highlighted the following regarding this issue:

4.2.1.2.1 Road Safety Initiatives

Road Safety Initiatives have been undertaken in Bangladesh in order to address concerns about accidents and safety. While such actions to create the institutional structures and technical standards appear to be substantial, the overall effectiveness appears to have been rather limited. Inadequate funding for road safety is another important factor that has not yet been resolved.

4.2.1.2.2 Traffic Law Enforcement

Traffic law enforcement is needed to encourage safer road use and orderly traffic flow. Effective enforcement of traffic regulations require training of the traffic police force in traffic related areas. including incident investigation, highway patrolling, motorcycle riding and car driving and management skills.

4.2.1.2.3 Driver Training and Testing

The behavior of drivers. particularly of commercial vehicles, is generally considered to be chaotic and does not reflect consideration for others. A 'motivational' training programme for all drivers, with the involvement and

support of the vehicle owners and professional associations is one example of the type of training that would be beneficial. Improved detection of false driving licenses is required to discourage forgery attempts.

4.2.1.2.4 Education and Publication

To develop safe road user behavior, children need to be taught skills (i.e. how to cross a street safely, how to use traffic signals properly, how to watch for and anticipate driver behavior, etc.) rather than focusing simply on rules, regulations and knowledge of traffic sings. Road safety education is a long-term intervention, aimed at developing positive attitudes in children such that they become safer road users in the future. Publicity is an indispensable part of any nation's road safety strategy.

4.2.1.2.5 Vehicle safety

It is widely accepted in Bangladesh that poor vehicle conditions contribute considerably to the number and severity of road collisions. Motivational training of the officials' concerned and strict enforcement of inspection procedures is needed. Five computerized vehicle inspection stations have been built and equipped with the assistance of loan from the ADB and these are awaiting commissioning.

4.2.1.2.6 Medical Service

Lack of first aid and prompt transportation to adequate medical support facilities contribute to what medical professionals call the 'second accident', where injury severity is worsened for lack of proper care and quick transport services. Improvements in at-the-scene first aid care are desperately needed. In addition, hospital facilities and rehabilitation services are inadequately equipped to provide needed medical attention. As a consequence of such factors, the death rate is higher and the severity of injuries of those who survive is higher than it would otherwise be.

4.2.1.2.7 Information and data

In order to improve road safety, it is important to determine the causes of road based collisions. At present the focus of data is on number of incidents and

their severity, in terms of fatalities, injury and casualties. There is as well a need to establish a mechanism to analyze the causes following every incident; however, investigations revealed that major causes include:

a. Irresponsible and careless behavior of drivers
b. Careless movement of pedestrians
c. Poor road geometry
d. Poor condition of vehicles
e. Poorly trained drivers.

4.2.1.2.8 Summary

Once the causes are clearly determined, countermeasures can be used to improve safety. Actions such as a motivational training program for all drivers who are already engaged in driving buses and trucks; greater awareness among pedestrians in urban areas and in market areas, fencing of footpath at traffic intersections; pedestrian over bridges or underpasses, physical barriers to build along the market places, separating the fast moving traffic lanes from the service lanes are but a few countermeasures that could, when properly applied, reduce the number and severity of incidents.

4.2.2 Vision and Goal of STP concerning Road Safety

Vision: *To develop and maintain a sustainable multi-modal transportation system, serving the mobility needs of society by ensuring a safe and efficient transport system that supports social and economic development as well as international competitiveness, ensures a healthy and secure environment for all of its residents and contributes towards the alleviation of poverty.*

Goal: *Develop and implement a coordinated and comprehensive set of safety improvement measures addressing all aspects of the transport system to reduce the number of transport-related deaths and the number and severity of transport related injuries and property damage.*

Chapter 6 of STP 'The Strategic Planning Approach' set out 8 strategic goals among which *Strategic Goal # 3* dealt with safety and urged the need of a Comprehensive

Programme at the national as well as at the local level addressing all elements of traffic safety. In addition, a set of six sub-goals were also set forth and those sub-goals addressed the primary issues of - vehicle/driver/infrastructure, enforcement, safety systems and regulations, better information and data, and safety awareness.

- Sub-Goal 3A – Improve vehicle/driver/infrastructure components of road safety.
- Sub-Goal 3B – Increase enforcement of existing laws and regulations.
- Sub-Goal 3C – Improve system safety and regulations
- Sub-Goal 3D – Improve safety related information and data.
- Sub-Goal 3F – Undertake a Safety Audit for all Arterial Highways.
- Sub-Goal 3E – Institute a comprehensive continuous safety awareness campaign.

4.2.3 Alternative Transport Strategies and their Subjective Evaluation

The ten transportation strategies developed and evaluated in STP are broadly identified as follows:

Base Case	ROADS	NO BRT	NO METRO
Alternative 1a	ROADS +	ALL BRT	NO METRO
Alternative 1b	ROADS +	BRT	METRO
Alternative 1c	ROADS +	NO BRT	ALL METRO
Alternative 2a	ROADS ++	ALL BRT	NO METRO
Alternative 2b	ROADS ++	BRT	METRO
Alternative 2c	ROADS ++	NO BRT	ALL METRO
Alternative 3a	ROADS +++	ALL BRT	NO METRO
Alternative 3b	ROADS +++	BRT	METRO
Alternative 3c	ROADS +++	NO BRT	ALL METRO
Alternative 3d	ROADS +++	NO BRT	NO METRO

A complete set of the subjective rating were provided for each of the 10 alternative transportation strategies with respect to the 8 goals, 35 sub-goals, and 125 objectives and the following observation (Observation No. 3 in STP) considered to be persistent in terms

of safety:

"In terms of safety, Strategies 1a and 2a are the highest, and the others are quite similar, except for Strategy 3d which is the lowest, scoring only half as much as the highest."

4 2 4 Recommendation

Seven primary recommendations on different aspects were provided in Chapter 9 of STP 'Recommendation'. Recommendation number 5 and 6 are cited below as these two recommendations cover safety improvements and pedestrian facilities in Dhaka city

Recommendation #5: Safety Improvements

Improve methods of driver training and testing, vehicle roadworthiness inspections and design layouts of highways.

The incidence of road collisions, injuries and deaths together with the associated economic loss in terms of property damage, medical costs and lost productivity has reached alarming levels in Bangladesh While efforts to reduce the number and severity of accidents involve many elements, "*good drivers driving well-maintained vehicles*" is an essential part of the solutions that should receive priority consideration.

In parallel with this report on the Strategic Transport Plan, the study has produced a companion volume which covers the issues of Urban Transport Policy. In this companion volume, the study recommends a complete overhaul of the driver and vehicle licensing and testing system. It is proposed that BRTA take on this role following a restructuring and strengthening of their operations and abilities. The activity will require the establishment of a comprehensive database which is to be kept up to date and which will include information on all vehicles (including Buses and Rickshaws) and all drivers of any type of vehicle. It is recommended that this data base includes accident data and should be made available on-line to relevant agencies such as Police and highway designers as well as safety specialists.

In terms of the safe design of roads, it is recommended that the authorities undertake a complete safety audit of the highways under their jurisdictions taking

into account the latest safety design measures and best practices in terms of sight lines, road markings, surface treatments, treatment for vulnerable road users and intersection channelization.

Recommendation #6: Pedestrian Facilities

Implement a program of pedestrian facility provision to serve pedestrians better and encourage people to walk from choice rather than from necessity.

Walking is currently a commonly used mode of transport in Dhaka. While walking is a matter of choice and convenience for some people, the reality is that for many people walking is a matter of economic necessity. Despite a high proportion of walking trips, suitable pedestrian facilities have traditionally been neglected. A major commitment to improve all types of pedestrian facilities is recommended. Not only is this aimed at serving those who have no choice but to walk, it is also to encourage others who have such a choice, to walk more often.

There are policy implications here as well as planning implications. At present, although the rules of the road require that preference be given to pedestrians, there is no evidence of this on the street. The project has recommended in its parallel report on Urban Transport Policy that a "Pedestrian First" policy be implemented. In this, the regulations would be reviewed and adjusted to ensure that the pedestrian has right of way in the appropriate circumstances (pedestrian crossing for example). This will also mean that motorists must be trained to understand this and the regulations must be enforced rigorously. A publicity campaigning should be launched to begin this process of understanding and awareness

4.3 Analysis of Road Safety Plans and Actions of STP for Dhaka

It is true that the comprehensive list of actions required to improve road safety is overwhelming, and the ability to implement many of these does not reside with any particular local authority/organization. It became apparent from the analysis of STP that some of the basics of road safety, especially for the children, are not in place at STP for Dhaka, and these need to be addressed as a priority. Once these are in place and solid foundations have been laid, then the programmes can be extended to other necessary but less critical activities.

4.3.1 General

Road safety is a concern of the whole community. As such we are all responsible for the reduction of road traffic incidents. Thus a comprehensive road safety plan, specifically for the children, is of utmost importance.

A comprehensive children road safety plan generally helps raise awareness and brings people together to address the safety crisis for the children at roads/streets, and it is of great essence in a developing and transitioning country like Bangladesh. The plan should include advocacy, facilitating collaboration with major institutional bodies, and organizing inclusive stakeholders' forums locally and regionally. The importance of having wide-ranging children road safety plan at regional or local level is also revealed

Figure 4.1: Key organizations influencing road safety plan.

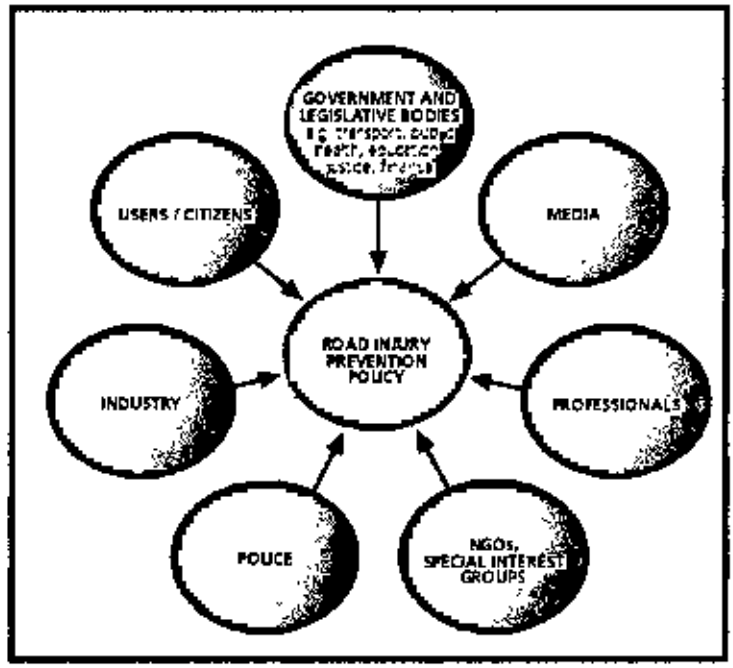
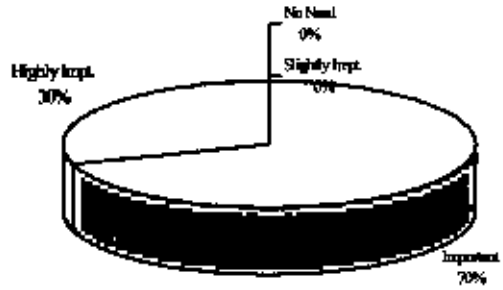


Figure 4.2: Opinion regarding the importance of having a comprehensive Children Road Safety Plan.



Source: Field Survey, 2008.

from the opinion poll.

Likely Time Frame. The likely time frame of such a strategic plan usually varies from three to fifteen years. In Great Britain the road safety strategic plan is assessed in every 3 years and thereby making necessary adjustments, if any, from time to time

Structure of the Plan: A review of the national road safety plans, policies and strategic actions across a range of countries and simultaneously a comparison of our national road safety policies and plans could be presented along with the safety actions stated in STP for Dhaka. The Plan should as well cover the following:

- Target setting;
- Development of strategies;
- Development of programmes/plans/projects;
- Key performance indicators;
- Quality management system for road safety of the vulnerable road user groups, children in particular.

At the same time the following reports could be provided as outputs:

- Report on key aspects of policies, plans and case studies concerning children road safety;
- Report on safety options based on Cost Benefit Analysis;
- Report on Legislative and Regulatory approaches to safer operation.

In a sense, our STP didn't consider to recognize plans and actions for road safety i.e. failed to address the above mentioned interrelated important guidelines properly.

4.3.2 Plan Content

From the consultation and interviews with the transport planners, highway engineers and concerned others, following key points have been marked as the drawbacks of STP for Dhaka as the plan considers very little or nothing about the issues.

4.3.2.1 Defined Safety Actions

4.3.2.1.1 Defined Responsibilities

Road Safety in Bangladesh is a statutory responsibility for National Road Safety Council (NRSC) placing a requirement to prepare and carry out a programme of

measures designed to promote road safety. One of the aims of the Council is to maintain and improve Road Safety throughout Bangladesh through the structured delivery of Action Plans and focused programmes of Education, Engineering, Enforcement and Encouragement. However, to this connection STP for Dhaka made nothing to foster road safety activities for the children of Dhaka.

The STP should focus the duties of concerned authorities to carry out a programme of measures designed to promote road safety, especially for the vulnerable road user groups, including the dissemination of information and advice relating to road user, specifically to age groups and providing practical training to road users also.

The safety plan of STP for Dhaka identifies, to a certain extent, the means by which the concerned authorities intend to carry out these responsibilities.

4.3.2.1.2 Given Deadlines

The simple answer to the question is that there are no given deadlines in the STP for Dhaka for the concerned authorities to target for the reduction of casualties, injuries and subsequent disabilities of the road users from road accidents, let alone deliberation for the children.

4.3.2.1.3 Casualty Reduction or other Performance Indicators

In terms of children road safety, the STP for Dhaka should have specific targets/aims to lessen the number of road fatalities for a given number of populations within a specific time period. Ideally, target is set in terms of 100,000 populations by a percentage of casualty reduction indicators to achieve, for example:

- A X% reduction within 2010 in the number of child fatalities or serious injuries.
- A Y% reduction in the slight casualty rate of children, expressed as the number of children slightly injured per 100 million vehicle kilometers.

Our STP contains no such casualty reduction or other performance indicators.

4.3.2.1.4 Estimation of Costs of the Safety Actions

From the consultation it is advised that investment for road safety activities should be maintained/monitored by all the spheres of government and will be better targeted to road safety by:

- improving the estimation of the cost of crashes used in the economic evaluation of road improvement options considering children limitations;
- widespread use of road safety audits in assuring safety outcomes for children from road improvement projects and in designing and planning proposed major developments;
- conducting safety investigations for children on the existing road network, taking into account the needs of children, giving priority to sites with a crash history and identifying significant remedial opportunities; and
- improving road design and traffic engineering measures to create a safer environment for pedestrians, cyclists, motorcyclists, and children in particular.

The cost of road crashes has to estimate conservatively and the potential saving in the cost of crashes is a factor to be taken into account in determining the quantum and allocation of children road safety expenditure. Nevertheless, STP for Dhaka fails to address/guide the issues.

4.3.2.2 Children Road Safety Components

To the following areas, at least, the STP for Dhaka could give guidance to make the sense that safety actions in STP have planned considering children:

4.3.2.2.1 Education/Awareness Programme

Road safety education programmes have to chalk out to cover education materials for different target groups - road safety education for children, training and workshops for parents, campaign against drunken driving & over-speeding, public education for safe driving practices, etc.

In an effort to reduce escalating children road accidents in Dhaka, the Roads and Highways Department (RHD), Ministry of Communications should

Photo 4.1: Road safety poster and training on community traffic policing.

immediately announce the launch of a Children Road Safety Awareness Programme and STP for Dhaka could offer some guidelines to make the programme superb.

Children Road Safety awareness and education programme should target the following:

- Continue major children awareness campaigns on road safety issues.
- Develop public awareness campaign on the metrication of speed limits.
- Further develop the National Road Safety Council (NRSC) website with a specific link to the road safety for children and the Council's penalty options.
- Development of road safety information and awareness material aimed at children.
- National Road Safety Council (NRSC) to develop and carry out a series of information talks on road safety issues for the children.
- Cycle safety leaflet aimed at children to be distributed.
- Promote use of the resources in primary and secondary schools, including involvement of School Teachers in promoting these.
- Pursue road safety effort focused on second and third level students.

4.3.2.2.2 System Safety and Regulations

Process and system indicators e.g. data on the number of hazardous locations treated or the number of junctions improved for safety are the prime considerations for a road safety plan. The specific goals and targets of STP for Dhaka regarding system safety and regulations are well organized indeed.

4.3.2.2.3 Infrastructure Development

Researchers and practitioners indicated that STP for Dhaka has made nothing to improve the overall children road safety situation through infrastructure development. However, to reach the objective, the improvement or implementation of a great variety of infrastructural maturity is urgent. Even though very little development has attained in the field of road safety, to support the grounding of major road infrastructures development should consider as leading necessity.

Photo 4.2: Sidewalks beside Scholastica School, Dhanmondi and Ideal School and College, Motijheel.

The objective of infrastructure development should be to collect and to evaluate previous approaches in order to make them accessible throughout Dhaka city and to develop tools which could be used in future to improve road safety. With these tools STP for Dhaka should as well intend to give scientific support to practitioners concerned with road design and road safety in Dhaka.

Broadly, the STP for Dhaka should. at least. include the following:

- To guide the planning, financing provision, maintenance and management of road infrastructure reforms for road safety;
- To support the preparation of major road infrastructure investment proposals aimed at improving the efficiency of the road transport network, bearing children limitations in mind; and
- To assist with greater privatization of roads engineering. construction. works. supervision and maintenance services in the sector.

It has also been pointed out that STP for Dhaka had made nothing related to road infrastructure management. Road safety plan concerning infrastructure management covers regulations, standards and best practice guidelines, information and research that governs or contributes to the planning. design, construction. maintenance and operation of the roadway and roadside. Thus, STP for Dhaka could highlight the responsibilities for different parts of the road network of Dhaka through Roads and Highways Department, Ministry of Communications. Government of Bangladesh or other responsible agencies. Monitoring of the road network and other roadside safety measures and infrastructures is necessary on a customary basis through crash analysis and investigation and risk assessment. Road safety audit programmes which check on the safety aspects of new work or major improvements have commented by the specialists to start immediately for our Dhaka city: our STP slightly highlighted the audit programme without any detail. Road safety engineering activity in many countries is supported by a range of professional engineering organizations. research and consultancy bodies and STP for Dhaka could also indicate some plans regarding this.

4.3.2.2.4 Enforcement/Implementation Phase

Better enforcement is an efficient and cost effective means to help reaching the target of reducing the fatalities on roads. In order to ensure compliance with the law, enforcement and follow-up of offences are necessary. Controls should be systematic, sanctions should be effective and applied to all offenders. Furthermore, encouraging road users. regardless of age, to improve

Photo 4.3: Initiatives of this type at Delhi, India help to implement safety rules and regulations.

their behavior by complying with basic road safety rules is a crucial element in this strategy. This applies especially to respecting applicable speed and alcohol limits and wearing seat belts, since these offences are the three main 'killers' on the road.

However, STP for Dhaka provides nothing for the application of financial/non-financial penalties where road users fail to comply with road traffic laws. There is no list or indication in the STP, even any clue of sanctions/penalties resulting from traffic offences.

Besides financial penalties, there is a wide array of non-financial penalties in the field of road traffic enforcement, such as:

- Disqualification from driving and driving license withdrawal;
- Penalties through record-keeping;
- Disqualification from operating a particular type of vehicle;
- Forced training and rehabilitation courses;
- Community service;
- Vehicle confiscation;
- Immobilization of vehicle, etc.

4.3.2.2.5 Medical Strategies

Timely and proper treatment of road casualties, especially for the vulnerable road user groups, is essential for reducing the severity of injury to crash victims. Education on first aid procedures and correct transportation of crash

victims is important. A single emergency telephone number (for example, '999' is used for Dhaka Metropolitan Police enquiry) can facilitate the simultaneous alerting of police, ambulance and other rescue services and help to reduce response times (also depending on the availability of road-side telephones).

The STP could incorporate health sector in the plan by defining the following probable policies/roles for the health sector:

- Becoming the leading champion for road safety by advocating for safe road transport systems that reject preventable deaths and serious injuries, supporting the implementation of effective measures, and supporting the efforts of the transport sector to keep speeds within safe levels.
- Providing evidence-based information such as injury information systems based on hospital data and facilitating the link and consistency between different data sources; identifying appropriate indicators to monitor various risk factors; and estimating the social costs of road traffic injuries.
- Ensuring that drivers are fit to drive: Opportunities to prevent deaths and to mitigate the effects of injuries start with the role of the health sector in ensuring that drivers are fit to drive.
- Delivering post-crash care through a chain of help starting with the possible interventions by bystanders' right up to hospital trauma care and rehabilitation.
- Leading research and modernization by improving the evidence base for practice in trauma care and rehabilitation and developing guidelines for implementation.
- Mainstreaming road safety into the policies of public health and other sectors.

Again, one example of integrating road safety into health policies through STP for Dhaka could be to reduce health risks related to sedentary lifestyle by implementing strategies for safer walking and cycling. European road safety experts have concluded that by implementing known countermeasures it is possible to achieve considerable increases in the use of healthier and more

environment friendly means of transport and thereby reducing the numbers of deaths and injuries among pedestrians, cyclists, children and other vulnerable road user groups. However, concentrated action needs to be taken by policymakers at local as well as national levels to ensure that this positive scenario can be brought about and STP could have highlighted the issue. Recent various home and abroad research projects and reviews such as have identified a range of actions could be further mentioned in the STP for Dhaka as reference for our local road safety practitioners.

A further practical means of pursuing road injury prevention within health policies and sustainable transport and urban planning is in area-wide safety impact assessment. The impacts of transport or land-use planning decisions on the occurrence of crashes and the resulting injury and damage on the entire road network affected need to be considered at an early stage to avoid adverse and unintended effects on road safety, but STP for Dhaka failed to foresee the consequences regarding this. Area-wide safety impact assessment could be presented in the STP for Dhaka as an essential component of other impact assessments that are carried out routinely for different projects. These include environmental impact assessment, strategic environmental assessment and health impact assessment of plans, policies and projects related to transport and land use.

In these ways, road safety could become a central apprehension in government policymaking, whereas our STP totally ignored the medical strategies concerning road safety.

4.3.2.2.6 Funding Sources

The major sources of funds of a road safety plan generally include:

- General tax revenues.
- Specific taxes (usually traffic fines) earmarked to support spending on road safety.
- Levies added to insurance premiums.
- Road funds that derive their revenues from road user charges
- Sponsorship by private businesses.

The following guidelines/recommendations, about which our STP completely lacks, have been highlighted from the opinion pool:

- Funding merits the same consideration as other technical aspects of a road safety plan, i.e. road safety engineering, traffic law enforcement, etc.
- Government should assume responsibility for road safety funding and ensure ministry budget includes road safety financing.
- Road maintenance budgets and road safety funds should also include hazardous location treatment programme expenditures.
- Road user charges should be used to provide a regular and dedicated funding source for the safety plan.
- A proportion of traffic fines should be allocated to traffic law enforcement for road casualty reduction activities only.
- Again, road safety funds should be established for those activities not the direct responsibility of the Ministry of Communications

4.3.3 Coordination of Safety Actions

Multi-sectoral inter-governmental co-ordination is necessary to implement systematically the safety actions in STP. Co-ordination involving all levels and stakeholder is also essential to avoid duplication and this is why a specific coordinating body is necessary to compose the safety actions of STP effective. Most of the interviewers opined that the coordinating body should work towards the execution of the road safety plans and strategies, rather than advisory role.

The following guiding principles have been underlined from the questionnaire surveys, interviews and consultation:

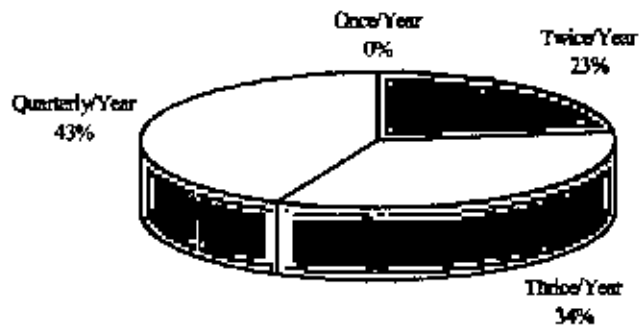
- Establishment of a multi-sectoral coordinating body.
- Lead responsibility of the coordinating body could be defined in STP for Dhaka and accepted by a key organization. STP for Dhaka could guide National Road Safety Council (NRSC) to assume the responsibility.
- A permanent secretariat assigned to assist the coordinating body. Road Safety Cell (RSC) is the perfect body to assume the responsibilities in this regard.

- Assigning a senior Government official with overall responsibility. However, representation, at least, from the following sectors is opined as necessary to the coordinating body:

  - Public sector members
  - Private sector members
  - Vulnerable road user group representation
  - Medical & health representative
  - Representative from the Police and Fire Brigade
  - Transport Planner / Highway Engineer
  - Representative from the drivers' community
  - Representative from the media
  - Insurance company representative.

- Office organization: A Director and other supporting officials and staffs could be appointed to the secretariat/office.
- Number of staff: As required to work efficiently and resourcefully.
- To help develop an efficient workforce for the secretariat, training exercises should continue along with foreign training for the selected bright executive officers. Relevant guideline in STP for Dhaka is considered well enough.
- A good bi-lateral working relationship between the secretariat and other safety organizations should be highlighted in the STP.
- Evaluation of outcomes on a regular basis.

Figure 4.3: Opinion regarding the meeting of the coordinating body.



Source: Field Survey, 2008.

- The coordinating body should meet at least in every four months, if possible in every three months.
- Legal status of the coordinating body;
- A regular and preferably dedicated funding source is required for the secretariat or support office to coordinate and promote road safety activities.

4.3.4 Technical Support

Most of the interviewers highly stressed about the importance of the existence of a road safety technical committee about which the STP for Dhaka is in absolute unawareness. The goal of the Road Safety Technical Committee should be, according to the dialogue, to improve the safety and efficiency of the road system, including the movement of people of all ages and goods on the network, while effectively managing the risks associated with road transport operations and the natural environment.

The following courses of actions/recommendations have been highlighted from the questionnaire surveys/interviews:

- The road safety central office/secretariat should be equipped, regardless of the organizational model chosen, with adequate financial, procedural and technical resources to be effective.
- Technical committee(s) and working group(s) should be used both to promote the participation of business and civil society in developing road safety policy.
- The road safety technical committee will ensure coordination across all stakeholders and should meet, at least, twice in a year.
- Committee members should have a superior role in the success of the safety programmes; members need to be committed and pro-active

4.3.5 Effectiveness

Systematic and transparent quantified monitoring of the implementation of road safety strategies and progress towards meeting the targets are essential both for maintaining the motivation of stakeholders and hence the effectiveness of implementation and for updating of the strategies and targets in light of experience.

Monitoring of targeted and other safety performance indicators are integral parts of measuring effectiveness of road safety strategies/plans. STP for Dhaka could set its own

performance indicators relating to speed reduction, child casualties, pedestrian fatalities, accident involvement of young and old drivers, accidents in relation to distance traveled, etc. In the light, it is unquestionably true that our STP is totally inadequate to ensure road safety for the children of Dhaka.

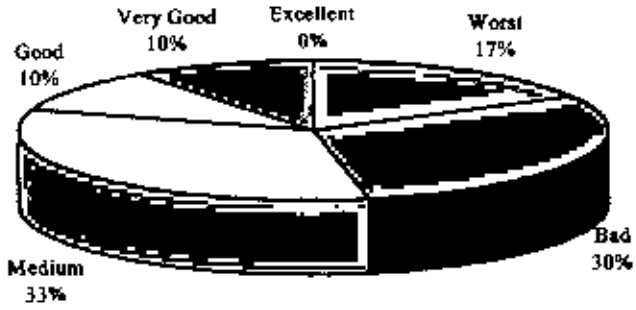
The following guidelines/recommendations have been highlighted from the questionnaire assessments/interviews:

- STP for Dhaka could guide to assess the progress/effectiveness of road safety plans by a Parliamentary Selected Committee on Transport or by a Road Safety Advisory Panel.
- Organizational performance also needs to be assessed to measure the effectiveness.
- Periodic reviews of the safety plans are essential to allow adjustments. STP for Dhaka allows reviews after every five years, which could be done in every three or at best four years and thereby incorporating lessons learnt in time to time.
- Measures could also be monitored and formally evaluated by independent institutions like Accident Research Institution (ARI), BUET, Center for Policy Dialogue (CPD), Center for Urban Studies (CUS), Institute of Business Administration (IBA), DU, etc.

4.3.6 Development Phase

Public acceptance surveys or consultation usually covers representative samples of road user opinion which are helpful in establishing levels of understanding and support for different interventions. However, the level of public consultation and hearing took place

Figure 4.4: Opinion regarding public Consultation behind STP.



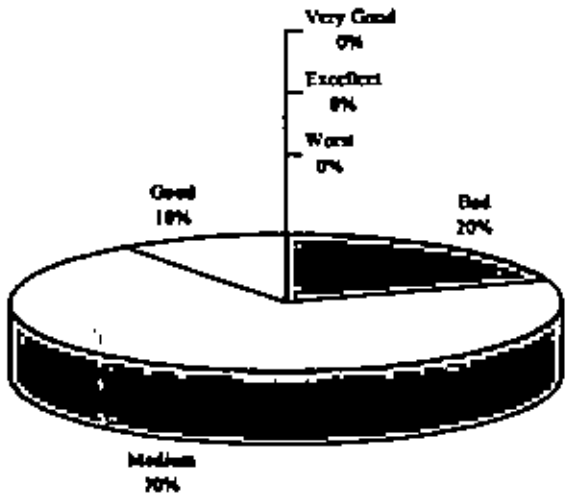
Source: Field Survey, 2008.

during the progression of STP for Dhaka is pointed as 'medium' by one third (33%) respondents and as 'bad' by another 30% respondents. It is very obscene that a very little fraction (10%) of the safety specialists and consultants termed the public consultation and involvement process as 'good' and 'very good'.

Again, most of the respondents (70%) pointed as 'medium' the way the Louis Berger Group, Inc and Bangladesh Consultants Ltd. developed safety actions of STP. Only 10% interviewers evaluated the process as 'good' and on the other hand, 20% interviewers mentioned the process as 'bad'.

Only 10% interviewers termed the contribution of local agencies/advisors towards STP for Dhaka as 'very good' and 3% as only 'good', whereas more than two third

Figure 4.5: Opinion regarding the development process of safety actions of STP.

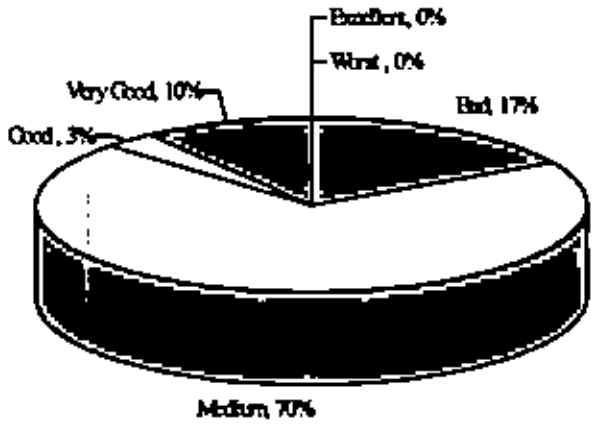


Source: Field Survey, 2008.

respondents (70%) labeled the contribution as 'medium' which indicates serious lapses and undue attention of the concerned authorities towards the formation of the strategic plan.

A national mid-term or long-term Road Safety Plan is a prerequisite for achieving sustainable improvements in road safety; our National Road Safety Strategic Action Plan (NRSSAP) was planned for 2002 to 2004 and then for 2005 to 2007 i.e. for only 3 years

Figure 4.6: Opinion regarding local advisors contribution towards STP.



Source: Field Survey, 2008

in each phase and it is at present out of date. Road safety targets, capacity of local institutions, and alternative sources of financing for road safety measures should be highly well thought-out during the progression of such a plan, whereas STP for Dhaka seems to be less serious to consider the issues.

4.3.7 Implementation, Monitoring & Evaluation

Implementation arrangements of a road safety plan, for the children in particular, include a range of tools, mechanisms and procedures that are needed to efficiently produce interventions. Managing this element means addressing elements such as funding sustainability, legislative efficacy, multi-sectoral coordination, performance monitoring, etc. along with children behavior and their limitations. STP for Dhaka provided very little, almost no attention towards these fundamentals.

Ideally, monitoring and evaluation consists of the systematic study of the effects of various separate programme elements of the safety plans for children at national, regional and local levels, whereas our STP failed to make out the system to a great extent.

Monitoring and subsequent updating are integral parts of implementation and require appropriate collection, processing and publication of reliable data for:

- Continuous monitoring of targeted and other safety performance indicators.
- Establishing the effectiveness of specific road safety measures for vulnerable road user groups by carrying out before and after studies.

- Reviewing and updating of safety policies and measures with redistribution of resources towards more cost-effective measures.
- Identifying delays in implementation requiring corrective action(s).
- Establishing the level of public support for interventions.

It is a great wastefulness of our STP that all the safety actions, even though very few, have been finalized without considering these doctrines in detail.

Road safety inspection bodies monitor the rate of implementation of road safety plans or measures and examine their quality. Ideally, road safety inspection body should be independent in relation to any related organization. STP for Dhaka hardly mentioned the name of any such independent organization or didn't even indicate the name of any organization that could assume the responsibility. Nevertheless, inspection to road safety activities belongs to Road Safety Cell (RSC), Bangladesh Road Transport Authority (BRTA).

Furthermore, regarding the process of monitoring and evaluation of road safety activities mentioned in STP, most of the safety specialists and consultants opined that the process is not well organized; only a negligible fraction of interviewers marked the monitoring and evaluation process as 'partially well'. On an another point, almost all the safety specialists, traffic & highway engineers and urban planners indicated that there is no need of taking consent from the implementing agencies to approve the safety action plans mentioned in STP.

4.3.8 Funding

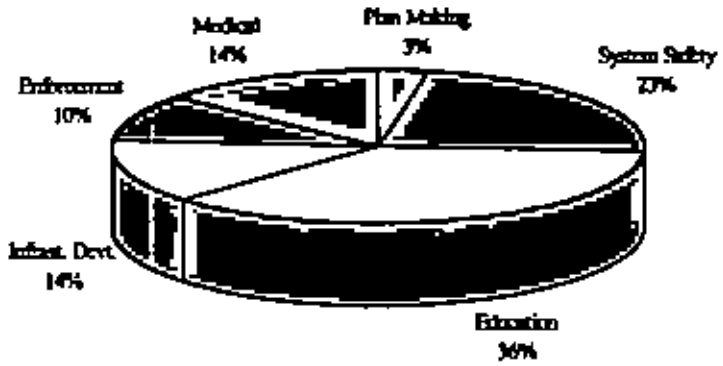
Most road safety activities are traditionally funded from a central government general revenue budget. This is then distributed to various sectors of road safety either identified specifically (e.g. road safety engineering schemes) or as part of the overall activity of a particular sector such as traffic policing or education for children. Detailed information on spending for specific aspects of road safety is rarely documented, but road safety tasks are often included in more general expenditure, for example with traffic engineering or law enforcement. STP for Dhaka failed to provide any strategies to overcome this loophole. STP also failed to recognize the sources of funding, funding streams and mechanisms that are needed to be clearly identified for the various elements of a plan, road safety plan for our children is particular in this case

It was strongly recommended by the safety practitioners and consultants that the likely amount needed to implement a road safety action plan should be clearly figured out in the strategic plan with every detail; our STP is seriously criticized as it didn't figure out the budget for overall road safety actions, let alone for the children. Even though government budget and donor assistance, according to the questionnaire assessment, should be the prime sources of funding for children road safety activities, other sources such as fuel levies, traffic fines, private and business sector participation/sponsorship could contribute a lot. All the interviewers were asked to give an idea towards the likely relative share of contribution of different stakeholders for generating a road safety fund, especially for the children and the following concept was perceived.

a) Government budget.....40-50%
b) Donor assistance.....40-50%
c) Fuel levies.....5-10%
d) Traffic fines.....10-15%
e) Private sector sponsorship.....5-10%

Furthermore, consultation with the respondents depicted that highest budget (36%) should allocate for the children road safety education and awareness programmes and lowest allocation to the plan making and policy design. Expenditure for system safety and

Figure 4.7: Relative share of expenditure of a children safety plan.



Source: Field Survey, 2008.

regulations could be nearly one fourth (23%) of the whole budget, whereas moderate budgets should allocate for infrastructure development (14%), enforcement /implementation phase (10%) and medical/medicine (14%).

Private firms usually contribute to road safety by donations in cash or kind to government led programmes, and by support to non-government organizations. Suppliers to the transport sector such as oil companies, vehicle dealers, insurance companies, and transport firms may promote road/traffic safety, at least for the vulnerable road user group, to their own financial gain. It is highly likely that there are untapped opportunities for support from the private sector, for the most part in connection with promotional campaigns for their own products. While financial contributions from non-government organizations may be insignificant, they may often be able to excerpt significant political pressure and support for programmes like children road safety.

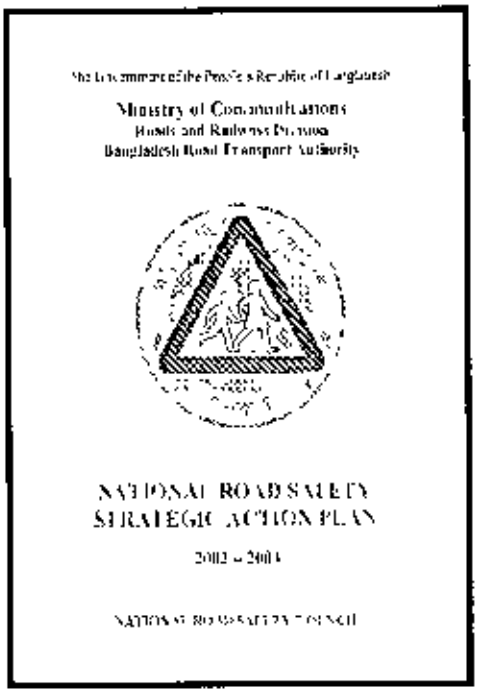
There is no suggestion or course of action in the STP for Dhaka to the involvement of the business sectors to children road safety activities. However, following opinions came out from the respondents in order to make sure the private/business sector participation in the children road safety projects:

- Identification and recognition of the participation of business sectors in promoting road safety for children and involving them in developing road safety strategy.
- Recognition and building on the management skills of the business sectors perceiving their capabilities to handle road safety plans and strategies.
- Encourage the adoption of best practice in risk management, including various types of training and workshops for children road safety.
- Matching potential sponsors to road safety activities.
- Promoting the commitment to children road safety through the use of awards.
- GRSP (Global Road Safety Partnership) partners, business partners and donor agencies could submit road safety portfolios and annual reviews of road safety work.

4.4 Good Practice Recommendations

The following section recommends some good practices which could be followed to develop a road safety plan.

- The first task in producing a road safety plan or incorporating safety issues in a strategic plan is to determine its specific purpose and for whom it is intended.
- The road safety plan is a means of stating clearly objectives, targets and actions. These should be highlighted within the body of the plan as well as being provided as a specific list.
- The road safety plan should always be current and state clearly the period to which it relates and should specify how often it will be reviewed.
- The road safety plan and action should be a quality production (within budgetary constraints) that uses good graphic design principles to make it easy and attractive to read.



- It is important to recognize that poor quality production can detract from the good points within the plan. Equally, high quality production cannot disguise poorly defined policies, objectives, targets and actions.
- The road safety plan should contain a review of any previous plan.
- The plan should clearly identify the staff and financial resources required to undertake the specific actions
- The plan should contain names (titles), addresses and telephone numbers of key road safety contacts.
- There should be a section within the plan giving basic information on accidents and casualties. It should be limited to key information only and a range of data could be included as an appendix or as a separate document.
- Data is best illustrated through graphs and tables with minimum text: and should be expressed in terms of percentages and absolute numbers.
- Local data should be set in context by comparing it with national, regional or other authority's accident data using standard costing figures.

- Current accident costs should be quoted and a "cost" calculated for the authority's accidents using standard costing figures.
- A standard baseline should establish and then it should be used in the context of the national one-third casualty reduction targets unless there are very good local reasons for using an alternative baseline.
- The road safety plan should contain an explanation of the differences between personal injury and damage only accidents and of how damage only accidents are dealt with.
- It is not necessary to describe the accident data collection process or the authority's accident database unless there are specific reasons to do so.
- There should be a section covering engineering aspects of road safety, which should state clearly the authority's policies, problems, objectives, targets and actions to achieve targets.
- Engineering actions to achieve targets should be specific, time related and be capable of being monitored.
- Extensive lists of schemes implemented or proposed should be confined to appendices or separate documents.
- There should be a section covering education, training and publicity aspects of road safety which should clearly state the authority's policies, problems, objectives, targets and actions to achieve targets.
- Education, training and publicity actions to achieve targets should be specific, time related and capable of being monitored.
- There should be a section in the road safety plan relating to enforcement which ideally should be produced in collaboration with the police and contributed to by them, covering policy, objectives, targets and actions.
- The authority's policy and programme relating to enforcement using new technology should be clearly stated.
- The local authority's own enforcement role in terms of trading standards and parking should not be overlooked.
- The plan should be a balanced document covering all aspects of road safety applicable to the particular local authority area.

- Each department within the authority should be asked to identify what contribution it can make to the overall casualty reduction effort and set out appropriate actions.
- The organizations who could contribute to the local casualty reduction effort should be asked to identify what contribution they could make and set out appropriate actions.
- The road safety plan should be a document which encourages everyone to understand and contribute to the road safety effort.
- Monitoring procedures need to be clearly defined within the plan to cover the monitoring of the effectiveness of individual actions, the implementation of the plan and progress toward casualty reduction targets.
- Targets and actions must be specific, time related and identify who is responsible for action if they are to be capable of being monitored.
- The monitoring process should define who is responsible for carrying out the monitoring, how the monitoring will be reported and how corrective action will be initiated.
- The role of elected members in the process of monitoring the plan's progress should be set out clearly.
- It is important to ensure that the actions proposed within the road safety plan are capable of achieving the casualty reduction targets.
- Authorities should consider including a comparison between the recommendations contained within the Local Authority's/Association's Road Safety Code of Good Practice, if any and their own position.
- Where shortfalls against the recommendations in the Code of Good Practice are identified specific actions to address the problem should be stated.
- The road safety plan should carry a foreword by an appropriate Member or Chief Officer giving endorsement and commitment to the plan. Where possible it should also carry the endorsement of the Inspector General of Police or relevant senior police officer.
- The outline of the plan should be well organized and visually interesting.
- The road safety plan should be written in plain language avoiding jargon wherever possible.

- The length of the plan should reflect its purpose and intended readership but typically the plan might cover 20 - 40 pages excluding appendices.
- The road safety plan should have a list of definitions of terminology and abbreviations used.
- The road safety plan should contain a reference list of other relevant reports and documents including previous road safety plans.

4.5 Overview

It became apparent from the analysis of STP for Dhaka (2004-2024) that some of the basics of road safety, especially for the children, are not in place and these need to be addressed as a priority. STP for Dhaka could set causality reduction or other performance indicators with given deadlines, could define actions and responsibilities for different road safety organizations, and as well could highlight children road safety components through courses of actions for education/awareness programmes, system safety and regulations, infrastructural development, enforcement/implementation, strategies for medical and treatment, funding sources, etc. i.e. a harmonization of safety issues and actions for the children.

Table 4.1: Road Safety Plan Content of Different Countries

	Bangladesh National Road Safety Strategic Action Plan (2001)	Sweden 11 Point Programme (1999)	UK Safer Roads for All: Govt's Road Safety Strategy (2000)	Zambia Road Safety Action Plan (1997)	South Africa Road Traffic Mgt. Strategy (1996)	Ghana National Road Safety Strategy (2001-2005)
Areas	Organization Accident data systems Road safety Engg. Traffic leg & enforcement Driver testing & training Vehicle safety Education & publicity	Special safety measures for the most dangerous roads Urban road safety Emphasis on road user responsibility Safer conditions for cyclists Quality assurance for transport services Compulsory use of winter tyers Better utilization of Swedish technology Greater responsibility on road traffic systems designer Handling of traffic offences The role of voluntary organizations All forms of financing roads	Safer for children; Safer drivers – training & testing: Safer drivers – drink, drugs & drowsiness: Safer infrastructure; Safer speeds Safer vehicles. Safer motorcycling: Safer pedestrians, cyclists & horse riders: Better enforcement Promoting safer road use	Road safety coordination Road safety engineering Accident data system Traffic law enforcement Traffic safety education Road Safety Publicity Driver Training and Testing Vehicle safety Medical services	Provincial-Local authority co-ordination Rd Traffic Safety Board Responsibility for Traffic Control & Policing Professionalism in Traffic Control Traffic Control Mgt Model SOS Hwy Patrols Traffic Operations Monitoring & Control Traffic Control Centers Incident Mgt Adjudication of Traffic Offences Road Traffic legislation National Traffic Information System Vehicle Testing Stations Education, Comm, Training & Testing Road & Traffic Operations Mgt System Critical Offence Mgt Programme Research Financing Implementation, Monitoring & Reporting	National Road Safety Commission Building and Road Research Institute Driver and Vehicle Licensing Authority Motor Traffic and Transport Unit Ghana Highway Authority Department of Urban Roads Department of Feeder Roads
No.	In 8 areas	In 11 areas	137 actions in 10 areas	In 9 areas	In 19 areas	41 actions for 7 organizations
Time frame	Two year		Ten year	Two year		Five Year
Targets	No		40% red K/SI 50% red child K/SI 10% red slight inj	10% reduction in road deaths	10% reduction Killed	5% reduction in road deaths (1998-2005) and a further 15% reduction before the end of 2010
Cost	Not given	Not given	Not given	Given	Not given	USD $28 million

CHAPTER 5: MAJOR FINDINGS

This chapter comprises of the major findings regarding road safety for the children of Dhaka City. After regression analysis of the composed Thana wise data, questionnaire surveys and interviews of children, parents and road safety specialists, and analysis of Strategic Transport Plan (2004-2024) for Dhaka, the following findings have been identified.

5.1 Factors Influencing Children Street Safety

Finally the following two regression equations of children accident rate for Dhaka City, one for children for whom walking is the mode of transportation and another for children who travel through car, bicycle or any other vehicle, have been derived from multiple regression analysis.

- Road Accident for walking children = $-39.29 - 1.115\ ZC + 15.758\ WFP$,

  Where,

  ZC = Number of Crosswalks / Zebra crossing

  WFP = Average width of Footpath

- Road Accident for traveling children = $-1.049 + 1.53\ SCV - 0.692\ STB$

  Where,

  SCV = Avg. speed of the Car or Vehicle

  STB = Usage of Seat Belt

The rate of children accident is actually influenced through a variety of issues. Except the above discussed factors there are, without any doubt, other factors which influence the rate of children accident at Dhaka. These are education, valuing safety, self esteem, attitude, behavior and others. Therefore it is very difficult to give a detail list of factors which influence a safe street network for the children of Dhaka. From the above discussion it can be said that the characteristics of a safe street network for the children of Dhaka is truly complex from different perspectives.

5.2 Children's Usage and Accessibility of Roads and Streets

- Knowledge on road safety
  - Basic road safety knowledge

    Most of the children confirmed they use safety equipment while traveling through vehicles; however, this declaration desires further

investigation.

- Even though most of the kids opined of having their awareness on road safety, they were incorrect and in most of the cases, were unable to present the right answers or any answer while they were asked some essential rules of using roads.
- Sources of road safety knowledge

  Parents play the prime role for road safety knowledge to a child, which is followed by school/teachers as the second largest source.
- Implementation of road safety knowledge

  Even though children go after no definite rule while waiting for transport, they provide high attention (23% most of the times and 77% always) in crossing roads. They try to follow traffic rules most of the times while they drive bicycle and follow safety rules at times in the event of walking street.

- Roads/street problems
  - Problems concerning roadway facilities

    Insufficient footpath, insufficient road width, having no crosswalks, unspecified speed breakers and damaged road surface seem to be the major problems pertaining to roadway facilities to children whereas parents indicated insufficient road width as the burning problem. Most surprisingly, having no median/island at roads is not a serious distress.
  - Problems concerning operation and administration

    High traffic volume, traffic jam, and adverse roadside setting are the major problems, according to both parents and children, in relation to operation and maintenance aspects of city roads.
  - Problems concerning legislation and enforcement

    Extreme speed, parking on roads and high degree of hydraulic horn are the solemn problems concerning legislation and enforcement of traffic rules.

- Street safety components and measures
  - Usefulness & Importance of Street safety components/measures

Road light, overpass/underpass, roundabout, guard railing, footpath and traffic police of Dhaka city are not functional to children. On the other hand, zebra crossing/crosswalks, speed breakers, traffic signal, and median/road island have been indicated as of high use for the children.

- Footpaths
  - Safety and accessibility of footpaths

    Amongst the diverse problems and mismanagements concerning footpaths, inadequate width, no guard railing/protective barriers, vicious environments, shocking design, illegal occupation, existence of uncovered manholes, and discontinuation of footpaths are the foremost drawbacks.

- Road Transport Accidents (RTAs)
  - Causes behind Road Transport Accidents

    Disappointing road safety education, pathetic enforcement of traffic laws, insufficient and inefficient traffic personnel and driver's blunder are the most important reasons, according to the parents, behind increased road traffic accidents. However, adverse roadside conditions, automobile defects and pedestrian inaccuracy are as well answerable to a medium extent.

5.3 Analysis of Strategic Transport Plan (STP) for Dhaka

- Defined Safety Actions
  - Defined responsibilities

    The STP for Dhaka must focus the duties of concerned authorities to carry out a programme of measures designed to uphold road safety, especially for the vulnerable road user groups, together with the dissemination of information and advice according to age groups, and providing sensible guidance to road users also.
  - Given deadlines

    There are no known deadlines in the STP for Dhaka for the concerned authorities to target for the reduction of casualties, injuries and

subsequent disabilities of the road users as of road accidents, let alone deliberation for the children.

- Casualty reduction or other performance indicators

  STP for Dhaka should have specific targets/aims to lessen the figure of road fatalities for a given number of age specific populations within a specific time period.

- Estimation of costs of the safety actions

  The cost of road crashes has to estimate conservatively and the potential saving in the cost of crashes is a factor to be taken into account in determining the quantum and allocation of children road safety expenditure; our STP fails to address/guide the issues

- Children Road Safety Components

  - Education/Awareness programme

    STP for Dhaka could assist the Roads and Highways Department (RHD), Ministry of Communications to launch a Children Road Safety Awareness Programme.

  - System safety and regulations

    Process and system indicators in view of children limitations e.g. data on the number of hazardous locations treated or the number of junctions improved for safety are the prime considerations for a road safety plan. The specific goals and targets of STP for Dhaka as regards system safety and regulations are well organized indeed.

  - Infrastructure development

    Researchers and practitioners indicated that STP for Dhaka has made zero to improve the overall children road safety situation neither through infrastructure development nor infrastructure management.

  - Our STP vaguely highlighted the road safety audit programme without any detail. Road security engineering activities with consideration of vulnerable road user groups in many countries is supported by a range of professional engineering organizations, research and consultancy bodies and STP for Dhaka could also indicate some strategies regarding this.

- Enforcement/Implementation phase

  STP for Dhaka provides nil for the submission of financial/non-financial penalties where road users fail to comply with road traffic laws. There is no list or indication in the STP, even any clue of sanctions/penalties resulting from traffic offences.

- Medical strategies

  The STP could incorporate health sector in the plan by defining a range of policies/roles for the health sector. For example, integration of road safety into health policies through STP for Dhaka could be to reduce health risks for our children related to sedentary lifestyle by implementing strategies for safer walking, cycling, etc.

- The impacts of transport or land-use planning decisions on the occurrence of crashes and the resulting injury and damage on the entire road network affected require being well thought-out at an early stage to avoid adverse and unintended effects on road safety, but STP for Dhaka disastrous to foresee the consequences as regards this. Furthermore, area-wide safety impact assessment could be offered in the STP for Dhaka as an essential component of other impact assessments that are carried out routinely for diverse projects.

- Coordination of Safety Actions

  Multi-sectoral inter-governmental coordination is necessary to implement systematically the safety actions in STP. Coordination involving all levels and stakeholder is also essential to avoid duplication and this is why a specific coordinating body is necessary to compose the safety actions of STP effective.

- Technical Support

  Most of the interviewers extremely stressed about the importance of the existence of a road safety technical committee/board about which the STP for Dhaka is in absolute ignorance.

- Effectiveness

  STP for Dhaka could set its own performance indicators relating to speed reduction, child casualties, pedestrian fatalities, accident involvement of young and old drivers, accidents in relation to distance traveled, etc

- Development Phase

  It is very obscene that a very little fraction (10%) of the safety specialists and consultants termed the public consultation and involvement process during the progression of STP for Dhaka as 'good' and 'very good'. More than two third respondents (70%) labeled the contribution of local agencies/advisors towards STP for Dhaka as 'medium' which indicates serious lapses and undue attention of the concerned authorities towards the formation of the strategic plan.

- Funding

  Road safety targets, capacity of local institutions, and alternative sources of financing for children road safety measures must be highly considered during the evolution of such a plan, whereas STP for Dhaka seems to be less serious to consider the issues.

- Implementation, Monitoring & Evaluation

  Implementation, monitoring & evaluation arrangements of a road safety plan, for the children in particular, include a range of tools, mechanisms and procedures such as funding sustainability, legislative efficacy, multi-sectoral coordination, performance monitoring and evaluation, etc. along with children behavior and their limitations which are needed to efficiently produce interventions. STP for Dhaka provided very little, almost no thought towards these basics.

CHAPTER 6: CONCLUSION

Providing challenging but achievable recommendations for children road safety is a sign of responsible management. There is no guarantee that simply by setting recommendations, children road safety performance will improve. A set of recommendations for the safety of children at the streets of Dhaka is outlined in this chapter in the light of the findings from processing and analyzing the collected data and information as well as considering local issues, challenges and priorities and taking note from the best practice guidelines exist at road safety championing countries.

6.1 Road Safety Education (RSE) for Children

The road environment plays a large and important part in all our lives, both as children and adults. Our young people are more likely to die or be injured as a result of an accident on the road than from any other cause. It is estimated that the incidence of overall child involvement in road accident fatalities in Bangladesh, as mentioned in Chapter 2, is very high, accounted for about 21 percent in a year. These accidents can bring considerable suffering, not only to the casualty themselves but also to family and friends.

Teaching safety skills to children can provide lifelong benefits to society, but should be seen as a long term intervention strategy also. Experience in many countries has shown that reliance on individuals or organizations visiting schools to give talks on road safety are not effective on their own. Children may remember the messages in the short term, but effective and sustainable development of positive attitudes towards road safety are best achieved by inclusion in the core curriculum, either as a compulsory subject in its own right or as a cross-curricular theme.

6.1.1 Why is RSE needed?

Children in Dhaka city and also in Bangladesh are more likely to die or be injured as a result of a road accident. A considerable percentage of traffic deaths are accounted to people under the age of 15 and this threat of road accidents to children will increase with motorization. Several factors contribute to this risk to children in our country, especially in Dhaka city:

- Both the speed and volume of motor vehicle:

- Roadside friction continues as poor land use planning, operational control, and limited road space lead to conflicting uses of road and roadsides;
- Road improvements tend to focus on motor vehicle requirements and not children and pedestrian needs;
- Traffic police can offer only limited help as they are poorly equipped to control motor vehicle traffic and not properly trained to consider children, the most vulnerable road user needs; and
- Most parents are unable to provide road safety training to children as they themselves never received any training and even if they did, traffic conditions have changed dramatically since their childhood.

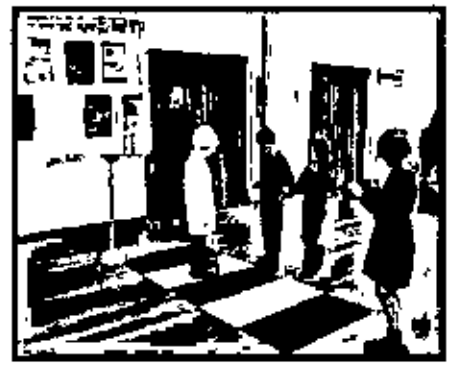
Photo 6.1: Road Safety Education – Practical & Theoretical sessions.

RSE is urgently needed to provide the necessary structure for the acquisition of safety knowledge and skills. These include decision making skills, and the identification and assessment of risk and strategies to reduce these risks. RSE should attempt to prepare children for different tasks at each stage of their increasingly independent use of the road network and, later, as adults.

6.1.2 School Curriculum with RSE

Road safety education is most effective if fully integrated with the curriculum and teaching by professional teachers who have themselves been trained in the safety issues relevant to children. It is also essential that education inputs are incremental (building on previous skills) and linked to the child's physical and psychological abilities. To reflect the increasing awareness and competency of children as they grow, it is necessary to

group children into age bands to enable their specific development requirements in terms of road safety to be met. And this is why, children road safety education could be planned for the following four age groups:



- Key Stage 1: 4 to 7 years
- Key Stage 2: 8 to 11 years
- Key Stage 3: 11 to 14 years
- Key Stage 4: 14 to 17 years

6.1.2.1 RSE to Pupils at Key Stage 1

Children of this age should be looking at safety in a wide context in which road safety is one aspect.

They need to learn:

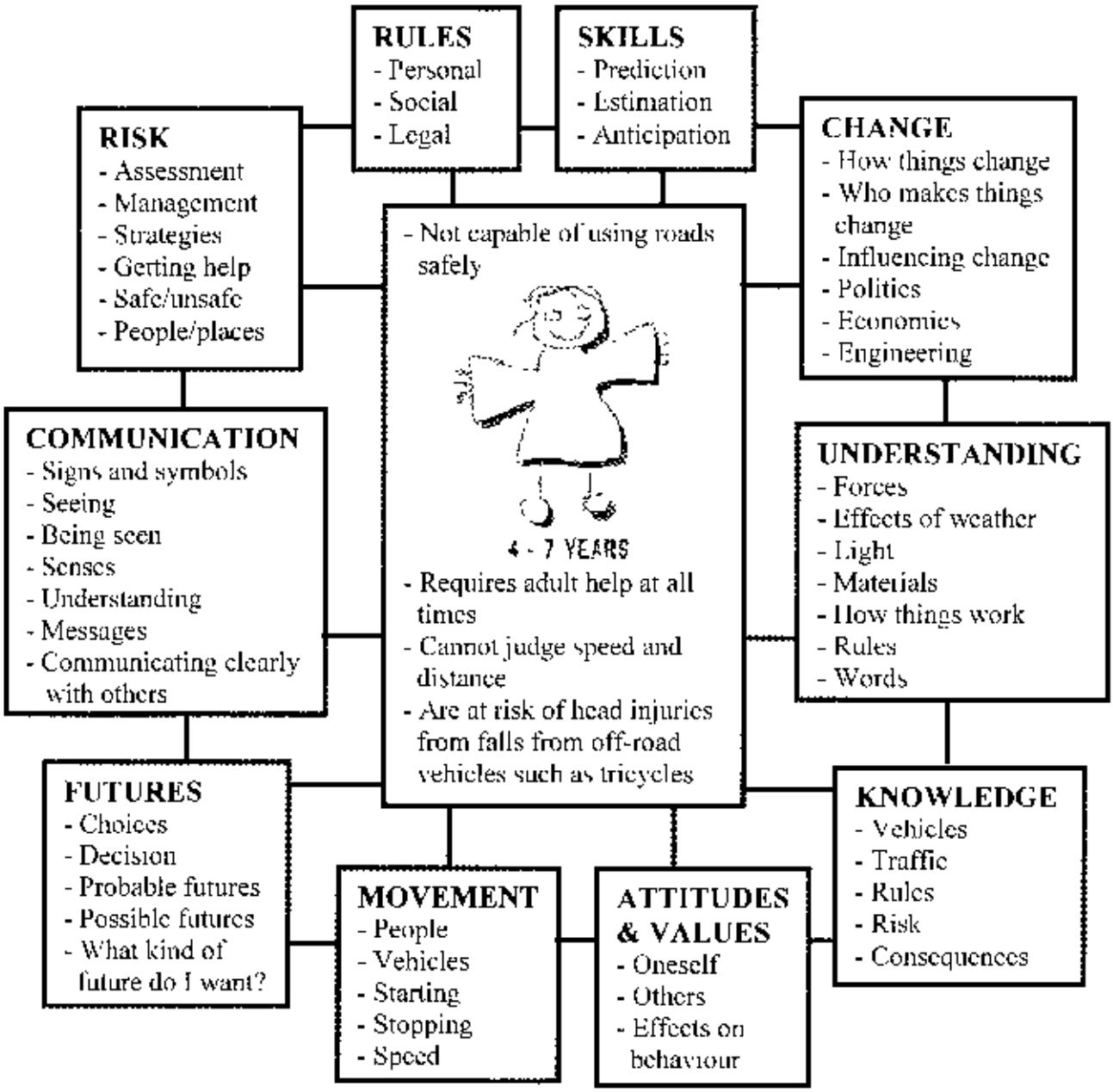
- Who they are; where they live; who is there; their telephone numbers; where they can go if nobody is at home.
- Where they are and are supposed to be; who knows where they are; how long it takes to get somewhere.
- Safe places to play, safe routes to get there. The rules for safe play.
- What are dangerous places and why these are dangerous.
- Who to trust and who is safe to be with. Who are the people who help to keep them safe.
- To ask for help.
- The causes of accidents.
- That keeping safe is their job too.
- The difference between real and imaginary dangers.

They need to practice:

- The skills needed to keep themselves safe.
- The rules that help to keep them safe.
- How to have fun, play safely and keep safe.
- Being a good passenger.
- Doing things on their own.

- How to ask for help and how to explain things clearly.
- Assessing risk in and around the school and in the places they visit.

Figure 6.1: Schematic diagram of RSE to pupils of 4 - 7 years.



- Using their senses to help keep safe.
- Making decisions and reflecting on the consequences.

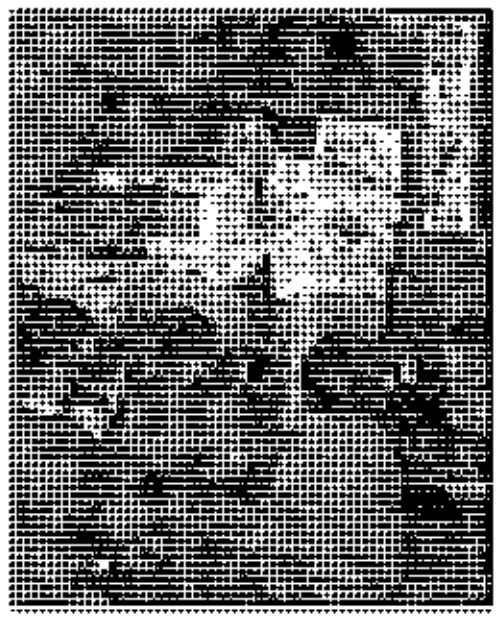
They need to understand

- The many causes of accidents.

- That they can prevent accidents.
- The meaning of the words Stop, Look, Listen & Think.
- What traffic is.
- What vehicles are.
- The vocabulary of the road - kerb, pavement, island, zebra crossing, etc.
- That the road environment is designed and built, that it can be changed; and how these changes can be brought about.

6.1.2.2 RSE to Pupils at Key Stage 2

They need to learn:

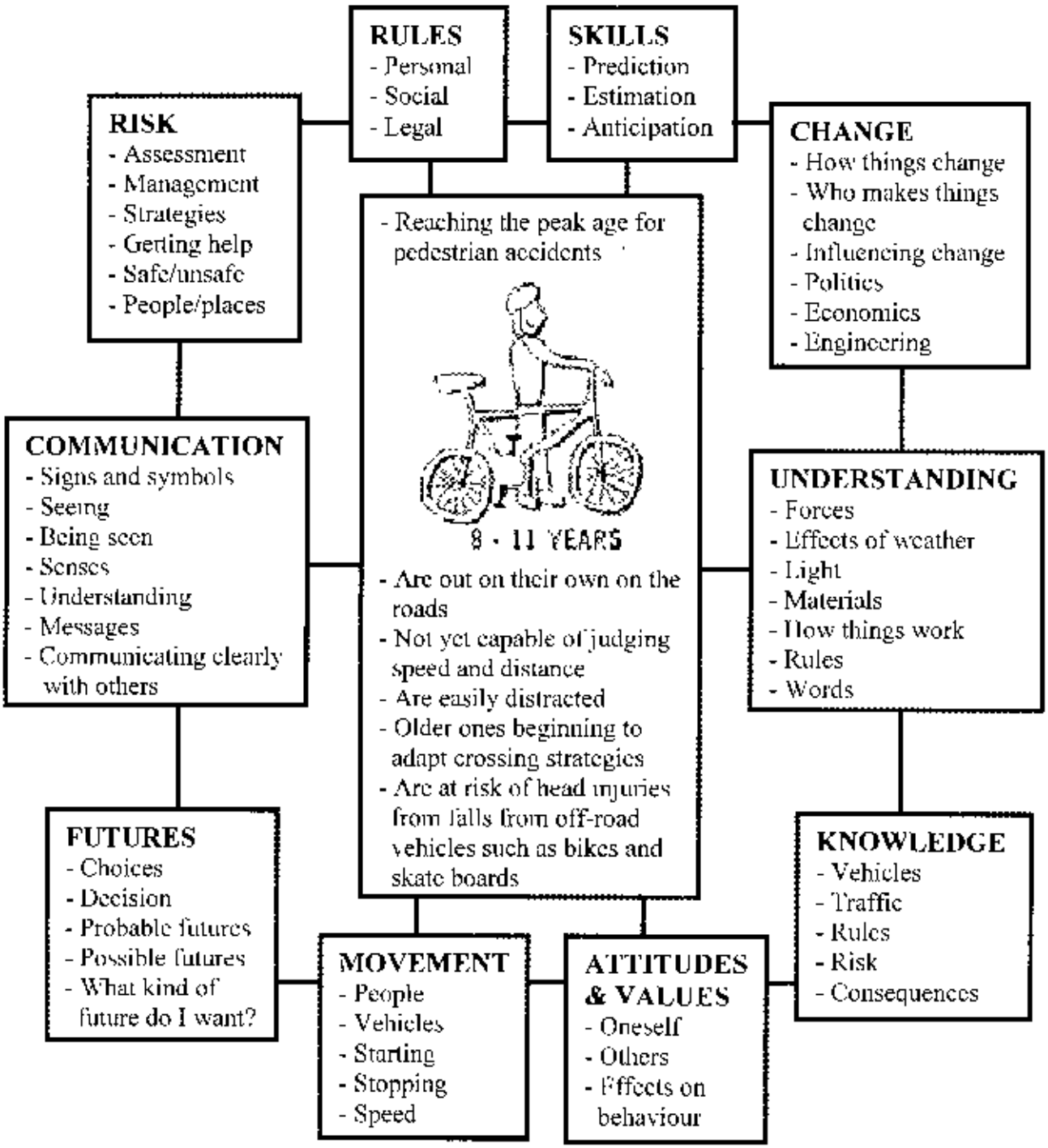


- Where they are and are supposed to be, who their friends are, the person in charge, and the person who needs to know where they are.
- How to get out and how to get home, how to contact home, another safe place to go How to tell the time, use a telephone, judge speed and distance.
- How to get help when they need it.
- The risks and hazards they might find when they are on their own.
- Which people are safe and not so safe and how to recognize them.
- Where and when accidents might happen and what to do if one happens.
- The skills to keep them safe in traffic, when they are alone or with other people: simple lifesaving skills.
- To resist pressure from their friends to do things they know are not safe or sensible, and the words they need to use to do this.
- The safety rules for different situations and how to keep them.
- How things in their local environment are changed and how they might influence those changes now and in the future.

They need to practice:

- Using things safely and playing safely.
- The skills they need to have fun, feel good, feel safe and keep safe.
- Being a good example to younger children and passing on their skills to others.

Figure 6.2: Schematic diagram of RSE to pupils of 8 - 11 years.



- Resisting threats, persuasion and bullying.
- Identifying and weighing up the risks in any new situation.
- Speaking and writing to those people who can help them to bring about changes to their local and/or national environment to make it safer.

They need to understand:

- There are people who help to keep them safe, but that is also their job.
- If something is frightening or upsetting to them that they have a right to say "NO" and that this is not rude or silly.
- That being able to do more things away from the family means they have more personal responsibility.
- That they will still need help to keep safe and asking for help is useful.
- That their actions can have consequences for other people.

6.1.2.3 RSE to Pupils at Key Stage 3

These pupils, aged between 11 and 14 years, are at the peak age for pedestrian and cycle accidents: they make longer and more frequent journeys; they are at risk of head injuries from falls from vehicles on and off the road; they are increasingly influenced by peer group pressure and are beginning to adopt adult crossing strategies which may not follow the safest procedures. Arising from these considerations the following could be developed for the Key Stage 3 pupils.

They need to learn:

- How to assess risk in different situations
- About the risks and hazards associated with different activities and how to manage these.
- How to keep safe in traffic when out alone or out with friends.
- How to identify real friends and 'safe' adults.
- To resist pressure from others to do things which they know to be unsafe or not sensible, and the words they need to use to do this.
- About local roads and traffic conditions and the effect these have upon their own behavior.

- The rules regulating traffic especially those applying to young road users, particularly pedestrians and cyclists.
- How to maintain on and off road vehicles in a safe condition.
- Safe crossing strategies.
- How to plan and time journeys, read maps and use timetables.
- How to identify and plan the safest route to and from places.
- How to inform others of where they are going, how long they will be and who they are with.
- The causes of common traffic accidents involving young people
- What to do if an accident happens.
- How to get help when it is needed
- How changes are brought about in the local community, and how they can influence these changes now and in the future.

They need to practice the skills required:

- To use things safely and to travel safely.
- To assess and manage risk in different situations.
- To have fun, feel good, feel safe and keep safe.
- To resist threats, persuasion and bullying.
- To plan and time journeys.
- To react properly and effectively in the event of an accident.
- To present problems, solutions and requests for action to those who control change in the local and/or national environment.

They need to understand:

- That greater independence means greater responsibility for the safety of themselves and others.
- That they have a right to resist pressure to do things which they know are unsafe or not sensible.
- That they still need help to keep safe and that asking for help is acceptable and sensible.
- That accident has far reaching consequences and affects the victims, their families and the community

6.1.2.4 RSE to Pupils at Key Stage 4

These pupils, aged between 14 and 17, are approaching the age group most likely to be killed or injured on the roads as young drivers, and are heavily influenced by peer group pressure.

Arising from the above mentioned considerations and building up on the work done in Key Stage 3 the following could be developed for the Key Stage 4 pupils.

They need to learn

- How to manage risks associated with different activities including those involving motor vehicles.
- How to keep themselves safe in motor vehicles either as passengers or drivers.
- How to identify and to resist pressure from other people or from media messages.
- The rules regulating traffic, especially those relating to drivers.
- The law which applies to vehicle ownership.
- How to maintain vehicles in a safe and legal condition.
- How to apply for insurance.
- How to plan and timing short and long journeys by car, using maps and timetables.
- The causes of common traffic accidents involving young drivers and how such accidents can be prevented.

They need to practice the skills required:

- To anticipate the likely actions and behavior of other road users.
- To consider the purchase and ownership of a motor vehicle.

They need to understand:

- That the right to own and drive a vehicle means greater responsibility for the safety of themselves and others
- The problems of other road users including children and the elderly.

6.1.3 Where does RSE fit into the Curriculum?

It is important that effective RSE does not rely simply on Integrated Curriculum. Materials for use in the classroom along with the curriculum plays a vital role which includes, but are not limited, to the following:

- Worksheets;
- Posters;
- Teaching pack;
- Slides;

Figure 6.3: Sample of Information Leaflet, Poster and Book.

- Games; and
- Videos.

However, RSE should support the subjects and areas of the curriculum and in turn the curriculum should also support the greater understanding of road safety for children. As such the school subjects could incorporate topics and issues according to age bands as listed below.

6.1.3.1 Science

For Key Stage 1 and 2:

- Movement, friction, stopping, uphill/downhill travel, forces, energy sources, etc.

- Use of materials, conspicuous/protective clothing, surfaces and friction.
- Effects of different light and weather conditions on safety, headlights, signals – visible, audible.
- Information, orders, warnings, senses, data logging.
- Human influences on the earth, vehicles, street furniture, safety, risk, pollution.

For Key Stage 3 and 4:

The contribution of scientific knowledge to personal health; safety and care of the environment e.g. pollution, road building; the use of materials for protection e.g. car construction, protective clothing, road surfaces; the effects of weather upon materials and implications for safety. Human and vehicular movements with particular reference to road safety, distance/speed/time, motion, friction, stopping distances, turning forces, stability, energy resources, fuel economy, transport in the future.

6.1.3.2 English

For Key Stage 1 and 2:
Rules, communication - non verbal, signs and symbols, ordering events, interpreting information, acting out events and reactions.

For Key Stage 3 and 4:
Communication - non verbal, signs and symbols, rules, ordering events, interpreting information, acting out events and reactions, debate on transport issues, role play, bringing about change through use of different media.

6.1.3.3 Mathematics

For Key Stage 1 and 2:
Collecting, classifying and interpreting data about how the environment is used: traffic and pedestrian flow shapes and signs: large and small: fast and slow; accident statistics, probability, journey times, timetables, energy costs of different types of transport.

For Key Stage 3 and 4:

Using networks to plan routes: collecting, classifying and interpreting data about how the environment is used, and the impact of transport systems on people and the environment, modeling.

6.1.3.4 Technology

For Key Stage 1 and 2:

Modeling the artifacts, systems and environments involved, identifying needs and opportunities, examining costs and benefits.

For Key Stage 3 and 4:

Within the road environment, identifying needs and opportunities, artifacts, systems and environments, benefits and costs, presenting solutions.

6.1.3.5 History

For Key Stage 1 and 2:

Cause and effect, past and present risks, protective clothing, keeping safe.

For Key Stage 3 and 4:

Cause and effect, growth of transport and its' benefits and costs, management of the major risks and hazards in different periods.

6.1 3.6 Geography

For Key Stage 1 and 2:

Mapping the local area, safe/unsafe places, changing the area, engineering.

For Key Stage 3 and 4:

Mapping the local area, identifying usage and problems, changing the area e.g engineering: planning routes, local transport.

6.1.3.7 Health Education

For Key Stage 1 and 2:

Responsibility for oneself and others to community and environment, growing and changing pattern, people who will help in emergency, first aid, safe people, safe places, rules, identification and managing risk, decision making.

For Key Stage 3 and 4:

Responding to greater independence, resisting pressure, responsibility for others, risk management, community involvement, survival skills.

6.1.3.8 Citizenship

For Key Stage 1 and 2:

- The needs of the community, how change occurs
- Industrial & economic understanding/careers.
- The people who design and build the roads, the costs of change.

For Key Stage 3 and 4:

Scarcity of resources, economic and political decisions affecting the provision of services, the role of the road safety engineer, the police and others involved with roads and transport, public debate around transport issues.

The law, public services, the routes to change - democracy in action, responsibility, the needs of the community.

6.1.3.9 Environmental Education

For Key Stage 1 and 2:

The effects of the motorized vehicles, the future.

For Key Stage 3 and 4:

Maintaining and protecting and improving the quality of the environment, the need for prudent and rational utilization of resources, personal influence, environmental impact of the motorized vehicles, probable and possible futures.

6.2 Organization for Economic Cooperation and Development (OECD) Experience

According to the new OECD (Organization for Economic Cooperation and Development) report, 'Keeping Children Safe in Traffic', more children are killed on the road than in any other type of accident, with Korea, New Zealand, Portugal and the United States having the highest child road-fatality rates, while Sweden, Japan, the United Kingdom and Italy have the lowest. Many of these deaths could be avoided by improving

education, making drivers more responsible for the safety of young passengers and pedestrians, and better design of vehicles and roads.

'Keeping Children Safe in Traffic' recommends, in general, implementing a series of measures to address the road safety issue for children:

- High quality road safety education to improve children's skills and awareness of risk, and publicity to encourage use of safety equipment such as seat belts and cycle helmets.
- The focus of responsibility for child road safety should also be shifted towards drivers. Even children educated and trained in road safety skills are less able than adults to use their knowledge consistently.
- Seat belts save lives – in countries with the lowest child fatality rates, 90% of passengers wear them. Wearing of seat belt rates vary widely even in the countries where it is mandatory; however, wearing seat belts should be mandatory by laws.
- Traffic engineers and urban planners should consider child safety in road design.
- Vehicle designers and manufacturers should give more attention to protecting pedestrians and cyclists.

More stringent safety measures, road safety education among which is the top most rated, halved the number of children killed every year on the roads in OECD countries over the past two decades. Thus from the OECD experience, road safety education for our children could be of utmost importance to keep them safe in the traffic of Dhaka city.

6.3 Safety Tips, Rules and Options for Children

Road traffic deaths and serious injuries of children are to a great extent preventable, since the risk of incurring injury in a crash is largely predictable and many countermeasures, proven to be effective, exist. The following section provides an overview of the wide range of interventions for children road safety. Proven interventions of abroad, of course, may not easily be transferable herein, but will instead require careful adaptation and evaluation

6.3.1 Walking, Traveling and Cycling Safety for Children

Whether our child is walking to school, travelling by bus, cycling or is in a car/vehicle to school or any other destination the following safety guidelines could apply.

6.3.1.1 Walking Safety

Walking with a toddler or preschooler opens up a whole new world at a whole new level. These young walkers are looking at new and exciting things and often too busy and too young to be aware of any dangers. That is a parent/guardian or caregiver's job and one that is made especially harder when these newly independent mobile children don't want to hold hands.

Generally speaking, children under 9 years of age lack the hearing, peripheral vision and judgment capabilities necessary for them to be able to safely navigate busy streets. Along with road and traffic safety rules, the following tips may help keep these little wanderers safe and happy:

- Don't let children walking alone.
- Small children should not cross roads alone. They cannot decide how far away a car is or how fast it is going.
- A great safety tool for toddlers and preschoolers is a harness. While some may feel they are kept on a leash, a harness offers the safety of keeping a child closer at hand, helping to direct them and also to even assist when a fall is inevitable.

Photo 6.2: Reflective clothing and holding hands of children are effective indeed.

- Holding hands at all intersections and when crossing any driveways or lanes.

- Do not be impatient on the road and do not rush or run on the road.
- Children walking on roads should wear reflective armbands and bright clothing.
- If there is no footpath, walking on the right-hand side of the road facing oncoming traffic keeping as close as possible to the side of the road.
- Teaching and enforcing a rule that the child must stop immediately when told to do so and following further instructions.
- Teaching children to stay away from the edge of the sidewalk.
- Keeping the short routes and be prepared to carry tired feet.
- Following and teaching safety tips and rules for the road.
- Showing child how to cross the road by example. Crossing only at zebra crossings, traffic signals, subways, foot over-bridges. Where such facilities do not exist, looking for a safe place to cross and taking time to explain why i.e. footbridges/underpass, zebra or pelican crossings, median/islands, traffic signal, etc.
- While crossing wide roads that have central islands, always cross in two stages. Cross to the central island, stop, and cross when the next section is clear.
- While crossing one-way streets, remember that the traffic will usually be moving in a number of lanes and at higher speeds. Do not cross unless all lanes are clear.
- Never crossing a road at a corner/curve, as the motorist taking the turn will not be able to see the crossing person in time.

6.3.1.2 Traveling by Car/Vehicle

- All children should be restrained when traveling in a car/vehicle.
- Selecting a restraint that is based on child's weight and height and is suitable for the type of car.
- It's safer if children travel in the rear of a car/vehicle.

- Never leaving children alone in a car.

6.3.1.3 Traveling by Bus

- Teaching children to take special care getting on or off a bus, mini-bus or school bus.
- While waiting for a bus, children should stand well in off the road.
- At the bus stand, always following the queue. Boarding the bus only after it has come to a halt, without rushing in or pushing others.
- Always holding onto the handrail if standing in a moving bus, especially on sharp turns.
- Do not sit, stand or travel on the footboard of the bus.
- Do not put any part of the body outside a moving or stationary bus.
- Before crossing the road children should wait until the bus has moved off and they can see clearly in both directions.

6.3.1.4 Cycle Safety

- Making sure the children are highly visible by wearing a reflective belt and bright clothes and wearing a bicycle safety helmet on all journeys
- Checking that the bicycle's brakes, lights, reflector and bell are in good working order.

6.3.2 STOP, LOOK, LISTEN & THINK

One of the premier rules of the road to teach our children is 'STOP, LOOK, LISTEN, & THINK'.

Young children do not have the skills and abilities needed to cross road safely on their own. They are less likely to notice objects not directly in front of them, and may have difficulty working out where sounds are coming from. Consequently, they must be encouraged to turn their heads when looking and listening for traffic. This 'Stop, Look, Listen, & Think' activity will give our children the opportunity to practice the Stop, Look, Listen, & Think procedure while crossing real roads.

'Stop, Look, Listen, & Think' procedure is as follows:

- Let the child holding an adult's hand.
- STOPPING one stop back from the kerb (or edge or shoulder of road if no footpath).
- LOOKING in all directions for approaching traffic
- LISTENING in all directions for approaching traffic
- THINKING about when it is safe to cross (when the road is clear or the traffic has stopped).
- Walking straight across the road. Keep LOOKING and LISTENING for traffic while crossing.

The following additional tips will help reinforce this 'Stop, Look, Listen, & Think' rule as well as provide more safety tips to practice and teach children:

- Always to look both ways and exercise caution when crossing at a cross walk or intersection. It is important to not just look at the cars stopped at the intersection but any approaching vehicles and cyclists as well.
- Even when crossing an intersection at a green light it is still important to look all ways and watching for turning cars.
- Making eye contact with drivers to be sure of being seen by him and that all cars have come to a complete stop before crossing at an intersection or cross walk.
- Constantly reinforcing and demonstrating safety rules when walking with children and even by ourselves - we never know who may be watching.
- Staying away from and never go into a

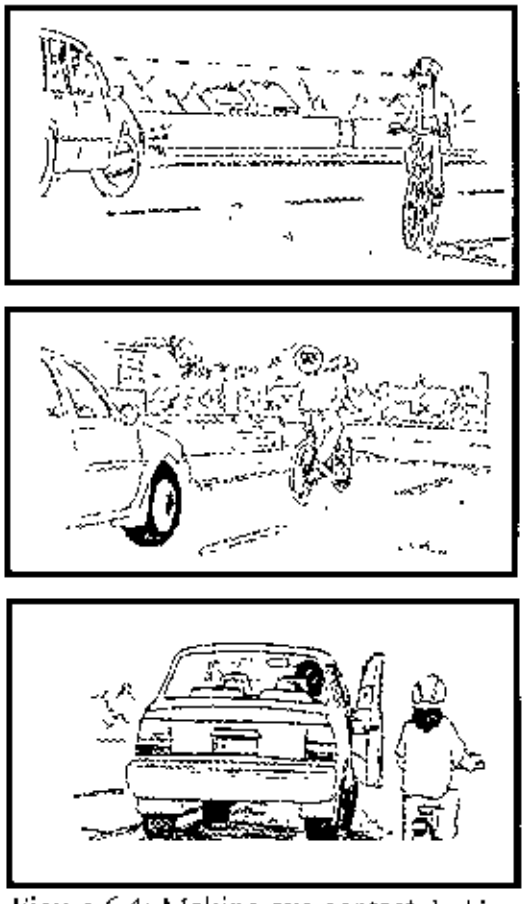


Figure 6.4: Making eye contact, looking well ahead and scanning the road

car with a stranger.

- Children should always tell parents where they are going. Similarly, adults should leave a note at home when they are going for a walk too - noting their destination and route in case of emergency.
- Teaching children to walk in safe areas - avoiding parking lots, paths through wooded areas, secluded areas, loose gravel and busy roads.
- Don't let children walking alone, especially at night.
- Wearing bright or reflective clothing for night or evening walks at least.
- Watching for cyclists.
- Walking across cross-walks and intersections only. Do not crossing the street between intersections and parked cars.
- Be aware of driveways and lanes. Look both ways and stop before crossing. This is especially important to teach young children.
- Staying out of ditches and away from ponds, streams and rivers.
- Staying away from school buses and other buses.
- It is best, hearing siren, to move away from the road as far as possible, stop and wait until the emergency vehicle has passed before continuing walk again.
- Coming to a complete stop at all stop signs and obeying all other road signs.
- Walking across all intersections, obeying traffic signals - never running across an intersection.
- Never walking along or on railroad tracks and bridges. Using caution when crossing railroad tracks. Never crossing railroad tracks when signals are flashing or a train is whistling.
- Looking for immediate indoor shelter during thunderstorms – it's best to check the weather before heading out.
- Planning routes that are not too long for the age of the youngest walker.
- Consulting with local library, government offices, police department and health departments for booklets, programs and guides about road safety.
- If visiting a playground as part of a walk practice playground safety.

6.3.3 Walking School Bus

A 'Walking School Bus' is a school bus powered not by an engine but by legs. Children don't sit inside this bus - they walk in a group to school, with an adult 'driver' and an

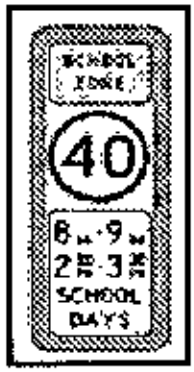
adult 'conductor' at the rear. The walkers are the bus. The bus travels along a set route to or from school, picking up or dropping off children along the way at designated 'bus stops'. Bus stops can be meeting points along the route or each child's front gate.

General principles of 'Walking School Bus':

- Leaving on time - Bikers and Walkers must be at designated point at or before leaving time.
- Children need to stick with the each other.
- Allowing the Driver to go before walkers.
- Conductor follows the group to avoid lost children.
- Gently remind children of important safety rules.
- If need be, stop the group if a child is behaving in an unsafe manner.

Photo 6.3: Walking School Bus.

Since it is powered by good old-fashioned legwork, it not only promotes healthy exercise but has the potential to reduce vehicular traffic and the associated pollution and hazard near the school gate.



6 3 4 School Safety Zones (SSZ)

A School Safety Zone (SSZ) consists of a length of road immediately outside a school catering for primary age children, where no motor vehicle can stop or park during school opening times and includes a maximum advisory speed limit of 20 mph. The Zone is clearly marked

by high profile road signs and carriageway markings. The following photo helps to explain the road layout in more detail.

Photo 6.4: A School Safety Zone.

The aim therefore of a SSZ is to provide a safer environment for children entering and leaving school, by discouraging drivers from parking or stopping within the zone and to drive at a maximum speed of 20 mph during school hours.

6.3.5 Traffic and Environmental Trails

With the support and help of schools and concerned others, traffic and environmental trails have proven to be an excellent programme that combines road safety with many of the core subjects, particularly History and Geography.

Photo 6.5: Traffic and Environmental Trails.

Road Safety Professionals accompanied by teachers escort classes of children through city and town centers providing practical assistance in understanding traffic hazards, whilst learning about the historical and geological context of how roads, buildings and transport modes have evolved.

6.3.6 School Bus/Van

Transporting children safely by school buses/vans is part of school life and it's very common at Dhaka city. Almost all the kindergartens and schools of Dhaka city provide school bus/van service for the children, the quality of service and monthly fare vary from school to school.

In our country buses/vans used only or primarily for taking children to or from school may or may not display the words SCHOOL BUS/ SCHOOL VAN; however, the school bus/van should display the words SCHOOL BUS/ SCHOOL VAN or an image of two children. The school bus/van should have signs, as practiced, in black letters or images on a yellow background.

Photo 6.6: Widely used non-motorized three wheelers school vans in Dhaka city.

School buses should have flashing yellow warning lights fitted to the front and rear of the bus/van. The driver of a school bus must flash its warning lights when children are being picked up or set down.

Drivers of other vehicles should slow down when approaching a school bus/van, especially when the yellow lights are flashing, and pass with care. At the same time it's a responsibility of others to watch for children who may run across the road from in front of or

behind the bus.

6.3.7 Young Drivers Scheme

This scheme could be targeted at persons aged between 13 and 24. Its main theme is to address the high number of casualties in this age group. There are three parts to the scheme including training in first aid in which the Road Safety Professionals provide an important role.

- Part one – In the Mind, covers the traffic rules, Highway Code, road casualties, driver documentation and bad driver habits.
- Part two – Under the Bonnet, is where candidates learn of the importance of car maintenance.
- Part three – Behind the Wheel, an Approved Driving Instructor supervises the candidate driving a vehicle on private land in order to experience various driving situations.

6.3.8 OECD Best Practice Examples

The 'Organization for Economic Cooperation and Development' report (OECD, 2004) identifies the following examples of best practice which distinguish the top-performing countries from those that did less well in terms of children's road safety:

- Traffic calming which reduces vehicle speeds is advocated as a key measure to improve the overall safety of road users, in particular children. Top-performing countries used area wide traffic calming to a greater extent and had a wider range of infrastructure safety measures.
- Children's safe mobility facilitated by the design of residential areas that incorporates traffic calming techniques and low speed zones such as 'Home Zones' to favor walking and cycling as the dominant modes.
- Making speed reduction a key objective in order to protect vulnerable road users and setting speed limits according to the function of roads within a hierarchy.
- Lower speeds on residential area roads and availability of foot and bicycle paths are important.

- Outside residential areas where low speed limits are less feasible and roads are wider with heavier traffic flows, attention should be given to designing safe places to cross the road. Safety should be encouraged by use of zebra crossings

Photo 6.7: Very poor and ill maintained safety measures/infrastructure at Dhaka city.

and signalized intersections, pedestrian islands, and school crossing patrols where necessary. For very busy roads, segregation from motorized traffic and provision of well-lit foot bridges and tunnels may be necessary.

- In the development of new educational facilities, consideration should be given to safe access using all travel modes, especially cycling, walking and use of public transport.
- Better maintenance of the road environment and in particular recreational areas and play fields, and safe access to such areas/spaces - as failure to repair damage or clear away obstructions often contributes to further deterioration.

Again, the OECD (2004) report, 'Keeping children safe in traffic', identifies the following examples of best practice in relation to road safety education, training and publicity:

- Road safety education should be part of the national education curriculum at all levels from pre-school on, with regular high-quality inputs to develop children's skills, risk awareness, attitudes and knowledge.
- Drivers should be aware of their responsibilities to their passengers and other road users, and they should understand the limitations of children's behavior in traffic. These outcomes can be achieved by effective education, training and publicity.

- Publicity could be used in conjunction with other measures as a powerful tool for delivering information and influencing attitudes and behavior in all areas of road safety, from environmental improvements to changes in legislation to vehicle modifications. It should engage all sectors of the society, from policy makers, professionals and businesses to communities and consumers.

Photo 6.8: Road safety publicity through rally, procession, public announcement, etc.

- Publicity campaigns should target drivers that encourage drivers to behave more safely by raising awareness of how children behave, alerting drivers to their responsibilities to protect car occupants and child pedestrians and cyclists, and highlighting such issues as choice of speed, etc.
- Publicity to maintain drivers' awareness of the importance of correct fitting and use of child restraints and seat belts in cars.

6.3.9 Better Road Conditions for Children

The effect on the provision and design of road engineering measures cannot be underestimated. It is widely recognized that well designed road schemes, which include the needs of the vulnerable road user groups, children in particular, can reduce the risk of accidents and crashes.

From the results of the study 'Road Safety for Children: An Accident Analysis for Better Road Conditions for Children in the Netherlands' by Van Loon A (2001), implementation of the following recommendations will obtain safer road conditions for children.

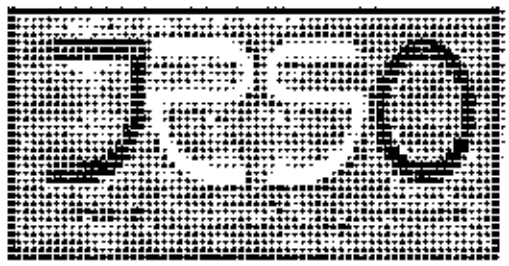
- The speed limit in residential zones must be set at maximum 30 km/h along with traffic calming measures. Residential streets with speed limits of maximum 30 km/h including traffic calming are 2-3 times safer than the same streets with speed limits of 50 km/h and no traffic calming. This is due to a shorter brake distance, a wider visual scope of the driver and a minor injury rate in 30 km/h residential zones.
- In residential areas where children tend to cross over, no sight restraint is allowed. At busy parked streets, special locations to cross with enough sight must be made. High objects along roads must be avoided.

Photo 6.9: Very few of our children enjoy better road conditions.

- Crossings on collector roads must be safer by slowing down traffic speed and making better sight conditions.
- A homogenous speed pattern must be obtained by adequately designed traffic calming measures at regular distances.
- Rows of parked cars must be regularly interrupted by an open space where children can cross the street safely.
- One-way streets must be avoided, but when this can't be avoided, traffic calming measures are needed.
- Collectors and arterials should be provided with bicycle lanes.
- Areas or roads near or around playgrounds, playfields, schools and shops must be designed as maximum 30 km/h streets or zones.
- Sight obstruction must be avoided.

6.3.10 Junior Road Safety Officer Scheme

'Road Safety Scotland' is continuing to develop the Junior Road Safety Officer (JRSO) scheme. This scheme was introduced to keep road safety at the forefront of children's attention and allowed these JRSOs to continue the Road Safety theme outside the school premises. A range of activities is being undertaken to stimulate motivation and to recognize the important role of JRSOs and reward their hard work and commitment to road safety. These include the provision of prizes for competitions run by JRSOs in schools, special JRSO clocks for every JRSO at the start of the school year and the award of certificates at the end of the year. The children under the JRSO scheme are encouraged to speak at assemblies, run competitions and link in with the Road Safety Unit. The website is a key element of the scheme. Planned improvements include



- A password protected media desk/section for JRSOs.
- Separate feedback sections/discussion forums for JRSOs to encourage the sharing of experiences and ideas.
- A school travel section incorporating environmental and health and safety issues.

6.4 Overview

In addition to the recommendations outlined in this chapter, realistic safety programmes must be developed, implemented and monitored properly and efficiently. Policy makers, planners, highway engineers and safety professionals need to provide attention to the above mentioned safety options: it's up to us which options we will accept/consider by judging local suitability. The author do not want to claim to have found the cure to the problems affecting road safety for children in Dhaka, because no model no matter how well it has been designed will always satisfy all interests. However, it can be said that most of the recommendations if adapted properly, road safety for children in Dhaka will soar higher. Simultaneously, we should seriously plan how to balance the safety recommendations according to our priorities, what barriers exist to implementing recommended actions, and how these could be overcome, and how meaningful accountability for the implementation of recommendations could be obtained

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APPENDICES

Bangladesh University of Engineering & Technology (BUET)
Department of Urban & Regional Planning

'Evaluation of the Existing Situation for Children-Safe Streets in Dhaka City'

(Questionnaire to ascertain the influence of the street safety factors on children's usage and accessibility of roads and streets - For academic purpose only)

Questionnaire Number: _____

Name of the respondent : _____ (for children/students only)
Name of the school/playfield/park : _____
School Timing : Opening _____ Closing _____
Name of Area of Residence : _____
Distance Traveled : _____ Km.
Time Needed : _____ min.

(Please √ where applicable)

1) Information about the respondent:

Age group	Sex	Education level
0-5 ☐	Male ☐	Primary ☐
5-8 ☐	Female ☐	Secondary (SSC) ☐
8-12 ☐		H.S.C ☐
12-16 ☐		

2) a. Major mode of transport to come to school / playfield / recreational area:

☐ Car
☐ Motorcycle
☐ Bus
☐ Walking
☐ Others
☐ School Bus / Van
☐ Bicycle
☐ Rickshaw
☐ Auto Rickshaw / CNG

b. In case of walking,

i) number of Roads have to cross to reach school/playfield/recreational area: .....
ii) number of Crosswalks/Zebra Crossing have to cross: .....

c. In case of using private/family vehicle to reach school/playfield/recreational area.

i) average speed of the car: .....
ii) number of Speed Breakers have to pass: .....
iii) number of Intersection or Turns have to cross/make: .....
iv) do you follow safety rules properly?

☐ Yes ☐ No ☐ At times

v) do you use safety equipment (seatbelt, helmet, etc.)?

☐ Yes ☐ No ☐ At times

3) a. Do you have basic road safety knowledge?

☐ Yes ☐ No ☐ Partially

If yes, from where?

☐ Parents ☐ School / Teachers

☐ Media ☐ Friend

☐ Others

b. Do your parents allow you to go to school / using roads alone?

☐ Yes ☐ No ☐ At times

c. How do you follow traffic rules regarding the following activities to reach school / playfield / recreational area?

0 = No definite rule; 1 = Ignore while in hurry; 2 = At times; 3 = Most of the times; 4 = Always

No	Events	0	1	2	3	4
1	Walking street					
2	Crossing roads					
3	Waiting for transport					
4	Driving bicycle					

4) Do you face any street problem reaching school / playfield / recreational area?

☐ Yes ☐ No

If yes, what is(are) the problem(s)?

☐ No footpath
☐ Insufficient/discontinuous footpath
☐ No crosswalk / zebra crossing
☐ Insufficient road width
☐ Unspecified speed breakers
☐ No island
☐ Damaged road surface
☐ Traffic Jam
☐ Variety of vehicles
☐ High traffic volume / crowded
☐ Adverse roadside environment
☐ Excessive speeding
☐ Parking on roads
☐ High volume of hydraulic horn
☐ Excessive pollution
☐ Dangerous overtaking
☐ Reckless driving
☐ Others.....

5) Opinion regarding the usefulness of the following street safety components (considering the scope of their usage & accessibility while reaching school/playfield/recreational area)

No.	Street Components	Not Useful	Useful	Highly Useful
1	Footpath			
2	Guard railing (beside footpath)			
3	Zebra crossing			
4	Speed breakers			
5	Island / Median			
6	Overpass / Underpass			
7	Roundabout			
8	Road signage and marking			
9	Traffic signal			
10	Traffic police			
11	Road light			
12	School signage			

6) Do you think the footpaths you use to reach school/playfield/recreational area are accessible?

☐ Yes ☐ No

- If no. what are the main reason(s)?

☐ Inadequate width
☐ Nasty environment
☐ Illegal / unauthorized occupation
☐ Presence of vendors
☐ Presence of dustbins
☐ Presence of manholes (without cover)
☐ No protective barriers
☐ Discontinuous
☐ Obstruction of vision by on street parking
☐ Submerged under water
☐ Improper design
☐ Others .....

7) Do you have previous road accident experience to reach school/playfield/recreational area?

☐ Yes ☐ No

- If yes, how many times?

☐ Once ☐ 2 – 3 ☐ 3+ ☐ No response

- You were involved in the accident(s) as a:

☐ Pedestrian
☐ Passenger
☐ Driver

- Severity of the accident:

☐ Hurt a little ☐ Sustained slight bruise or laceration
☐ Head fracture ☐ Multiple / head injury
☐ Others

- How long have you suffered?

☐ 1 day ☐ 2 – 4 days
☐ 5 – 7 days ☐ Others

8) Which street problem(s) do you tremendously face reaching school/playfield/recreational area?

.....

9) Comments (if any).

.....

Thanks for your kind co-operation.

Signature of the Surveyor. _____

Date: _____ Time: _____

Appendix B

Bangladesh University of Engineering & Technology (BUET)
Department of Urban & Regional Planning

'Evaluation of the Existing Situation for Children-Safe Streets in Dhaka City'

(Questionnaire to ascertain the influence of the street safety factors on children's usage and accessibility of roads and streets - For academic purpose only)

Questionnaire Number _____

Name of the respondent : _____ (for Parent/Guardian only)
Name of the school/recreational area : _____
School Timing : Opening _____ Closing _____
Name of Area of Residence : _____
Distance Traveled : _____ Km.
Time Needed : _____ min.

(Please √ where applicable)

1) Information about the respondent:

Age group	Sex	Education level	Monthly Family income (TK.)
0 - 10 ☐	Male ☐	Primary ☐	0 - 5,000 ☐
10 - 20 ☐	Female ☐	Secondary (SSC) ☐	5,001 - 10,000 ☐
20 - 30 ☐		H.S.C ☐	10,001- 15,000 ☐
30 - 40 ☐		Degree and above ☐	15,001- 20,000 ☐
40 - 50 ☐		Technical education ☐	20,001- 25,000 ☐
50 - 60 ☐		Other ☐	25,001- 30,000 ☐
60÷ ☐			30,000+ ☐

2) a. Major mode of transport of your child to reach to school:

☐ Car
☐ Motorcycle
☐ Bus
☐ Walking
☐ Others
☐ School Bus / Van
☐ Bicycle
☐ Rickshaw
☐ Auto Rickshaw / CNG

b. In case of walking,

i) number of Roads have to cross to reach school/recreational area: . ...

ii) number of Crosswalks/Zebra Crossing have to cross: ....

c. In case of car/vehicle ownership.

i) average speed of the car: ....

ii) number of Speed Breakers have to pass: . . ..

iii) number of Intersection or Turns have to cross/make: .....

iv) do you follow safety rules properly?

☐ Yes ☐ No ☐ At times

v) do you use safety equipment (seatbelt, helmet, etc.)?

☐ Yes ☐ No ☐ At times

3) a. i) Do you have proper road safety knowledge?

☐ Yes ☐ No ☐ Partially

ii) Do you teach basic road safety education your children?

☐ Yes ☐ No

b. Do you allow your children to go to school / using roads alone?

☐ Yes ☐ No

c. How do you follow traffic rules regarding the following activities to reach school / recreational area?

0 = No definite rule; 1 = Ignore while in hurry, 2 = At times; 3 = Most of the times; 4 = Always.

No	Events	0	1	2	3	4
1	Walking street					
2	Crossing roads					
3	Waiting for transport					
4	Driving car / vehicle					

4) What is your opinion about the roads/streets of Dhaka city for children?

☐ Safe ☐ Unsafe

- If unsafe, the reasons are:

☐ No footpath
☐ Insufficient/discontinuous footpath
☐ No crosswalk / zebra crossing
☐ Insufficient road width
☐ Unspecified speed breakers
☐ No island
☐ Damaged road surface
☐ Traffic Jam
☐ Variety of vehicles
☐ High traffic volume / crowded
☐ Adverse roadside environment
☐ Excessive speeding
☐ Parking on roads
☐ High volume of hydraulic horn
☐ Excessive pollution
☐ Dangerous overtaking
☐ Reckless driving
☐ Others.....

5) Opinion regarding overall condition of the following street (safety) components and facilities (considering the scope of their usage and accessibility by children to reach to school/play ground/recreational area).

0 = Worst; 1 = Bad; 2 = Medium; 3 = Good; 4 = Very Good; 5 = Excellent.

No.	Street Components	0	1	2	3	4	5
1	Footpath						
2	Guard railing (beside footpath)						
3	Zebra crossing						
4	Speed breakers						
5	Island / Median						
6	Underpass / Overpass						
7	Roundabout						
8	Road signage and marking						
9	Traffic signal						

10	Traffic police						
11	Road light						
12	School signage						
13	Intersection design / Channelization						
14	Road design						
15	Road width						
16	Parking provision (on the street)						

6) How do you consider / rate the importance of the following safety measures near the school fringe area / play field / recreational area?

0 = No Need; 1 = Slightly Important; 2 = Important; 3 = Highly Important.

No.	Safety Measures	0	1	2	3
1	Protected footpath (with guard railing)				
2	Zebra crossing				
3	Speed breakers				
4	Speed limit				
5	Pedestrian refuge islands				
6	School signage				
7	Underpass / Overpass				
8	Special signal light				
9	Designated traffic police				
10	Marked division for non-motorized & motorized vehicles				
11	Car free zone around school				
12	Others				

7) Do you think the footpaths you use to reach school/recreational area are accessible by children?

☐ Yes ☐ No

- If no. what are the main reason(s)?

☐ Inadequate width
☐ Discontinuous
☐ No protective barriers
☐ Improper design
☐ Illegal / unauthorized occupation
☐ Submerged under water
☐ Presence of vendors
☐ Presence of dustbins
☐ Presence of manholes (without cover)
☐ Nasty environment
☐ Obstruction of vision by on street parking
☐ Others .....

8) What do you think the major cause(s) behind increasing number of Road Transport Accident?

☐ User / Pedestrian error
☐ Adverse road conditions / environments
☐ Vehicle defects
☐ Drivers' error
☐ Unsatisfactory road safety education
☐ Weak enforcement of traffic rules
☐ Insufficient and inefficient traffic personnel
☐ Others .....

9) Do you have previous road accident experience to reach to your child's school / recreational area?

☐ Yes ☐ No

- If yes, how many times?

☐ Once ☐ 2 – 3 ☐ 3+ ☐ No response

- You were involved in the accident(s) as a:

☐ Pedestrian
☐ Passenger
☐ Driver

- Was your child accompanied with you and injured?

☐ Yes ☐ No

- Severity of the accident:

☐ Hurt a little ☐ Sustained slight bruise or laceration
☐ Head fracture ☐ Multiple / head injury
☐ Others

- How long have you suffered?

☐ 1 day ☐ 2 – 4 days
☐ 5 – 7 days ☐ Others

10) How do you opine the following measures regarding Traffic Police presence and their activities at school fringe area?

☐ Available at school fringe area during school opening, closing and tiffin hours only.
☐ Available for the whole school period.
☐ Standby at zebra crossing.
☐ Help children to cross roads after every ☐2 ☐4 ☐5 ☐6 ☐8 minutes by stopping vehicular flow.

11) Which street problem(s) do you / your children tremendously face coming school / recreational area

.....

12) Do you think that in any new street development children safety should be considered?

☐ Yes ☐ No

13) Please make comments on possible engineering and planning improvement of roads / streets.

.....

.....

Thanks for your kind co-operation.

Signature of the Surveyor: _____

Date _____ Time. _____

Appendix C

Bangladesh University of Engineering & Technology (BUET)
Department of Urban & Regional Planning

'Evaluation of the Existing Situation for Children-Safe Streets in Dhaka City'
(Reconnaissance Survey)

Name of the School/Play Field/Recreational Area: ....

Type of the Road adjacent to the School/Play Field/Recreational Area:

☐ One way ☐ Double way

Available Street Safety Components at the School Precinct or zone of Play Field / Recreational Area:

☐ Speed limit	☐ Protected sidewalks	☐ Marked crosswalks
☐ Speed beakers	☐ Median	☐ School signage
☐ Overpass/Underpass	☐ Road signage and marking	☐ Signal light
☐ Road light	☐ Designated traffic police	☐ Marked division for NMV & MV
☐ First aid arrangement	☐ Others.....	

General Questions to the Authority of the School/Play Field/Recreational Area:

- Arrangement of school bus / van: .....
- Road safety education .....
- First aid arrangement: .....
- Car free zone around school/play field/recreational area: .....
- Provision of school signage or special signage: .....
- Employment of traffic personnel: .....
- .....
- .....
- .....
- .....

Signature of the Surveyor: _____
Date: _____ Time: _____

Appendix D

Bangladesh University of Engineering & Technology (BUET)
Department of Urban & Regional Planning

'Evaluation of the Existing Situation for Children-Safe Streets in Dhaka City'
(Questionnaire / Interview Script to analyze the present Strategic Transport Plan (STP) for Dhaka (2004 – 2024) - For academic purpose only)

Questionnaire / Interview Script Number: _____

(Please √ where applicable)

Name of the respondent : _____

Name of the organization : Designation _____

_____

1. General

1.1) Importance of having comprehensive children road safety plans at regional or local level?

☐No Need ☐Slightly Important ☐Important ☐Highly Important

1.2) What should be the likely time frame of such a plan and how it should be structured?

.....

2. Plan Content

2.1) How the safety actions in STP should be defined?

☐Defined responsibilities
☐Given deadlines
☐Given casualty reduction or other performance indicators
☐Estimation of costs of the actions

2.2) To which areas, at least, the STP should give guidance to make the sense that safety actions in STP have planned considering children?

☐Education / Awareness programme
☐System safety and regulations
☐Infrastructure development
☐Enforcement / Implementation phase
☐Medical strategies
☐Funding sources

3. Coordination of Safety Actions

3.1) Is it necessary of having a coordinating body to make the safety actions of STP a successful one?

☐Yes ☐No

- If yes, what should be the intended role of the coordinating body?

☐Executive ☐Advisory

- Should have a permanent secretariat assigned to assist the coordinating body?

☐Yes ☐No ☐Not necessarily

If yes, i) Organization of the office: _____

ii) Probable number of staffs: _____

iii) Need relevant training? ☐Yes ☐No

- How often the coordinating body should meet?

☐ At least once in a year ☐ At least twice in a year
☐ At least thrice in a year ☐ At least once in every three months

- What should be the legal status of the coordinating body?

.....

- Which group(s) should, at least, represent in the coordination body?

☐Public sector members
☐Private sector members
☐Vulnerable road user group representation
☐Medical and health representative
☐Representative from the Police and Fire Brigade
☐Transport Planner / Highway Engineer
☐Representative from the drivers' community
☐Representative from the media
☐Insurance company representative

- What should the terms of reference be for the coordinating body?

.....

- Suggested guidelines to make the coordinating body and its secretariat more effective.

.....

4. Technical Support

4.1) Should have a technical committee to support/monitor the safety actions of STP?

☐Yes ☐No

- If yes, what kind of technical support is necessary to make the safety actions of STP a successful one?

.....

5. Effectiveness

5.1) Is the STP for Dhaka adequate to ensure road safety for children in Dhaka?

☐Yes ☐No

- If No, why?

.....

- Suggested guidelines that could make the STP more effective to ensure children road safety

.....

5.2) Is it necessary to rate the effectiveness of the safety actions in STP in time to time?

☐Yes ☐No

5.3) Is there scope. in the safety actions of STP, to incorporate lessons learnt from past experiences / time to time?

☐Yes ☐No ☐Partially

6. Development Phase

6.1) Evaluation on the way the Louis Berger Group, Inc and Bangladesh Consultants Ltd developed the safety actions of STP.

☐0 = Worst ☐1 = Bad ☐2 = Medium ☐3 = Good ☐4 = Very Good ☐5 = Excellent.

6.2) Evaluation of the contributions of local agencies / advisors towards the formation of STP.

☐0 = Worst ☐1 = Bad ☐2 = Medium ☐3 = Good ☐4 = Very Good ☐5 = Excellent.

6.3) What should be the intended role of the advisors?

Local advisors : .....

Foreign advisors : .....

6.4) Evaluation of the kinds of stakeholders and public consultation involved.

☐0 = Worst ☐1 = Bad ☐2 = Medium ☐3 = Good ☐4 = Very Good ☐5 = Excellent.

7. Implementation, Monitoring & Evaluation

7.1) Comment on the approval and implementation process of the safety plans of STP

.....

7.2) Should the implementing agencies provide consent to approve the safety action plans mentioned in STP?

☐Yes ☐No

7.3) Is the monitoring and evaluation process of road safety activities mentioned in STP well organized?

☐Yes ☐No ☐Partially

8. Funding

8.1) Should it be figured out in a strategic plan the likely amount needed for the road safety activities?

☐Yes ☐No

8.2) What should be the prime sources of funding for the children road safety activities?

- ☐ Government budget
- ☐ Donor assistance
- ☐ Fuel levies
- ☐ Traffic fines
- ☐ Private / Business sector sponsorship

8.3) Please give an idea of the relative share of contribution.

a) Government budget .....%
b) Donor assistance .....%
c) Fuel levies .....%
d) Traffic fines .....%
e) Private sector sponsorship .....%

8.4) To which sectors the relative share of the children road safety expenditure should have:

- ☐ Plan making and policy design
- ☐ System safety and regulations
- ☐ Education / Awareness programme
- ☐ Infrastructure development
- ☐ Enforcement / Implementation phase
- ☐ Medical and medicine

8.5) Guidelines to the involvement of the business sectors to the children road safety activities of STP.

☐ High ☐ Medium ☐ Low ☐ Nothing

Thanks for your kind co-operation.

Signature of the Surveyor / Interviewer: _____

Date: _____ Time: _____

Appendix E: National Road Safety Council Composition

Zambia (1995)	Bangladesh (1996)	Fiji (1995)	Chile (1994)	New Zealand (1993)	Victoria (AUS)	Botswana (1975)
PS, MOCT Dir of Roads, MOWS Dir of Road Transp, MOCT Zambia Police Service Local Govt. Assoc Min of Comm. Dev and Social Welfare Motor Trade Assoc Insurance Industry Road Transp Assoc. Medical Council Law Assoc Motor Sports Assoc Eng Institute Pass, Pedestrian and Cyclist Assoc CIT 2 interested others	Minister, Min of Communications Secretary, Cabinet Division Chief Secretary, Prime Ministers' Secretariat Secretary, Road and Road Transport Division, MOC Secretary, Home Affairs Secretary, Local Government Division Secretary, Forest and Environment Ministry Secretary, Information Ministry Inspector General of Police, Bangladesh Police Chief Engineer, Roads and Highways Department Chief Executive Officer, Dhaka City Corporation Chairman, BRTA President, Road Transport Association Representative, Labour Federation (to be nominated by Govt) Dr. Anwar Hossain, ICTUTR Tongi Mr. ANM Saleh, Rajshahi Government College Dr. Mr. Khan, ICDDRB Mr. Md Serajul Haque, Begum Tafazal Hossain Manik Mia Girls College Mr. MA Rakib, Osmani Medical College Mr. Ehtesham Chowdhury, PIAG Adamjee Court	PS Min of Transport and Tourism Comm, Fiji Police Force CEO, Land Transport Authority Director of Roads, PWD PS, Min of Education PS, Min of Health Solicitor General, Attorney General Chambers Chairman, Fiji Local Govt Assoc. PS, Min of Information Lord Mayor, Suva City Council Chairman, FMTA Secretary, Fiji Taxi Union Chairman, Fiji Bus Operators Assoc. Chairman, Ins Council of Fiji Acting Director General, PNTC Chairman, Fiji Chamber of Commerce Secretary, Millennium Minibus Transport Assoc Secretary, Society of Fiji Travel Association 2 Individuals	Min. of Interior Min. for the General Secretary of the President Min. for the General Secretary of the Government Min. of Education Min of Justice Min of Public Works Min of Health Min of Transp. and Telecomm Police	Director, LTSA Secretary of Transport Commissioner of Police GM Transit NZ CEO Accident Compensation Corporation	CEO VicRoads CFO Victoria Police CFO Transport Accident Commission	PS, MOWYC Director of Roads PS, Min of Finance PS, Min of Education Attorney General Comm, Of Police Dir. of Nat'l Transport and Communications/Principle Officer of Road Safety Division Insurance Companies Chamber of Commerce Service Clubs

Appendix F: Road Safety Organization Key Features

	Victoria, Australia	New Zealand	Sweden	UK	Chile	South Africa
Lead agency Legal authority	VicRoads Yes	Land Transport Safety Authority Yes	Swedish National Roads Administration Yes	Dept. of Environment, Transport & Regions Yes	National Comm. of Road Safety /MOTC Yes	National Department of Transport/ MOT Yes
Coordinating Body a) total members b) Private sector c) Community/ VRU/ victim d) Chairman	RS Executive Group a) 3 b) none c) none d) VicRoads	NRSC a) 7 b) one c) none d) LTSA	Multi agency working group a) 5 b) no c) no but an NGO (NTF) is an associate member d) SNRA	Interagency Working Group a) b) c) d) DETR	CONASET a) 9 b) none c) none d) MOTC	RTMCC a) 20-30 (provincial rep) b) none c) none d) MOT
Role Meeting frequency	Executive quarterly	Executive Quarterly + one annual planning workshop	Advisory To be completed	Advisory	Executive Every 3-4 months	Executive Bi-monthly
Plan development Responsibility	Develop plan	Approved plan	Consultation only	Established after strategy published	Developed work Programme	Approve strategy and Programmes
Technical committees	RS Mgt Group RS Reference Group Traffic Safety Educ Group	NRSC WorkingGroup NRSCAdvisory Group Industry Con. Group NRSC Mgt Review	Several steering/inquiry committees and working groups	Road Safety Advisory Panel, Child Pedestrian Safety, Statistics, and Occup. Road Safety Working Group (4)	No	Nine standing technical committees and special project task forces also
Central Office a) staff b) training	a) yes b) yes	a) 483 in LTSA b) yes	a) Traffic Safety Dept. b) yes	a) RS and Env Directorate b) yes	a) 22 staff b) yes	a) 63 in Rd Traffic Mgt/NDOT b) yes
Budget Funding Sources	$40 million Vic Roads General revenue, insurance sponsorship	$190 m NZRSP NZRSP, Crown, Contract, Third Party Insurance	Yes General revenue	DETR (not Panel) General revenue	Dedicated budget General revenue	Yes 4 proposed sources fees, fines & penalties interest &parliament
Effectiveness	Strong leadership Coordinated lead agencies approach Proactive	Strong leadership Also good coordination	Strong leadership Good political support (Vision Zero)	Strong lead agency Traffic policing not given priority No medical sector inv.	Good leadership Crash rate reduced US$1 M budget in 1999 (down 35% from 1998)	New mgt structure being established 1996 RTMS inadequately financed

Appendix F: Road Safety Organization Key Features (continued)

	Bangalore	Bangladesh	Ethiopia	Fiji	Ghana	Indonesia	Zambia
Lead agency	Traffic Police	BRTA/ Ministry of Communications	Federal Police	Ministry of Works/NRSC	Ministry of Road & Transport/NRSC	Director General of Land Comm. (MOC)	NRSC/ Ministry of Communications
Legal authority	No	1996 Legislation	No	Yes	1999 Act	N/A	1995 Proclamation
Coordinating Body a) total members b) Private sector c) Community/ VRU/ victim d) Chairman	Bangalore Road Safety Committee a) 10-15 b) recommended c) no d) Police Comm	NRSC a) 20 b) yes c) no d) Minister of Com	RSB proposed a) 4 recommended b) to be on TWGs c) to be on TWGs d) to be elected	NRSC a) 23 b) c) none d)	NRSC (commission) a) 19 b) 10 c) No d) MRT Minister	None a) n/a b) n/a c) n/a d) n/a	NRSC a) b) c) yes d) appointed
Role	Advisory	Advisory	Advisory/Executive	Advisory/Executive	Advisory/Executive	N/A	Advisory/Executive
Meeting frequency	Rarely	Rarely	Quarterly proposed	Quarterly	Every 2 months	N/A	
Plan development Responsibility	Not yet	Approved	Approval and funding requests approval	Second Plan drafted	Drafted National Programme	Produced with donor assistance	Produced with donor Assistance
Technical committees	None	No	Technical working groups (TWG) and regional road safety committees recommended	Executive, Finance, Education, Research & Dev. Traffic & Roads Committees (5)	Yes	N/A	No
Central Office a) staff b) training	a) no b) no	a) 1-2 seconded b) no	a) Included in plan b) Included in plan	a) 8-12 b) yes	a) 20 (19 seconded) b) very little	a) no b) n/a	a) yes b) no
Budget	No	No	Not yet	Yes	C500	None	Very small
Funding Sources	Sponsorship, state revenue	General revenue, 2% RHD maint budget proposed	Road Fund, general revenue	General, Third Party Safety Levy, Fees, Sponsorship	Consolidated fund, Ins comm. (C10m) sponsorship	None	General revenue, minimal from Road Fund
Effectiveness	Not yet begun Private sector leadership	Road safety eng capacity being developed but NRSC has no resources	No leadership yet Road Fund Board agreed up to 3% for road safety measures	Strong mgt. Dedicated funding source & office staff. Clearly defined roles Interagency coordination improving, more funding needed	New NRSC structure being tried Previous NRSC was not resourced and ineffective	No leadership No national policy but engineering capacity being improved in road projects	Weak leadership No financial investment in road safety, NRSC staff unpaid and demoralized